AquaEdge® 23XRV
High-Efficiency Variable Speed Screw Chiller
with Greenspeed® Intelligence and PIC6 Controls
50/60 Hz
R-134a or R-513A

Start-Up, Operation and Maintenance Instructions

CONTENTS

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 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 devices 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. Intentional 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 machine for any purpose. Oxygen gas reacts violently with oil, grease, and other common substances.

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

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 VALVE OFF any safety device.

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

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

UNIT AND ELECTRICAL CONSTRUCTION is designed for use in a non-hazardous environment (non-flammable and non-explosive). DO NOT install the chiller in a hazardous (flammable or explosive) location or environment.

⚠ WARNING

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

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 gage for how much oil to add to the system.

Carefully unsweat remaining tubing stubs when necessary. Oil can ignite when exposed to torch flame.

DO NOT USE eyebolts or eyebolt holes to rig heat exchangers or the entire assembly.

DO NOT work on high (or medium) voltage equipment unless you are a qualified electrician.

DO NOT WORK ON electrical components, including control panels, switches, starters, or oil heater 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 deenergized 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 over pressure can result. When it is necessary to heat refrigerant, use only warm (110°F [43°C]) water.

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 machine. The introduction of the wrong refrigerant can cause machine damage or malfunction.

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 machine with other refrigerants.

DO NOT ATTEMPT TO REMOVE fittings, covers, etc., while machine is under pressure or while machine is running. Be sure pressure is at 0 psig (0 kPa) before breaking any refrigerant connection.

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

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

⚠ WARNING

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.

SOME MODELS MAY EXCEED 85 dBA. Hearing protection should be worn when working in the vicinity of such chillers.

⚠ 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 machine. 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 fan, and pumps. Shut off the machine or pump before servicing equipment.

USE only repaired 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.

DOUBLE-CHECK that coupling nut wrenches, dial indicators, or other items have been removed before rotating any shafts.

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 re-use compressor oil or any oil that has been exposed to the atmosphere. Dispose of oil per local codes and regulations.

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 oil contamination when timely repairs cannot be completed.

Chiller must be installed in an indoor environment where the ambient temperature is between 40 to 104°F (4 to 40°C) with a relative humidity (non-condensing) of 95% or less. To ensure that electrical components operate properly and to avoid equipment damage, do not locate chiller in an area exposed to dust, dirt, corrosive fumes, or excessive heat and humidity.

INTRODUCTION

⚠ 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 center.

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 chiller 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.

Prior to initial start-up of the 23XRV chiller, those involved in the start-up, operation, and maintenance should be thoroughly familiar with these instructions and other necessary job data. This book is outlined to familiarize those involved in the start-up, operation and maintenance of the unit with the control system before performing start-up procedures. Procedures in this manual are arranged in the sequence required for proper chiller start-up and operation.

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

ABBREVIATIONS AND EXPLANATIONS

Frequently used abbreviations in this manual include:

CCN	—	Carrier Comfort Network®
CCW	—	Counterclockwise
CSM	—	Chillervisor System Manager
CW	—	Clockwise
DPI	—	LF2 VFD Drive Peripheral Interface Board
ECDL	—	Entering Condenser Liquid
ECL	—	Entering Chilled Liquid
EMS	—	Energy Management System
EXV	—	Electronic Expansion Valve
HGBP	—	Hot Gas Bypass
HMI	—	Human Machine Interface
IGBT	—	Insulated Gate Bipolar Transistor
I/O	—	Input/Output
IOB	—	Input/Output Board
KAIC	—	Kiloamps Interrupt Capacity
LCD	—	Liquid Crystal Display
LCDL	—	Leaving Condenser Liquid
LCL	—	Leaving Chilled Liquid
LED	—	Light-Emitting Diode
LEI	—	Local Equipment Interface Translator
LEN	—	Local Equipment Network
LF2	—	Reliance LiquiFlo[a] 2 VFD with Active Rectifier
OIM	—	Reliance Operator Interface Module
OLTA	—	Overload Trip Amps
PIC6	—	Product Integrated Control 6
RLA	—	Rated Load Amps
RS485	—	Communications Type used by PIC
SCR	—	Silicon Controlled Rectifier
SI	—	International System of Units
SIOB	—	Starfire Input Output Board
TB1	—	Control Center Terminal Block 1
TB2	—	Control Center Terminal Block 2
VFD	—	Variable Frequency Drive
VFG	—	Variable Frequency Gateway Module

NOTE(S):

a. Third-party trademarks and logos are the property of their respective owners.

23XRV CHILLER FAMILIARIZATION

See Fig. 1-7 for 23XRV details.

Chiller Identification Nameplate

The chiller identification nameplate is located on the right side of the chiller control center.

System Components

The components include cooler and condenser, heat exchangers in separate vessels, motor-compressor, lubrication system, control center, and optional economizer.

23XRV 40 42 N R V AA 5 0 – –

23XRV – High Efficiency Variable Speed Screw Chiller

Evaporator Size [1]
A1-A6
B1-B6
30-32
35-37
40-42
45-47
50-52
55-57

Condenser Size [1]
A1-A6
B1-B6
30-32
35-37
40-42, 4D
45-47, 4E
50-52
55-57

Economizer Option
E – With Economizer
N – No Economizer

Compressor Code [2]
P
Q
R

Motor Code

H	**S**
J	**T**
P	**U**
Q	**V**
R	**X**

Drive Code [3]
AA – LF-2, 440 Amps In, 442 Amps Out
BA – LF-2, 520 Amps In, 442 Amps Out
CC – LF-2, 608 Amps In, 608 Amps Out
R1 – Std Tier, 575-v, 269 Amps In, 269 Amps Out
R2 – Std Tier, 230 Amps In, 230 Amps Out
R3 – Std Tier, 335 Amps In, 335 Amps Out
R4 – Std Tier, 445 Amps In, 445 Amps Out

Voltage Code
3 –380-3-60
4 –416-3-60
5 –460-3-60
7 –575-3-60
9 –380/415-3-50

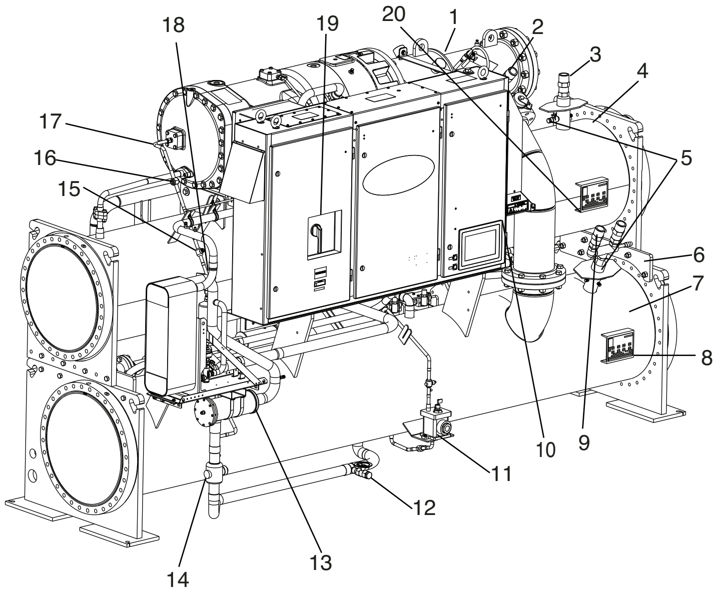
Compressor Option
0 – Full Load Optimized
1 – Part Load Optimized

– –Not Used

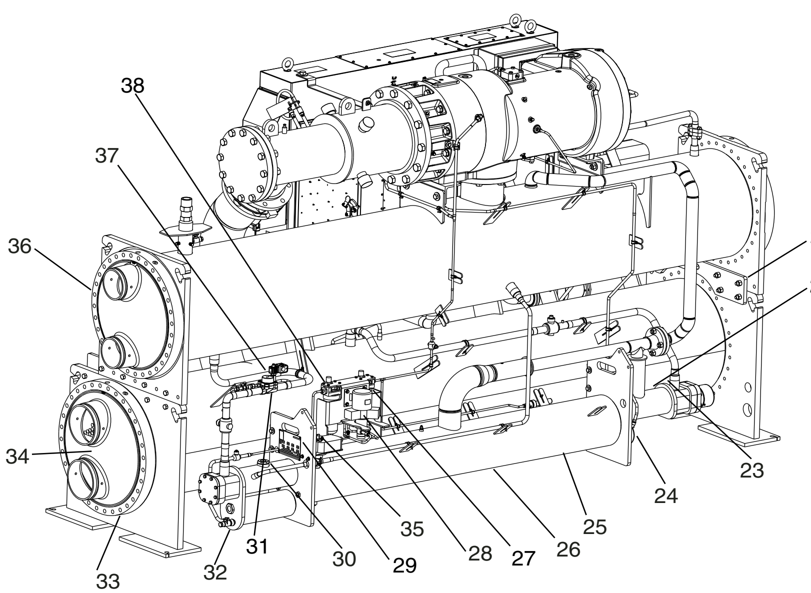
– –Standard
S –Special

NOTE(S):
1. First character denotes frame size.
2. Only H and J motors are used with P compressors. Only type V motors are used with Q compressors.
3. Maximum limits only. Additional application limits apply that may reduce these ampacities.

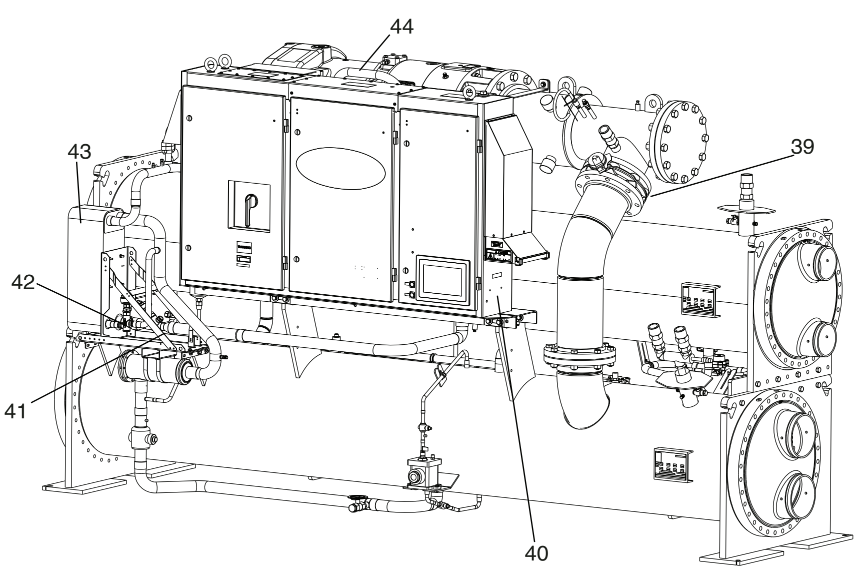
Fig. 1 — Model Number Identification



1 — Discharge Pipe
2 — Variable Frequency Drive
3 — Cooler Relief Valve
4 — Compressor Discharge Pipe
5 — Refrigerant Charging Valve
6 — Tubesheet Mounting Brackets
7 — Condenser
8 — ASME Nameplate, Condenser
9 — Condenser Relief Valves
10 — PIC6 Controller
11 — Level Sensing Chamber
12 — Condenser Refrigerant Pumpout Valve
13 — Refrigerant Strainer
14 — Cooler Inlet Isolation Valve
15 — Motor Cooling Isolation Valve
16 — Motor Cooling Sight Glass
17 — Motor Cooling Supply Line
18 — Motor Cooling Line Filter Drier (Hidden)
19 — VFD Disconnect
20 — ASME Nameplate, Evaporator

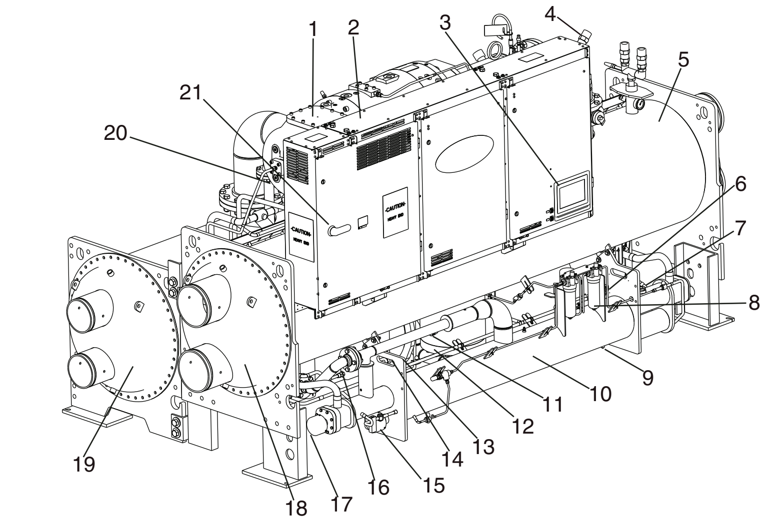


21 — Tubesheet Mounting Brackets
22 — Vaporizer Sight Glass
23 — Vaporizer Drain Sight Glass (Hidden)
24 — Oil Sump Heater (Hidden)
25 — Oil Sump
26 — Oil Sump Sight Glass (Hidden)
27 — Oil Pump Outlet Filter
28 — Oil Pump
29 — ASME Nameplate Oil Concentrator
30 — Oil Reclaim Actuator
31 — Vaporizer Sight Glass
32 — Hot Gas Bypass Line
33 — Oil Charging Drain Valve
34 — Typical Waterbox Drain Coupling (Hidden)
35 — Condenser Supply/Return End Waterbox
36 — Cooler Supply/Return End Waterbox
37 — Variable Orifice
38 — Oil Pump Inlet Filter

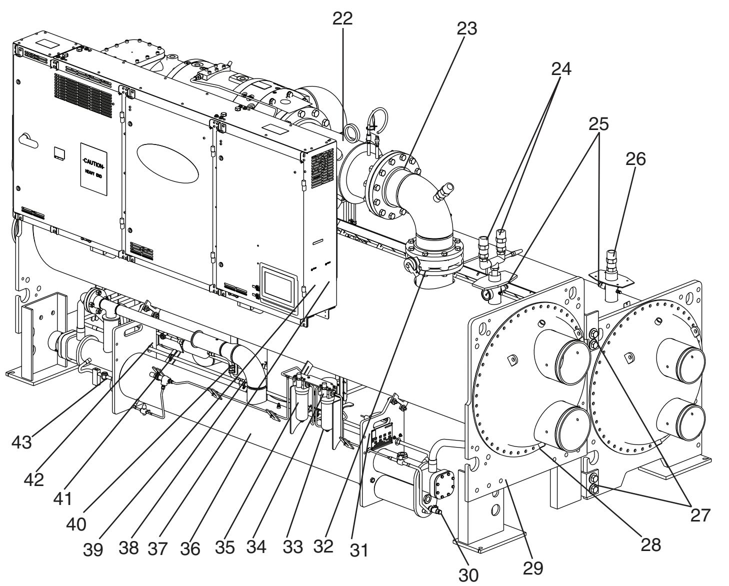


39 — Discharge Isolation Valve Assembly (Option or Accessory)
40 — Machine Electrical Data Nameplate
41 — Main EXV
42 — Economizer Gas EXV (Option)
43 — Economizer (Option)
44 — Economizer Muffler (Hidden)

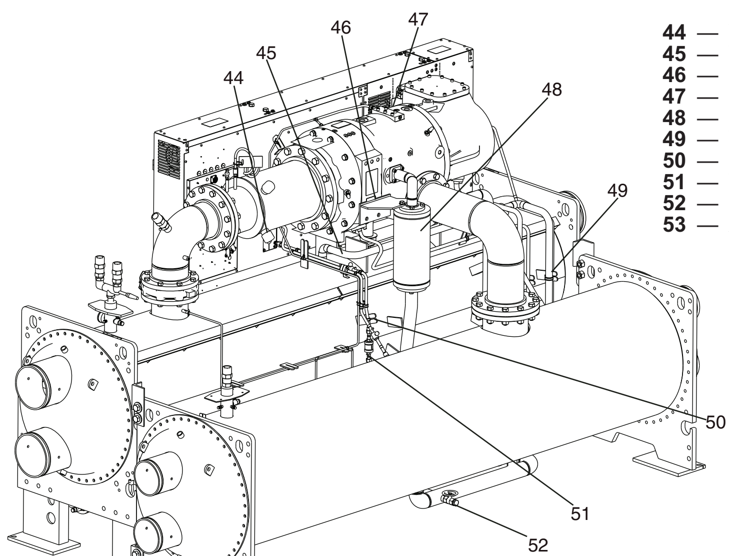
Fig. 2 — Typical 23XRV Components (Units with P Compressor)



1 — Motor Terminal Cover Plate
2 — Variable Frequency Drive
3 — PIC6 Controller
4 — Discharge Pipe Relief Valve
5 — Condenser
6 — Oil Reclaim Actuator
7 — Vaporizer Sight Glass
8 — Oil Filter Assembly
9 — Oil Sump Temperature (hidden)
10 — Oil Sump
11 — Condenser Refrigerant Pumpout Valve
12 — Condenser Float Chamber
13 — Cooler Inlet Isolation Valve (Hidden)
14 — ASME Nameplate, Economizer (Hidden)
15 — Oil Sump Heater
16 — Filter Drier
17 — Vaporizer Heater
18 — Condenser Supply/Return End Waterbox
19 — Cooler Supply/Return End Waterbox
20 — Motor Cooling Supply Line
21 — VFD Disconnect

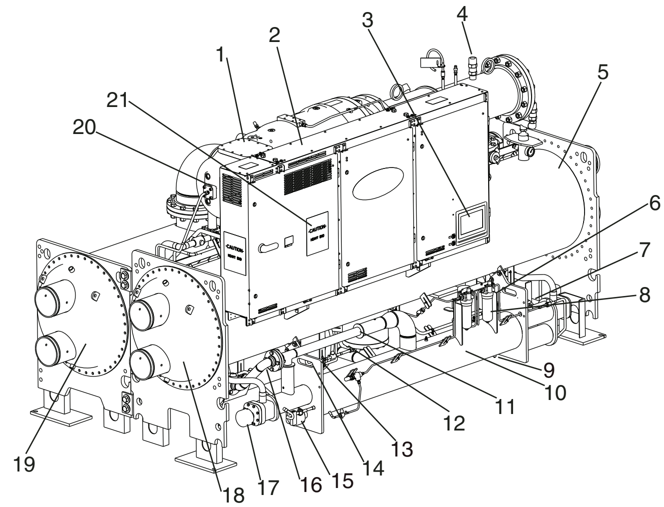


22 — Discharge Pipe
23 — Compressor Discharge Check Valve Access Cover
24 — Condenser Relief Valves
25 — Refrigerant Charging Valves
26 — Cooler Relief Valve
27 — Tubesheet Mounting Brackets
28 — Typical Waterbox Drain Coupling
29 — ASME Nameplate, Condenser
30 — Oil Drain
31 — ASME Nameplate Oil Concentrator
32 — Discharge Isolation Valve (Option or Accessory)
33 — Suction Oil Filter
34 — Oil Pump
35 — Discharge Oil Filter
36 — Oil Sump Sight Glass
37 — Refrigeration Machine Nameplate
38 — Filter Drier Isolation Valve with Schrader Valve
39 — Machine Electrical Data Nameplate
40 — Economizer
41 — Motor Cooling Sight Glass
42 — Motor Cooling Isolation Valve
43 — Vaporizer Drain Sight Glass

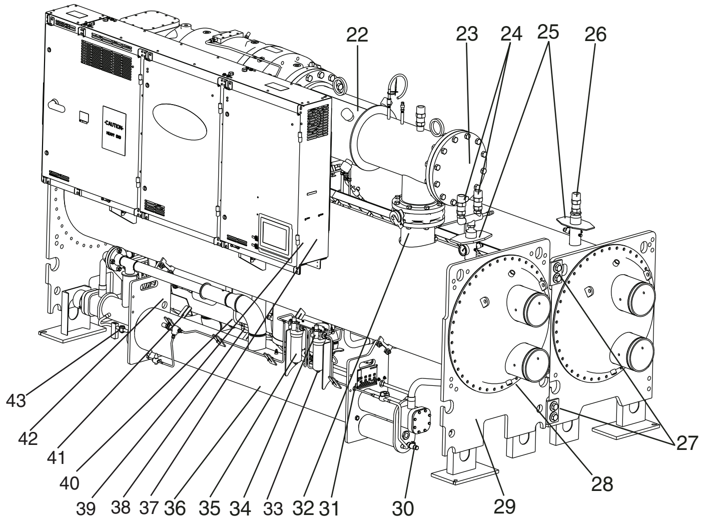


44 — VFD Cold Plate Refrigeration Inlet Connection (Outlet Hidden)
45 — VFD Cold Plate Orifice
46 — Compressor Nameplate
47 — Compressor Lubrication Block
48 — Economizer Muffler
49 — Vaporizer Condenser Gas Isolation Valve
50 — Hot Gas Bypass Isolation and Trim Valve
51 — VFD Cooling Refrigerant Strainer
52 — Cooler Refrigerant Pumpout Valve
53 — ASME Nameplate, Cooler

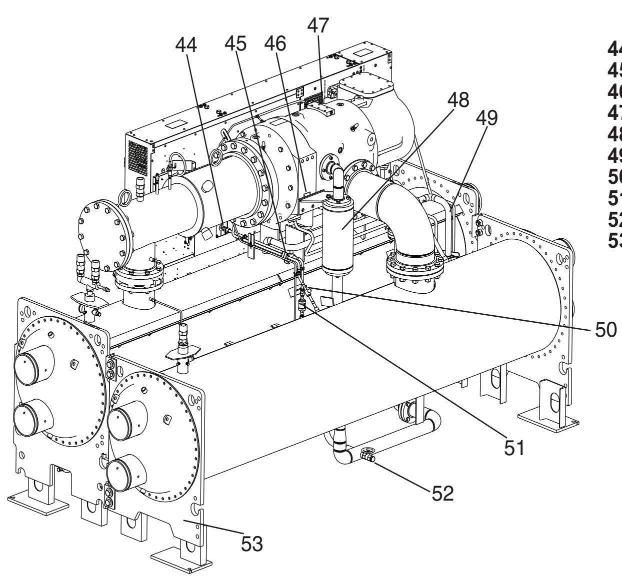
Fig. 3 — Typical 23XRV Components (Units with Q Compressor)



1 — Motor Terminal Cover Plate
2 — Variable Frequency Drive
3 — PIC6 Controller
4 — Discharge Pipe Relief Valve
5 — Condenser
6 — Oil Reclaim Actuator
7 — Vaporizer Sight Glass
8 — Oil Filter Assembly
9 — Oil Sump Temperature
10 — Oil Sump
11 — Condenser Refrigerant Pumpout Valve
12 — Condenser Float Chamber
13 — Cooler Inlet Isolation Valve (Hidden)
14 — ASME Nameplate, Economizer (Hidden)
15 — Oil Sump Heater
16 — Filter Drier
17 — Vaporizer Heater
18 — Condenser Supply/Return End Waterbox
19 — Cooler Supply/Return End Waterbox
20 — Motor Cooling Supply Line
21 — VFD Disconnect

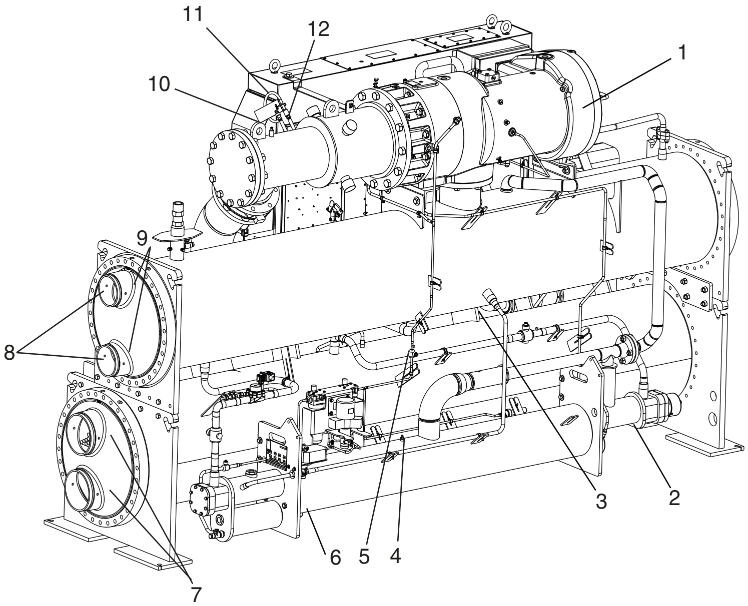


22 — Discharge Pipe
23 — Compressor Discharge Check Valve Access Cover
24 — Condenser Relief Valves
25 — Refrigerant Charging Valves
26 — Cooler Relief Valve
27 — Tubesheet Mounting Brackets
28 — Typical Waterbox Drain Coupling
29 — ASME Nameplate, Condenser
30 — Oil Drain
31 — ASME Nameplate Vaporizer
32 — Discharge Isolation Valve (Option or Accessory)
33 — Suction Oil Filter
34 — Oil Pump
35 — Discharge Oil Filter
36 — Oil Sump Sight Glass
37 — Refrigeration Machine Nameplate
38 — Filter Drier Isolation Valve with Schrader Valve
39 — Machine Electrical Data Nameplate
40 — Economizer
41 — Motor Cooling Sight Glass
42 — Motor Cooling Isolation Valve
43 — Vaporizer Drain Sight Glass

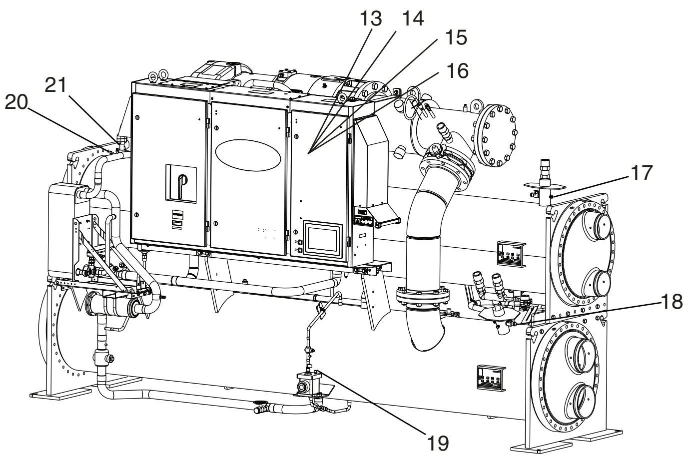


44 — VFD Cold Plate Refrigeration Inlet Connection (Outlet Hidden)
45 — VFD Cold Plate Orifice
46 — Compressor Nameplate
47 — Compressor Lubrication Block
48 — Economizer Muffler
49 — Vaporizer Condenser Gas Isolation Valve
50 — Hot Gas Bypass Isolation and Trim Valve
51 — VFD Cooling Refrigerant Strainer
52 — Cooler Refrigerant Pumpout Valve
53 — ASME Nameplate, Cooler

Fig. 4 — Typical 23XRV Components (Units with R Compressor)

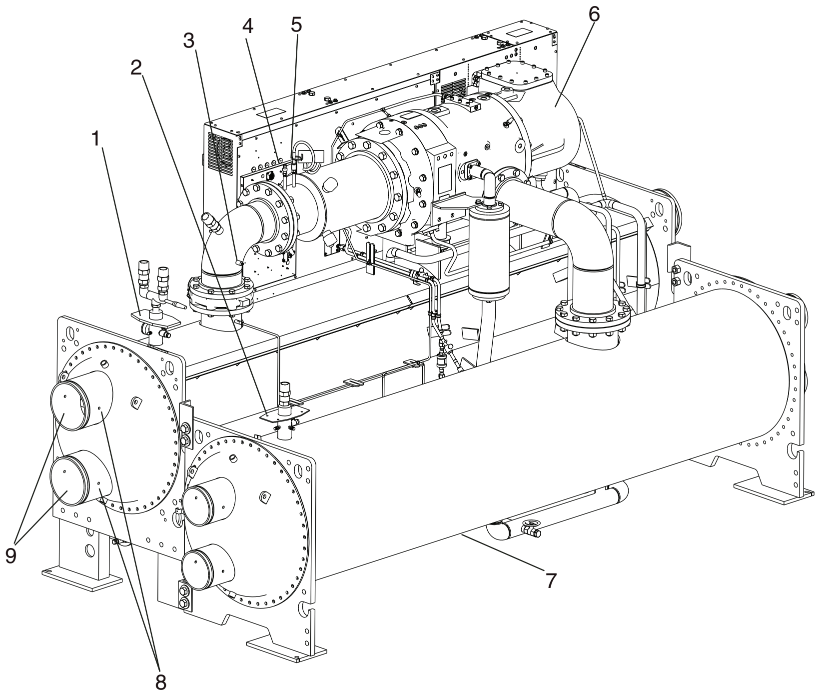


1 — Compressor Motor Winding Temperature (Hidden)
2 — Vaporizer Temperature
3 — Evaporator Return Liquid Temperature (Hidden)
4 — Oil Sump Pressure
5 — Oil Sump Temperature
6 — Supply Oil Pressure
7 — Condenser Liquid Temperature (Hidden)
8 — Evaporator Liquid Flow (Optional)
9 — Evaporator Liquid Temperature (Hidden)
10 — Compressor Discharge Temperature
11 — Compressor Discharge Pressure
12 — Compressor Discharge High Pressure Switch

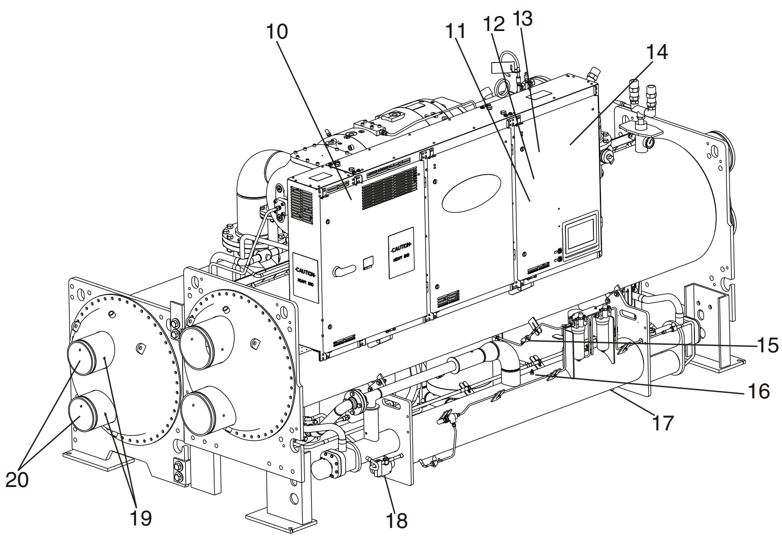


13 — Inductor Temperature Switch (Inside VFD Enclosure)
14 — VFD Rectifier Temperature (Inside Power Module)
15 — VFD Heat Sink Temperature (Inside VFD Enclosure)
16 — VFD Inverter Temperature (Inside Power Module)
17 — Evaporator Temperature
18 — Condenser Pressure
19 — Condenser Liquid Level Sensor
20 — Economizer Pressure (Optional)
21 — Economizer Temperature (Optional)

Fig. 5 — Typical 23XRV Installation — Sensor Locations (Units with P Compressor)

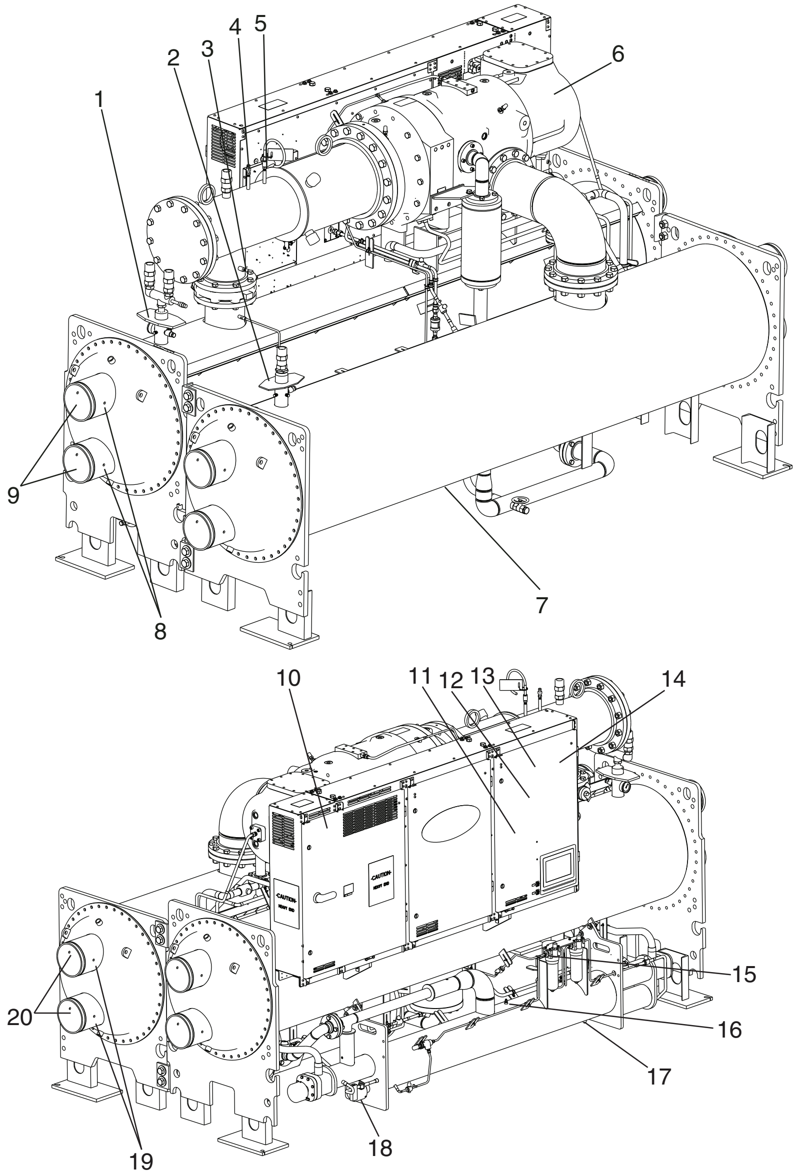


1 — Condenser Pressure
2 — Evaporator Pressure
3 — Compressor Discharge Temperature
4 — Compressor Discharge Pressure
5 — Compressor Discharge High Pressure Switch
6 — Compressor Motor Winding Temperature (Hidden)
7 — Evaporator Refrigerant Liquid Temperature (Hidden)
8 — Condenser Liquid Temperature
9 — Condenser Liquid Flow (Optional)



10 — Inductor Temperature Switch (Inside VFD Enclosure)
11 — VFD Rectifier Temperature (Inside Power Module)
12 — VFD Cold Plate Temperature (Inside VFD Enclosure)
13 — VFD Inverter Temperature (Inside Power Module)
14 — Humidity Sensor (Inside LF2 VFD Enclosure)
15 — Oil Pressure Leaving Filter (Hidden)
16 — Oil Sump Pressure (Hidden)
17 — Oil Sump Temperature (Hidden)
18 — Vaporizer Temperature
19 — Evaporator Liquid Temperature
20 — Evaporator Liquid Flow (Optional)

Fig. 6 — Typical 23XRV Installation — Sensor Locations (Units with Q Compressor)



1 — Condenser Pressure
2 — Evaporator Pressure
3 — Compressor Discharge Temperature
4 — Compressor Discharge Pressure
5 — Compressor Discharge High Pressure Switch
6 — Compressor Motor Winding Temperature (Hidden)
7 — Evaporator Refrigerant Liquid Temperature (Hidden)
8 — Condenser Liquid Temperature
9 — Condenser Liquid Flow (Optional)

10 — Inductor Temperature Switch (Inside VFD Enclosure)
11 — VFD Rectifier Temperature (Inside Power Module)
12 — VFD Cold Plate Temperature (Inside VFD Enclosure)
13 — VFD Inverter Temperature (Inside Power Module)
14 — Humidity Sensor (Inside LF2 VFD Enclosure)
15 — Oil Pressure Leaving Filter
16 — Oil Sump Pressure (Hidden)
17 — Oil Sump Temperature (Hidden)
18 — Vaporizer Temperature
19 — Evaporator Liquid Temperature
20 — Evaporator Liquid Flow (Optional)

Fig. 7 — Typical 23XRV Installation — Sensor Locations (Units with R Compressor)

Cooler

The cooler (also known as the evaporator) is maintained at low temperature/pressure so that evaporating refrigerant can remove heat from the liquid flowing through its internal tubes.

Condenser

This vessel is located underneath the compressor. The condenser operates at a higher temperature/pressure than the cooler and has liquid flowing through its internal tubes to remove heat from the refrigerant.

Motor-Compressor

The motor-compressor maintains system temperature/pressure differences and moves the heat carrying refrigerant from the cooler to the condenser. See Fig. 8.

Muffler

The muffler provides acoustical attenuation. A check valve just downstream of the muffler prevents reverse compressor rotation during shutdown.

Control Center

The control center is the user interface for controlling the chiller and regulating the chiller's capacity to maintain the proper chilled liquid temperature.

The control center:

- Registers cooler, condenser, and lubricating system pressures
- Shows chiller operating condition and alarm shutdown conditions
- Records the total chiller operating hours, starts, and the number of hours the chiller has been currently running
- Sequences chiller start, stop, and recycle under microprocessor control
- Provides access to other Carrier Comfort Network® devices
- Provides machine protection

Storage Vessel (Optional)

Two sizes of storage vessels are available. The vessels have double relief valves, a magnetically coupled dial-type refrigerant level gage, a 1-in. FPT drain valve, and a 1/2-in. male flare vapor connection for the pumpout unit. A 30-in.-0-400 psi (–101-0-2750 kPa) gage is also supplied with each unit.

NOTE: If a storage vessel is not used at the jobsite, factory-installed optional isolation valves may be used to isolate the chiller charge in either the cooler or condenser. An optional pumpout compressor system is used to transfer refrigerant from vessel to vessel.

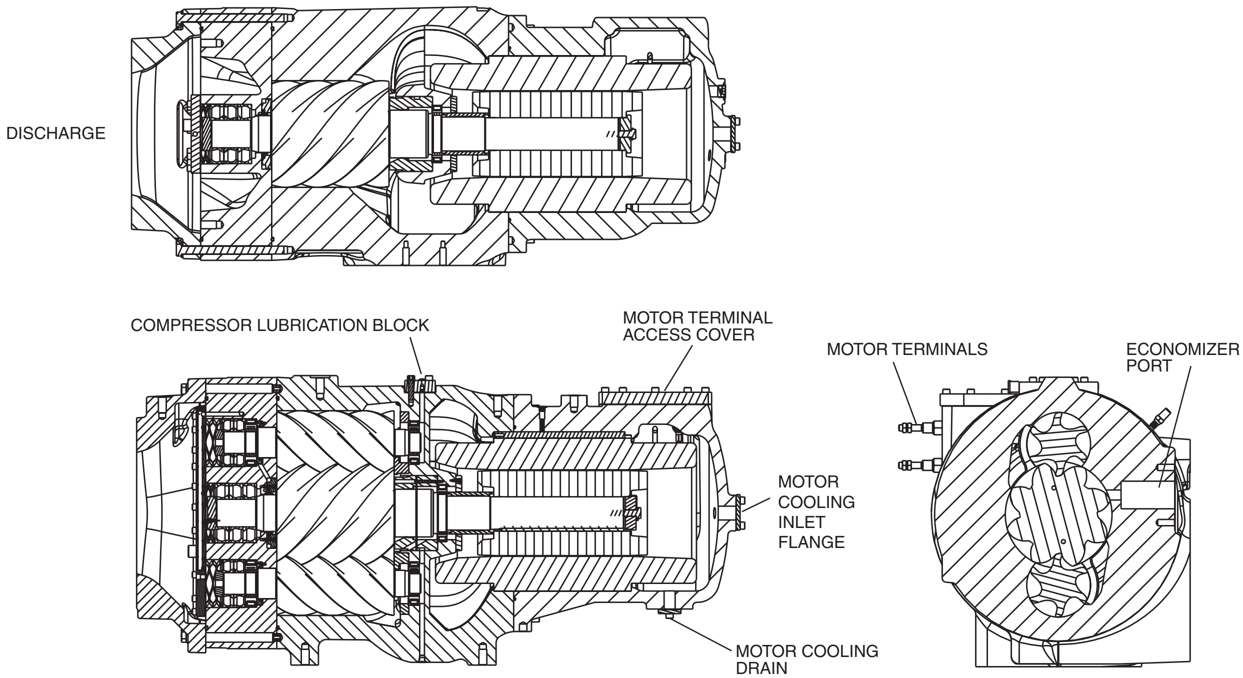


Fig. 8 — Compressor (Typical, R Compressor Shown)

REFRIGERATION CYCLE

The compressor continuously draws refrigerant vapor from the cooler. As the compressor suction reduces the pressure in the cooler, 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 liquid flowing through the cooler tubes. With heat energy removed, the liquid becomes cold enough for use in an air-conditioning circuit or process liquid cooling.

After absorbing heat from the chilled liquid, the refrigerant vapor is compressed. Compression adds still more energy, and the refrigerant is quite warm (typically 90 to 130°F [32 to 54°C]) when it is discharged from compressor into condenser.

Relatively cool (typically 65 to 85°F [18 to 29°C]) liquid flowing into the condenser tubes removes heat from the refrigerant and the vapor condenses to liquid, refrigerant.

For heat exchangers frame sizes 3-5, the liquid refrigerant in the condenser passes through orifices into the FLASC (Flash Subcooler) chamber (Fig. 9). Since the FLASC chamber is at a lower pressure, part of the liquid refrigerant flashes to vapor, thereby cooling the remaining liquid. The FLASC vapor is recondensed on the tubes which are cooled by entering condenser liquid. The liquid then passes through a float valve assembly which forms a liquid seal to keep FLASC chamber vapor from entering the cooler.

Heat exchanger frame sizes A and B incorporate a sensible subcooler instead of the FLASC, and the liquid seal and throttle level control are performed by an electronic expansion valve instead of a float valve. See Fig. 10.

An optional economizer can be installed between the condenser and cooler. Pressure in this chamber is intermediate between condenser and cooler pressures. At this lower pressure, some of the liquid refrigerant flashes to gas, cooling the remaining liquid. For heat exchanger frame sizes 3-5, an in-line orifice on the economizer drain flange meters the refrigerant liquid into the cooler. For size A and B heat exchangers, the flash gas to the compressor is produced in a brazed plate heat exchanger where some of the condenser liquid prior to throttling is diverted through the economizer electronic expansion valve (EXV). The EXV control logic is based on economizer saturated temperature, superheat and compressor speed. The flash gas, having absorbed heat, is returned directly to the compressor at a point after suction cutoff (Fig. 11 and 12). Here it is mixed with gas from the suction cut-off point to produce an increase in the mass flow of refrigerant transported and compressed without either an increase in suction volume or a change in suction temperature.

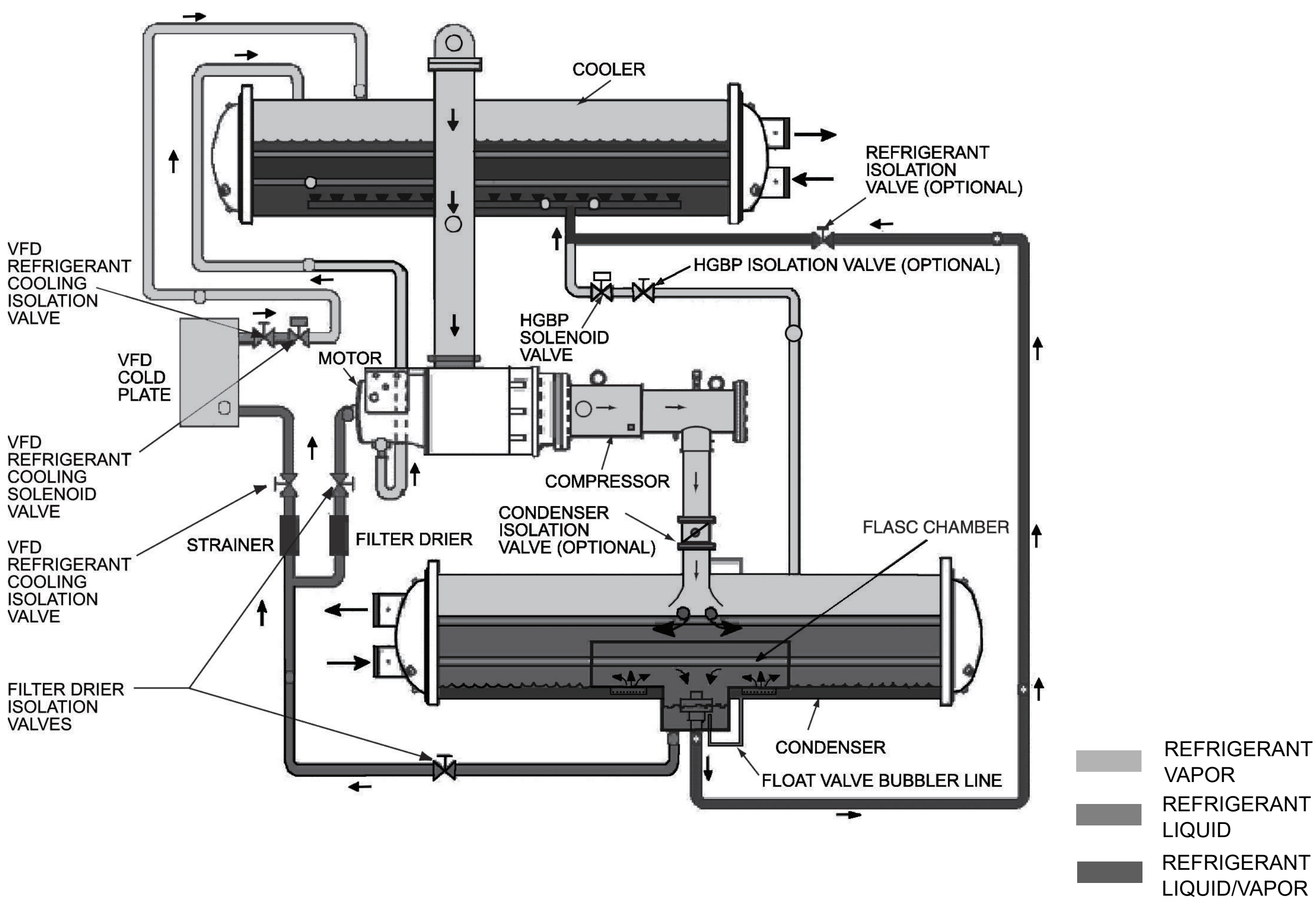


Fig. 9 — Refrigerant Flow Schematic, Q and R Compressors (Without Optional Flash Economizer)

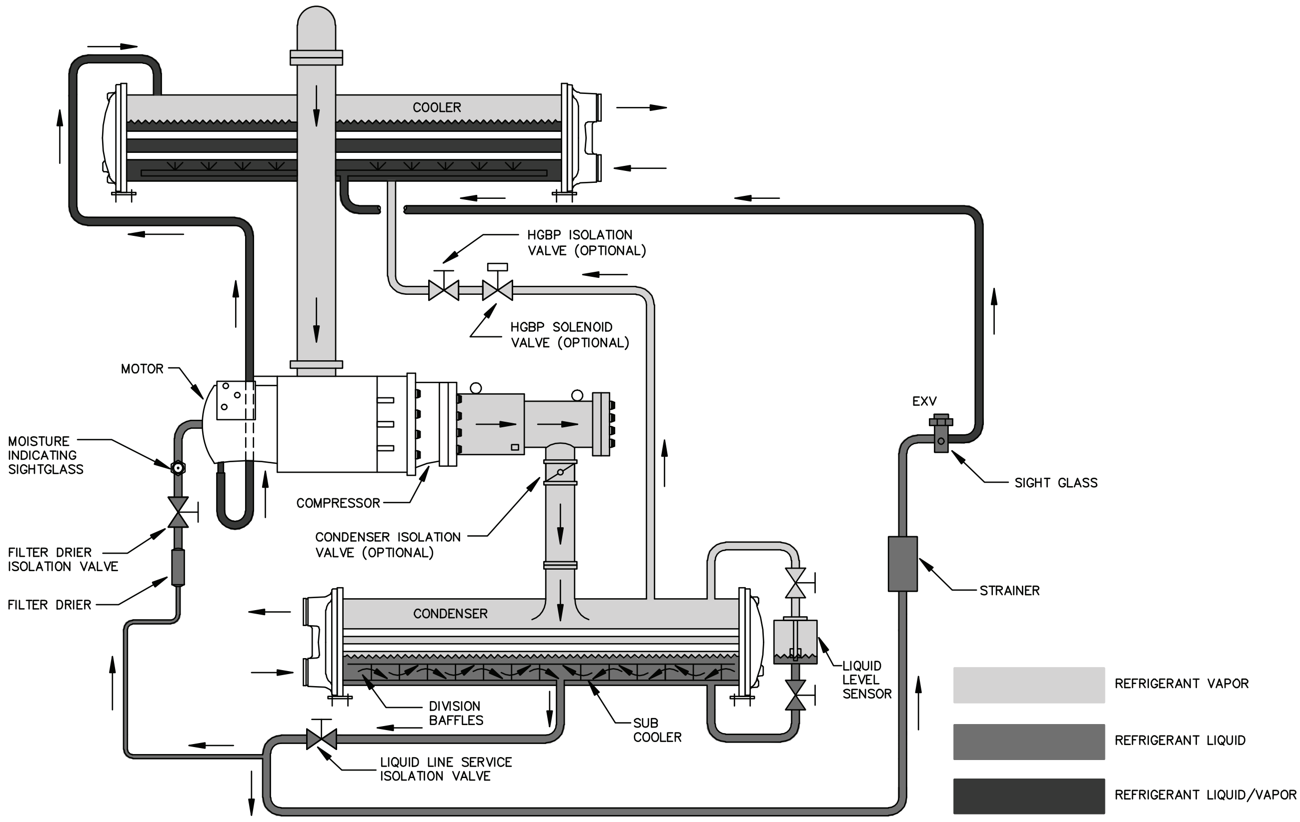


Fig. 10 — Refrigerant Flow Schematic, P Compressor (Without Optional Economizer)

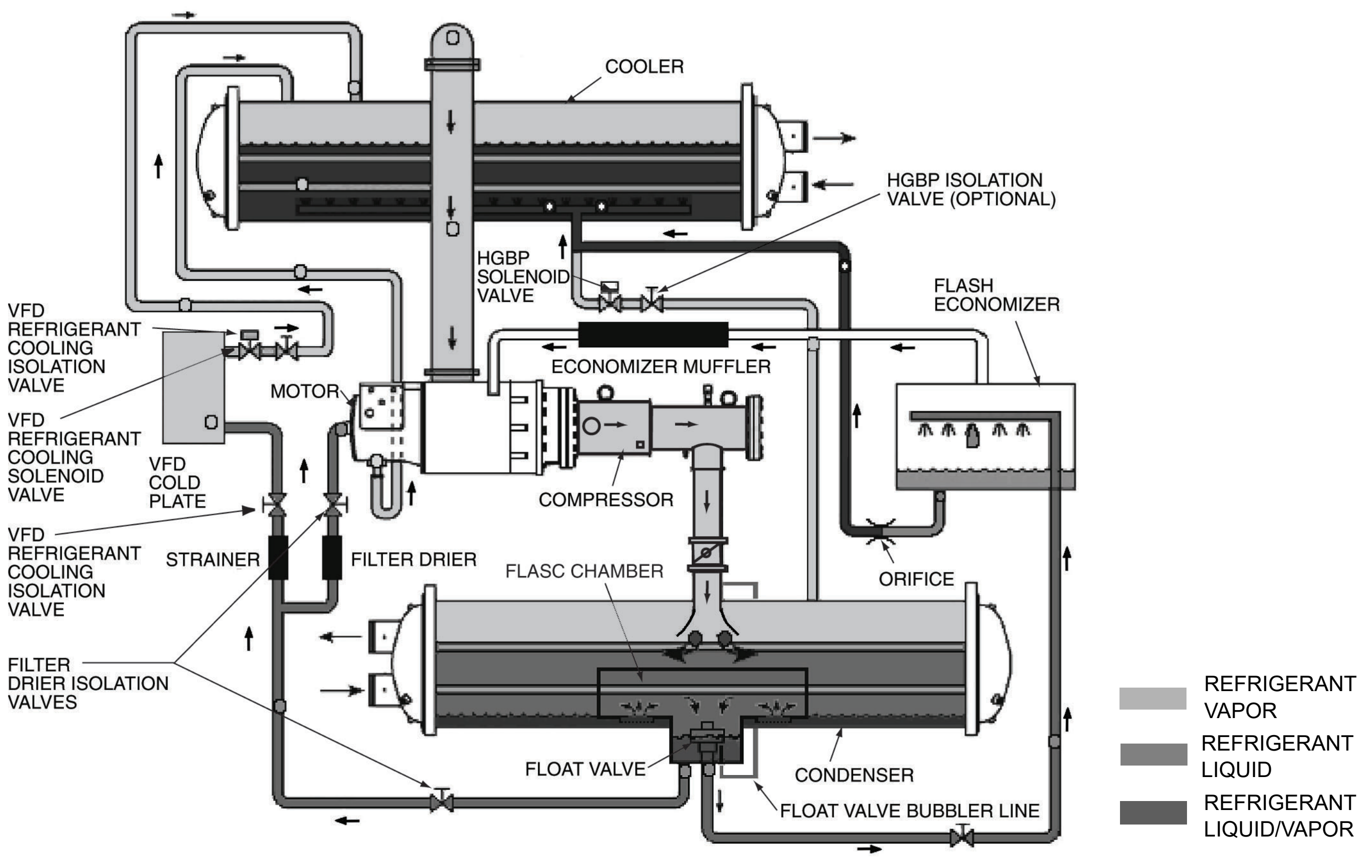


Fig. 11 — Refrigerant Flow Schematic, Q and R Compressors (With Optional Flash Economizer)

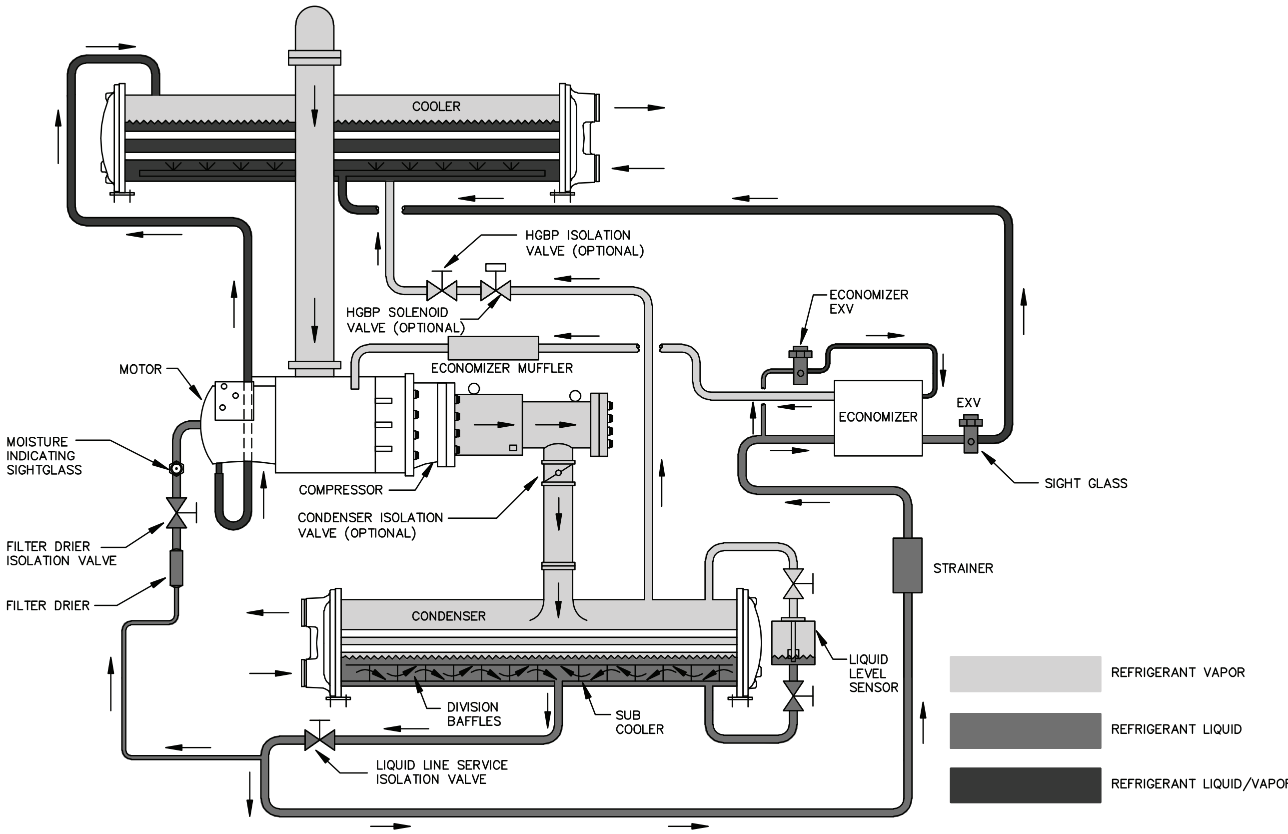


Fig. 12 — Refrigerant Flow Schematic, P Compressor (With Optional Economizer)

MOTOR COOLING CYCLE

For Q and R compressors, one half of the motor is cooled by suction gas while the other half is cooled by liquid refrigerant taken from the bottom of the condenser vessel. The P compressor has two spray nozzles that cool the motor by injecting liquid refrigerant. The flow of liquid refrigerant is maintained by the pressure differential that exists due to compressor operation. The refrigerant flows through an isolation valve, in-line filter/drier, and a sight glass/moisture indicator (dry-eye), into the motor through the motor spray nozzle. See Fig. 9-12.

> IMPORTANT: To avoid adverse effects on chiller operation, consideration must be made to condenser water temperature control. Consult the Chiller Builder for required steady state operational limits. Inverted start conditions are acceptable for short durations; generally, for periods exceeding 5 minutes, special control strategy solutions are to be used to allow the chiller to build minimum refrigerant pressure differential (and thereby adequate equipment cooling).

The motor spray nozzle is orificed to control refrigerant flow through the gaps between the rotor and stator. The refrigerant collects in the bottom of the motor casing and then drains into the cooler through the motor cooling drain line.

The motor is protected by a temperature sensor and a temperature switch embedded in the stator windings. If motor thermistor temperature exceeds 197°F (88°C) the override function will start unloading the compressor. If the motor winding temperature rises above the 200°F (93°C) safety limit, the compressor will shut down.

LUBRICATION CYCLE

Summary

The 23XRV chiller requires an oil pump. Oil flow is provided by a magnetically coupled, motor-driven oil pump. Oil flows through the oil filter into the compressor rotors and bearings. The cycle is referred to as a “low side” oil system. See Fig. 13.

Details

The oil system:

- Lubricates the roller bearings which support the male and female rotors, and the ball bearings of the 23XRV compressor.
- Lubricates the male and female rotors.

Oil is charged into the system through a hand valve located on the bottom of the oil sump. Sight glasses on the oil sump permit oil level observation. When the compressor is shut down, an oil level should be visible in the oil sump sight glass. During operation, the oil level should always be visible in the oil sump sight glass. Approximately 10 gal. (37.9 L) of oil is charged into the sump.

Oil from the compressor bearing drain is drained directly into the oil sump. Refrigerant is driven from the oil as it flows around the oil sump heater and into the strainer housing. The oil pump draws the oil through a strainer and forces it through an oil filter.

The filter housing is capable of being isolated by upstream and downstream valves to permit filter replacement. An oil pressure regulator valve directs excessive oil back into the oil sump. Oil supplied to the compressor is monitored by an oil pressure sensor. The Oil Delta P value is equal to the difference between the oil pressure leaving the filter and the oil sump pressure. It is read directly from the PIC6 home screen.

Oil is supplied to the compressor through two separate inlets. One inlet leads to the suction bearings, the other leads to the discharge bearings. Most of the oil drains back into the sump while a small amount is used to lubricate the rotors. Rotor lubrication oil leaves the compressor mixed with the compressed discharge refrigerant vapor.

The oil sump contains temperature and pressure sensors and an oil heater. (In some cases a two-stage heater is supplied, with 500 W for the first stage and 1000 W for the second stage.) The oil sump is vented to the compressor suction to minimize the amount of refrigerant absorbed by the oil. Oil Sump T is displayed on the PIC6 home screen. The oil sump pressure is used to calculate the Oil Delta P value.

Operating Oil Delta P must be at least 18 psid (124 kPa) after the Oil Pressure Verify Time has elapsed. Under normal full load conditions, oil pressure is typically 20 to 28 psid (138 to 193 kPa). If sufficient oil pressure is not established or maintained the chiller will shut down. An oil pressure delta P sensor fault will be declared if the OIL DELTA P is not less than 4 psid (27.6 kPa) prior to start-up.

If the oil pressure falls below the values specified in Table 1 during start-up, the PIC6 control will shut down the chiller.

Table 1 — Oil Pressure Requirements

TIME (SEC)	MINIMUM START-UP OIL PRESSURE REQUIREMENT R-134a/R-513A	
	PSID	kPa
Before Oil Pump On	< 6	41.4
After Oil Press Verify Time	18	124
During Start/Run	15	103

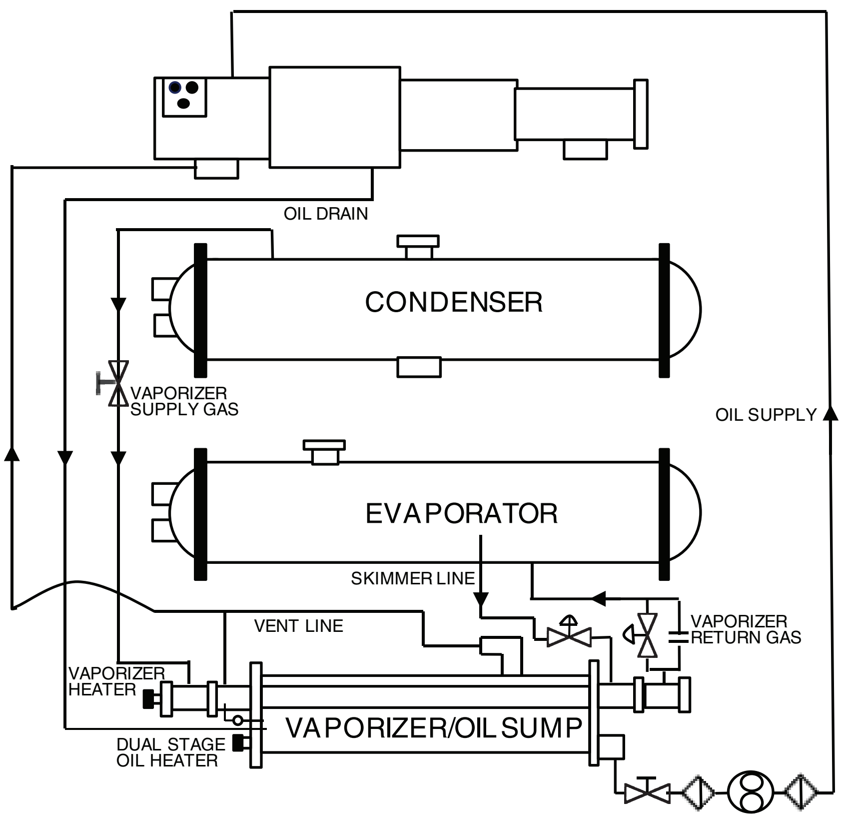


Fig. 13 — Oil Flow Schematic

Oil Reclaim System

The oil reclaim system recovers oil from the cooler, removes the refrigerant, filters and returns the oil back to the compressor. One or more oil reclaim nozzles are positioned along the length of the cooler to draw the oil and refrigerant mixture from the surface of the refrigerant level. The mixture passes through an oil reclaim modulating valve and into the vaporizer. The flow of refrigerant and oil is regulated to prevent the vaporizer from becoming overloaded with liquid refrigerant. The modulating valve position is adjusted in accordance with the difference between the Vaporizer Temp and the Evap Sat Temp. The oil reclaim modulating valve closes when chiller is shut down to prevent vaporizer and oil sump from being flooded with refrigerant. Do not manually open the oil reclaim modulating valve when the chiller is shut down. Doing so will severely degrade the viscosity of the oil in the sump. Flow of refrigerant and oil from the cooler can be observed through a sight glass on top of the vaporizer.

Viscosity of compressor oil is significantly reduced when it absorbs refrigerant. A combination of heat and low pressure is used to vaporize refrigerant that has been absorbed by the oil mixture reclaimed from the cooler. Condenser gas is used to warm the refrigerant and oil mixture in the vaporizer. Warm refrigerant is bled from the condenser top, directed through tubes that line the bottom of the vaporizer, and discharged into the cooler. A 1500 W electric heater provides supplemental heat to the vaporizer when the compressor is operating at lower loads. Refrigerant boiled out of the reclaimed mixture is vented to the compressor suction. The concentrated oil mixture drains out of the vaporizer, through a sight glass, past the vaporizer temperature sensor, and into the oil sump. The oil sump heaters maintain the temperature of the reclaimed oil and the oil returned from the compressor at approximately 90°F (32.2°C) when the chiller is running and 140°F (60°C) when the chiller is off. The oil sump is also vented to compressor suction to increase oil viscosity by boiling off additional refrigerant.

Capacity Control

The PIC6 controls provide chilled liquid temperature control by modulating the frequency of the power delivered by the VFD to the compressor motor. The compressor speed is adjusted in response to the difference between the *CONTROL POINT* and the *LEAVING CHILL WATER TEMP* or *ENT CHILL WATER TEMP* temperatures.

The PIC6 controls respond to the difference between the *CONTROL POINT* and *LEAVING CHILL WATER TEMP* temperatures when the *EWT CONTROL OPTION* is DISABLED.

The PIC6 controls respond to the difference between the *CONTROL POINT* and *ENT CHILL WATER TEMP* temperatures when the *EWT CONTROL OPTION* is ENABLED.

The chiller capacity is controlled by varying the *TGT. VFD SPEED* from 0% to 100%. The PIC6 controls monitor the compressor oil properties and set a Compressor Minimum Speed to ensure sufficient compressor bearing lubrication under all operating conditions. It will limit the circuit capacity to Circuit Capacity Limit% in the General Configuration Table.

CONTROLS

Definitions

ANALOG SIGNAL

An analog signal varies in proportion to the monitored source. It quantifies values between operating limits. (Example: A temperature sensor is an analog device because its resistance changes in proportion to the temperature, generating many values.)

DISCRETE SIGNAL

A discrete signal is a two-position representation of the value of a monitored source. (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 23XRV hermetic screw liquid chiller contains a touch screen 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 load while providing state-of-the-art chiller protection. The system controls cooling capacity within the set point plus the deadband by sensing the leaving chilled liquid or brine temperature (see Fig. 14 and 15) and regulating the compressor speed. Reducing the compressor speed decreases the volume flow rate of refrigerant through the compressor. Chiller protection is provided by the PIC6 processor, which monitors the digital and analog inputs and executes capacity overrides or safety shutdowns, if required.

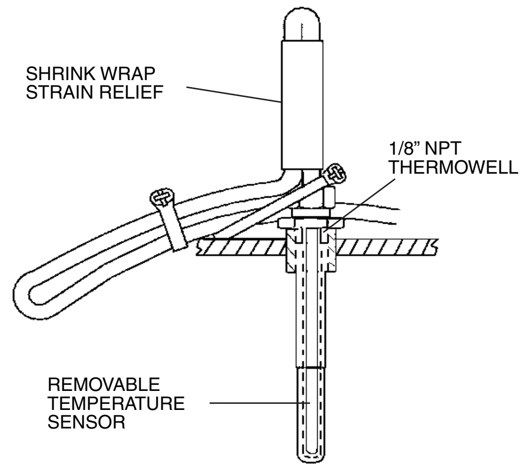


Fig. 14 — Control Sensors (Temperature)

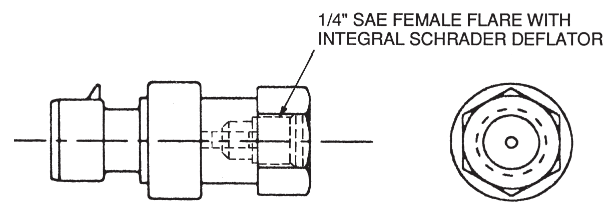


Fig. 15 — Control Sensors (Pressure Transducers)

PIC6 System Components

The chiller control system is called PIC6. See Fig. 16-21 and Table 2. The PIC6 system controls the chiller by monitoring all operating conditions. The PIC6 control system can diagnose a problem and let the operator know what the problem is and what to check. It promptly adjusts compressor speed to maintain leaving chilled liquid temperature. It 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. It also regulates the oil heater and regulates the hot gas bypass valve, if installed. The PIC6 control system provides critical protection for the compressor motor and control of the variable frequency drive.

The PIC6 control system supports native CCN and LEN protocols and can communicate via CCN to other PIC I, PIC II, PIC III, and PIC6 equipped chillers or other CCN devices. PIC6 has native capability to communicate with building automation system via BACnet[1] MS/TP, BACnet/IP, Modbus[1] RTU, and Modbus TCP/IP. The PIC6 controls are housed inside the control center enclosure. See Fig. 2-4. The component names are listed in Table 2.

1. Third-party trademarks and logos are the property of their respective owners.

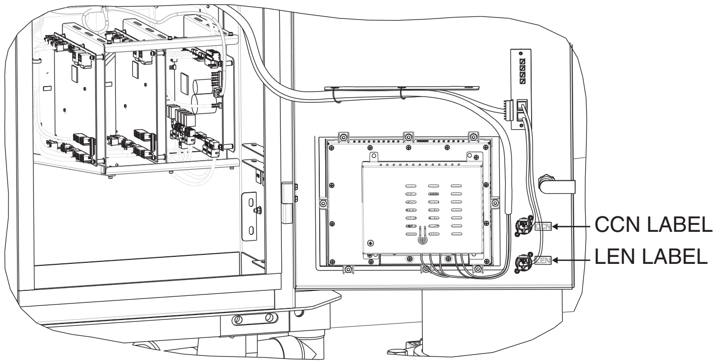
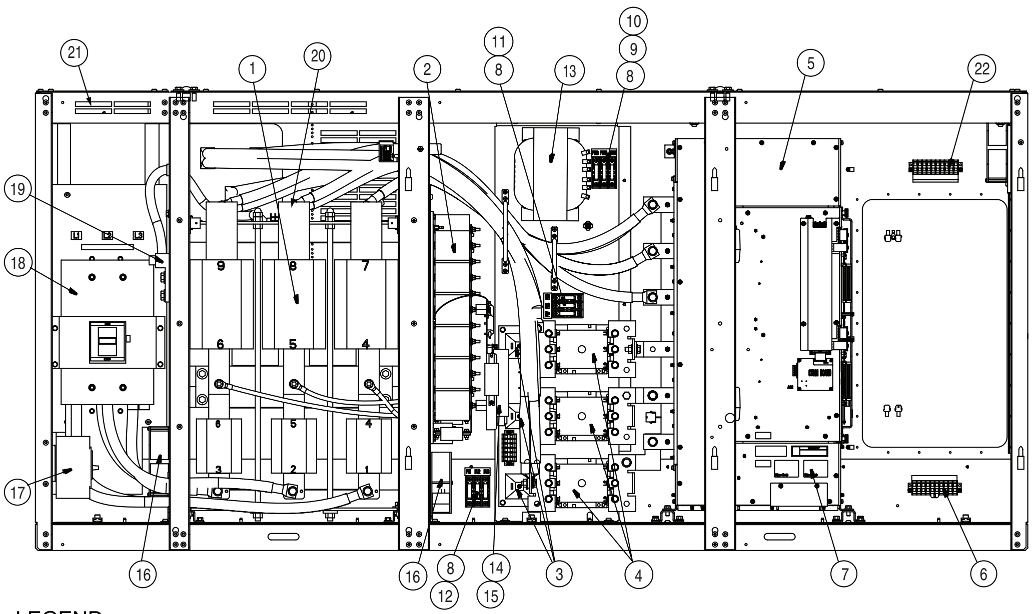


Fig. 16 — PIC6 Wiring

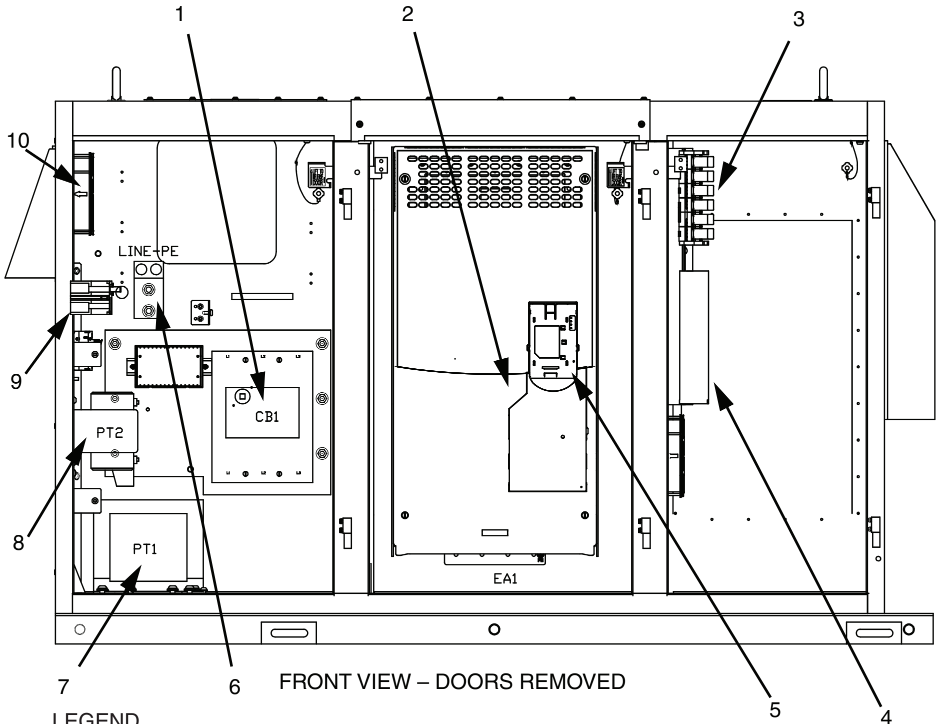


FUSE REF	FUSE DESCRIPTION
FU1	CLASS CC, 1A/600V
FU2	CLASS CC, 1A/600V
FU3	CLASS CC, 1A/600V
FU4	150A/600V
FU5	150A/600V
FU6	150A/600V
FU7	CLASS CC, 20A/600V
FU8	CLASS CC, 20A/600V
FU9	CLASS CC, 20A/600V
FU10	CLASS CC, 5A/600V
FU11A&B	CLASS CC, 25A/600V
A2–F1	3AG SLO–BLO

LEGEND

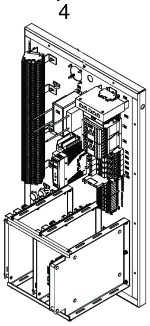
1 — Input Inductor Assembly
2 — Capacitor Bank Assembly
3 — Pre-Charge Resistor Assembly
4 — AC Contactor (3)
5 — Power Module Assembly
6 — Terminal Block, 10-Position (Extra Low Voltage)
7 — Power Module Assembly
8 — Fuse Block, 30A, 600V, Class CC
9 — Fuse, Class CC, 600V, 25A (2)
10 — Fuse, Class CC, 600V, 5A (1)
11 — Fuse, Class CC, 600V, 20A (3)
12 — Fuse, Class CC, 600V, 1A (3)
13 — Transformer, 3kVA
14 — Line Sync PC Board Assembly
15 — Line Sync Board Cover
16 — Fan, 115V (3)
17 — Control Power Circuit Breaker, 600V, 25A
18 — Circuit Breaker, 600V
19 — Lug, Ground, 2-600 MCM
20 — Inductor Overtemperature Switch (Hidden)
21 — Input Power Wiring Access Panel
22 — Terminal Block (Hazardous voltage)

Fig. 17 — Control Center VFD Input Components (LF-2 VFD)



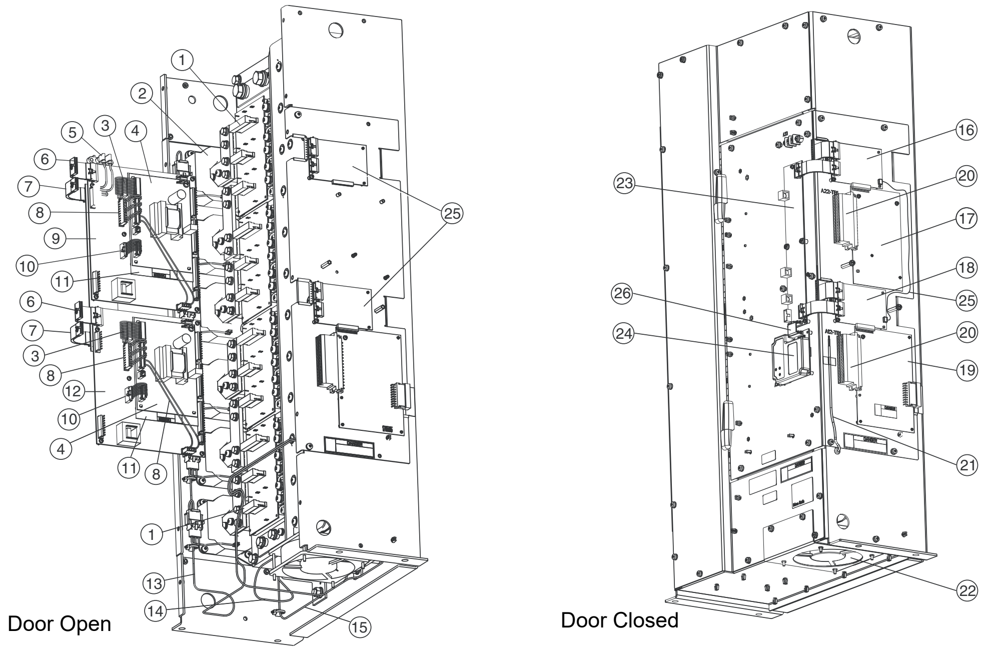
LEGEND

1 — Input Circuit Breaker
2 — Power Module
3 — Control Relays (CR1 - CR6)
4 — Location of Control Panel Assembly - see expanded view
5 — Drive Status Indicator
6 — Ground Lug
7 — 120V Control Transformer
8 — 120V Vaporizer Heater Transformer
9 — 15 Amp Control Circuit Breaker
10 — Cooling Fan



Control Panel Assembly Expanded View

Fig. 18 — Control Center VFD Input Components (Std Tier VFD)



LEGEND

1 — Wire Harness Assembly, Gate Driver
2 — Current Feedback Device, 1000 A
3 — Wire Harness Assembly, Power Supply, Logic
4 — 80 W Power Supply Assembly
5 — Terminal Block, 2-Position
6 — Cable Assembly, 40-Pin
7 — Cable Assembly, 30-Pin
8 — Wire Harness Assembly, Power Supply, Upper Gate
9 — Inverter Power Interface Assembly
10 — Wire Harness Assembly, Power Supply, Lower Gate
11 — Insulation Sheet
12 — Rectifier Power Interface Assembly
13 — Wire Harness Assembly, Current Feedback Device
14 — Wire Harness Assembly, DC Bus Bleeder Resistors
15 — Wire Harness Assembly, Line Sync
16 — Inverter Control Assembly[a]
17 — Standard I/O Option, 24 V Assembly
18 — Rectifier Control Assembly[a]
19 — AC Line I/O Assembly
20 — Connector, Terminal Block, 32-Pin
21 — NTC Assembly
22 — Internal Fan
23 — DPI Communications Interface Assembly
24 — RS-485 Communications Assembly (VFD Gateway)
25 — Wire Harness Assembly, Control Sync
26 — Cable Assembly, 20-pin

NOTE(S):

a. The inverter control assembly (item 16) and rectifier control assembly (item 18) are physically similar but are loaded with different software. These boards are NOT interchangeable

Fig. 19 — Power Module Components (LF2 shown)

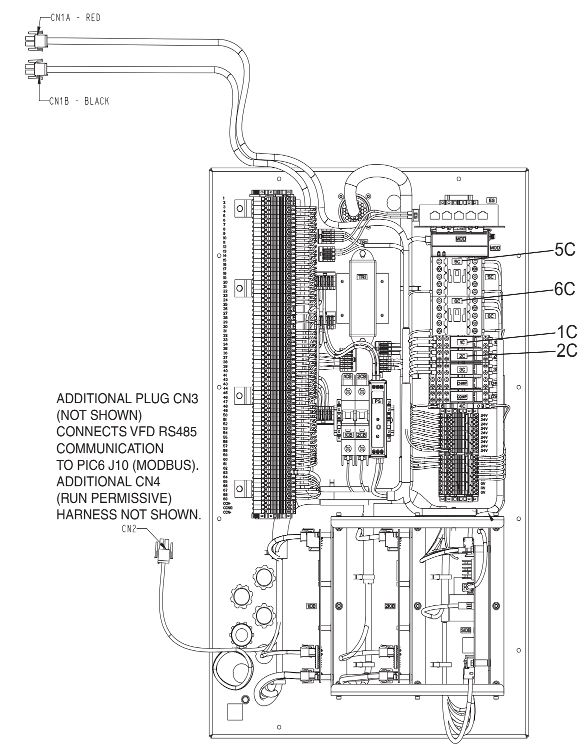


Fig. 20 — Control Panel (TB1-15,16 is the high pressure switch)

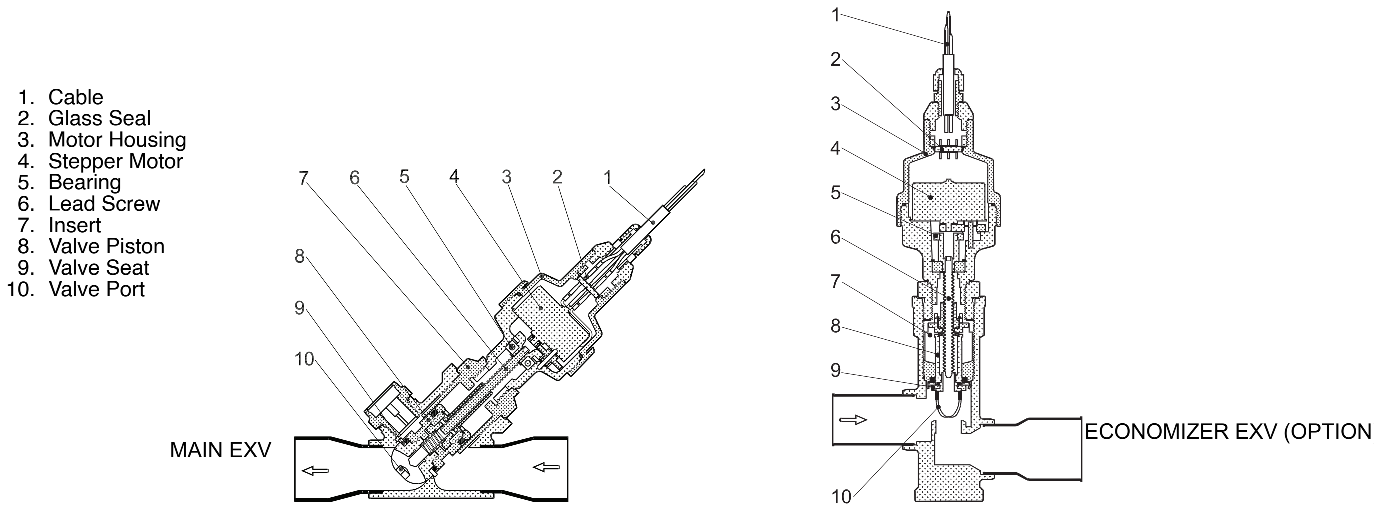


Fig. 21 — Cutaway Views of Electronic Expansion Valves (EXV) (P Compressor Only)

Table 2 — Major PIC6 Control Components and Panel Locations

PIC6 COMPONENT	PANEL LOCATION
HMI (human-machine interface) and Display	Control Center Door
VFD Power Module	Inside Control Center
Starfire Input/Output Board (SIOB)	Control Panel
Input/Output Board (IOB)	Control Panel
Oil Heater Contactor, 500W (1C)	Control Panel
Oil Heater Contactor (2nd stage), 1000 W (5C)	Control Panel
Oil Pump Contactor (2C)	Control Panel
Hot Gas Bypass Relay (3C) (Optional)	Control Panel
Control Transformers (TR1)	Control Panel
Control Transformer Circuit Breaker (CB-1)	Control Panel
Temperature Sensors	See Fig. 5-7 and 14
Condenser Level Sensor	See Fig. 5
Pressure Transducers	See Fig. 5-7 and 15
Vaporizer Heater Contactor (6C)	Control Panel
Auxiliary Control Module	Near PD-4 EXV Board

PIC6 HMI

The PIC6 HMI is the “brain” of the PIC6 control system. This module contains all the primary software needed to control the chiller. The HMI is the input center for all local chiller set points, schedules, configurable functions, and options. The HMI is a touchscreen controller and is mounted to the inside of the control panel door near the bottom right of the enclosure (when facing the unit and door is closed). See Fig. 2-4 and Fig. 16.

INPUT OUTPUT BOARDS (IOB)

The 23XRVchillder has two IOBs. The 1IOB is the first board from the left, followed by 2IOB. The IOBs functions as the input and output interface for the HMI.

STARFIRE INPUT OUTPUT BOARD (SIOB)

The SIOB card follows the 2IOB. It provides control output signals and control input signals for the HMI to process. The SIOB board contains all EXV outputs.

This module is located on the control panel in the control center. Both the SIOB and the IOBs provide the input and outputs necessary to control the chiller. These modules monitor refrigerant pressure, entering and leaving liquid temperatures and pressures, and outputs control for the oil reclaim valve, oil heaters, and oil pump. The SIOB and IOBs are the connection point for optional demand limit, automatic chilled liquid reset, 4 to 20 mA kW output, remote temperature reset, and refrigerant leak sensor.

FIELD WIRING TERMINAL BLOCK (7TB)

Key inputs and outputs are terminated at the field wiring terminal block (7TB). 7TB contains low voltage input / outputs such as remote start contact, spare safety, 4-20 mA head pressure output, flow switch inputs, Chiller Run Status, pressure options etc. See wiring diagram for specific terminations.

VFD POWER MODULE

This module is located in the control center. The power module converts AC power to DC power and manages the pulse-width-modulation signals to the motor for VFD operation based on speed signal from the PIC6 HMI.

VFD GATEWAY MODULE

The VFD Gateway Module translates the protocols between the PIC 6 HMI and VFD. This module is a standard 20-COMM-H RS-485 adapter. Module is set for Modbus RTU communication, 32-bit mode.

OIL HEATER CONTACTOR (1C)

This contactor is located on the control panel (Fig. 20) and operates the heater at 115 V. It is controlled by the PIC6 control system to maintain oil temperature during chiller shutdown or to keep the oil sump temperature at an acceptable level.

OIL PUMP CONTACTOR (2C)

This contactor is located in the control panel (Fig. 20) and operates the oil pump. The oil pump is controlled by the PIC6 to provide oil pressure during pre-lube and when the chiller is starting or running.

HOT GAS BYPASS CONTACTOR RELAY (3C)

This relay, located in the power panel, controls the opening of the hot gas bypass valve. The PIC6 energizes the relay based on hot gas bypass algorithm settings.

SECOND STAGE OIL HEATER CONTACTOR (5C)

This contactor is located in the control panel (Fig. 20), and is activated by PIC6 to maintain oil quality at low temperature.

VAPORIZER HEATER CONTACTOR (6C)

This contactor is located in the control panel (Fig. 20) and energizes the surface mounted heater on the bottom of the vaporizer.

CONTROL TRANSFORMER (TR1)

Transformer TR1 converts incoming control voltage to 24 vac power for the Ethernet switch, SIOB, IOBs, and HMI.

POWER SUPPLY (PS)

The 115VAC to 24VDC power supply provides power to the cellular modem used for remote connectivity of the chiller.

MODEM

The 23XRVchiller with PIC6 controls is provided with a standard remote connectivity option which, when enabled, communicates chiller performance parameters via a cellular modem to the cloud.

ELECTRONIC EXPANSION VALVE (P COMPRESSORS ONLY, HEAT EXCHANGER FRAME SIZE A AND B)

High pressure refrigerant enters the EXV and goes through the variable orifice. Refrigerant flow control for different operating conditions is controlled by an actuator that modulates the valve opening. The stepper motor moves in increments and is controlled by the SIOB module. As the stepper motor rotates, motion is transferred into linear movement by the lead screw. The main EXV stepper motor has 3810 total steps, while the optional economizer EXV has 2625 steps. See Fig. 21.

Main EXV Control

The valve is modulated to achieve the condenser level set point by a continuous loop that compares desired level to sensed level. At initial start-up the valve position is driven to the start position and is held at this position for approximately 2 minutes or as defined by the start delay setting, after which the level control algorithm takes over. After shutdown, the EXV will be driven to the condenser EXV start position which will allow pressure equalization between cooler and condenser.

NOTE: Changing default values associated with the EXV control is not recommended without support from Service Engineering.

Economizer EXV Control (Option)

The economizer EXV is activated at approximately 50% speed. After this, it is controlled to maintain the economizer superheat set point that provides gas flow to the compressor. When it deactivates, or if the Economizer Option is disabled, the valve is fully closed. If the Economizer Option is enabled then the EXV control logic algorithm will be active 5 minutes after completion of startup.

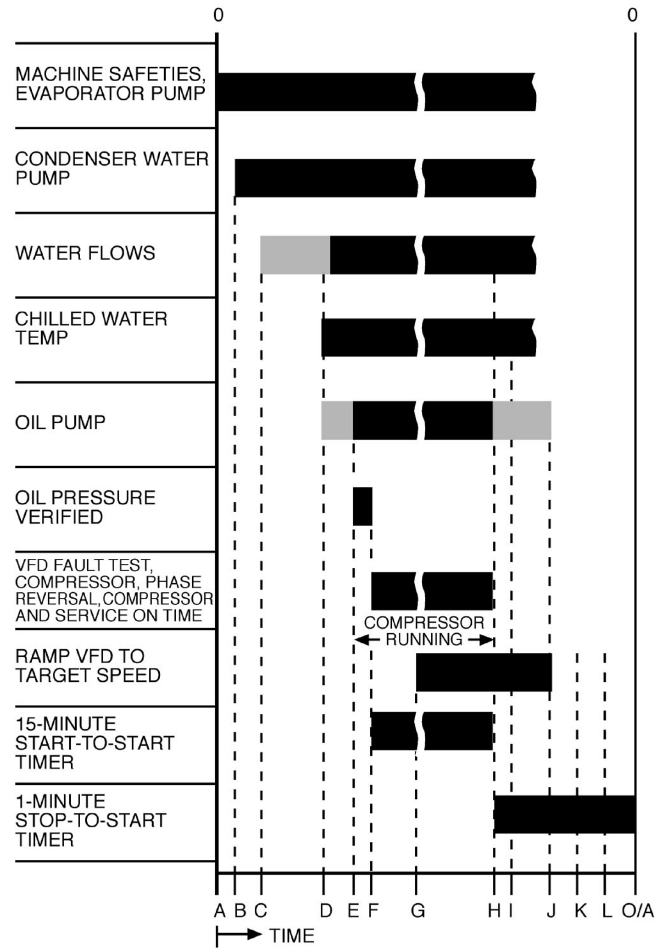
NOTE: Changing default values associated with the EXV control is not recommended without support from Service Engineering.

CONDENSER LEVEL SENSOR (P COMPRESSORS ONLY, HEAT EXCHANGER FRAME SIZE A AND B)

This sensor monitors the liquid level in the condenser and transmits a continuous 0 to 5 v signal proportional to the liquid level in the condenser sensing chamber. See Fig. 5.

START-UP/SHUTDOWN/RECYCLE SEQUENCE

See Fig. 22 for control sequence.



0 — Phase reversal monitored
A — START INITIATED: Pre-start checks are made; evaporator pump started
B — Condenser liquid pump started (5 seconds after A)
C — Liquid flows verified (30 sec to 5 minutes maximum after B)
D — Chilled liquid temperature checked against control point; oil pump on.
E — Oil pressure verified (oil pressure verified 45-300 sec after D).
F — VFD starts; phase reversal conditions monitored; compressor ontime and service ontime start; 15-minute inhibit timer starts (VFD fault tests for 15 sec after F)
G — Verify average current >5% within 15 sec after VFD start, ramp to VFD target speed.
H — Compressor reaches target speed, chiller set to running status
I — Shutdown initiated: Target VFD speed to 0% (or J occurs)
J — Ramp down until percent line current $\leq$ soft stop amps threshold (0 to 60 sec after I)
K — Oil pump relay off (1-20 sec after J)
L — Evaporator pump de-energized (60 sec after K); condenser pump may continue to operate if condenser pressure is high; evaporator pump may continue if in RECYCLE mode
O/A — Restart permitted (both inhibit timers expired) (minimum of 15 minutes after F; minimum of 3 minutes after L)

Fig. 22 — Control Sequence

Local Start/Stop Control

Local start-up (or manual start-up) is initiated by pressing the gray Start/Stop icon on the PIC6 Home Screen. See Fig. 23.

Fig. 23 — Chiller Start/Stop Icon

Activating the Start/Stop icon initiates a screen where chiller start/stop can be configured for Local use or by Auto Start controlled by Network and/or Remote contacts. The type of remote control can be set in the Configure Startup Options. User login or higher is required. See Fig. 24.

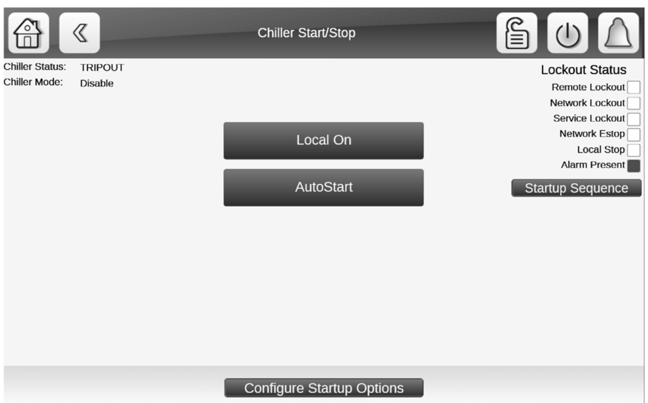


Fig. 24 — Local On

Unit can be started locally by selecting "Local On" which initiates the chiller start-up procedure. The "Local On" feature only allows start/stop to be done locally at the PIC6 touchscreen.

When a start-up is initiated, the status screen displays start-up in progress and the Start/stop icon blinks green. Once the local start-up begins, the PIC6 control system performs a series of prestart tests to verify that all prestart alerts and safeties are within acceptable limits. Table 3 shows the Prestart Alert/Alarm conditions. If a test is not successful, the startup is delayed or aborted. If the tests are successful, the startup will be in progress and the Compressor Run Status shall be Startup. The controls then energize the chilled water pump relay.

Five seconds later, the condenser pump relay energizes. Thirty seconds later the PIC6 module monitors the chilled liquid and condenser liquid flow devices and waits until the *Evap Flow Verify time / Cond Flow Verify time* (operator-configured in Hydronics Config, default 30 seconds) expires to confirm flow. After flow is verified, the chilled liquid 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 controls turn off the condenser pump relay and goes into a RECYCLE mode.

If the liquid temperature is high enough to require cooling, the start-up sequence continues and the oil pump starts. Oil pressure is verified for 30 seconds. The oil pressure must reach a minimum of 18 psid during this period in order to proceed.

Table 3 — Prestart Alert/Alarm Conditions

Prestart Check	Alert
Condenser flow not detected during flow verification time	401
Evaporator flow not detected during flow verification time	402
Recycle Restarts in last 4 hours > 5	403
Invalid Control Program	404
Economizer EXV error (if equipped)	405
Main EXV error (if equipped)	407
Condenser Pressure > High Cond P Trip Threshold	409
Discharge Temp > Hi Disch T Trip Threshold = 200F	411
Percent Line Voltage > 115	413
Motor Temp > Hi Motor Temp Trip Threshold	415
Invalid Compressor Envelope	417
Percent Line Voltage < 85	419
Oil Temperature < 110°F (43.3°C)	421
Evap refrigerant liquid temp ≤ freeze temp limit value of limit	423
Evap saturated refrigerant temp ≤freeze temp limit value of limit	425
Oil Pressure > 6 psig prior to start	429
Starts in 12 hours ≥ 8 (not counting recycle restarts or auto restarts after power failure)	431
Inverter temp > 200°F	433
Rectifier temp > 200°F	435

The VFD is set to START following oil pressure verification and the controls verify that no prestart faults exist. Proper compressor rotation is verified by monitoring the discharge pressure.

The control center monitors load current to verify that the compressor is running then steps the compressor up to target speed. The start-to-start and service ontime timers are activated when compressor operation is confirmed.

The controls will abort the start and display the applicable prestart alert on the PIC6 display if any of the conditions above are not verified. Any fault after the start-up process is complete results in a safety shutdown, advancing the STARTS IN 12 HOURS counter by one, and display of the applicable shutdown status on the PIC6 display.

Compressor ontime and service ontime timers start, and the compressor STARTS IN 12 HOURS counter in the RUNTIME screen and the COMPRESSOR STARTS counter advance by one.

Shutdown Sequence

The unit can be stopped locally using the HMI by pressing the green Start/Stop icon. The Unit Start/Stop screen is displayed. Press Disable Unit / Stop. See Fig. 25 to stop the unit.

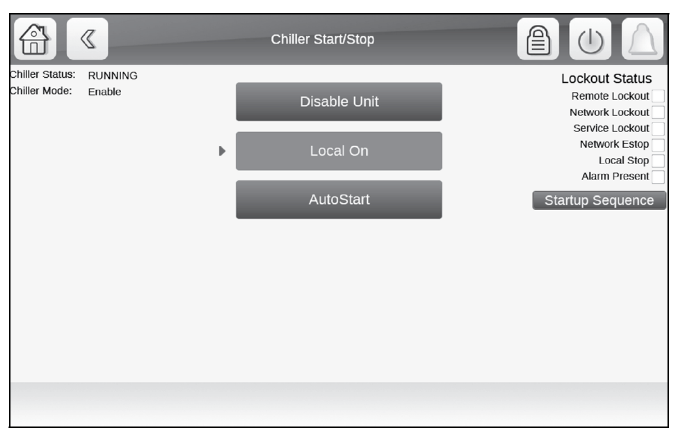


Fig. 25 — Confirm Stop

BEFORE INITIAL START-UP

Job Data Required

- list of applicable design temperatures and pressures (product data submittal)
- chiller certified prints
- starting equipment details and wiring diagrams
- diagrams and instructions for special controls or options
- 23XRV Installation Instructions
- 23XRV Start-up, Operations and Maintenance Instructions
- pumpout unit instructions

Equipment Required

- T30 hexalobular socket screw driver to remove control center door shipping brackets
- mechanic's tools (refrigeration)
- digital volt-ohmmeter (DVM)
- clamp-on ammeter
- electronic leak detector
- absolute pressure manometer
- 500-v insulation tester (megohmmeter) for compressor motors with nameplate voltage of 600 v or less

Remove Shipping Packaging

Remove any packaging material from the unit and starter.

Open Oil Circuit Valves

Check to ensure the oil filter isolation valves (Fig. 13) are open by removing the valve cap and checking the valve stem.

Oil Charge

The oil charge for the 23XRV chiller is split between the cooler and the oil vaporizer:

FRAME SIZE	COOLER CHARGE	OIL SUMP CHARGE	TOTAL
A	1 gal.(3.8 L)	9.0 gal.(34.1 L)	10.0 gal. (37.9 L)
B			
3			
4			
5			

The chiller is shipped with its oil charge. The oil level in the vaporizer will initially be in the center of the oil sump sight glass. This level will vary depending on the amount of refrigerant that has been absorbed by the oil and the operating conditions of the chiller. Normal oil levels will vary from the top of the strainer housing sight glass to above the top of the oil sump sight glass.

If oil is added, it must conform to Carrier's specification for screw compressor use as described in the Oil Specification section. Charge the oil through the oil charging valve located near the bottom of the oil strainer housing. The oil must be pumped from the oil container through the charging valve due to the higher refrigerant pressure. The pumping device must be able to lift from 0 to 200 psig (1379 kPa) or above unit pressure. Oil should only be charged or removed when the chiller is shut down.

Tighten All Gasketed Joints

Gaskets normally relax by the time the chiller arrives at the jobsite. Tighten all gasketed joints to ensure a leak-tight chiller. See Tables 4 and 5 for waterbox torque specifications.

Table 4 — 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	6	9	9	13
5/16	8	11	13	18	20	28
3/8	13	19	22	31	32	46
7/16	21	30	35	50	53	75
1/2	32	45	53	75	80	115
9/16	46	65	75	110	115	165
5/8	65	95	105	150	160	225
3/4	105	150	175	250	260	370
7/8	140	200	265	380	415	590
1	210	300	410	580	625	893
1-1/8	330	475	545	780	985	1,410
1-1/4	460	660	770	1,100	1,380	1,960
1-3/8	620	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 5 — Bolt Torque Requirements, Foot Pounds (Metric Bolts)

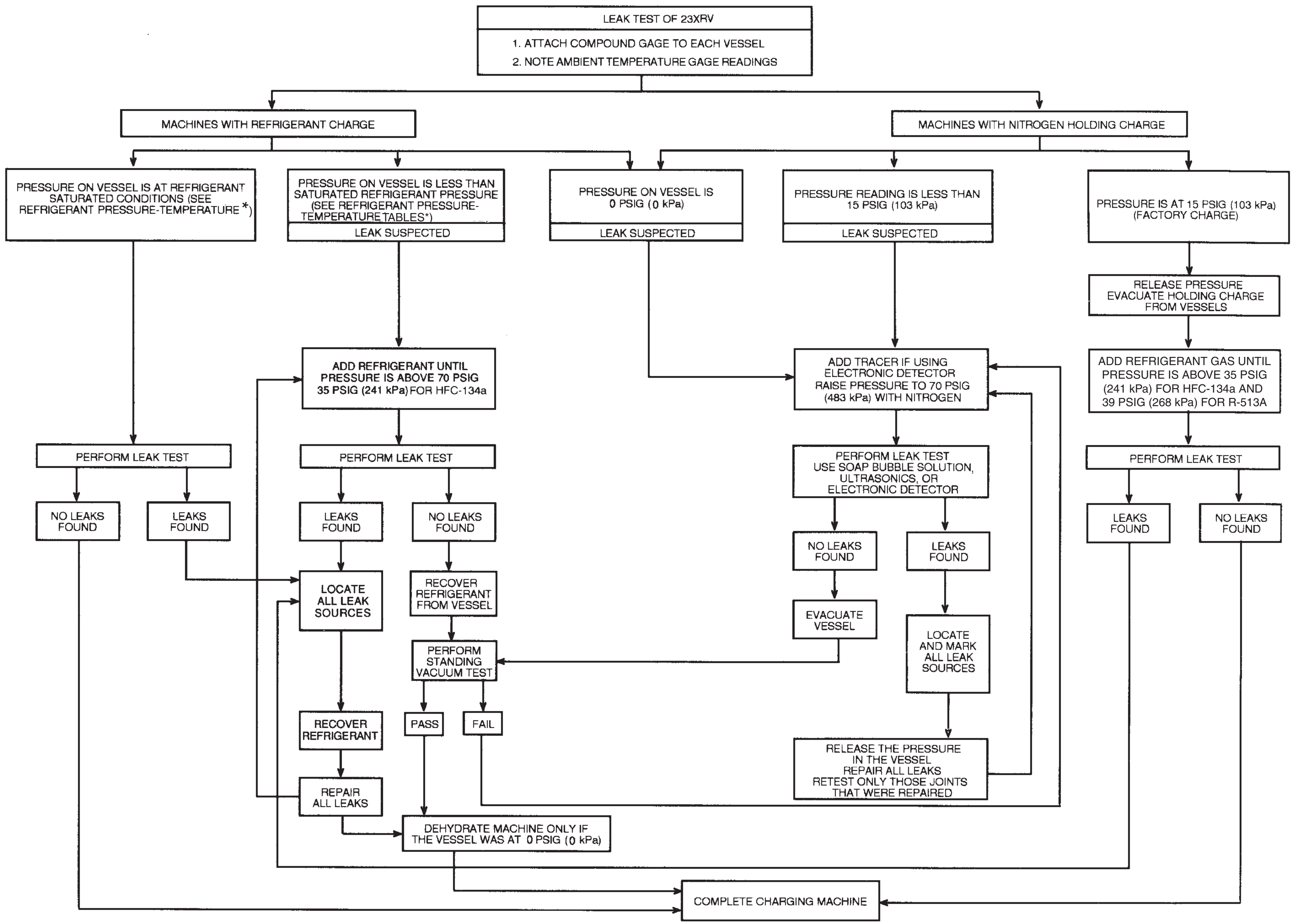
BOLT SIZE (METRIC)	CLASS 8.8		CLASS 10.9	
	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
M4	1.75	2.5	2.5	3.5
M6	6	9	8	12
M8	14	20	20	30
M10	28	40	40	57
M12	48	70	70	100
M16	118	170	170	240
M20	230	330	330	470
M24	400	570	570	810
M27	580	830	820	1175

Check Chiller Tightness

Figure 26 outlines the proper sequence and procedures for leak testing.

The 23XRV chillers are shipped with a full refrigerant and oil charge. Units may be ordered with the refrigerant shipped separately, and a 15 psig (103 kPa) nitrogen-holding charge in each vessel. To determine if there are any leaks, the chiller should be charged with a refrigerant tracer. 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.

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 liquid circuits are full.



*See Tables 7 and 8.

Fig. 26 — 23XRV Leak Test Procedure

Refrigerant Tracer

Carrier recommends the use of an environmentally acceptable refrigerant tracer for leak testing with an electronic detector or halide torch.

Ultrasonic leak detectors can also be used if the chiller is under pressure.

⚠ WARNING

Do not use air or oxygen as a means of pressurizing the chiller. Mixtures of R-134a or R-513A 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 refrigerant, Carrier recommends the following leak test procedures. See Fig. 26 for an outline of the leak test procedures. Refer to Fig. 27-30 during pumpout procedures. See the Pumpout and Refrigerant Transfer Procedures section on page 45. Refer to Tables 7 and 8 for temperature/pressure relationships for R-134a or R-513A refrigerant.

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

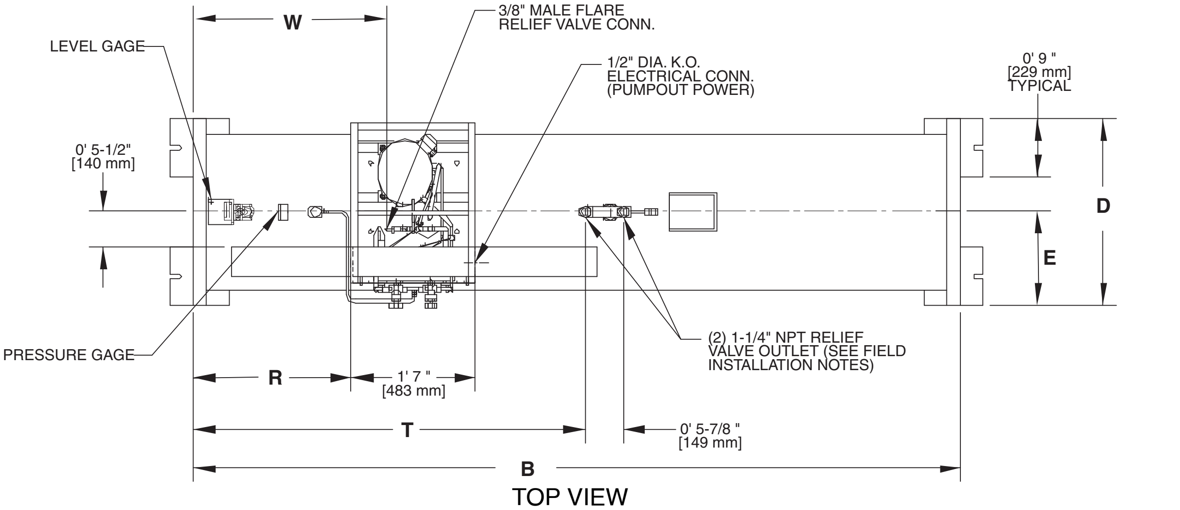
⚠ WARNING

Never charge liquid refrigerant into the chiller if the pressure in the chiller is less than 35 psig (241 kPa) for R-134a or less than 39 psig (268 kPa) for R-513A. Charge as a gas only, with the cooler and condenser pumps running, until this pressure is reached. Flashing of liquid refrigerant at low pressures can cause tube freeze-up and considerable damage.

   c. Leak test chiller as outlined in Steps 3-7.
2. If the pressure readings are abnormal for chiller condition:
   a. Prepare to leak test chillers shipped with refrigerant. If chiller is shipped with refrigerant, proceed to Step 3.
   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 to 2h).
   c. Plainly mark any leaks which are found.
   d. Release the pressure in the system.
   e. Repair all leaks.
   f. Retest only those 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. This can be accomplished by following the dehydration procedure, outlined in the Chiller Dehydration section, page 32.
   h. Slowly raise the system pressure to normal operating pressures for the refrigerant used in the chiller. Proceed with the test for small leaks (Steps 3 to 7).
3. Check the chiller carefully with an electronic leak detector or halide torch.
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 1 lb/year (0.45 kg/year) for the entire chiller must be repaired. Note total chiller leak rate on the start-up report.
5. If no leak is found during 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 Chiller Dehydration section, page 32.
   b. If the chiller fails this test, check for large leaks (Step 2b).
   c. Dehydrate the chiller if it passes the standing vacuum test. Follow the procedure in the Chiller Dehydration section, page 32. Charge chiller with refrigerant.
7. If a leak is found, pump the refrigerant back into the storage tank, or if isolation valves are present, pump into the vessel that is not leaking.

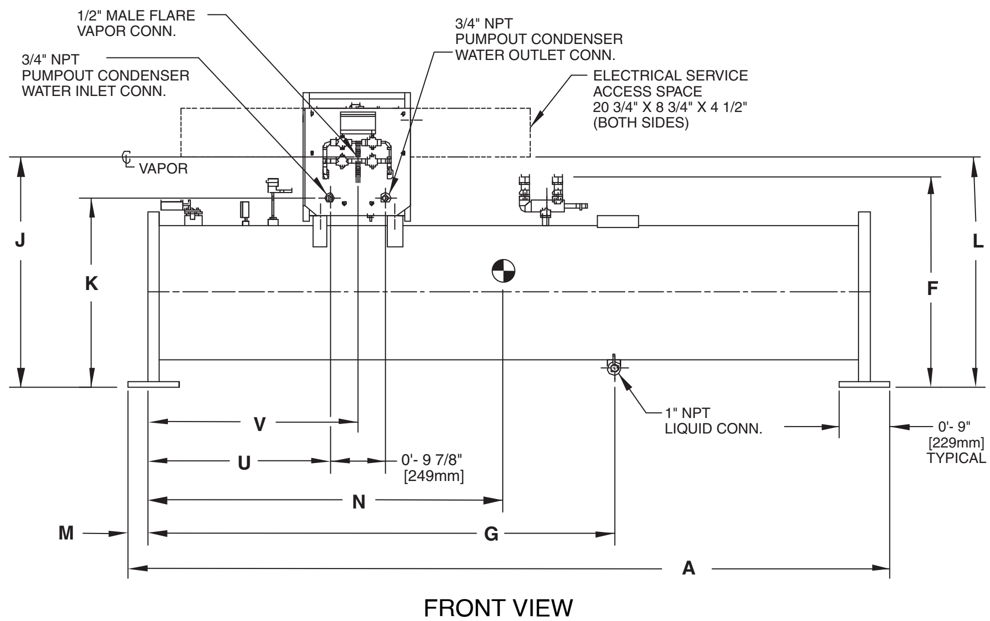
   Transfer the refrigerant until chiller pressure is at least equal to the pressure specified by the EPA under 40 CFR Part 82.

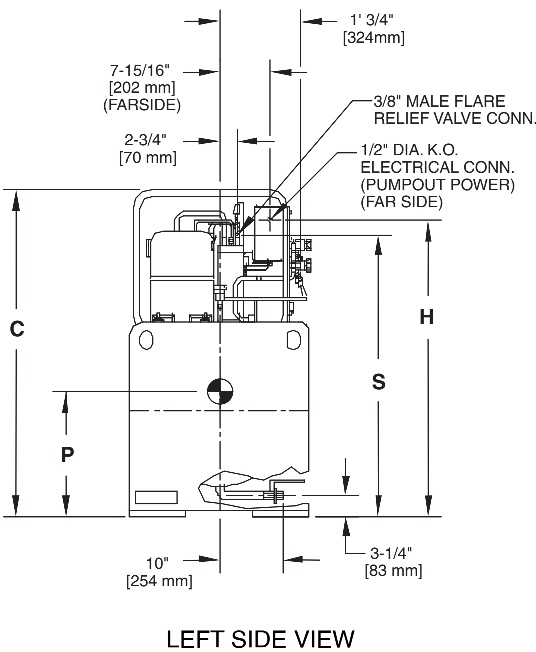
   Repair the leak and repeat the procedure, beginning from Step 2h to ensure a leak tight repair. If chiller is opened to the atmosphere for an extended period, evacuate it before repeating leak test.



NOTES:

1. Denotes center of gravity.
2. Dimensions in [ ] are in millimeters.
3. The weights and center of gravity values given are for an empty storage tank.
4. For additional information on the pumpout unit, see certified drawings.
5. Conduit knockout is located on the side of the control box.
6. 28 cubic ft storage tank weight: 2334 lb (1059 kg).
7. 52 cu ft storage tank weight: 3414 lb (1549 kg).





DIMENSIONS

ENGLISH (ft-in.)

TANK SIZE	A	B	C	D	E	F	G	H	J	K
0428	10' 5"	9' 10"	4' 4-1/4"	2' 4-3/4"	1' 2-3/8"	3' 1-1/4"	6' 4-3/16"	3' 11-3/8"	3' 4-7/8"	2' 9-9/16"
0452	14' 11-1/4"	14' 4-1/2"	4' 8-1/4"	2' 8-1/2"	1' 4-1/4"	3' 4-1/2"	7' 2-1/4"	4' 3-1/4"	3' 8-3/4"	3' 1-7/16"

TANK SIZE	L	M	N	P	R	S	T	U	V	W
0428	3' 4-5/8"	0' 3-1/2"	4' 9-1/2"	1' 7-7/8"	2' 3/8"	3' 9"	5' 1/4"	2' 5"	2' 9-7/8"	2' 5-3/4"
0452	3' 8-1/2"	0' 3-3/8"	6' 11-5/8"	1' 8-3/4"	2' 5/8"	4' 1"	5' 1/2"	2' 5-1/4"	2' 10-1/8"	2' 6"

SI (mm)

TANK SIZE	A	B	C	D	E	F	G	H	J	K
0428	3175	2997	1327	730	365	946	1935	1203	1038	852
0452	4553	4381	1429	826	413	1029	2191	1302	1137	951

TANK SIZE	L	M	N	P	R	S	T	U	V	W
0428	1032	89	1451	505	619	1143	1530	737	860	756
0452	1130	86	2124	527	625	1225	1537	742	867	762

Fig. 27 — Optional Pumpout Unit and Storage Tank

Table 6 — Optional Storage Tank and/or Pumpout System Physical Data[a,b]

UNIT SIZE	TANK OUTSIDE DIAMETER		DRY WEIGHT		MAXIMUM REFRIGERANT CAPACITY ASHRAE/ANSI 15			
					R-134a		R-513A	
	in.	mm	lb	kg	lb	kg	lb	kg
28	24.00	610	2334	1059	1860	844	1744	791
52	27.25	692	3414	1549	3563	1616	3340	1515

NOTE(S):

a. ANSI/ASHRAE 15 — Safety Code for Mechanical Refrigeration.
b. Dry weights include the pumpout condensing unit weight of 164 lb (75 kg).

LEGEND

ANSI — American National Standards Institute
ASHRAE — American Society of Heating, Refrigerating, and Air-Conditioning Engineers
UL — Underwriters Laboratories

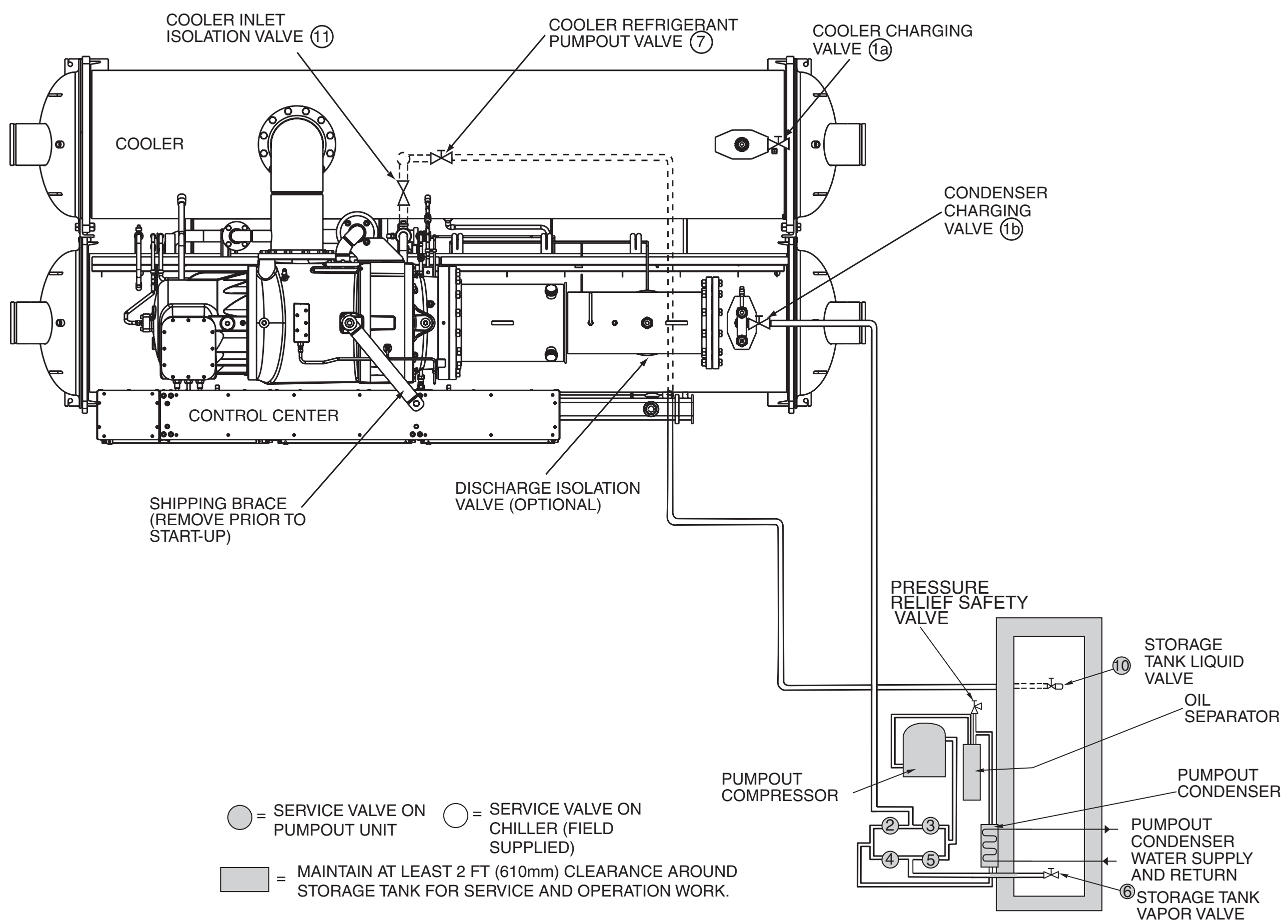


Fig. 28 — Optional Pumpout System Piping Schematic with Storage Tank — Configured to Push Liquid into Storage Tank (Unit with R Compressor Shown)

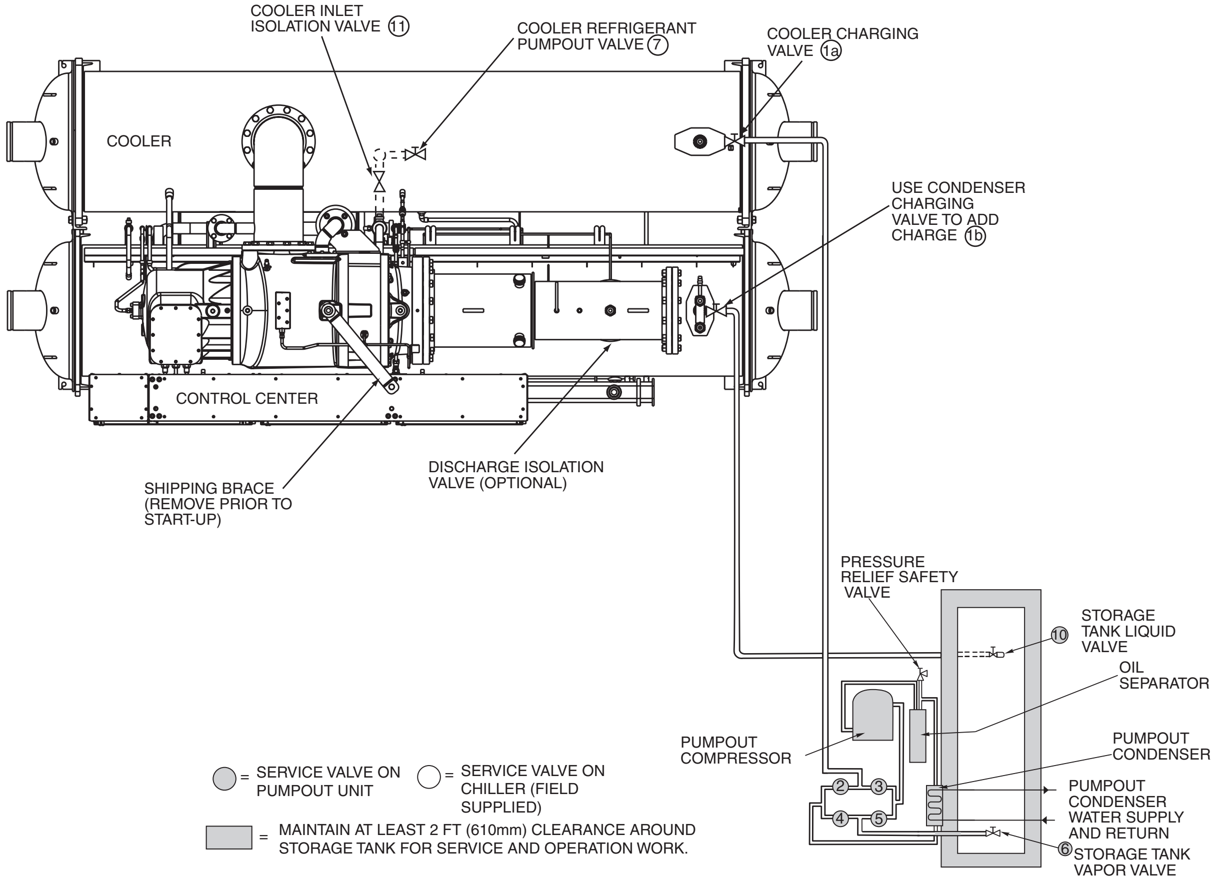


Fig. 29 — Optional Pumpout System Piping Schematic with Storage Tank — Configured to Pull Vapor out of Chiller or to Charge Chiller from Storage Tank (Unit with R Compressor Shown)

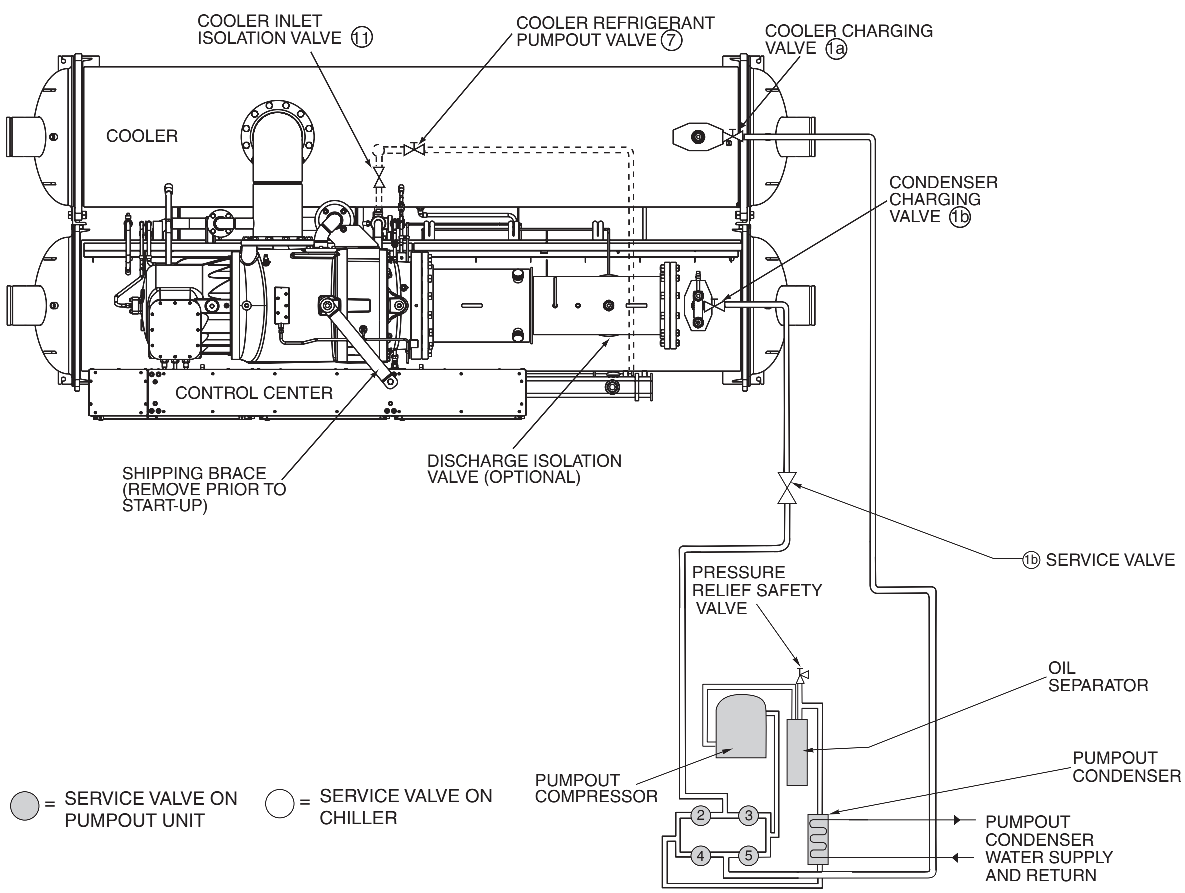


Fig. 30 — Optional Pumpout System Piping Schematic without Storage Tank — Configured to Store Refrigerant in Cooler or Condenser (Unit with R Compressor Shown)

Table 7 — Pressure — Temperature (F)

TEMPERATURE (F)	R-134a PRESURE (PSIG)	R-513A PRESSURE (PSIG)
0	6.50	9.22
2	7.52	10.32
4	8.60	11.45
6	9.66	12.62
8	10.79	13.84
10	11.96	15.09
12	13.17	16.39
14	14.42	17.73
16	15.72	19.11
18	17.06	20.54
20	18.45	22.02
22	19.88	23.54
24	21.37	25.11
26	22.90	26.73
28	24.48	28.40
30	26.11	30.12
32	27.80	31.89
34	29.53	33.71
36	31.32	35.59
38	33.17	37.52
40	35.08	39.51
42	37.04	41.56
44	39.06	43.66
46	41.14	45.83
48	43.28	48.05
50	45.48	50.34
52	47.74	52.68
54	50.07	55.09
56	52.47	57.57
58	54.93	60.11
60	57.46	62.72
62	60.06	65.40
64	62.73	68.14
66	65.47	70.96
68	68.29	73.84
70	71.18	76.80
72	74.14	79.83
74	77.18	82.94
76	80.30	86.13
78	83.49	89.39
80	86.17	92.73
82	90.13	96.14
84	93.57	99.64
86	97.09	103.23
88	100.70	106.89
90	104.40	110.64
92	108.18	114.48
94	112.06	118.40
96	116.02	122.41
98	120.08	126.51
100	124.23	130.71
102	128.47	134.99
104	132.81	139.37
106	137.25	143.84
108	141.79	148.41
110	146.43	153.08
112	151.17	157.85
114	156.01	162.72
116	160.96	167.69
118	166.01	172.76
120	171.17	177.94
122	176.45	183.23
124	181.83	188.62
126	187.32	194.12
128	192.93	199.74
130	198.66	205.47
132	204.50	211.31
134	210.47	217.26
136	216.55	223.34
138	222.76	229.54
140	229.09	235.85

Table 8 — Pressure — Temperature (C)

TEMPERATURE (C)	R-134a PRESSURE (kPa)	R-513A PRESSURE (kPa)
–17.8	44.8	63.6
–16.7	51.9	71.1
–15.6	59.3	79.0
–14.4	66.6	87.0
–13.3	74.4	95.4
–12.2	82.5	104.1
–11.1	90.8	113.0
–10.0	99.4	122.2
–8.9	108.0	131.8
–7.8	118.0	141.6
–6.7	127.0	151.8
–5.6	137.0	162.3
–4.4	147.0	173.1
–3.3	158.0	184.3
–2.2	169.0	195.8
–1.1	180.0	207.6
0.0	192.0	219.9
1.1	204.0	232.4
2.2	216.0	245.4
3.3	229.0	258.7
4.4	242.0	272.4
5.6	255.0	286.5
6.7	269.0	301.0
7.8	284.0	316.0
8.9	298.0	331.3
10.0	314.0	347.1
11.1	329.0	363.2
12.2	345.0	379.9
13.3	362.0	396.9
14.4	379.0	414.5
15.6	396.0	432.4
16.7	414.0	450.9
17.8	433.0	469.8
18.9	451.0	489.2
20.0	471.0	509.1
21.1	491.0	529.5
22.2	511.0	550.4
23.3	532.0	571.9
24.4	554.0	593.8
25.6	576.0	616.3
26.7	598.0	639.4
27.8	621.0	662.9
28.9	645.0	687.0
30.0	669.0	711.7
31.1	694.0	737.0
32.2	720.0	762.8
33.3	746.0	789.3
34.4	773.0	816.3
35.6	800.0	844.0
36.7	828.0	872.3
37.8	857.0	901.2
38.9	886.0	930.7
40.0	916.0	960.9
41.1	946.0	991.7
42.2	978.0	1023.3
43.3	1010.0	1055.4
44.4	1042.0	1088.3
45.6	1076.0	1121.9
46.7	1110.0	1156.2
47.8	1145.0	1191.1
48.9	1180.0	1226.9
50.0	1217.0	1263.3
51.1	1254.0	1300.5
52.2	1292.0	1338.4
53.3	1330.0	1377.2
54.4	1370.0	1416.7
55.6	1410.0	1456.9
56.7	1451.0	1498.0
57.8	1493.0	1539.9
58.9	1536.0	1582.6
60.0	1580.0	1626.1

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, even for a rotation check, if the chiller is under dehydration vacuum. Insulation breakdown and severe damage may result if voltage is applied to the motor.

Dehydration can be done at room temperatures. 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. If low ambient temperatures are involved, contact a qualified service representative for the dehydration techniques required.

Perform dehydration as follows:

1. Disconnect power from the VFD before placing the chiller under a vacuum.
2. Connect a high capacity vacuum pump (5 cfm [.002 m^3/s] or larger is recommended) to the cooler or condenser charging valve (Fig. 2-4). Tubing from the pump to the chiller should be as short in length and as large in diameter as possible to provide least resistance to gas flow.
3. Use an absolute pressure manometer or a wet bulb vacuum indicator 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.
4. If the entire chiller is to be dehydrated, open all isolation valves (if present).
5. With the chiller ambient temperature at 60°F (15.6°C) or higher, operate the vacuum pump until the manometer reads 29.72 in Hg (vac) (754.9 mm Hg), 0.1 kPa, or a vacuum indicator reads 35°F (1.7°C). Operate the pump an additional 2 hours.

   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. Final dehydration vacuum should be 29.9 in. Hg vac or less [500 microns, 0.07 kPa (abs)].
8. If the reading continues to change after several attempts, perform a leak test up to the maximum 160 psig (1103 kPa) pressure. Locate and repair the leak, and repeat dehydration.

Inspect Liquid Piping

Refer to piping diagrams provided in the certified drawings and the piping instructions in the 23XRV Installation Instructions manual. Inspect the piping to the cooler 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 waterbox nozzles and covers. Liquid flows through the cooler and condenser must meet job requirements. Measure the pressure drop across the cooler 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.

Inspect Refrigerant Cooling Lines (Q,R Compressors Only)

Inspect the refrigerant cooling lines for condensation using an infrared temperature sensor or temperature meter. The leaving refrigerant cooling line from the drive should have a temperature of 95 to 100°F (35 to 38°C) or a temperature that is 3 to 5°F (2 to 3°C) greater than the condenser refrigerant temperature. If the leaving refrigerant temperature is colder than these levels, or if condensation is noted on the power module or refrigerant cooling lines, the isolation valve on the leaving refrigerant cooling line should be partially closed (typically about half closed) to help with temperature regulation. See Fig. 31. Note that the adjustment is more accurate at a greater load that is fixed for at least 10 minutes, and there should be no condensation on the tube leaving the power module before the orifice.

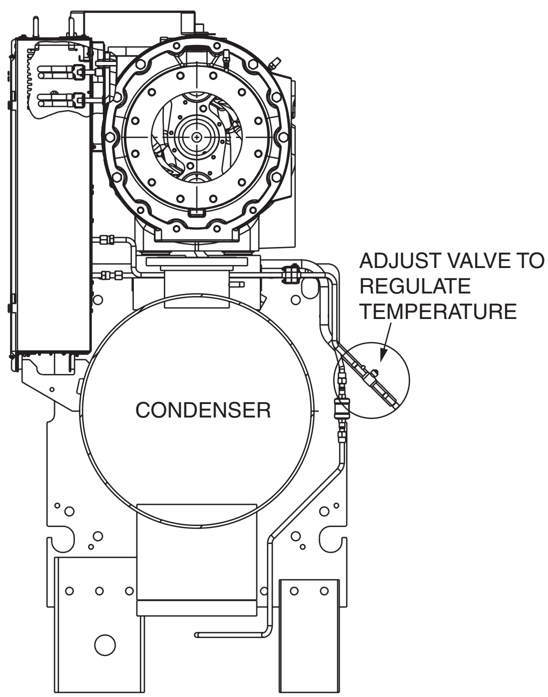


Fig. 31 — Isolation Valve, Leaving Refrigerant Cooling Line

Check Optional Pumpout Compressor Piping

If the optional pumpout storage tank and/or pumpout system are installed, check to ensure the pumpout condenser liquid has been piped in. Check for field-supplied shutoff valves and controls as specified in the job data. Check for refrigerant leaks on field-installed piping. See Fig. 27-30.

Check Relief Valves

Be sure the relief 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 23XRV relief valves are set to relieve at the 185 psig (1276 kPa) chiller design pressure.

Identify the VFD

The 23XRV product is offered with an active rectifier product option as well as a passive rectifier option. The LiquiFlo™ 2.0 AC drive is a PWM (Pulse Width Modulated) active rectifier, liquid-cooled drive that provides vector and general purpose regulation for a wide range of applications. The standard tier drive offering is a fixed rectifier option. Identify the drive from the Drive Part Number on the drive's nameplate. LiquiFlo 2.0 is an active front end drive. The 23XRV product is also offered with fixed front end PWM drives.

⚠ WARNING

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

⚠ WARNING

The drive can operate at and maintain zero speed. The user is responsible for assuring safe conditions for operating personnel by providing suitable guards, audible or visual alarms, or other devices to indicate that the drive is operating or may operate at zero speed. Failure to observe this precaution could result in severe bodily injury or loss of life.

⚠ CAUTION

The drive contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing, or repairing the drive. Erratic machine operation and damage to, or destruction of equipment can result if this procedure is not followed.

The control center is designed to operate in the following environmental conditions:

CONDITION	SPECIFICATION
Ambient Temperature (outside NEMA 1 enclosure)	32 to 122°F (0° to 50°C)
Storage Temperature (ambient)	–40 to 149°F (–40 to 65°C)
Humidity	5% to 95% (noncondensing)

IDENTIFYING THE DRIVE BY PART NUMBER

Each AC drive can be identified by its assembly number. This number appears on the shipping label and on the drive's nameplate. Power ratings for LF-2 VFDs are provided in Table 9. Power ratings for Std Tier VFDs are provided in Table 10.

Table 9 — Drive Assembly and Power Module Ratings (LF-2 VFD)

CARRIER PART NUMBER	FRAME SIZE	ENCLOSURE TYPE	INPUT VOLTAGE (V) RANGE	MAX INPUT CURRENT (AMPS)	MAX OUTPUT CURRENT[a] at 4kHz (AMPS)
23XRB2AA_ _ _ _ _ _ _ _ _ _ _	Frame 2AA	NEMA 1	380 to 460	440	442
23XRB2BA_ _ _ _ _ _ _ _ _ _ _	Frame 2BA	NEMA 1	380 to 460	520	442
23XRB2BB_ _ _ _ _ _ _ _ _ _ _	Frame 2BB	NEMA 1	380 to 460	520	520
23XRB2CC_ _ _ _ _ _ _ _ _ _ _	Frame 2CC	NEMA 1	380 to 460	608	608

NOTE(S):

a. 110% output current capability for one minute, 150% output current for 5 seconds.

Table 10 — Drive Assembly and Power Module Ratings (Std Tier VFD) [a]

CARRIER PART NUMBER	ENCLOSURE TYPE	INPUT VOLTAGE (Digit Y of part number)		MAX INPUT CURRENT (AMPS)	MAX OUTPUT CURRENT[b] at 2kHz (AMPS)
		Y	Voltage/Hz		
23XVS0_ _ _00Y _ _ F0[c]	NEMA 1	3 4 5 7 9	380 v / 50 Hz 416 v / 60 Hz 460 v / 60 Hz 575 v / 60 Hz 400 v / 50 Hz	230 269 335 445	230 269 335 445

NOTE(S):

a. All voltage and current combinations listed may not be available for sale. Please review Carrier marketing literature for latest offering.
b. 110% output current capability for one minute, 150% output current for 5 seconds.
c. Last character 0 indicates refrigerant-cooled; last digit A indicates air-cooled.

Check Control Center

⚠ CAUTION

BE AWARE that certain automatic start arrangements *can engage the VFD*. Open the disconnect *ahead* of the control center in addition to shutting off the chiller or pump to avoid equipment damage and possible personal injury.

⚠ CAUTION

The main disconnect on the control center does not de-energize all internal circuits. Open all internal and remote disconnects before servicing the starter to avoid equipment damage and possible personal injury.

Input Power Wiring

All wiring should be installed in conformance with applicable local, national, and international codes. Use grommets, when hubs are not provided, to guard against wire chafing.

Use the following steps to connect AC input power to the main input circuit breaker and ground leads to the ground lug.

1. Turn off, lockout, and tag the input power to the drive.
2. Remove the input power wiring panel from the top of the control center and drill the required number of openings in the input power wiring panel. Take care that metal chips do not enter the VFD enclosure.
3. Wire the AC input power leads and ground leads by routing them through the opening in the top of the control center to the main input circuit breaker.

⚠ CAUTION

Do not route control wiring carrying 30 v or less within a conduit carrying 50 v or higher. Failure to observe this precaution could result in electromagnetic interference in the control wiring.

4. Connect the three-phase AC input power leads (per job specification) to the appropriate input terminals of the circuit breaker.
5. Tighten the AC input power terminals and lugs to the proper torque as specified on the input circuit breaker.
6. Connect and tighten the ground leads to the ground lug.

Checking the Installation

Use the following instructions to verify the condition of the installation:

1. Turn off, lockout, and tag the input power to the drive. Wait a minimum of 5 minutes for the DC bus to discharge.
2. Verify that there is no voltage at the input terminals (L1, L2 and L3) of the power module or main circuit breaker.
3. Verify that the status LEDs on the DPI communications interface board are not lit. The location of the DPI communications interface board is shown in Fig. 19.
4. Remove any debris, such as metal shavings, from the enclosure.
5. Check that there is adequate clearance around the machine.
6. Verify that the wiring to the terminal strip and the AC input power terminals is correct. Verify that all of the VFD power module circuit board connectors are fully engaged and secured in place.
7. Check that the wire size is within terminal specifications and that the wires are tightened properly.
8. Check that specified branch circuit protection is installed and correctly rated.
9. Check that the incoming power is within ± 10% of chiller nameplate voltage.
10. All wiring should be installed in conformance with the applicable local, national, and international codes (for example, NEC/CEC). 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.

Inspect Wiring

⚠ WARNING

Do not check the voltage supply without proper equipment and precautions. Serious 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.

1. Examine the wiring for conformance to the job wiring diagrams and all applicable electrical codes. Confirm that there is at least a 6-in. clearance surrounding the control center louvers. Use an inspection mirror to visually inspect the top of the power module to confirm that no debris has fallen inside of it.
2. Connect a voltmeter across the power wires to the VFD and measure the phase to phase and phase to ground voltage. Compare this reading to the voltage rating on the compressor and starter nameplates.
3. Compare the ampere ratings on the Machine Electrical Data Nameplate. LOCKED ROTOR AMPS should be equal to RATED LINE AMPS. OVERLOAD TRIP AMPS should be equal to 1.08 x RATED LINE AMPS.
4. The control center must be wired to components and terminals required for PIC6 refrigeration control. Check line side power and for control components shown on the Certified Prints. The control center must share control of cooler and condenser liquid pumps and cooling tower fans.
5. Check the phase to phase and phase to ground line voltage to the optional pumpout compressor. Compare voltages against nameplate values. Refer to Fig. 32.
6. Ensure that fused disconnects or circuit breakers have been supplied to the control center and optional pumpout unit.
7. Ensure all electrical equipment and controls are properly grounded in accordance with the job drawings, certified drawings, and all applicable electrical codes.
8. 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.
9. Tighten all wiring connections on the high and low voltage terminal blocks in the control center enclosure above and below the control panel.
10. Inspect the control panel in control center enclosure to ensure that the contractor has used the knockouts to feed the wires

into the back of the control panel. Wiring through the top of the control center can cause debris to fall into the power module. Clean and inspect the interior of the control center if this has occurred. Contact Carrier Service before applying power if debris may have fallen inside of the power module.

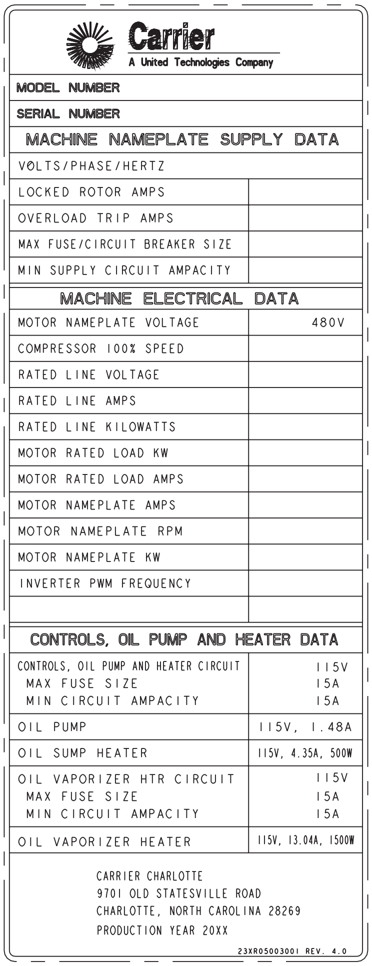


Fig. 32 — Machine Electrical Data Nameplate

> **⚠ WARNING**
>
> Do not apply power unless a qualified Carrier technician is present. Electrical shock could cause serious personal injury or death.

Ground Fault Troubleshooting

Use this procedure only if ground faults are declared:

> **⚠ CAUTION**
>
> Disconnect the motor leads from the control center before a motor insulation test is performed. The voltage generated from the testing equipment will damage the VFD.

Test the compressor motor and its power lead insulation resistance with a 500-v insulation tester such as a megohmmeter. With the tester connected to the motor leads, take 10 second and 60 second megaohm readings as follows:

1. Tie terminals 1, 2, and 3 together and test between the grouped motor terminals and ground.
2. 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.
3. If the readings are unsatisfactory, repeat the test with the motor leads disconnected from the motor. Satisfactory readings in this second test indicate the fault is in the power leads.

CCN Interface and LEN Interface

The 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 the 23XRV Installation Instructions.

NOTE: Conductors and drain wire must be 20 AWG minimum stranded, tinned copper. Individual conductors must be insulated with PVC, PVC/nylon, vinyl, Teflon[1], or polyethylene. An aluminum/polyester 100% foil shield and an outer jacket of PVC, PVC/nylon, chrome vinyl, or Teflon with a minimum operating temperature range of –4°F to 140°F (–20°C to 60°C) is required. See table below for cables that meet the requirements.

MANUFACTURER	CABLE NO.
Alpha	2413 or 5463
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 following color code is recommended:

SIGNAL TYPE	CCN BUS CONDUCTOR INSULATION COLOR
+	Red
Ground	Black
–	White or Clear

For Modbus communication wire, Belden 3106A (RS-485 cable) is recommended.

Power Up Controls and Check Oil Heater

Ensure that an oil level is visible in the oil sump before energizing the controls. A 4 KVA control transformer located in the VFD cabinet provides via plug CN1A power to the controls and the 1st stage oil heater, oil pump, and HGBP. The plug providing the power from the transformer is labeled CN1A.

Plug CN1B protected by a 25A fuse provides power to the vaporizer heater and the second stage oil heater.When first powered, the PIC6 should display the Home screen within a short period of time.

The oil heater is energized when power is applied to the control circuit. Be sure to do this at least 4 hours before start-up to minimize oil-refrigerant migration. Unit will not start unless a specific oil temperature is reached, so in colder environments the heater may need to be on longer.

The oil heater is controlled by the PIC6 controls and primary oil heater is powered through contactor 1C located in the controls section of the VFD enclosure. At times PIC6 controls can, depending on conditions, determine the need to turn on the secondary oil heater controlled by contactor 5C in order to improve chiller operation. The power for the 4 KVA transformer which powers all Carrier controls is pulled from upstream of the main circuit breaker. This allows the heater to energize when the main motor circuit breaker is off for service work or extended shutdowns. The oil heater relay status, both primary and secondary oil heater stage,

1. Teflon is a registered trademark of DuPont.

can be viewed on the PIC6 OUTPUTS screen. Oil sump temperature can be viewed on the PIC6 Main screen.

Software Configuration

> **⚠ WARNING**
>
> Do not operate the chiller before the control configurations have been checked and a Control Test has been satisfactorily completed. Protection by safety controls cannot be assumed until all control configurations have been confirmed. Do not assume the values in the chiller are correct. They should match the chiller labels and data sheets for the selection. If you have questions contact the Carrier Technical Service Manager or Service Engineering.

Consult the 23XRV with PIC6 Controls Operation and Troubleshooting manual for controls-related issues. As the unit is configured, the configurations should be written down or a file should be generated using ProView service tool to have settings for any future needs. When installing new software, be sure to select to keep all configuration data so that all data does not have to be reentered manually. If new parameters are added to the new software they will need to be manually configured. As the 23XRV unit is configured, all configuration settings should be written down. A log, such as the one shown on pages CL-1 to CL-10, provides a convenient list for configuration values.

It is recommended that all control configuration tables be uploaded via Service Tool and stored for reference when the software configuration is complete.

Input the Design Set Points

To access the set point screen, press the Main Menu icon on the Home screen. Figure 33 is an example of the 23XRV TP home screen and Fig. 34 is an example of the 23XRV TR/TQ home screen.

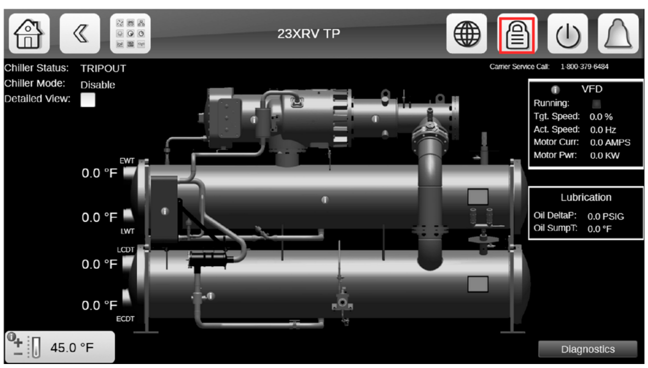


Fig. 33 — 23XRV TP Home Screen

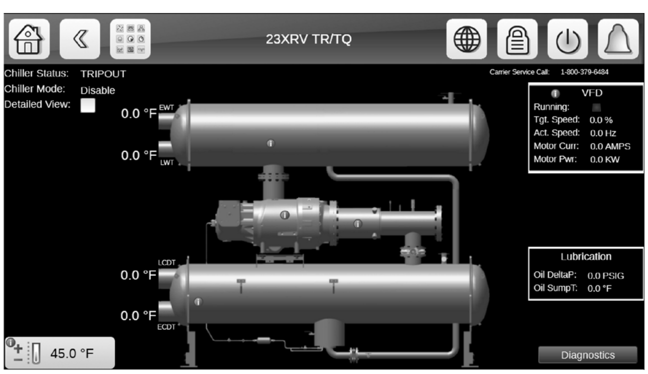


Fig. 34 — 23XRV TR/TQ Home Screen

Then, at Main Menu (Fig. 35), select Set Points in order to display the menu (Fig. 36).

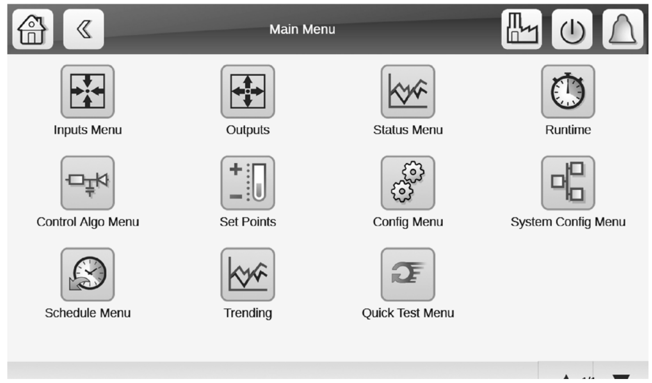


Fig. 35 — Main Menu

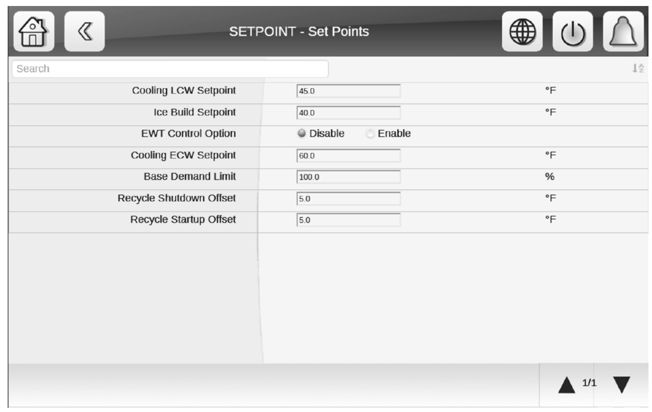


Fig. 36 — Set Points Menu

The setpoint can be set for either Entering Chilled Water (ECW) or the default Leaving Chilled Water (LCW). ECW control option can be enabled by setting EWT Control Option = Enable.

Additionally set Base Demand Limit if different from 100%.

Input the Local Occupancy Schedule

Access the Occupancy icon located in the Main Menu. Here the Occupancy Schedule and Holiday Schedule for the chiller can be configured. The default Occupancy Schedule is for both Local Schedule (OCCPC01S), shown in Fig. 37, and Network Schedule (OCCPC03S) to be set for 24 hours occupied, 7 days per week including Holidays.

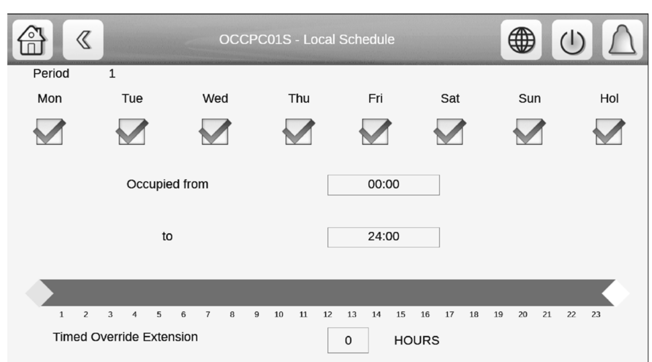


Fig. 37 — Occupancy Schedule (LOCALOCC), Local Schedule

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. To activate LOCALOCC the Startup Options must be configured for Enable Schedule Start and AutoStart in Chiller Start/Stop menu must be selected.

Input Configurations

The following tables are typically required for configuration. Tables with (*) should be reviewed and if necessary modified during commissioning. Other tables are for reference only.

- System Configuration Menu
  - Date/Time Configuration Menu
- Factory Configuration*
- Service Configuration
- Circuit A Configuration Menu
  - Hot Gas A Configuration
  - Drive A Configuration*
  - Lube A Configuration

Review other tables with options as needed; not limited to:

- Hydronics Configuration
- Head Pressure Configuration
- Reset Configuration
- General Configuration

PASSWORD

The PIC6 control system includes different access level passwords for various tasks: Basic access, User access, Service access, and Factory access. Basic access provides the user access to basic chiller information and does not require a password. User access provides the operator access to chiller screens such as Setpoint, Schedules, Date/Time and Water Reset Configuration menus. Service level access has full access to all tables in the controller. Password configurations are as follows:

- Basic (No password required)
- User (1111)
- Service (3333)
- Factory; Access via authorized Carrier SmartService OR PIC6 enabled Special User. Initial static Factory password is time dependent (4444), and will cease to work after 48 hours of power-up and a power recycle.

User password can be modified in Main Menu, System Configuration, User Password Change and can be changed with a password of choice of up to 23 characters.

The applicable password can be entered by selecting the Lock Icon on the Home Screen; see Fig. 38 and 39. This gives access for entering the applicable PIC6 password by selecting the appropriate icon. The Login screen for login level Basic is shown in Fig. 40.

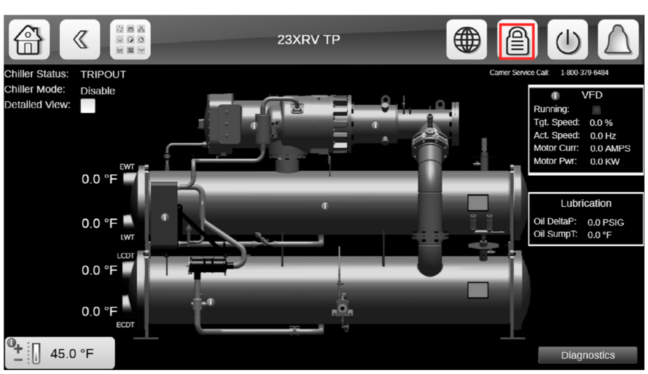


Fig. 38 — 23XRV TP Home Screen Lock Icon

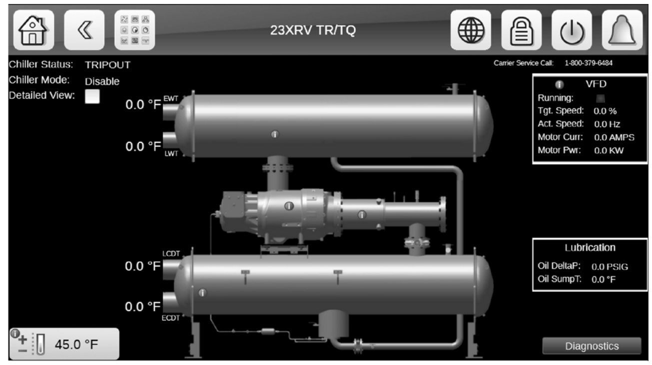


Fig. 39 — 23XRV TR/TQ Home Screen Lock Icon

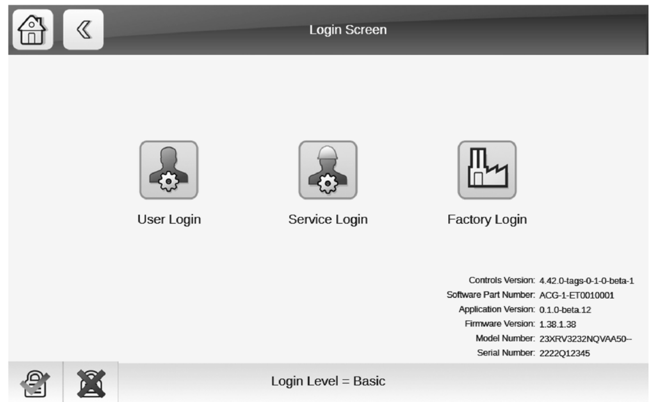


Fig. 40 — User Login, Login Level = Basic

ENGLISH TO METRIC UNITS

To change the PIC display from English to metric units or to change the default language select the Globe icon located next to the Lock icon on the Home screen. Figure 41 shows the Language and Units Selection screen.

Fig. 41 — Language and Units Selection Screen

MODIFY CONTROLLER IDENTIFICATION IF NECESSARY

The controller module address can be changed in Main Menu, System Configuration. Here Ethernet ports, Gateway/DNS, and CCN configuration.

Perform a Control Test

Chiller controls can be verified by performing a Control Test. To activate QuickTest, log in as Service or Factory and access the Chiller Start/Stop screen.

Once QuickTest has been enabled (by selecting QuickTest on Chiller Start/Stop Screen), navigate to ***Main Menu → Quick Test Menu → Quick Test A***. From this menu, select Quick Test A and the listed control points can be controlled. It can only be performed with the chiller is stopped. See Fig. 42-44.

Fig. 42 — Enable QuickTest, Screen 1

Fig. 43 — Enable QuickTest, Screen 2

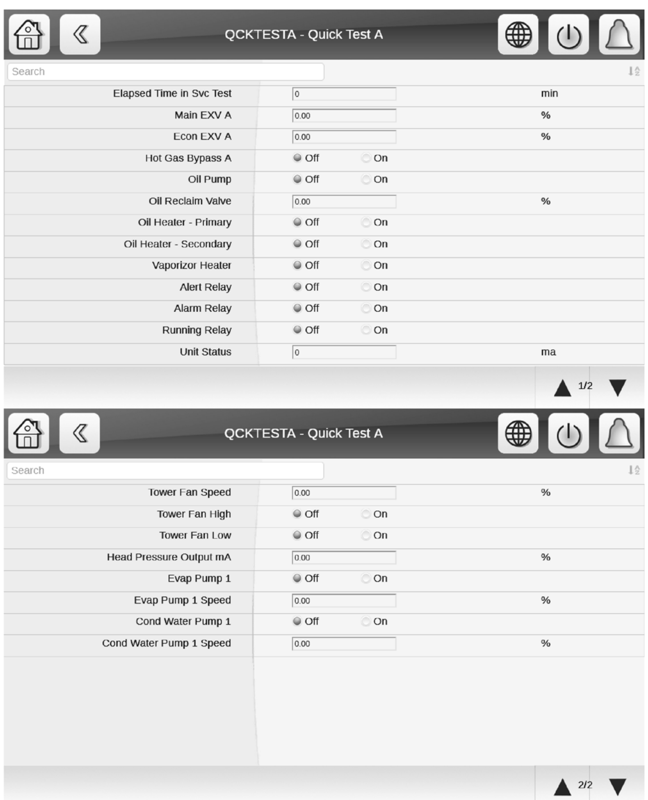


Fig. 44 — QCKTESTA - Quick Test A

Check Optional Pumpout System Controls and Compressor

Controls include an on/off switch, a 0.5-amp fuse for the secondary side of the transformer, 0.25-amp fuses for the primary side of the transformer, the compressor overloads, an internal thermostat, a compressor contactor, refrigerant low pressure cutout and a refrigerant high pressure cutout. The high pressure cutout is factory set to open at 185 psig (1276 kPa) and reset at 140 psig (965 kPa).

The low pressure cutout is factory set to open at 7 psia (–15.7 in. Hg) and close at 9 psia (–11.6 in. Hg). Ensure the water-cooled condenser has been connected. Ensure oil is visible in the compressor sight glass. Add oil if necessary.

See the Pumpout and Refrigerant Transfer Procedures section on page 45 and the Optional Pumpout System Maintenance section on page 58 for details on the transfer of refrigerant, oil specifications, etc.

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. Thermistor and pressure transducer calibration menus are found in the Quick Test Menu. See the calibration procedure in the Troubleshooting Guide section.

Charge Refrigerant into Chiller

⚠CAUTION

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

⚠CAUTION

Always operate the condenser and chilled liquid pumps during charging operations to prevent freeze-ups. Damage may result to equipment if the condenser and chilled water pumps are not operated during pumpdown or charging.

The standard 23XRV chiller is shipped with the refrigerant already charged in the vessels. However, the 23XRV chiller may be ordered with a nitrogen holding charge of 15 psig (103 kPa). In this case, evacuate the nitrogen from the entire chiller, and charge the chiller from refrigerant cylinders.

CHILLER EQUALIZATION WITHOUT A PUMPOUT UNIT

⚠WARNING

When equalizing refrigerant pressure on the 23XRV chiller after service work or during the initial chiller start-up, *do not use the discharge isolation valve to equalize* because the force that could be exerted by the valve handle could cause personal injury. Either the motor cooling isolation valve or the charging hose (connected between the pumpout valves on top of the cooler and condenser) should be used as the equalization valve.

The following steps describe how to equalize refrigerant pressure in an isolated 23XRV chiller without a pumpout unit.

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

1. Equalizing:
   a. Preferred method: Connect a charging hose between the two valves on top of the cooler and condenser. Open one valve fully and open the other valve slowly. This process should take approximately 15 minutes.
   b. Alternate method: Use this method if no charging hose available. Slowly open the motor cooling isolation valve. The chiller cooler and condenser pressures will gradually equalize. This process takes approximately 15 minutes.

   Note that for option (b), since the condenser contains liquid refrigerant, the valve opening must be limited to prevent liquid refrigerant from entering the cooler which could cause potential freeze-up.
2. Once the pressures have equalized, the following isolation valves should be opened:

- discharge isolation valve
- cooler inlet valve
- HGBP isolation valve
- vaporizer condenser gas valve
- filter/drier isolation valve (2 places)
- VFD cooling isolation valves (2 places)
- oil filter isolation valve
- oil pump isolation valve
- oil pressure regulator valve

Refer to Fig. 2-4 and 9-12 for isolation valve locations.

⚠ CAUTION

Whenever turning the discharge isolation valve, be sure that the spring-loaded lever lock fully engages within one of the latch plate detents. This will prevent the valve from opening or closing during service work or during chiller operation.

CHILLER EQUALIZATION WITH PUMPOUT UNIT

The following steps describe how to equalize refrigerant pressure on an isolated 23XRV chiller using the pumpout unit.

The top valve tee on a unit-mounted pumpout is connected to the condenser and the bottom valve tee is connected to the cooler. This is different from unit-mounted installations on other Carrier chillers.

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

1. Refer to Fig. 27-30. Open valve 4 on the pumpout unit and open valves 1a and 1b on the chiller cooler and condenser. Slowly open valve 2 on the pumpout unit to equalize the pressure. This process takes approximately 15 minutes.
2. Once the pressures have equalized, the following isolation valves should be opened:

- discharge isolation valve
- cooler inlet valve
- hot gas bypass valve
- vaporizer condenser gas valve
- oil pump valve
- oil filter valve
- oil pressure regulator valve
- filter/drier valve (2 places)
- VFD cooling inlet valve
- VFD cooling drain valve

Refer to Fig. 2-7 and Oil Heater section on page 55 for isolation valve locations.

⚠ WARNING

Whenever turning the discharge isolation valve, be sure that the spring-loaded lever lock fully engages within one of the latch plate detents. This will prevent the valve from opening or closing during service work or during chiller operation. Opening of the valve during service would result in the release of the refrigerant charge which could result in severe personal injury or death.

The full refrigerant charge on the 23XRV chiller will vary with chiller components and design conditions, as indicated on the job data specifications. An approximate charge may be determined by adding the condenser charge to the cooler charge as listed in Tables and .

⚠ CAUTION

Always operate the condenser and chilled liquid pumps whenever charging, transferring, or removing refrigerant from the chiller to prevent damage to the heat exchanger tubes.

Table 11 — Refrigerant Charges, Frame Sizes 3-5

FRAME SIZE	COOLER LENGTH ft (m)	COOLER CODE	CHARGE AMOUNT (R-134a, R-513A)			
			WITH ECONOMIZER		WITHOUT ECONOMIZER	
			lb (± 25 lb)	kg (± 11 kg)	lb (± 25 lb)	kg (± 11 kg)
3	12 (3.6)	30	800	363	650	295
		31	800	363	650	295
		32	800	363	650	295
	14 (4.3)	35	910	413	760	345
		36	910	413	760	345
		37	910	413	760	345
4	12 (3.6)	40	900	408	750	340
		41	900	408	750	340
		42	900	408	750	340
	14 (4.3)	45	1015	460	865	392
		46	1015	460	865	392
		47	1015	460	865	392
5	12 (3.6)	50	1250	567	1100	499
		51	1250	567	1100	499
		52	1250	567	1100	499
	14 (4.3)	55	1430	649	1280	581
		56	1430	649	1280	581
		57	1430	649	1280	581

Table 12 — Refrigerant Charges, Frame Sizes A,B

FRAME SIZE	COOLER LENGTH ft (m)	CHARGE AMOUNT (R-134a, R-513A)			
		WITH ECONOMIZER		WITHOUT ECONOMIZER	
		lb (± 25 lb)	kg (± 11 kg)	lb (± 25 lb)	kg (± 11 kg)
A1	12 (3.6)	840	381	820	372
A2		860	390	840	381
A3		880	399	860	390
A4		900	408	880	399
A5		930	422	910	413
A6		960	435	940	426
B1	14 (4.3)	950	431	930	422
B2		970	440	950	431
B3		1000	454	980	445
B4		1020	463	1000	454
B5		1060	481	1040	472
B6		1090	494	1070	485

CHILLER SHIPPED WITH HOLDING CHARGE

If the chiller has been shipped with a holding charge, the refrigerant is added through the refrigerant charging valve (Fig. 27-30, valves 1a and 1b) or to the pumpout charging connection. First evacuate the nitrogen holding charge from the chiller vessels. Charge the refrigerant as a gas until the system pressure exceeds 35 psig (141 kPa) for R-134a or 39 psig (268 kPa) for R-513A. After the chiller is beyond this pressure the refrigerant should be charged as a liquid until all the recommended refrigerant charge has been added. Ensure that pumps are running while system is being charged.

TRIMMING REFRIGERANT CHARGE

The 23XRV chiller is shipped with the correct charge for the design duty of the chiller. The Evaporator Approach (difference between Saturated Refrigerant Temp and Leaving Water Temp) can be checked against the design conditions to confirm that the charge is correct. In the case where leaks have been found and corrected and the Evaporator Approach is greater than about 4°F (2.2°C) above design, add refrigerant until the full load design LTD is approached. (A high Evaporator Approach can also be caused by dirty tubes, water box division plate bypass, a partially closed liquid isolation valve, or the float valve.)

Trimming the charge can best be accomplished when the design load is available. The calibration of the Evaporator Refrigerant Pressure and Leaving Chilled Water Temp should be confirmed prior to checking for proper Evaporator Approach. Compare the difference between Evaporator Refrigerant Temp and Leaving Chilled Water Temp to the chiller design conditions. Add or remove refrigerant, if necessary, to bring the cooler leaving temperature difference to design conditions or within minimum differential.

Check for low load oil recovery after making adjustments to the refrigerant charge. The bubbling mixture of refrigerant and oil mixture should be visible through the vaporizer sight glass at low load when the oil reclaim valve is open. If a bubbling mixture is not observed when the oil reclaim valve is open, add refrigerant.

The preferred location at which refrigerant should be added directly into the chiller is through the service valves on top of the cooler or condenser. If these valves are not accessible due to presence of an attached pumpdown unit which does not have a storage tank, slowly add charge through the valve connected to the side of the condenser drain float sump. Adding charge through the cooler refrigerant pumpout valve at the base of the cooler (off the liquid line) may force debris into the condenser float valve and is not recommended.

INITIAL START-UP

IMPORTANT: Start-up engineer must be properly certified for the VFD being started up, or extended VFD warranty may be affected.

1. The chiller must be started by a technician that has completed Reliance LiquiFlo2 training.
2. The start-up technician must be registered with Reliance.
3. The start-up technician must register the chiller start-up on the Reliance web site.

Preparation

Before starting the chiller, verify:

1. Power is on to the main power circuit breaker, oil pump relay, tower fan starter, oil heater relay, and chiller control center.
2. Verify that main circuit breaker, 1CB, and 2CB control circuit breaker are in the On position.
3. Cooling tower liquid is at proper level and at-or-below design entering temperature. Check cooling tower bypass valve.
4. Chiller is charged with refrigerant and all refrigerant and oil valves are in their proper operating positions.
5. Oil is at the proper level in the oil sump sight glass.
6. The Oil Sump Temperature must be above 140°F (60°C) before the controls will allow the chiller to start to ensure that a sufficient amount of refrigerant has been driven out of the oil. Control power should be applied up to 24 hours prior to start-up to ensure adequate oil temperature. Actual time is dependent on ambient temperatures.
7. All valves listed on page CL-3 of the Initial Start-Up Checklist are fully open.
8. If equipped, the VFD cold plate refrigerant isolation valves are open.
9. Remove the control center shipping bracket (see Fig. 45).

NOTE: For seismic units, do not remove the shipping bracket.

⚠ CAUTION

Operating the chiller with the shipping bracket attached may result in excessive vibration and noise. The shipping brace should be removed to avoid possible equipment damage (except for seismic units).

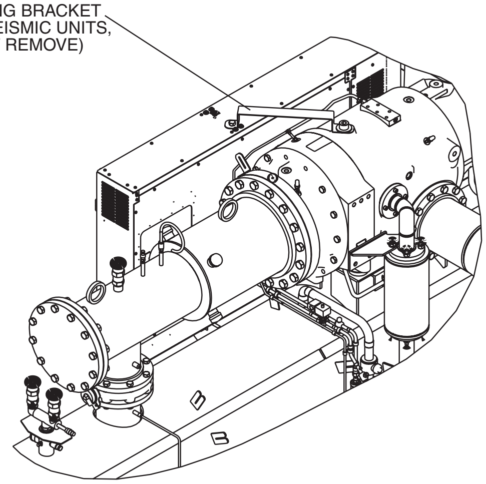


Fig. 45 — Control Center Shipping Bracket (Unit with R Compressor Shown)

⚠ WARNING

Do not permit liquid or brine that is warmer than 110°F (43°C) to flow through the cooler or condenser. Refrigerant overpressure may discharge through the relief valves and result in the loss of refrigerant charge and possible personal injury.

Check Oil Pressure and Compressor Stop

Start the chiller and allow it to automatically ramp load.

1. Two minutes after start-up, check the Pressure Menu to verify the Oil Discharge Pressure. This pressure should be approximately 20 to 28 psig (138 to 193 kPa) greater than the oil sump pressure.
2. Press the STOP softkey and listen for any unusual sounds from the compressor as it coasts to a stop.

To Prevent Accidental Start-Up

A Service Lockout override may have been entered to prevent accidental start-up. From the main menu access ***Configuration Menu → Service Configuration***; if Service Lockout = Yes, the unit will be unable to start.

Check Chiller Operating Condition

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

Instruct the Customer Operator

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

COOLER-CONDENSER

Float chamber, relief valves, refrigerant charging valve, temperature sensor locations, pressure transducer locations, Schrader fittings, waterboxes and tubes, and vents and drains.

OPTIONAL PUMPOUT STORAGE TANK AND PUMPOUT SYSTEM

Transfer valves and pumpout system, refrigerant charging and pumpdown procedure, and relief devices.

COMPRESSOR ASSEMBLY

Motor cooling system, oil system, temperature and pressure sensors, sight glasses, motor temperature sensors, synthetic oil, and compressor serviceability.

COMPRESSOR LUBRICATION SYSTEM

Concentrator, oil pump, oil filter, oil heaters, oil charge and specification, strainers, sight glasses, operating and shutdown oil level, temperature and pressure sensors, and oil charging connections.

CONTROL SYSTEM

Auto and Local start, reset, menu, softkey functions, PIC operation, occupancy schedule, set points, safety controls, and auxiliary and optional controls.

AUXILIARY EQUIPMENT

Disconnects, separate electrical sources, pumps, cooling tower, chilled liquid strainers, and condenser liquid strainers.

DESCRIBE CHILLER CYCLES

Refrigerant, motor cooling, lubrication, and oil reclaim.

REVIEW MAINTENANCE

Scheduled, routine, and extended shutdowns, importance of a log sheet, importance of liquid 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 and oil charging, and job safety.

MANUALS

The Installation Instructions, Start-Up, Operation, and Maintenance Manual and the Controls and Troubleshooting Manual.

> **⚠ CAUTION**
>
> Manuals and notebooks should not be stored under the VFD power module; they will block air flow into the power module cooling fan and cause the VFD to overheat.

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 appropriate Control Tests. Maintain the proper oil and refrigerant levels.
5. Protect the system from damage during shutdown periods.
6. Maintain set point, time schedules, and other PIC6 functions.

Prepare the Chiller for Start-Up

Follow the steps described in the Initial Start-Up section, page 41.

To Start the Chiller

1. Start the liquid pumps, if they are not automatic.
2. On the main screen, press the Start Icon and select if unit is to be started up using Local or Auto Start. If the chiller is in the OCCUPIED mode and the start timers have expired, the start sequence will start and the start icon will turn green.. Follow the procedure described in the Start-Up/Shutdown/Recycle Sequence section, page 22.

NOTE: The startup options can be configured on the Chiller Start/Stop screen. For AutoStart either Schedule (OCCUPIED mode), Network, or Remote Contacts can be configured. Unit will start/stop from any of the selected sources.

Check the Running System

After the compressor starts, the operator should monitor the PIC6 HMI display and observe the parameters for normal operating conditions. Observing values from the 23XRV Diagnostics Menu (available from Home Screen) is particular useful for this purpose.

1. The oil sump temperature will vary from 50°F to 150°F (10°C to 66°C) depending on the operating conditions. If the chiller has not been running for a few hours the Oil Sump Temp will be warmer than the *EVAP SATURATED TEMP* +15°F. When the chiller is not running, the oil heater is energized whenever the Oil Sump Temp is less than the smaller of 140°F (60°C) or 53°F (29.4°C) greater than the *EVAP SATURATED TEMP*. The Oil Sump Temp generally decreases slowly following start-up and eventually stabilizes at a point lower than the temperature maintained during shutdown. The Oil Delta P increases above 18 psid (124 kPad) during start-up and generally does not vary by more than ± 2 psid (14 kPad). The level in the oil sump is generally very stable. Changes in the oil level occur very slowly.
2. When the compressor is running, the liquid level should be visible in the oil sump or the strainer housing sight glass. Low oil pressure alarms are imminent if the oil level drops below the bottom of the oil strainer housing sight glass.
3. The Oil Delta P displayed on the PIC6 Main screen is equal to the difference between the oil pressure leaving the oil filter and the oil sump pressure transducer readings. Typically the reading will be between 20 and 28 psid (138 and 193 kPad) after the oil pressure ramp up is complete.
4. The moisture indicator (dry-eye) sight glass on the refrigerant motor cooling line should indicate refrigerant flow and a dry condition.
5. The condenser pressure and temperature varies with the chiller design conditions. Typically the pressure will range between 60 and 135 psig (329 and 780 kPa) with a corresponding temperature range of 60 to 105°F (15 to 41°C). The condenser entering liquid temperature may be controlled below the specified design entering liquid temperature to save on compressor kilowatt requirements but not be below 55°F (12.8°C).
6. Cooler pressure and temperature also will vary with the design conditions. Typical pressure range will be between 30 and 40 psig (204 and 260 kPa) with temperature ranging between 34 and 45°F (1 and 8°C).
7. The compressor may operate at full capacity for a short time after the pulldown ramping has ended, even though the building load is small. 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 for the short period of high demand operation. Pulldown rate can be based on load rate or temperature rate. Pulldown ramp rate is configured in General Configuration Menu (Fig. 46).

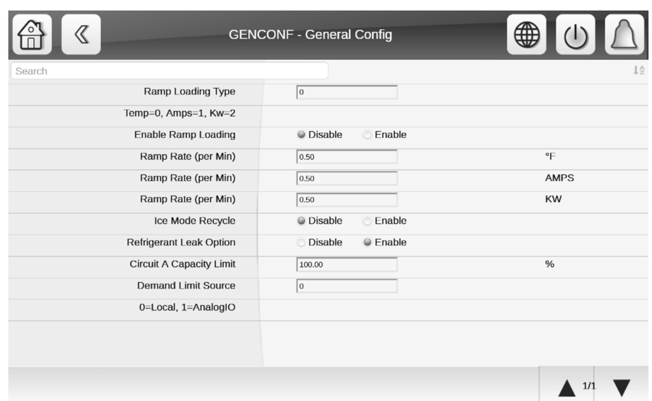


Fig. 46 — General Configuration Menu

To Stop the Chiller

1. The occupancy schedule starts and stops the chiller automatically once the time schedule is configured.
2. The unit can be stopped manually using the HMI by pressing the Disable Unit icon under the Chiller Start/Stop Menu. After the icon is pressed the unit will start the shutdown sequence.

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

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 Pumpout and Refrigerant Transfer Procedures) to reduce chiller pressure and the possibility of leaks. Maintain a holding charge of 5 to 10 psi (34 to 69 kPa) of refrigerant or nitrogen to prevent air from leaking into the chiller.

For seasonal 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 reduce 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 liquid, condenser liquid, and the pumpout condenser liquid circuits to avoid freeze-up. Keep the waterbox drains open.

Leave the oil charge in the chiller with the oil heater and controls energized to maintain the minimum oil reservoir temperature.

After Extended Shutdown

Ensure the liquid system drains are closed. It may be advisable to flush the liquid circuits to remove any soft rust which may have formed. This is a good time to brush the tubes and inspect the Schrader fittings on the optional liquid side flow devices for fouling, if necessary.

Check the cooler pressure on the HMI panel and compare it to the original holding charge that was left in the chiller. If (after adjusting for ambient temperature changes) any loss in pressure is indicated, check for refrigerant leaks. See Check Chiller Tightness section, page 25.

Recharge the chiller by transferring refrigerant from the pumpout storage tank (if supplied). Follow the Pumpout and Refrigerant Transfer Procedures section, page 45. Observe freeze-up precautions.

Carefully make all regular preliminary and running system checks. Perform a Control Test before start-up. If the oil level appears abnormally high, the oil may have absorbed refrigerant. A *LOW OIL TEMP* prestart alert will be declared if the oil temperature is not greater than the *EVAPORATOR SATURATED TEMP* plus 15°F (8.3°C) or 140°F (60°C), whichever is lower.

Cold Weather Operation

When the entering condenser liquid drops very low (55°F [13°C] minimum), the operator or tower control should automatically cycle the cooling tower fans off to keep the temperature up. Piping may also be arranged to bypass the cooling tower.

For cold weather operation it is also recommended to use the chiller HPR output to control the condenser water flow to keep the chiller pressure differential at a satisfactory level.

Refrigeration Log

A refrigeration log, such as the one shown in Fig. 47, provides a convenient checklist for routine inspection and maintenance, and provides a continuous record of chiller performance. It is an aid in scheduling routine maintenance and in diagnosing chiller problems.

Keep a record of the chiller pressures, temperatures, and liquid levels on a sheet similar to that shown. Automatic recording of PIC6 data is possible through the use of CCN/LEN devices such as ProView service tool. Contact your Carrier representative for more information.

PLANT____________ MODEL NO. __________________SERIAL NO. __________________REFRIGERANT TYPE ____________________

DATE:	COOLER							CONDENSER							CONCENTRATOR			COMPRESSOR			VFD							OPER-ATOR INITIALS	REMARKS
TIME	REFRIGERANT		LIQUID					REFRIGERANT		LIQUID					RECLAIM DELTA T	OIL RECLAIM OUTPUT	OIL LEVEL	OIL PRESS DELTA P	OIL SUMP TEMP	COMP. DISCH. TEMP	AVG. LINE CURRENT	AVG. LINE VOLTAGE	LINE KW	AVG. LOAD CURRENT	INVERTER TEMP	RECTIFIER TEMP	VFD COOLANT FLOW		
	PRESS.	TEMP	PRESSURE			TEMP		PRESS.	TEMP	PRESSURE			TEMP																
			IN	OUT	GPM	IN	OUT			IN	OUT	GPM	IN	OUT															

REMARKS: Indicate shutdowns on safety controls, repairs made, oil or refrigerant added or removed, operating hours, and start counts. Include amounts.

Fig. 47 — Refrigeration Log: Carrier 23XRV Hermetic Screw Refrigeration

PUMPOUT AND REFRIGERANT TRANSFER PROCEDURES

Preparation

The 23XRV chiller may come equipped with an optional pumpout storage tank, pumpout system, or pumpout compressor. The refrigerant can be pumped for service work to either the chiller compressor evaporator 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 evacuations.

⚠ CAUTION

Always run the chiller cooler and condenser liquid pumps and always charge or transfer refrigerant as a gas when the chiller pressure is less than 35 psig (241 kPa) for R-134a and less than 39 psig (268 kPa) for R-513A. Below these pressures, liquid refrigerant flashes into gas, resulting in extremely low temperatures in the cooler/condenser tubes and possibly causing tube freeze-up.

⚠ WARNING

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 personal injury.

⚠ CAUTION

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

Operating the Optional Pumpout Unit

1. Be sure that the suction and the discharge service valves on the optional pumpout compressor are open (backseated) during operation. Rotate the valve stem fully counterclockwise to open. Frontseating the valve closes the refrigerant line and opens the gage port to compressor pressure.
2. Ensure that the compressor holddown bolts have been loosened to allow free spring travel.
3. Open the refrigerant inlet valve on the pumpout compressor.
4. Oil should be visible in the pumpout unit compressor sight glass under all operating conditions and during shutdown. If oil is low, add oil as described under Optional Pumpout System Maintenance section, page 58. The pumpout unit control wiring schematic is detailed in Fig. 48.

TO READ REFRIGERANT PRESSURES DURING PUMPOUT OR LEAK TESTING:

1. The PIC display on the chiller control center 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 evaporator or condenser pressure transducer (Fig. 5-7).
2. To determine pumpout storage tank pressure, a 30 in. Hg vacuum –0-400 psi (–101 kPa -0-2769 kPa) compound gage is attached to the storage tank.
3. Refer to Fig. 27-30 and 49, for valve locations and numbers.

⚠ CAUTION

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

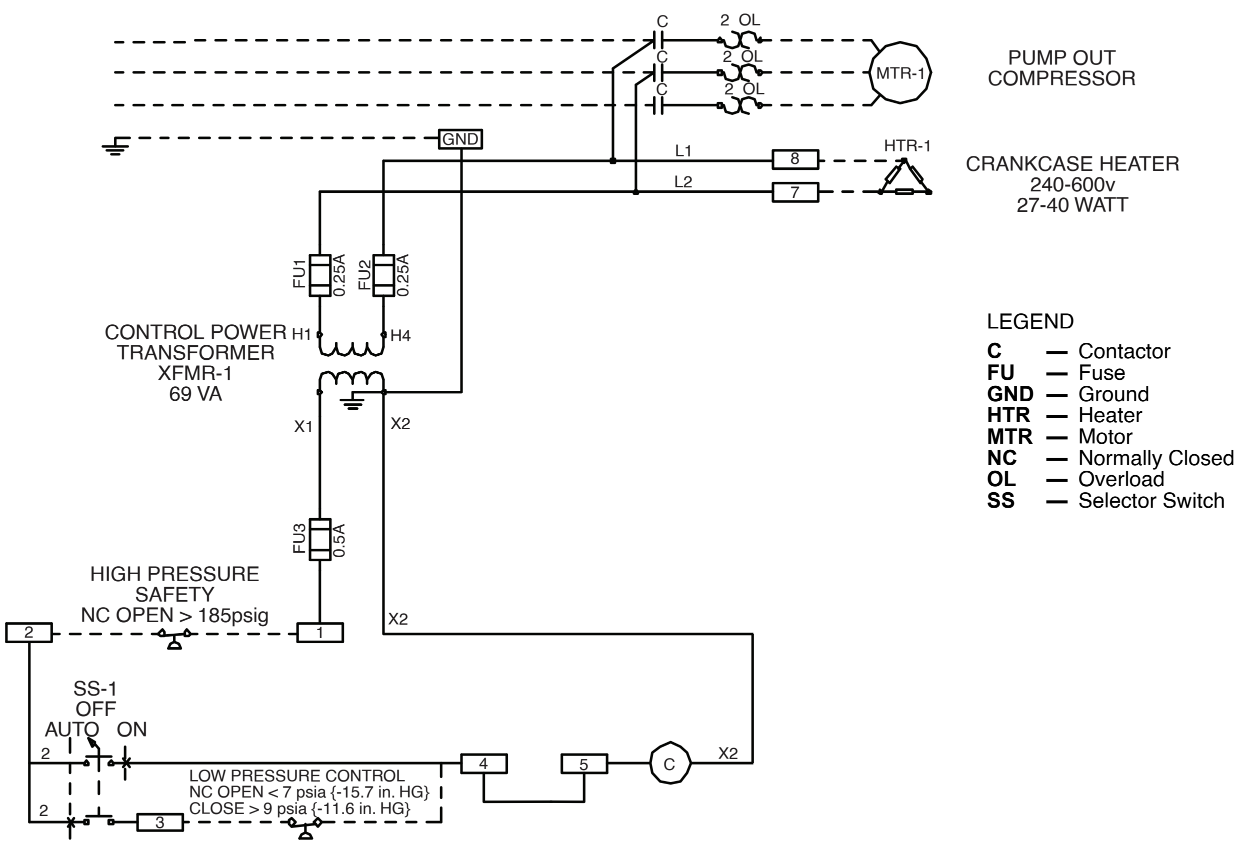


Fig. 48 — 23XRV Pumpout Unit Wiring Schematic

Chillers with Storage Tanks

In the Valve/Condition tables that accompany these instructions, the letter “C” indicates a closed valve. Figures 49-51 show the locations of the valves.

⚠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) for R-134a and less than 39 psig (268 kPa) for R-513A. Below these pressures, liquid refrigerant flashes into gas, resulting in extremely low temperatures in the cooler/condenser tubes and possibly causing tube freeze-up.

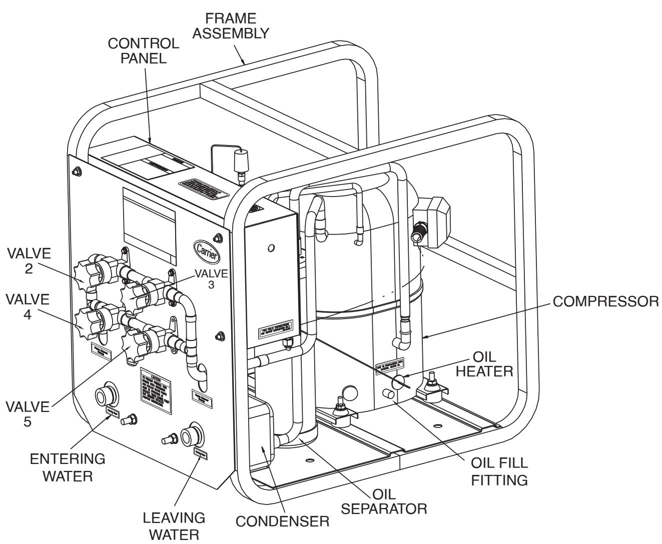


Fig. 49 — Optional Pumpout Unit

FOR UNITS WITH Q AND R COMPRESSORS ONLY

Transfer Refrigerant from Pumpout Storage Tank to Chiller

⚠WARNING

During transfer of refrigerant into and out of the 23XRV 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, establishing water flow (assumes vacuum condition in chiller system).
   b. Close pumpout and storage tank valves 2, 4, 5, 7, 8, 10 (if present open isolation valve 11 and other isolation valves between cooler and condenser). Open storage tank valves 6; open chiller valves 1A and 1B.

VALVE	1A	1B	2	3	4	5	6	7	8	10	11
CONDITION			C		C	C		C	C	C	

   c. Gradually open valve 5 to slowly increase chiller pressure to 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A to reduce the potential of tube freeze up.
   d. Open valve 5 fully after the chiller pressure reaches 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A or greater. Let chiller pressure reach 40 psig (276 kPa), then chiller water pumps can be turned off. Fully close valve 5.

VALVE	1A	1B	2	3	4	5	6	7	8	10	11
CONDITION			C		C	C		C	C	C	

   e. Open valve 8 and 10 to let higher pressure in the recovery tank push liquid refrigerant into the condenser float chamber and heat exchangers until the refrigerant pressure equalizes between the recovery tank and chiller.

VALVE	1A	1B	2	3	4	5	6	7	8	10	11
CONDITION			C		C	C		C			

2. Push liquid to chiller, them remove remaining vapor from storage tank:
   a. To prepare for liquid, push open valve 4.

VALVE	1A	1B	2	3	4	5	6	7	8	10	11
CONDITION			C			C		C			

   b. Ensure pumpout condenser water is off, then turn on the pumpout compressor in manual mode to push liquid to chiller. Monitor the storage tank level until tank is empty of liquid refrigerant.
   c. Close charging valves 8 and 10.
   d. Turn off the pumpout compressor.
   e. To prepare for removal of remaining refrigerant vapor in storage tank, close pumpout valves 3 and 4 and open valves 2 and 5.

VALVE	1A	1B	2	3	4	5	6	7	8	10	11
CONDITION				C	C			C	C	C	

   f. Turn on pumpout condenser water.
   g. Run pumpout unit in auto until the vacuum switch is satisfied. This occurs approximately at 15 in Hg vacuum (48 kPa absolute or 7 psia), removing the residual refrigerant vapor from the recovery tank and condensing to a liquid in the chiller.
   h. Close valves 1A, 1B, 2, 5, 6.

VALVE	1A	1B	2	3	4	5	6	7	8	10	11
CONDITION	C	C	C	C	C	C	C	C	C	C	

   i. Turn off pumpout condenser water.

Transfer Refrigerant from Chiller to Storage Tank Vessel

1. Equalize refrigerant pressure.
   a. Dehydrate the refrigerant storage vessel, and connected hoses/piping so there are no non-condensables mixed with the refrigerant.
   b. Locate valves as identified below:

VALVE	1A	1B	2	3	4	5	6	7	8	10	11
CONDITION			C		C	C		C	C	C	

   c. Slowly open valve 5 until the refrigerant pressure reaches 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A in the storage tank, followed by valves 7 and 10 to allow liquid refrigerant to drain by gravity.

VALVE	1A	1B	2	3	4	5	6	7	8	10	11
CONDITION			C		C				C		

2. Push remaining liquid, followed by refrigerant vapor removal from chiller.
   a. To prepare for liquid push, turn off the pumpout condenser water. Place valves in the following positions:

VALVE	1A	1B	2	3	4	5	6	7	8	10	11
CONDITION				C	C				C		

b. Run the pumpout compressor in manual until all liquid is pushed out of the chiller (approximately 45 minutes). Close valves 2, 5, 7, and 10, then stop compressor.

VALVE	1A	1B	2	3	4	5	6	7	8	10	11
CONDITION			C	C	C	C		C	C	C	

c. Turn on pumpout condenser water.

d. Open valves 3 and 4, and place valves in the following positions:

VALVE	1A	1B	2	3	4	5	6	7	8	10	11
CONDITION			C			C		C	C	C	

e. Run the pumpout compressor until the chiller pressure reaches 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A, followed by turning off the pumpout compressor. Warm chiller condenser water will boil off any entrapped liquid refrigerant, and chiller pressure will rise.

f. When chiller pressure rises to 40 psig (276 kPa), turn on the pumpout compressor until the pressure reaches 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A again; then turn off the pumpout compressor. Repeat this process until the chiller pressure no longer rises.

g. Start the chiller water pumps (condenser and cooler), establishing water flow. At this point, turn on the pumpout compressor in auto until the vacuum switch is satisfied. This occurs at approximately 15 in Hg vacuum (48 kPa absolute or 7 psia).

h. Close valves.

VALVE	1A	1B	2	3	4	5	6	7	8	10	11
CONDITION	C	C	C	C	C	C	C	C	C	C	

i. Turn off the pumpout condenser water.

Chillers with Isolation Valves

The valves referred to in the following instructions are shown in Fig. 50 and 51. The cooler/condenser vessels can be used for refrigerant isolation for certain service conditions when the isolation valve package is specified.

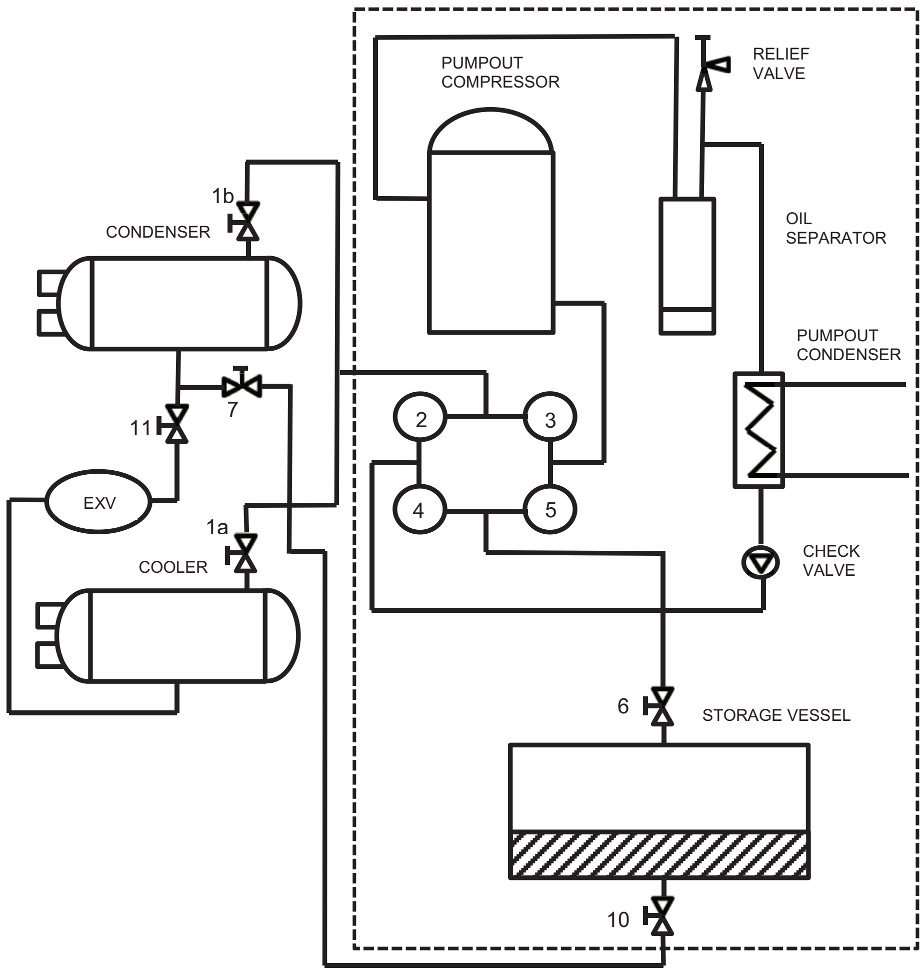


Fig. 50 — Pumpout System Piping Schematic with Storage Tank for 23XRV Units with P Compressor

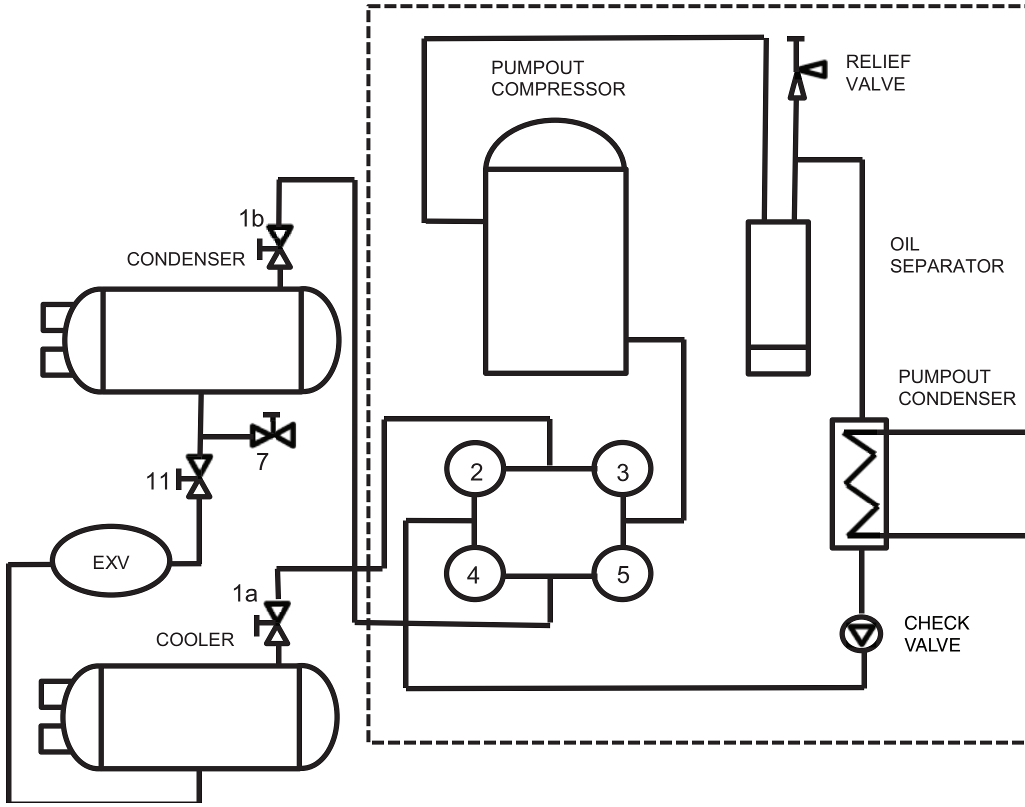


Fig. 51 — Pumpout System Piping Schematic without Storage Tank for 23XRV Units with P Compressor

Transfer Refrigerant from Cooler to Condenser

1. Turn off chiller water pumps and pumpout condenser water supply (if applicable). It is assumed that the starting point is as shown in the following table and that pressures in both vessels are above 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A.

VALVE	1A	1B	2	3	4	5	7	8	11
CONDITION	C	C	C	C	C	C	C	C	C

2. Keeping valves 7 and 8 closed, install charging hose from liquid line charging valve 7 to valve 8 on the condenser float chamber. Evacuate or purge hose of non-condensables. Note that this creates a flow path between cooler and condenser that bypasses the linear float, reducing the potential for damage during refrigerant transfer.
3. Open valves 1A, 1B, 2, 5, and 8.

VALVE	1A	1B	2	3	4	5	7	8	11
CONDITION				C	C		C		C

4. Turn on pumpout compressor, generating a refrigerant pressure differential of 10 to 20 psi (69 to 138 kPa) to push liquid out of the chiller cooler vessel.
5. Slowly open valve 7 to allow liquid transfer. Rapid opening of valve 7 can result in float valve damage.
6. When all liquid has been pushed into the chiller condenser vessel, close valve 8.

VALVE	1A	1B	2	3	4	5	7	8	11
CONDITION				C	C			C	C

7. Turn off the pumpout compressor.
8. Close pumpout valves 2 and 5 while opening valve 3 and 4 to prepare for removal of remaining refrigerant vapor in cooler vessel.

VALVE	1A	1B	2	3	4	5	7	8	11
CONDITION			C			C		C	C

9. Turn on pumpout condenser water.
10. Turn on pumpout compressor. Turn on the chiller water pump to establish water flow when the cooler refrigerant pressure is 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A. **The water pumps have to be in operation whenever the refrigerant pressure is equal to or less than 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A to reduce the potential of tube damage.**
11. Run the pumpout compressor until the cooler pressure reaches 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A, then turn off the pumpout compressor. Warm chiller cooler water will boil off any entrapped liquid refrigerant, and chiller pressure will rise. Repeat this process until the chiller pressure no longer rises.
12. Run pumpout unit in auto until the vacuum switch is satisfied; this occurs at approximately 15 in. Hg vacuum (48 kPa absolute or 7 psia). Close valve 1A.

VALVE	1A	1B	2	3	4	5	7	8	11
CONDITION	C		C			C		C	C

13. Monitor that cooler pressure does not rise (if it does, then repeat previous step).
14. With service valve 1A closed, shut down pumpout compressor (if still running).
15. Close remaining valves.

VALVE	1A	1B	2	3	4	5	7	8	11
CONDITION	C	C	C	C	C	C	C	C	C

16. Remove charging hose between 7 and 8 (evacuate prior to removal).
17. Turn off pumpout condenser water.
18. Turn off chiller water pumps, and lockout chiller compressor.

Transfer Refrigerant from Condenser to Cooler

1. Turn off chiller water pumps and pumpout condenser water supply (if applicable). It is assumed that the starting point is as shown in the following table and that pressures in both vessels are above 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A.

VALVE	1A	1B	2	3	4	5	7	8	11
CONDITION	C	C	C	C	C	C	C	C	C

2. Set valves as shown below to allow the refrigerant to equalize:

VALVE	1A	1B	2	3	4	5	7	8	11
CONDITION			C			C	C	C	C

3. Turn on pumpout compressor, and develop a 10 to 20 psi (69 to 138 kPa) refrigerant differential pressure between the vessels.
4. Partially open valve 11 while maintaining a refrigerant pressure differential to push liquid refrigerant out of the chiller condenser to the cooler.
5. When all liquid is out of the chiller condenser, close valve 11 and any other isolation valves on the chiller.
6. Turn off the pumpout compressor.
7. Close pumpout valves 3 and 4 while opening valve 2 and 5 to prepare for removal of remaining refrigerant vapor in condenser vessel.

VALVE	1A	1B	2	3	4	5	7	8	11
CONDITION				C	C		C	C	C

8. Turn on pumpout condenser water.
9. Turn on pumpout compressor.
10. Turn on the chiller water pumps, establishing water flow when the condenser refrigerant pressure is 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A. **The water pumps have to be in operation whenever the refrigerant pressure is equal to or less than 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A to reduce the potential of tube damage.**
11. Run the pumpout compressor until the condenser refrigerant pressure reaches 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A then turn off the pumpout compressor. Warm condenser water will boil off any entrapped liquid refrigerant, and chiller pressure will rise. Repeat this process until the chiller pressure no longer rises.
12. Run pumpout unit in auto until the vacuum switch is satisfied; this occurs at approximately 15 in. Hg vacuum (48 kPa absolute or 7 psia). Close valve 1B.

VALVE	1A	1B	2	3	4	5	7	8	11
CONDITION		C		C	C		C	C	C

13. Monitor that condenser pressure does not rise (if it does, then repeat previous step).
14. With service valve 1B closed, shut down pumpout compressor (if still running).
15. Close remaining valves.

VALVE	1A	1B	2	3	4	5	7	8	11
CONDITION	C	C	C	C	C	C	C	C	C

16. Turn off pumpout condenser water.
17. Turn off chiller water pumps, and lock out chiller compressor.

Return Chiller to Normal Operating Conditions

1. Vapor Pressure Equalization:
   a. Ensure that the chiller vessel that was exposed to ambient has been evacuated. Final vacuum prior to charging with refrigerant should in all cases be 29.9 in. Hg (500 microns, 0.07 kPa [abs]) or less.
   b. Turn on chiller water pumps.
   c. Open valves 1A, 1B, and 2.

VALVE	1A	1B	2	3	4	5	7	8	11
CONDITION				C	C	C	C	C	C

   d. Slowly open valve 4, gradually increasing pressure in the evacuated vessel to 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A.
   e. Leak test to ensure chiller vessel integrity.
   f. Open valve 4 fully for cooler and condenser pressure equalization (vapor equalization).

VALVE	1A	1B	2	3	4	5	7	8	11
CONDITION				C		C	C	C	C

   g. Close valves 1A, 1B, 2, and 4.

VALVE	1A	1B	2	3	4	5	7	8	11
CONDITION	C	C	C	C	C	C	C	C	C

2. Liquid equalization:
   a. If refrigerant is stored in cooler, install a charging hose between valves 7 and 8, and open both the valves and any other isolation valves (except valve 11) for liquid to drain into the condenser while bypassing the linear float valve. If refrigerant is stored in the condenser, keep valve 11 and any other isolation valves open for liquid drain.

VALVE	1A	1B	2	3	4	5	7	8	11
CONDITION (CHARGE IN COOLER)	C	C	C	C	C	C			C
CONDITION (CHARGE IN CONDENSER)	C	C	C	C	C	C	C	C	

   b. If valves 7 and 8 were used to bypass the linear float valve, once the liquid transfer is complete, close these valves, and slowly open valve 11.
   c. 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 Refrigerant from Chiller to Storage Tank Vessel section.
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) for R-134a and 39 psig (268 kPa) for R-513A. 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	

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

UNITS WITH P COMPRESSORS ONLY

Transfer Refrigerant from Pumpout Storage Tank to Chiller

⚠ WARNING

During transfer of refrigerant into and out of the 23XRV 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, establishing water flow (assumes vacuum condition in chiller system).

b. Close pumpout and storage tank valves 2, 4, 5, 7, 10 (if present open isolation valve 11 and other isolation valves between cooler and condenser). Open storage tank valves 6; open chiller valves 1A and 1B.

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

c. Gradually open valve 5 to slowly increase chiller pressure to 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A to reduce the potential of tube freeze up.

d. Open valve 5 fully after the chiller pressure reaches 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A or greater. Let chiller pressure reach 40 psig (276 kPa), then chiller water pumps can be turned off. Fully close valve 5.

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

e. Open valve 7 and 10 to let higher pressure in the recovery tank push liquid refrigerant into the condenser float chamber and heat exchangers until the refrigerant pressure equalizes between the recovery tank and chiller.

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

2. Push liquid to chiller, then remove remaining vapor from storage tank:

a. To prepare for liquid, push open valve 4.

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

b. Ensure pumpout condenser water is off, then turn on the pumpout compressor in manual mode to push liquid to chiller. Monitor the storage tank level until tank is empty of liquid refrigerant.

c. Close charging valves 7 and 10.

d. Turn off the pumpout compressor.

e. To prepare for removal of remaining refrigerant vapor in storage tank, close pumpout valves 3 and 4 and open valves 2 and 5.

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

f. Turn on pumpout condenser water.

g. Run pumpout unit in auto until the vacuum switch is satisfied. This occurs approximately at 15 in Hg vacuum (48 kPa absolute or 7 psia), removing the residual refrigerant vapor from the recovery tank and condensing to a liquid in the chiller.

h. Close valves 1A, 1B, 2, 5, 6.

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

i. Turn off pumpout condenser water.

Transfer Refrigerant from Chiller to Storage Tank Vessel

1. Equalize refrigerant pressure.

a. Dehydrate the refrigerant storage vessel, and connected hoses/piping so there are no non-condensables mixed with the refrigerant.

b. Locate valves as identified below:

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

c. Slowly open valve 5 until the refrigerant pressure reaches 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A in the storage tank, followed by valves 7 and 10 to allow liquid refrigerant to drain by gravity.

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

2. Push remaining liquid, followed by refrigerant vapor removal from chiller.

a. To prepare for liquid push, turn off the 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 manual until all liquid is pushed out of the chiller (approximately 45 minutes). Close valves 2, 5, 7, and 10, then stop compressor.

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

c. Turn on pumpout condenser water.

d. Open valves 3 and 4, and place valves in the following positions:

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

e. Run the pumpout compressor until the chiller pressure reaches 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A, followed by turning off the pumpout compressor. Warm chiller condenser water will boil off any entrapped liquid refrigerant, and chiller pressure will rise.

f. When chiller pressure rises to 40 psig (276 kPa), turn on the pumpout compressor until the pressure reaches 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A again; then turn off the pumpout compressor. Repeat this process until the chiller pressure no longer rises.

g. Start the chiller water pumps (condenser and cooler), establishing water flow. At this point, turn on the pumpout compressor in auto until the vacuum switch is satisfied. This occurs at approximately 15 in Hg vacuum (48 kPa absolute or 7 psia).

h. Close valves.

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

i. Turn off the pumpout condenser water.

Chillers with Isolation Valves

The valves referred to in the following instructions are shown in Fig. 50 and 51. The cooler/condenser vessels can be used for refrigerant isolation for certain service conditions when the isolation valve package is specified.

Transfer Refrigerant from Cooler to Condenser

a. Turn off chiller water pumps and pumpout condenser water supply (if applicable). It is assumed that the starting point is as shown in the following table and that pressures in both vessels are above 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A.

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

b. Open valves 1A, 1B, 2, and 5.

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

c. Turn on pumpout compressor, generating a refrigerant pressure differential of 10 to 20 psi (69 to 138 kPa) to push liquid out of the chiller cooler vessel.

d. <u>Slowly</u> open valve 11 to allow liquid transfer.

e. When all liquid has been pushed into the chiller condenser vessel, close valve 11.

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

f. Turn off the pumpout compressor.

g. Close pumpout valves 2 and 5 while opening valve 3 and 4 to prepare for removal of remaining refrigerant vapor in cooler vessel.

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

h. Turn on pumpout condenser water.

i. Turn on pumpout compressor. Turn on the chiller water pump to establish water flow when the cooler refrigerant pressure is 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A. **The water pumps have to be in operation whenever the refrigerant pressure is equal to or less than 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A to reduce the potential of tube damage.**

j. Run the pumpout compressor until the cooler pressure reaches 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A, then turn off the pumpout compressor. Warm chiller cooler water will boil off any entrapped liquid refrigerant, and chiller pressure will rise. Repeat this process until the chiller pressure no longer rises.

k. Run pumpout unit in auto until the vacuum switch is satisfied; this occurs at approximately 15 in. Hg vacuum (48 kPa absolute or 7 psia). Close valve 1A.

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

l. Monitor that cooler pressure does not rise (if it does, then repeat previous step).

m. With service valve 1A closed, shut down pumpout compressor (if still running).

n. Close remaining valves.

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

o. Turn off pumpout condenser water.

p. Turn off chiller water pumps, and lockout chiller compressor.

Transfer Refrigerant from Condenser to Cooler

a. Turn off chiller water pumps and pumpout condenser water supply (if applicable). It is assumed that the starting point is as shown in the following table and that pressures in both vessels are above 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A.

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

b. Set valves as shown below to allow the refrigerant to equalize:

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

c. Turn on pumpout compressor, and develop a 10 to 20 psi (69 to 138 kPa) refrigerant differential pressure between the vessels.

d. Partially open valve 11 while maintaining a refrigerant pressure differential to push liquid refrigerant out of the chiller condenser to the cooler.

e. When all liquid is out of the chiller condenser, close valve 11 and any other isolation valves on the chiller.

f. Turn off the pumpout compressor.

g. Close pumpout valves 3 and 4 while opening valve 2 and 5 to prepare for removal of remaining refrigerant vapor in condenser vessel.

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

h. Turn on pumpout condenser water.

i. Turn on pumpout compressor.

j. Turn on the chiller water pumps, establishing water flow when the condenser refrigerant pressure is 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A. **The water pumps have to be in operation whenever the refrigerant pressure is equal to or less than 35 psig (241 kPa) for R-134a and 39 psig**

(268 kPa) for R-513A to reduce the potential of tube damage.

k. Run the pumpout compressor until the condenser refrigerant pressure reaches 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A then turn off the pumpout compressor. Warm condenser water will boil off any entrapped liquid refrigerant, and chiller pressure will rise. Repeat this process until the chiller pressure no longer rises.

l. Run pumpout unit in auto until the vacuum switch is satisfied; this occurs at approximately 15 in. Hg vacuum (48 kPa absolute or 7 psia). Close valve 1B.

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

m. Monitor that condenser pressure does not rise (if it does, then repeat previous step).

n. With service valve 1B closed, shut down pumpout compressor (if still running).

o. Close remaining valves.

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

p. Turn off pumpout condenser water.

q. Turn off chiller water pumps, and lock out chiller compressor.

Return Chiller to Normal Operating Conditions

1. Vapor Pressure Equalization:

   a. Ensure that the chiller vessel that was exposed to ambient has been evacuated. Final vacuum prior to charging with refrigerant should in all cases be 29.9 in. Hg (500 microns, 0.07 kPa [abs]) or less.

   b. Turn on chiller water pumps.

   c. Open valves 1A, 1B, and 2.

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

   d. Slowly open valve 4, gradually increasing pressure in the evacuated vessel to 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A.

   e. Leak test to ensure chiller vessel integrity.

   f. Open valve 4 fully for cooler and condenser pressure equalization (vapor equalization).

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

   g. Close valves 1A, 1B, 2, and 4.

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

2. Liquid equalization:

   a. Slowly open valve 11 and any other isolation valves open for liquid drain.

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

   b. 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 Refrigerant from Chiller to Storage Tank Vessel section.

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) for R-134a and 39 psig (268 kPa) for R-513A. 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	

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

GENERAL MAINTENANCE

Refrigerant Properties

R-134a and R-513A are the standard refrigerants in the 23XRV chiller. At normal atmospheric pressure, R-134a will boil at –14°F (–25°C) and R-513A will boil at –28°F (–33°C), and must, therefore, be kept in pressurized containers or storage tanks. The refrigerant is practically odorless when mixed with air. R-134a 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.

⚠ WARNING

R-134a and R-513A will dissolve oil and some non-metallic materials, will dry the skin, and, in heavy concentrations, may displace enough oxygen to cause asphyxiation. In handling this refrigerant, protect hands and eyes and avoid breathing fumes.

Adding Refrigerant

Follow the procedures described in the Charge Refrigerant into Chiller section, page 38.

> ⚠ **CAUTION**
>
> Always use the compressor pumpdown function in the Control Test mode to turn on the evaporator pump and lock out the compressor when transferring refrigerant. Liquid refrigerant may flash into a gas and cause possible freeze-up when the chiller pressure is below 35 psig (241 kPa) for R-134a and 39 psig (268 kPa) for R-513A.

Removing Refrigerant

If the optional pumpout system is used, the 23XRV refrigerant charge may be transferred to a storage vessel or within the condenser or cooler if isolation valves are present. Follow procedures in the Pumpout and Refrigerant Transfer Procedures section when removing refrigerant from the storage tank to the chiller.

Adjusting the Refrigerant Charge

If the addition or removal of refrigerant is required for improved chiller performance, follow the procedures given under the Trim Refrigerant Charge section, on page 53.

Refrigerant Leak Testing

Because R-134a/R-513A is above atmospheric pressure at room temperature, leak testing can be performed with refrigerant in the chiller. Use an electronic leak detector, halide leak detector, soap bubble solution, or ultra-sonic leak detector. Be sure 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. The chiller should be leak tested at least once per year.

Refrigerant Leak Rate

ASHRAE recommends that chillers should be immediately taken off line and repaired if the refrigerant leakage rate for the entire chiller is more than 10% of operating refrigerant charge per year.

Additionally, Carrier recommends that leaks totaling less than the above rate but more than a rate of 1 lb (0.5 kg) per year should be repaired during annual maintenance or whenever the refrigerant is pumped over for other service work.

Test After Service, Repair, or Major Leak

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

REFRIGERANT TRACER

Use an environmentally acceptable refrigerant as a tracer for leak test procedures.

TO PRESSURIZE WITH DRY NITROGEN

Another method of leak testing is to pressure with nitrogen only and use soap bubble solution or an ultrasonic leak detector to determine if leaks are present. This should only be done if all refrigerant has been evacuated from the vessel.

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 no longer required.

Repair the Refrigerant Leak, Retest, and Apply Standing Vacuum Test

After pressurizing the chiller, test for leaks with a soap bubble solution, an electronic leak detector, a halide torch, or an 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 Chiller Dehydration in the Before Initial Start-Up section, page 32.

Trim Refrigerant Charge

If it becomes necessary to adjust the refrigerant charge to obtain optimum chiller performance, operate the chiller at design load and then add or remove refrigerant slowly until the difference between *LEAVING CHILLED LIQUID* chilled liquid temperature and the *EVAP REFRIG LIQUID TEMP* reaches design conditions. *Do not overcharge*. For superheat information, see the Troubleshooting Guide section on page 59.

Refrigerant may be added either through the optional storage tank or directly into the chiller as described in the section entitled Refrigerant Charging.

To remove any excess refrigerant, follow the procedure in Transfer Refrigerant from Chiller to Storage Tank Vessel section, Steps 1a, b on page 50.

WEEKLY MAINTENANCE

Check the Lubrication System

Mark the oil level on the oil sump sight glasses and observe the level each week while the chiller is running. Check the moisture indicator on the motor cooling line.

If the level goes below the bottom of the oil sump sight glass, the oil reclaim system must be checked for proper operation. The oil reclaim system is operating properly if the level in the oil sump increases after running the chiller near full load with a 95°F (35°C) or higher *CONDENSER SATURATED TEMPERATURE* for 1 hour. If additional oil is required, add it through the oil charging valve (Fig. 2-7). A hand pump is required for adding oil against refrigerant pressure. The oil charge for the 23XRV chiller is 10 gallons (38 L).

The oil *must* meet Carrier's specifications for the 23XRV chillers. Refer to Changing Oil and Oil Filter section. Any oil that is added should be logged by noting the amount and date in Fig. 47 on page 44. Any oil that is added due to oil loss not related to service will eventually return to the sump. Excess oil must be removed when the level is above the top of the oil sump sight glass.

A 530-watt oil sump heater and 1000W second stage heater are controlled by the PIC6 controls to maintain oil temperature above 140°F (60°C) or *EVAPORATOR SATURATED TEMPERATURE* plus 53°F (29.4°C) when the compressor is off (see the Controls section on page 17). The PIC6 Status Output menu displays which heater is energized. If the Output menu shows that the sump heater is energized, but the sump is not heating up, the power to the oil sump heater may be off or the oil level may be too low. Check the oil level, the sump oil heater contactor voltage, and oil heater resistance.

The PIC6 controls will not permit compressor start-up if the oil temperature is less than 140°F (60°C) or *EVAPORATED SATURATED TEMPERATURE* plus 15°F (8.3°C), whichever is lower. The control will continue with start-up only after the temperature is within limits.

SCHEDULED MAINTENANCE

Establish a regular maintenance schedule based on the actual chiller requirements such as chiller load, run hours, and cooler and condenser liquid quality. The time intervals listed in this section are offered as guides to service only. Jobsite conditions may dictate that maintenance schedule is performed more often than recommended.

NOTE: The Optional Extended Warranty includes specific maintenance requirements and service intervals that must be documented. See specific details in the Optional Extended Warranty agreement.

Service Ontime

In the Runtime menu the PIC6 controller captures Service Runtime and other service relevant information. This value should be reset to zero by service person or operator each time major service work is completed so that time between service can be seen.

Inspect the Control Center

Maintenance is generally limited to general cleaning and tightening of connections. Vacuum the control center enclosure to eliminate dust build-up. In the event of chiller control malfunctions, refer to the Troubleshooting Guide section for control checks and adjustments.

Power connections on newly installed equipment may relax and loosen after a month of operation. Turn off power and retighten; check annually thereafter.

⚠ DANGER

Be sure power to the control center is off when cleaning and tightening connections inside the control center. Failure to be sure power is off will result in severe personal injury or death.

⚠ CAUTION

Do not manually open oil reclaim isolation valve when chiller is shut down. Doing so will flood the vaporizer with refrigerant and severely degrade the viscosity of the oil in the sump.

Changing Oil and Oil Filter

If Oil Delta P approaches the 18 psid (124 kPad) Low Oil Pressure Alarm threshold, change oil filter as needed. Otherwise, change the oil filter on a two year schedule.

Oil analysis is an important part of a good preventive maintenance program. Carrier recommends a yearly oil analysis. Changing oil is not recommended unless the oil analysis indicates problems. (The Optional Extended Warranty program has specific requirements.) If no analysis is being performed, change the oil after 5 years. See Oil Specification section below for additional information.

⚠ CAUTION

Compressor oil is hygroscopic. Containers should remain tightly sealed in a clean and dry environment to prevent moisture absorption from the air.

CHANGING OIL

The 23XRV oil pump and filter can be isolated to change the oil filter and oil while the refrigerant remains inside the chiller. Use the following procedures to change the oil and oil filter (if required):

1. Make sure the compressor is off and the CB1 main circuit breaker (behind left door on the VFD) for the control center is open.
2. Open the CB2 (behind left door on the VFD) control power and oil heater circuit breaker in order to turn off the power to the oil heater.
3. Record the oil level observed in the oil sump sight glass.

⚠ CAUTION

Be sure the power to the oil heater is off when the oil sump is drained. If the oil heater remains energized when the sump is empty, it will overheat any residual oil on the heating element and become fouled. Overheating the elements will also significantly reduce their useful life.

4. Connect an oil charging hose to the oil drain valve on the strainer housing. See Fig. 5-7. Place the other end of the oil charging hose in a clean container suitable for used oil. A portion of the oil drained from the sump should be used as an oil sample and should be sent to a laboratory for proper analysis. *Do not contaminate this sample*.
5. Slowly open the drain valve to drain the oil from the sump.

⚠ WARNING

The oil sump is at high pressure. Relieve pressure slowly to prevent injury.

6. Charge new oil through the drain valve on the strainer housing. A hand pump or portable electric oil pump will be required to charge oil back into the oil sump against refrigerant pressure.
7. Add oil (approximately 10 gal [38 L]) until it returns to the level noted in Step 3. The oil sight glass will not fill completely since a small amount of gas will be trapped inside (even under vacuum conditions).
8. Apply power through the CB2 (behind left door on the VFD) controls and oil heater circuit breaker.

Changing Oil Filter

1. Make sure the compressor is off and the disconnect for the compressor starter is open.
2. Close both oil filter isolation valves. See Fig. 52.
3. Place a container underneath the oil filter assembly.
4. When a Schrader valve is provided, use it to relieve the pressure. Slowly open the drain plug, located on the bottom of the oil filter housing, to relieve pressure. *Do not remove the plug*.
5. Remove the filter canisters by unscrewing the retainer nut. The filter may now be removed and disposed of properly.
6. Install new oil filter. Install the new O-ring. Tighten the retainer nut.
7. If a Schrader valve is supplied, evacuate the oil filter by connecting the vacuum pump to the Schrader valve.
8. Slowly open the isolation valve located near the oil pump to equalize the pressure. Fully open both oil filter isolation valves.

Oil Specification

If oil is to be added, it must meet Carrier specifications:

- Carrier Part Number....... PP23BZ110001 (1x1 gal. can)
  PP23BZ110005 (1x5 gal. can)
- Oil type.......................... Inhibited polyolester-based synthetic compressor lubricant with ISO Viscosity Grade 220 suitable for use in screw compressors where high viscosity and compatibility with R-134a/R-513A refrigerants is required.

> ⚠ **CAUTION**
>
> Compressor oil is hygroscopic. Containers should remain tightly sealed in a clean and dry environment to prevent moisture absorption from the air.

This oil (part number PP23BZ110001 [1x1 gal. can] and PP23BZ110005 [1x5 gal. can]) may be ordered from your local Carrier representative.

Oil Heater

Inspect the oil heater for carbon build-up on the heating element if an adequate oil sump temperature cannot be maintained when the chiller is shut down. It may be necessary to temporarily install the heater element terminal cover to provide additional leverage while threading the oil heater into the sump. The sump oil heater elements must be positioned vertically to allow proper heat convection. See Fig. 52 and 53. The heater element must be installed with the word "TOP" on the threaded fitting facing upward.

Refrigerant Filter/Drier

A refrigerant filter/drier, located on the motor cooling line, should be changed once every two years, or as necessary, if the condition of the filter indicates a need for less or more frequent replacement (see Fig. 54). A moisture indicator (dry eye) sight glass is located beyond the filter/drier to indicate the concentration of moisture in the refrigerant. If the moisture indicator indicates moisture, locate the source of the liquid immediately by performing a thorough leak check. Close the isolation valves on either side of the filter drier. Use the Schrader valve to relieve pressure in the isolated filter/drier. Replace the filter/drier and evacuate the isolated section of tubing with a vacuum pump attached to the Schrader valve.

Oil Filters

The oil system has two filters: one prior to the pump and one immediately after the pump. They are conveniently mounted on the vaporizer in between two isolation ball valves.

VFD Refrigerant Strainer

For refrigerant-cooled drives, a refrigerant strainer is located in the line that supplies refrigerant to the VFD. Three isolation valves in the refrigerant cooling lines must be closed before this strainer is changed. See Fig. 54.

Vaporizer Refrigerant Return Line Orifice

For the two-piece vaporizer, there is a metering orifice where the refrigerant return line attaches to the vaporizer (see Fig. 52). This orifice can only be inspected by cutting the vaporizer refrigerant return line near the vaporizer. This orifice should be inspected if hot condenser gas flow through the vaporizer appears to be obstructed. For the single-piece vaporizer, the orifice has been moved outside the vaporizer in the gas return line to the cooler. This orifice is variable (see Fig 52).

Compressor Inlet Bearing Oil Orifice

The oil line leading to the compressor lubrication block is connected to the inlet bearing oil orifice. The orifice is pressed into a standard reducer/expander fitting and protected by a 50 x 50 mesh screen (see Fig. 55). Compressor oil lines and fittings between the oil filter and compressor must be capped during disassembly to prevent contamination. Inspect the inlet bearing oil orifice whenever the oil line between the oil filter and compressor is disconnected.

Inspect Condenser Refrigerant Float System (Frame 3-5 Heat Exchangers)

Perform this inspection when the condenser is opened for service. See Fig. 56.

1. Transfer the refrigerant into the cooler vessel or into a pumpout storage tank.
2. Remove the float access cover.
3. Clean the chamber and valve assembly thoroughly. Be sure the valve moves freely. Ensure that all openings are free of obstructions.
4. Apply thread locking adhesive (P/N 24221 [10 ml] or 24231 [50 ml]) the 3/8-in. 16 bolts that hold the float valve in place. See Fig. 56 for a view of the float valve design. Inspect the orientation of the float slide pin. It must be pointed toward the bubbler tube for proper operation.
5. Apply gasket sealant (P/N 19XL680-002) to both sides of new gasket when reinstalling cover.

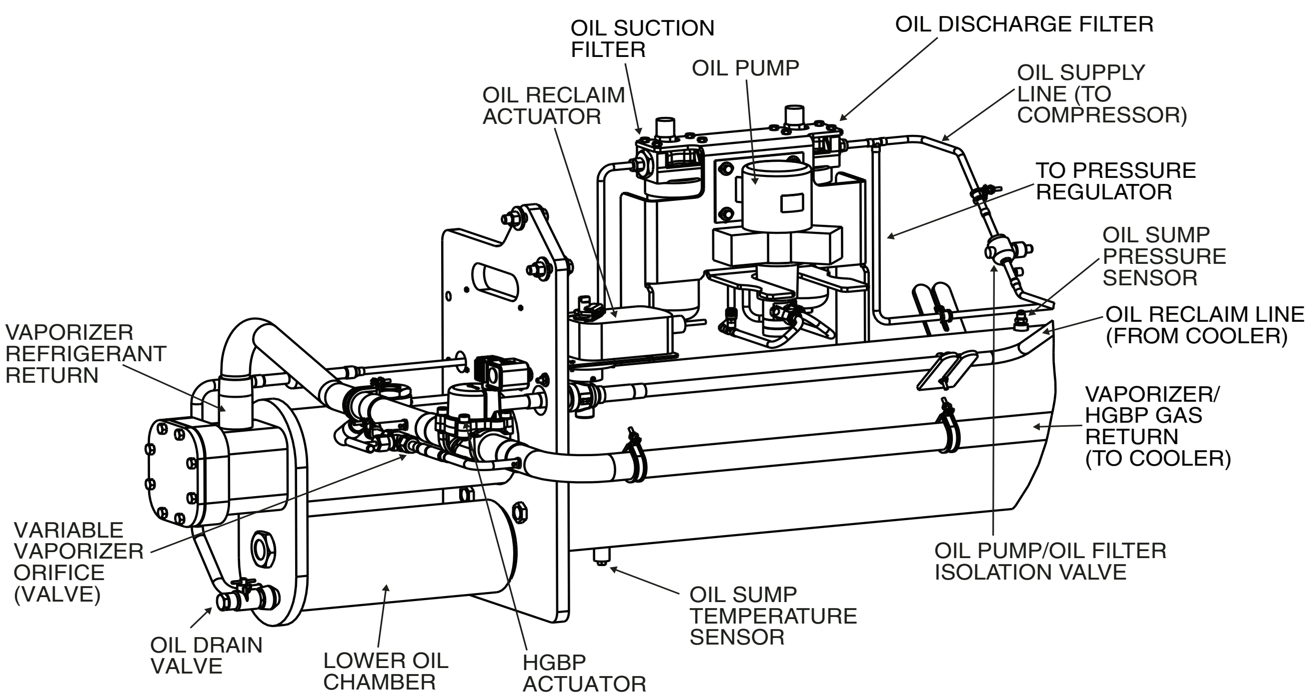


Fig. 52 — 1-Piece Vaporizer Oil Management System

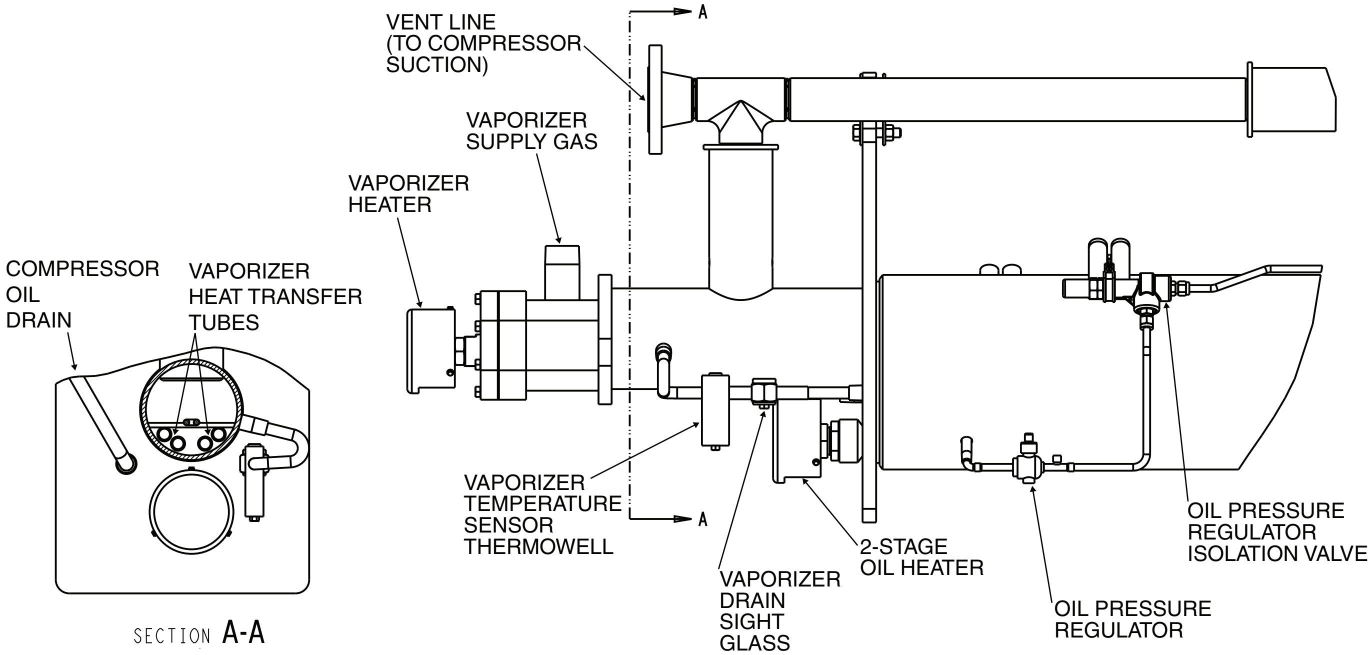


Fig. 53 — Oil Reclaim Cross Section (Q, R Compressors Shown)

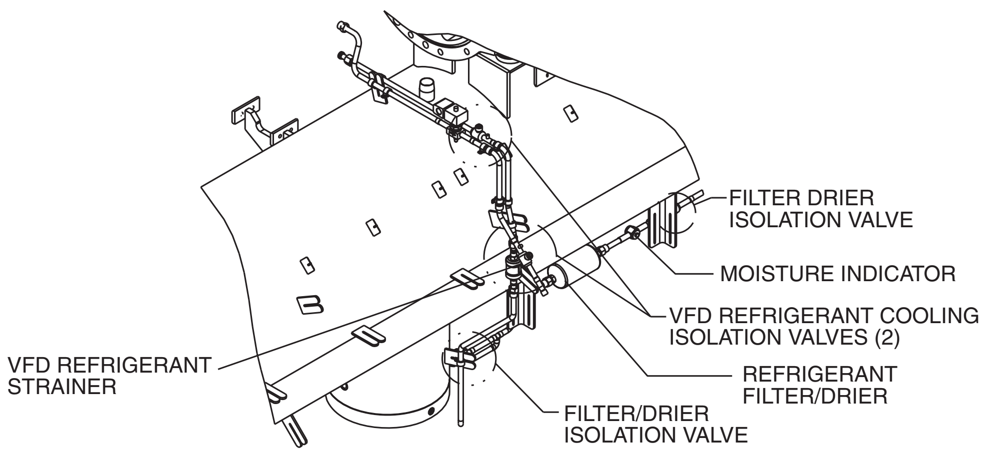


Fig. 54 — Refrigerant Filter/Drier

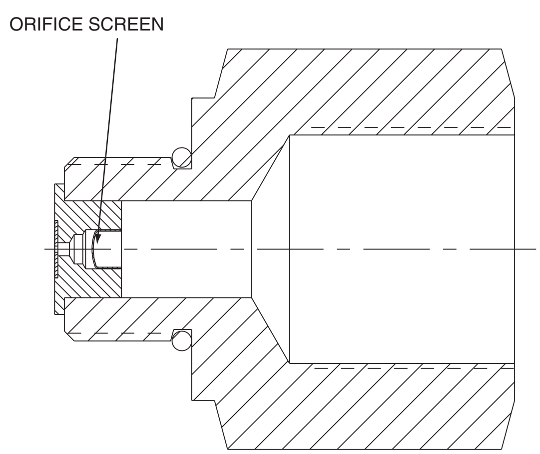
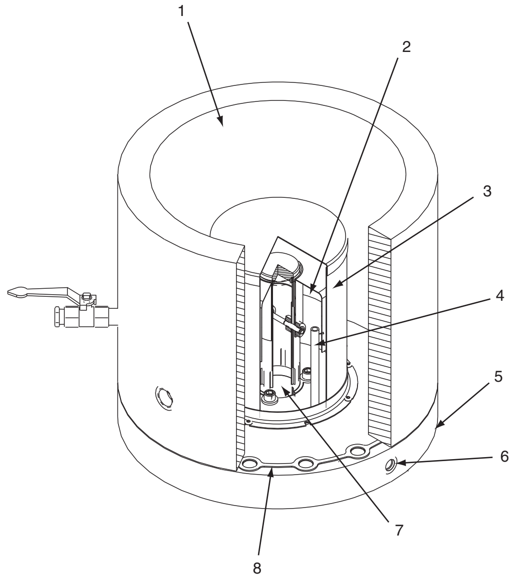


Fig. 55 — Compressor Inlet Bearing Oil Orifice



LEGEND

1	—	Refrigerant Inlet from FLASC Chamber
2	—	Linear Float Assembly
3	—	Float Screen
4	—	Bubbler Line
5	—	Float Cover
6	—	Bubble Line Connection
7	—	Refrigerant Outlet to Cooler
8	—	Gasket

Fig. 56 — 23XRV Float Valve Design (Frame 3-5 Heat Exchangers Only)

Inspect Variable Frequency Drive

Perform the following variable frequency drive inspections annually:

- Inspect the cooling fan.
- Clean the power module and cabinet (vacuum clean).
- Check and tighten electrical connections as needed.
- Perform visual inspection and capacitor test of the filter section of the VFD.
- Perform visual inspection of the inductors for overheating or other signs of deterioration. If yes, isolate and check for voltage leak.
- Test to ground (line and link reactors if applicable).
- Inspect, clean, and test harmonic filter (if applicable).
- Review and record the alarm history of the starter.
- Check drive configurations for accuracy.
- Verify that the variable frequency drive installed location is in an ambient temperature range and humidity (non-condensing) within its design values and altitude level.
- Verify that the variable speed drive throughout the year is in a clean, ventilated location.
- Verify the power supply for the VFD does not include power factor correction capacitors.
- Do not try to maintain chiller operation through an open power transfer from secondary power supplies.
- Verify that the variable speed drive is not subject to dirty electrical power, spikes, low voltage, sags, or other electrical power abnormalities.

Inspect Relief Valves and Piping

The relief valves on this chiller protect 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. Inspect the relief valves in accordance with local codes.

At 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 valve body and mechanism for any evidence of internal corrosion or rust, dirt, scale, leakage, etc.
2. If corrosion or foreign material is found, do not attempt to repair or recondition. *Replace the valve*.
3. If the chiller is installed in a corrosive atmosphere or the relief valves are vented into a corrosive atmosphere, make valve inspections at more frequent intervals.

Compressor Bearing Maintenance

The compressor bearings are designed to last for the life of the chiller. The key to good bearing maintenance is proper lubrication. Use the proper grade of oil, maintained at recommended level, temperature, and pressure. Inspect the lubrication system regularly and thoroughly.

Excessive bearing wear can be detected through increased vibration. Carrier recommends that periodic vibration analysis be performed as part of compressor preventative maintenance program. For Optional Extended Warranty, consult the warranty's specific requirements. Contact an experienced and responsible service organization to perform vibration analysis on the compressor.

Compressor Rotor Check

Use Carrier specified oil. Excessive compressor rotor wear is shown by a lack of performance. If a lack of performance is noted, have the compressor rotors inspected by a trained service person.

Motor Insulation

Periodic checks of the motor insulation are recommended. (For Optional Extended Warranty, consult the warranty's specific requirements.) A 500-v megohmmeter test is recommended to assist troubleshooting if there are indications of problems including, but not limited to, moisture in the refrigerant, and chronic current imbalance or over current trips. See guidelines for megohmmeter test in the Before Initial Start-Up, Ground Fault Troubleshooting section on page 35.

⚠ CAUTION

The motor leads must be disconnected from the VFD before an insulation test is performed. The voltage generated from the test equipment can damage the solid-state VFD components.

Inspect the Heat Exchanger Tubes

COOLER

Inspect and clean the cooler tubes at the end of the first operating season. Because these tubes have internal ridges, a rotary-type tube cleaning system is necessary to fully clean the tubes. Upon inspection, the tube condition will determine the scheduled frequency for cleaning, and will indicate whether liquid treatment is adequate in the chilled liquid/brine circuit. Inspect the entering and leaving chilled liquid temperature sensors for signs of corrosion or scale. Replace the sensor if corroded or remove any scale if found.

CONDENSER

Since this liquid 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 liquid is contaminated. Inspect the entering and leaving condenser liquid sensors for signs of corrosion or scale. Replace the sensor 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 liquid temperature. If this reading is more than what the design difference is supposed to be, then the condenser tubes may be dirty or liquid flow may be incorrect. Because R-134a/R-513A is a high-pressure refrigerant, air usually does not enter the chiller.

During the tube cleaning process, use brushes especially designed to avoid scraping and scratching the tube wall. Contact your Carrier representative to obtain these brushes. *Do not use wire brushes*.

⚠ CAUTION

Hard scale may require chemical treatment for its prevention or removal. Consult a liquid treatment specialist for proper treatment. Failure to properly treat liquid could result in property damage or personal injury.

Water/Brine Leaks

Moisture in the refrigerant is indicated during chiller operation by the refrigerant moisture indicator on the refrigerant motor cooling line. See Fig. 2-4. Leaks should be repaired immediately.

⚠ CAUTION

The chiller must be dehydrated after repair of liquid leaks. See Chiller Dehydration section, page 32. Failure to dehydrate the chiller after repair of liquid leaks could result in equipment damage or personal injury.

Water/Brine Treatment

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

⚠ CAUTION

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

Inspect the Control Center

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

⚠ WARNING

Before working on any VFD, shut off the chiller, open and tag all disconnects supplying power to the starter. After disconnecting input power to a VFD and before touching any internal components, wait 5 minutes for the DC bus capacitors to discharge, then check the voltage with a voltmeter. Failure to observe this warning could result in severe bodily injury or death.

⚠ WARNING

The disconnect on the front of the control center does not de-energize all internal circuits. Open all internal control power and remote disconnects before servicing 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.

⚠ WARNING

Never open isolating knife switches while equipment is operating. Electrical arcing can cause serious injury.

Periodically vacuum or blow off accumulated debris on the internal parts with a high-velocity, low-pressure blower.

Power connections on newly installed control centers may relax and loosen after a month of operation. Turn power off and retighten. Recheck annually thereafter.

⚠ CAUTION

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

Recalibrate Pressure Transducers

Once a year, the pressure transducers should be checked against a pressure gage reading. Check all transducers (up to 9): the oil pressure delta P transducers, discharge pressure transducer, the condenser pressure transducer, the cooler pressure transducer, and the optional water side pressure transducers (consisting of 4 optional flow devices: 2 cooler, 2 condenser).

Note the evaporator and condenser pressure readings on the PRESSURE screen. Attach an accurate set of refrigeration gages to the cooler and condenser Schrader fittings. Compare the two readings. If there is a difference in readings, the transducer can be calibrated as described in the Troubleshooting Guide section. The path for pressure transducer calibration is ***Main Menu→Quick Test→Transducer Calibration***.

Optional Pumpout System Maintenance

For pumpout unit compressor maintenance details, refer to the 19XR Positive Pressure Storage System Installation, Start-Up, and Service Instructions.

Verify Thermistor Readings

If required, the cooler water side thermistors should be verified after a completed pressure recalibration. The PIC6 control system allows for up to ±5°F (2.8°C) adjustment of the as-read temperature. Set the thermistor in a known temperature water bath to recalibrate the reading. The path is ***Main Menu→ Quick Test→Thermistor Calibration.***

⚠ CAUTION

Compressor oil is hygroscopic. Containers should remain tightly sealed in clean and dry environments to prevent moisture absorption from the air.

Ordering Replacement Chiller Parts

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

- chiller model number and serial number
- VFD model number and serial number (if applicable)
- name, quantity, and part number of the part required
- delivery address and method of shipment

TROUBLESHOOTING GUIDE

Overview

The PIC6 control system has many features to help the operator and technician troubleshoot a 23XRV chiller.

- The HMI shows the chiller's actual operating conditions and can be viewed while the unit is running.
- The HMI home screen indicates when an alarm occurs. Once all alarms have been cleared and corrected, the HMI default screen indicates normal operation. For information about displaying and resetting alarms and a list of alert/ alarm codes see 23XRV with PIC6 Controls Operation and Troubleshooting manual.
- The main menu screens contain and display information that helps diagnose problems with chilled water temperature control, chilled water temperature control overrides, hot gas bypass, heater controls and time schedule operation.
- The controls test located under Service Tests in the Main Menu allows testing by activation of listed outputs such as but not limited to HGBP, EXV, oil pump, oil reclaim valve, various heaters and control outputs.
- A controls test provides a path to manually test operation and should be utilized as part of any troubleshooting.
- If an operating fault is detected, an alarm or alert message is generated and displayed on the HMI screen. A more detailed message — along with a diagnostic message — is also stored into the Current Alarms tables.
- Review the Alarms History table to view other critical events and abnormal conditions which may have occurred. Compare timing of relevant alerts and alarms. If a conclusion is not obvious, collect Black Box data for future use since Alarm History tables will fill up and write over existing information.

Checking Display Messages

The first area to check when troubleshooting the 23XRV chiller is the HMI display. Status messages are displayed at the bottom of the screen, and the alarm icon indicates a fault. For lists of Alerts/ Alarms see the 23XRV with PIC6 Controls Operation and Troubleshooting manual.

Checking Temperature Sensors

Except for the motor temperature sensors, all temperature sensors are installed in thermowells. This eliminates the need to drain the refrigerant, oil, or liquid from the chiller to replace the sensor. 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.

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 Table 13 or 14. 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. Table 13 or 14 lists 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. Check the sensor wire at the sensor for 5 vdc if the control is powered on.

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 0.5ºF (.25ºC) graduations. The sensor in question should be accurate to within 2º F (1.2ºC). If more than 1°F (0.6°C) difference it is suggested to recalibrate the sensor by entering the Thermistor Calibration Menu (Main Menu, Service Test, Thermistor Calibration). This menu allows for a ±5°F (2.8°C) calibration of the shown value.

See Fig. 5-7 for sensor locations. Temperature sensors are inserted into a thermowell in the refrigerant or liquid circuits. When installing a new sensor thermowell, apply a pipe sealant or thread sealant (RC part number 56507) to the thermowell threads. Coat the temperature sensors with thermally conductive grease (RC Part Number PP8024) before inserting into the thermowell.

DUAL MOTOR TEMPERATURE SENSORS

For servicing convenience, there are 2 sensors on the motor temperature sensor. If one of the sensors is damaged, the other can be used by simply moving a wire. The number 2 terminal in the sensor terminal box is the common line. To use the second sensor, move the wire from the number 1 position to the number 3 position.

Checking Pressure Transducers

The 23XRV chillers may have the following pressure transducers: evaporator, condenser, oil pump discharge, oil sump, discharge, and optional economizer (for TP compressors). The Oil Delta P (oil pressure leaving filter – oil sump pressure) is calculated by the PIC.

All pressure transducers should be calibrated prior to initial start-up. At high altitude locations, it is necessary to calibrate the transducers to ensure the proper refrigerant temperature/pressure relationship. Each transducer is supplied with 5 vdc power. If the transducer reading is suspected of being faulty, check the supply voltage. It should be 5 vdc ± .5 v. If the transducer voltage reference is correct, the transducer should be recalibrated or replaced.

Additionally check that any 4-20mA field input to the Carrier controls has not accidentally been grounded or are receiving a different signal than 4-20 mA.

COOLER CONDENSER PRESSURE TRANSDUCER AND OPTIONAL WATER SIDE 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 from the Diagnostic screen or, in the case of Hydronics measurements, from the Hydronics Status menu located under Status Menu. If needed calibrated from the Quick Test Menu, Transducer Calibration menu.

To calibrate these transducers:

1. Shut down the compressor, cooler, and condenser pumps.

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

2. Disconnect transducer in question from its Schrader fitting for cooler or condenser transducer calibration. For oil pressure delta P, the optional cooler and condenser liquid delta P, or flow device calibration, leave the transducer in place.

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

3. On the Transducer Calibration screen the particular pressure reading can be adjusted to meet the standard/reference with up to ± 5 psi.

If calibration problems are encountered on the Oil Pressure Differential channel, sometimes swapping the oil pressure leaving filter and the oil sump pressure transducer locations will offset an adverse transducer tolerance stack up and allow the calibration to proceed.

TRANSDUCER REPLACEMENT

Since the pressure transducers are mounted on Schrader-type fittings, there is no need to remove refrigerant from the vessel when replacing the transducers. Disconnect the transducer wiring by pulling up on the locking tab while pulling up on the weather-tight connecting plug from the end of the transducer. *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. Be sure to properly identify the transducer being replaced since the high pressure switch DOES NOT have a Schrader valve which if removed with charge in the chiller can result in refrigerant burns and loss of charge.

⚠ CAUTION

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.

Quick Test

The Quick Test feature can check most thermistor temperature sensors, pressure transducers, pumps and their associated flow devices, the oil reclaim output, the head pressure output, and other control outputs such as tower fans, oil heaters, alarm relay, and hot gas bypass. The tests can help to determine whether a switch is defective or if a pump relay is not operating, as well as other useful troubleshooting issues. During pumpdown operations, the pumps must energize to prevent freeze-up.

Table 13 — Thermistor Temperature (F) vs Resistance/Voltage Drop

TEMPERATURE (F)	PIC6 VOLTAGE DROP (V)	RESISTANCE (OHMS)
–25	4.700	97,706
–24	4.690	94,549
–23	4.680	91,474
–22	4.670	88,480
–21	4.659	85,568
–20	4.648	82,737
–19	4.637	79,988
–18	4.625	77,320
–17	4.613	74,734
–16	4.601	72,229
–15	4.588	69,806
–14	4.576	67,465
–13	4.562	65,205
–12	4.549	63,027
–11	4.535	60,930
–10	4.521	58,915
–9	4.507	56,981
–8	4.492	55,129
–7	4.477	53,358
–6	4.461	51,669
–5	4.446	50,062
–4	4.429	48,536
–3	4.413	47,007
–2	4.396	45,528
–1	4.379	44,098
0	4.361	42,715
1	4.344	41,380
2	4.325	40,089
3	4.307	38,843
4	4.288	37,639
5	4.269	36,476
6	4.249	35,354
7	4.229	34,270
8	4.209	33,224
9	4.188	32,214
10	4.167	31,239
11	4.145	30,298
12	4.123	29,389
13	4.101	28,511
14	4.079	27,663
15	4.056	26,844
16	4.033	26,052
17	4.009	25,285
18	3.985	24,544
19	3.960	23,826
20	3.936	23,130
21	3.911	22,455
22	3.886	21,800
23	3.861	21,163
24	3.835	20,556
25	3.808	19,967
26	3.782	19,396
27	3.755	18,843
28	3.727	18,307
29	3.700	17,787
30	3.672	17,284
31	3.644	16,797
32	3.617	16,325
33	3.588	15,868
34	3.559	15,426
35	3.530	14,997
36	3.501	14,582
37	3.471	14,181
38	3.442	13,791
39	3.412	13,415
40	3.382	13,050
41	3.353	12,696
42	3.322	12,353
43	3.291	12,021
44	3.260	11,699
45	3.229	11,386
46	3.198	11,082
47	3.167	10,787
48	3.135	10,500
49	3.104	10,221
50	3.074	9,949
51	3.042	9,689
52	3.010	9,436
53	2.978	9,190
54	2.946	8,951
55	2.914	8,719
56	2.882	8,494
57	2.850	8,275
58	2.819	8,062
59	2.788	7,855
60	2.756	7,655
61	2.724	7,460
62	2.692	7,271
63	2.660	7,088
64	2.628	6,909
65	2.596	6,736
66	2.565	6,568
67	2.533	6,405
68	2.503	6,246
69	2.472	6,092
70	2.440	5,942
71	2.409	5,796
72	2.378	5,655
73	2.347	5,517
74	2.317	5,382
75	2.287	5,252
76	2.256	5,124
77	2.227	5,000
78	2.197	4,880
79	2.167	4,764
80	2.137	4,650
81	2.108	4,539
82	2.079	4,432
83	2.050	4,327
84	2.021	4,225
85	1.993	4,125
86	1.965	4,028
87	1.937	3,934
88	1.909	3,843
89	1.881	3,753
90	1.854	3,667
91	1.827	3,582
92	1.800	3,500
93	1.773	3,420
94	1.747	3,342
95	1.721	3,266
96	1.695	3,192
97	1.670	3,120
98	1.644	3,049
99	1.619	2,981
100	1.595	2,914
101	1.570	2,849
102	1.546	2,786
103	1.523	2,724
104	1.499	2,663
105	1.476	2,605
106	1.453	2,547
107	1.430	2,492
108	1.408	2,437
109	1.386	2,384
110	1.364	2,332
111	1.343	2,282
112	1.321	2,232
113	1.300	2,184
114	1.279	2,137
115	1.259	2,092
116	1.239	2,047
117	1.219	2,003
118	1.200	1,961
119	1.180	1,920
120	1.161	1,879
121	1.143	1,840
122	1.124	1,801
123	1.106	1,764
124	1.088	1,727
125	1.070	1,691
126	1.053	1,656
127	1.036	1,622
128	1.019	1,589
129	1.002	1,556
130	0.986	1,524
131	0.969	1,493
132	0.953	1,463
133	0.938	1,433
134	0.922	1,404
135	0.907	1,376
136	0.893	1,348
137	0.878	1,321
138	0.864	1,295
139	0.849	1,269
140	0.835	1,244
141	0.821	1,219
142	0.808	1,195
143	0.795	1,172
144	0.782	1,149
145	0.769	1,126
146	0.756	1,104
147	0.744	1,083
148	0.731	1,062
149	0.719	1,041
150	0.707	1,021
151	0.696	1,002
152	0.684	983
153	0.673	964
154	0.662	945
155	0.651	928
156	0.640	910
157	0.630	893
158	0.619	876
159	0.609	859
160	0.599	843
161	0.589	827
162	0.579	812
163	0.570	797
164	0.561	782
165	0.551	768
166	0.542	753
167	0.533	740
168	0.524	726
169	0.516	713
170	0.508	700
171	0.499	687
172	0.491	675
173	0.484	663
174	0.476	651
175	0.468	639
176	0.460	628
177	0.453	616
178	0.445	605
179	0.438	595
180	0.431	584
181	0.424	574
182	0.418	564
183	0.411	554
184	0.404	544
185	0.398	535
186	0.392	526
187	0.385	516
188	0.379	508
189	0.373	499
190	0.367	490
191	0.361	482
192	0.356	474
193	0.350	466
194	0.344	458
195	0.339	450
196	0.333	442
197	0.328	435
198	0.323	428
199	0.318	421
200	0.313	414
201	0.308	407
202	0.304	400
203	0.299	393
204	0.294	387
205	0.290	381
206	0.285	374
207	0.281	368
208	0.277	362
209	0.272	356
210	0.268	351
211	0.264	345
212	0.260	339
213	0.256	334
214	0.252	329
215	0.248	323
216	0.245	318
217	0.241	313
218	0.237	308
219	0.234	303
220	0.230	299
221	0.227	294
222	0.224	289
223	0.220	285
224	0.217	280
225	0.214	276
226	0.211	272
227	0.208	267
228	0.205	263
229	0.203	259
230	0.198	255
231	0.195	251
232	0.192	248
233	0.190	244
234	0.187	240
235	0.184	236
236	0.182	233
237	0.179	229
238	0.176	226
239	0.174	223
240	0.172	219
241	0.169	216
242	0.167	213
243	0.164	210
244	0.162	207
245	0.160	204
246	0.158	201
247	0.155	198
248	0.153	195

Table 14 — Thermistor Temperature (C) vs Resistance/Voltage Drop

TEMPERATURE (C)	PIC6 VOLTAGE DROP (V)	RESISTANCE (OHMS)
–33	4.722	105 616
–32	4.706	99 640
–31	4.688	93 928
–30	4.670	88 480
–29	4.650	83 297
–28	4.630	78 377
–27	4.608	73 722
–26	4.586	69 332
–25	4.562	65 205
–24	4.538	61 343
–23	4.512	57 745
–22	4.486	54 411
–21	4.458	51 341
–20	4.429	48 536
–19	4.399	45 819
–18	4.368	43 263
–17	4.336	40 858
–16	4.303	38 598
–15	4.269	36 476
–14	4.233	34 484
–13	4.196	32 613
–12	4.158	30 858
–11	4.119	29 211
–10	4.079	27 663
–9	4.037	26 208
–8	3.994	24 838
–7	3.951	23 545
–6	3.906	22 323
–5	3.861	21 163
–4	3.814	20 083
–3	3.765	19 062
–2	3.716	18 097
–1	3.667	17 185
0	3.617	16 325
1	3.565	15 513
2	3.512	14 747
3	3.459	14 023
4	3.406	13 341
5	3.353	12 696
6	3.298	12 087
7	3.242	11 510
8	3.185	10 963
9	3.129	10 444
10	3.074	9 949
11	3.016	9 486
12	2.959	9 046
13	2.901	8 628
14	2.844	8 232
15	2.788	7 855
16	2.730	7 499
17	2.672	7 160
18	2.615	6 839
19	2.559	6 535
20	2.503	6 246
21	2.447	5 972
22	2.391	5 711
23	2.335	5 463
24	2.280	5 226
25	2.227	5 000
26	2.173	4 787
27	2.120	4 583
28	2.067	4 389
29	2.015	4 204
30	1.965	4 028
31	1.914	3 861
32	1.865	3 701
33	1.816	3 549
34	1.768	3 404
35	1.721	3 266
36	1.675	3 134
37	1.629	3 008
38	1.585	2 888
39	1.542	2 773
40	1.499	2 663
41	1.457	2 559
42	1.417	2 459
43	1.377	2 363
44	1.338	2 272
45	1.300	2 184
46	1.263	2 101
47	1.227	2 021
48	1.192	1 944
49	1.158	1 871
50	1.124	1 801
51	1.091	1 734
52	1.060	1 670
53	1.029	1 609
54	0.999	1 550
55	0.969	1 493
56	0.941	1 439
57	0.913	1 387
58	0.887	1 337
59	0.861	1 290
60	0.835	1 244
61	0.811	1 200
62	0.787	1 158
63	0.764	1 117
64	0.741	1 079
65	0.719	1 041
66	0.698	1 006
67	0.677	971
68	0.657	938
69	0.638	906
70	0.619	876
71	0.601	846
72	0.583	818
73	0.566	791
74	0.549	765
75	0.533	740
76	0.518	715
77	0.503	692
78	0.488	670
79	0.474	648
80	0.460	628
81	0.447	608
82	0.434	588
83	0.422	570
84	0.410	552
85	0.398	535
86	0.387	518
87	0.376	502
88	0.365	487
89	0.355	472
90	0.344	458
91	0.335	444
92	0.325	431
93	0.316	418
94	0.308	405
95	0.299	393
96	0.291	382
97	0.283	371
98	0.275	360
99	0.267	349
100	0.260	339
101	0.253	330
102	0.246	320
103	0.239	311
104	0.233	302
105	0.227	294
106	0.221	286
107	0.215	278
108	0.210	270
109	0.205	262
110	0.198	255
111	0.193	248
112	0.188	242
113	0.183	235
114	0.178	229
115	0.174	223
116	0.170	217
117	0.165	211
118	0.161	205
119	0.157	200
120	0.153	195

Control Modules

Turn controller power off before servicing controls. This ensures safety and prevents damage to the controller.

The PIC6 control system, including SIOB and IOBs, performs continuous diagnostic evaluations of the hardware to determine its condition. Proper operation of SIOB and IOBs are indicated by LEDs (light-emitting diodes) located on the boards.

Gateway Status LEDs

The RS485 VFD Gateway provides a communication link between the PIC6 and the VFD Drive Peripheral Interface (DPI) board. The PIC communicates with the Gateway via Modbus.

The Gateway has four status indicators on the top side of the module.

DRIVE STATUS INDICATOR

The DRIVE status indicator is on the left side of the Gateway. See Fig. 57 and Table 15.

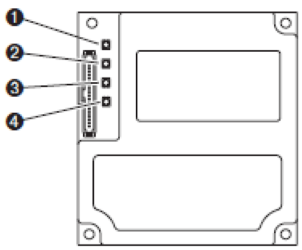


Fig. 57 — Gateway Drive Status Indicator

Table 15 — Gateway Drive Status Indicator Description

Item	Status Indicator	Description
1	PORT	DPI Connection Status
2	MOD	Adapter Status
3	NET A	Serial Communication Status
4	NET B	Serial Communication Traffic Status

NET A STATUS INDICATOR

This red/green bicolor LED indicates the receive status of the adapter as shown in Table 16.

Table 16 — NET A Status Indicator

Status	Cause	Corrective Actions
Off	The adapter is not powered or is not connected properly to the network. The first incoming network command is not yet recognized.	• Securely connect the adapter to the drive using the internal interface (ribbon) cable. • Correctly connect the RS-485 cable to the connector. • Apply power to the drive.
Flashing Red	A network connection has timed out.	• Set the timeout in **Parameter 11 - [Network Timeout]**. • Place the scanner in RUN mode. • Verify that there is not too much traffic on the network.
Steady Red	The device has detected an error that has made it incapable of communication on the network.	• Select the correct network protocol. • Select correct data rate. • Verify node address is correct. • Cycle power to apply changes.
Flashing Green	Online to network, but not producing or consuming I/O. If **Parameter 11 - [Network Timeout]** has not been set to 0 (zero), this indicates that the adapter has not received any messages within the interval, but it has not yet timed out. The LED will turn steady green when communication resumes.	• Place the scanner in RUN mode. • Program the scanner to send messages to this specific adapter within the specified timeout. • Configure the adapter for the program in the controller.
Steady Green	The adapter is properly connected and communicating on the network.	No action required.

NET B STATUS INDICATOR

This green LED indicates the transmit status of the adapter as shown in Table 17.

Table 17 — NET B Status Indicator

Status	Cause	Corrective Actions
Off	The adapter is not powered or is not transmitting on the network.	• Program a controller to recognize and transmit I/O to the adapter. • Place the controller in RUN mode or apply power. • Configure the adapter for the program in the controller.
Steady Green	The adapter is transmitting data on the network.	No action required.

PORT STATUS INDICATOR

This red/green bicolor LED indicates the status of the adapter's DPI connection to the drive as shown in Table 18.

Table 18 — PORT Status Indicator

Status	Cause	Corrective Actions
Off	The adapter is not powered or is not connected properly to the drive.	• Securely connect the adapter to the drive using the internal interface (ribbon) cable. • Correctly connect the RS-485 cable to the connector. • Apply power to the drive.
Flashing Red	The adapter is not receiving a ping message from the drive.	• Verify that cables are securely connected and not damaged. Replace cables if necessary. • Cycle power to the drive.
Steady Red	The drive has refused an I/O connection form the adapter. Another DPI peripheral is using the same DPI port as the adapter.	**IMPORTANT**: Cycle power to the drive after making any of the following corrections: • Verify that all DPI cables on the drive are securely connected and not damaged. Replace cables if necessary. • Verify that the DPI drive supports Datalinks. • Configure the adapter to use a Datalink that is not already being used by another peripheral.
Steady Orange	The adapter is connected to a product that does not support Rockwell Automation DPI communications. A connection to a host with a 32-bit reference or 32-bit Datalinks is detected when the peripheral has been configured to use the P1 FLN protocol. The peripheral doesn't support 32-bit devices when using the P1 FLN protocol.	• Connect the adapter to a product that supports Allen-Bradley DPI communications (for example, a PowerFlex 7-Class drive). • Connect the adapter to a product that uses a 16-bit reference and 16-bit Datalinks.
Flashing Green	The adapter is establishing an I/O connection to the drive or I/O has been disabled.	• Verify the settings of **Parameter 16 - [DPI I/O Cfg]**. • Normal behaviour if all I/O is disabled in **Parameter 16 - [DPI I/O Cfg]**..
Steady Green	The adapter is properly connected and is communicating with the drive.	No action required.

MOD STATUS INDICATOR

This red/green bicolor LED indicates the status of the adapter as shown in Table 19.

Table 19 — MOD Status Indicator

Status	Cause	Corrective Actions
Off	The adapter is not powered or is not connected properly to the drive.	• Securely connect the adapter to the drive using the internal interface (ribbon) cable. • Apply power to the drive.
Flashing Red	Bad CRC of adapter parameters or flash program; other recoverable fault condition.	• Clear faults in the adapter. • Cycle power to the drive. • If cycling power does not correct the problem, the adapter parameter settings may have been corrupted. Reset defaults and reconfigure the adapter. • If resetting defaults does not correct the problem, flash the adapter with the latest firmware release.
Steady Red	The adapter has failed the hardware test.	• Cycle power to the drive. • Replace the adapter.
Flashing Green	The adapter is operational, but is not transferring I/O data.	• Place the scanner in RUN mode. • Program the controller to recognize and transmit I/O to the adapter. • Configure the adapter for the program in the controller. • Normal behavior if all I/O has been disabled in **Parameter 16 - [DPI I/O Cfg]**.
Flashing Red/Green	The adapter has detected a framing error.	• Check **Parameter 09 - [Stop Bits Act]** and **Parameter 30- [Stop Bits Cfg]**..
Steady Green	The adapter is operational and transferring I/O data.	No action required.

EXV TROUBLESHOOTING

If it appears that the main EXV or economizer EXV is not properly controlled, perform the following checks. Through Controls Test move the EXV fully open. The actuator should be felt through the EXV body. Then close the valve fully. The actuator should knock when it reaches the bottom of its stroke.

If the valve is not operating properly, the expansion valve and EXV wiring should be checked. Check the EXV connector and interconnecting wiring by double checking color-coding and make sure that all are connected to the correct terminals and that wires are not crossed. Check for continuity and tight connections at all pin terminals.

Disassembling and Assembling the EXV

Disassemble the EXV to check EXV motor windings and the condenser liquid level sensor. When disassembling the EXV, always have a new o-ring available. Do not use the existing o-ring. Place the piston in the fully open position to disassembly the EXV. When assembling the VFD, it is easier to install the motor assembly with the piston in the fully closed position. See Fig. 21 for EXV cross-section diagrams. See Fig. 58 and 59 for disassembly and assembly instructions.

Check EXV Motor Windings Resistance

To check the resistance of the EXV motor windings, remove the EXV plug at J2A (economizer EXV) or J2B (condenser EXV) and check resistance. The resistance should be 52 ohms (± 10%). See Fig. 60.

Check the EXV Board Output

1. Verify board dipswitch setting against unit schematic.
2. Check the EXV output signals at the appropriate terminals on the EXV module. Note that the EXV board pins do not match the EXV board plug designations. Do not disconnect EXV connector with power applied to the board.
3. Connect positive test lead to proper EXV board, terminal 5.
4. Set meter to approximately 20 Vdc.
5. Using Quick test move the valve to 100%. DO NOT short meter leads together for pin 5 or any other pin as board damage will occur.
6. During the next several seconds connect the negative test lead to EXV board pin 1, 2, 3, and 4 in succession. A digital voltmeter will average this signal and display approximately 6 Vdc. If the voltage remains constant at a voltage other than 6 Vdc or show 0 Vdc then remove power from the EXV board and then remove the connector to the EXV valve and repeat the process with the EXV stepper motor disconnected.
7. Close the EXV by driving the valve to 0% in Quick Test.

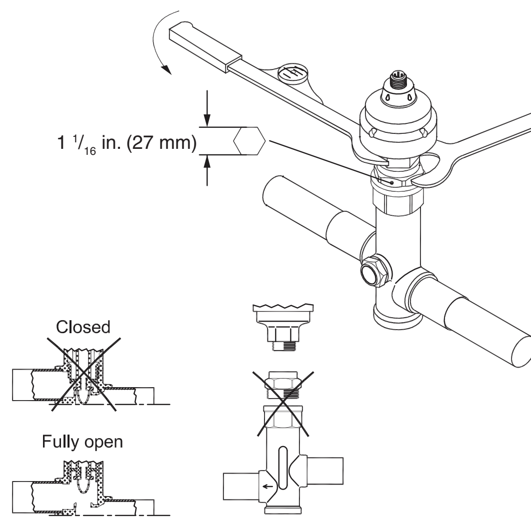


Fig. 58 — EXV Disassembly

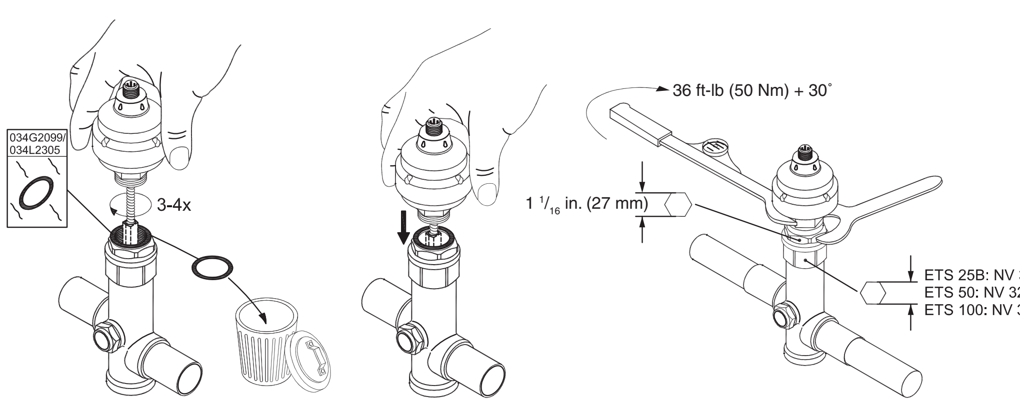


Fig. 59 — EXV Assembly

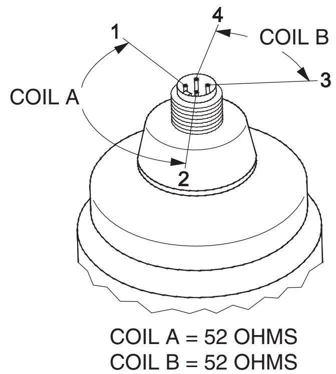


Fig. 60 — EXV Motor Windings Resistance

Check Condenser Level Sensor Resistance

The level sensor provides a voltage between white (output) and black (ground) wires proportional to red (+) and black (ground) voltage. If the level sensor is suspected of misreading, check the resistance between red (+) and black (ground) wires. It should measure approximately 1800 ohms. Figure 61 shows condenser liquid level sensor components. This can be verified at the EXV plug by checking resistance between the Brown and White wires for Coil A and Blue and Black wires for Coil B.

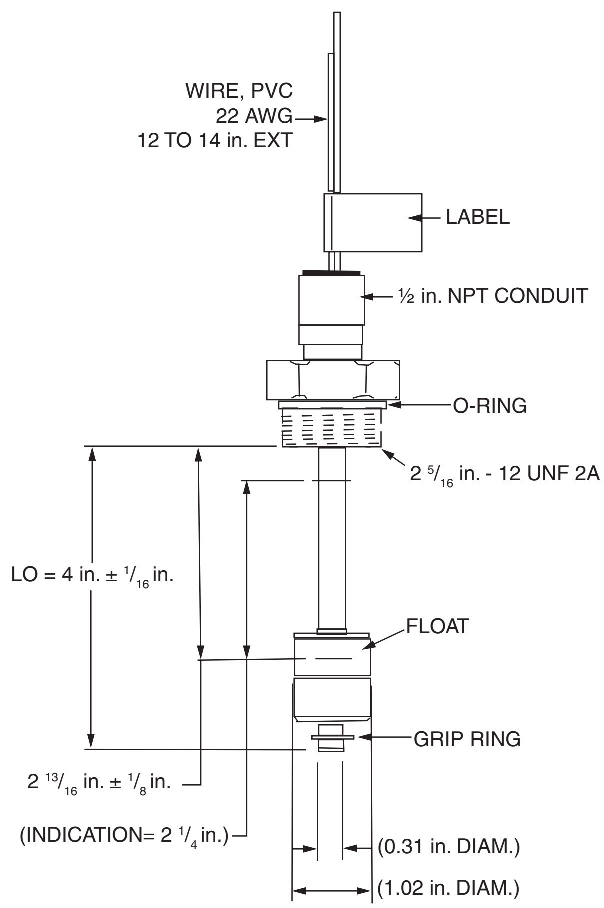


Fig. 61 — Condenser Liquid Level Sensor

⚠ CAUTION

Do not attempt to disconnect flanges while the machine is under pressure. Failure to relieve pressure can result in personal injury or damage to the unit.

⚠ CAUTION

Before rigging the compressor, disconnect all wires entering the power panel to avoid damage to the panel.

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, 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

Tables 20-31 and Fig. 62-65 provide additional information on component weights, physical and electrical data, and wiring schematics for the operator's convenience during troubleshooting.

Table 20 — 23XRV Cooler Frame Size A1-A6, B1-B6 Heat Exchanger Weights[a]

FRAME SIZE	ENGLISH							METRIC (SI)						
	STEEL WT (lb)	COPPER WT (lb)	DRY RIGGING WT (lb)	REFRIG. WT (lb)	SHIP WT (lb)	WATER VOL (Gal)	OPER. WT (lb)	STEEL WT (kg)	COPPER WT (kg)	DRY RIGGING WT (kg)	REFRIG. WT (kg)	SHIP WT (kg)	WATER VOL (L)	OPER. WT (kg)
A1	2506	734	3240	270	3510	47	3904	1137	333	1470	122	1592	178	1771
A2	2506	789	3295	290	3585	51	4009	1137	358	1495	132	1627	193	1819
A3	2506	889	3395	310	3705	57	4182	1137	403	1540	141	1681	216	1897
A4	2506	962	3468	330	3798	62	4315	1137	436	1573	150	1723	235	1958
A5	2506	1076	3582	360	3942	69	4520	1137	488	1625	163	1788	261	2050
A6	2506	1190	3696	390	4086	77	4725	1137	540	1677	177	1854	291	2144
B1	2642	839	3481	305	3786	54	4236	1198	381	1579	138	1717	204	1921
B2	2642	901	3543	325	3868	58	4352	1198	409	1607	147	1754	220	1974
B3	2642	1016	3658	355	4013	65	4558	1198	461	1659	161	1820	246	2067
B4	2642	1099	3741	375	4116	71	4706	1198	498	1696	170	1866	269	2134
B5	2642	1229	3871	415	4286	79	4946	1198	557	1755	188	1943	299	2242
B6	2642	1360	4002	445	4447	87	5177	1198	617	1815	202	2017	329	2348

NOTE(S):

a. Dry rigging weight = Steel weight + Copper weight.

Table 21 — 23XRV Condenser Frame Size A1-A6, B1-B6 Heat Exchanger Weights[a]

FRAME SIZE	ENGLISH							METRIC (SI)						
	STEEL WT (lb)	COPPER WT (lb)	DRY RIGGING WT (lb)	REFRIG. WT (lb)	SHIP WT (lb)	WATER VOL (Gal)	OPER. WT (lb)	STEEL WT (kg)	COPPER WT (kg)	DRY RIGGING WT (kg)	REFRIG. WT (kg)	SHIP WT (kg)	WATER VOL (L)	OPER. WT (kg)
A1	3390	734	4124	550	4674	47	5068	1538	333	1871	249	2120	178	2299
A2	3390	844	4234	550	4784	54	5237	1538	383	1921	249	2170	204	2375
A3	3390	944	4334	550	4884	61	5391	1538	428	1966	249	2215	231	2445
A4	3390	1049	4439	550	4989	67	5552	1538	476	2014	249	2263	254	2518
A5	3390	1190	4580	550	5130	77	5769	1538	540	2078	249	2327	291	2617
A6	3390	1345	4735	550	5285	87	6007	1538	610	2148	249	2397	329	2724
B1	3571	839	4410	625	5035	54	5485	1620	381	2001	283	2284	204	2488
B2	3571	964	4535	625	5160	62	5677	1620	437	2057	283	2340	235	2575
B3	3571	1078	4649	625	5274	69	5853	1620	489	2109	283	2392	261	2655
B4	3571	1198	4769	625	5394	77	6037	1620	543	2163	283	2446	291	2738
B5	3571	1360	4931	625	5556	87	6286	1620	617	2237	283	2520	329	2851
B6	3571	1537	5108	625	5733	99	6558	1620	697	2317	283	2600	375	2974

NOTE(S):

a. Dry rigging weight = Steel weight + Copper weight.

Table 22 — 23XRV Code 30-57 Heat Exchanger Weights[a,b,c,d,e,f]

CODE	ENGLISH						SI					
	DRY RIGGING WEIGHT (lb)		MACHINE CHARGE				DRY RIGGING WEIGHT (kg)		MACHINE CHARGE			
			REFRIGERANT WEIGHT (lb)		LIQUID VOLUME (Gal)				REFRIGERANT WEIGHT (kg)		LIQUID VOLUME (L)	
	COOLER ONLY	CONDENSER ONLY	WITH ECONOMIZER	WITHOUT ECONOMIZER	COOLER	CONDENSER	COOLER ONLY	CONDENSER ONLY	WITH ECONOMIZER	WITHOUT ECONOMIZER	COOLER	CONDENSER
30	4148	3617	800	650	56	56	1877	1676	363	295	212	212
31	4330	3818	800	650	64	65	1959	1769	363	295	242	246
32	4522	4023	800	650	72	74	2046	1860	363	295	273	280
35	4419	4529	910	760	61	61	2000	2089	413	345	231	231
36	4627	4758	910	760	70	72	2094	2195	413	345	265	273
37	4845	4992	910	760	80	83	2193	2299	413	345	303	314
40	5008	4962	900	750	103	110	2675	2746	408	340	390	416
41	5178	5155	900	750	111	119	2758	2839	408	340	420	450
42	5326	5347	900	750	119	129	2832	2932	408	340	450	488
4D	5326	5347	900	750	119	129	2832	2932	408	340	450	488
45	5463	5525	1015	865	112	120	2882	3001	460	392	424	454
46	5659	5747	1015	865	122	130	2976	3108	460	392	462	492
47	5830	5967	1015	865	130	141	3061	3214	460	392	492	534
4E	5830	5967	1015	865	130	141	3061	3214	460	392	492	534
50	5827	6013	1250	1100	132	147	3182	3304	567	499	500	556
51	6053	6206	1250	1100	143	156	3294	3397	567	499	541	590
52	6196	6387	1250	1100	150	165	3364	3485	567	499	568	625
55	6370	6708	1430	1280	144	160	3429	3620	649	581	545	606
56	6631	6930	1430	1280	156	171	3556	3726	649	581	590	647
57	6795	7138	1430	1280	164	181	3636	3826	649	581	621	685

NOTE(S):

a. Rigging weights are for standard tubes of standard wall thickness (Turbo-B3 and Spikefin 2, 0.025-in. [0.635 mm] wall)
b. Cooler includes the suction elbow and 1/2 the distribution piping weight.
c. Condenser includes float valve and sump, discharge stub-out, and 1/2 the distribution piping weight.
d. For special tubes refer to the 23XRV Computer Selection Program.
e. All weights for standard 2-pass NIH (nozzle-in-head) design with Victaulic grooves.
f. 42D and 42E heat exchangers are for the condenser only.

Table 23 — 23XRV Compressor and Motor Weights

COMPRESSOR TYPE	MOTOR SIZE	ENGLISH (lb)				SI (kg)			
		Total Compressor Weight	Stator Weight	Rotor Weight	Motor Terminal Cover	Total Compressor Weight	Stator Weight	Rotor Weight	Motor Terminal Cover
P	H,J	3036	110	167	N/A	1377	50	76	N/A
Q	V	4090	370	193	39	1855	168	88	18
R	P,Q,R,S,T,U,V,X	4866	441	229	46	2207	200	104	21

Table 24 — 23XRV Maximum Component Weights[a]

COMPONENT		FRAME A HEAT EXCHANGER		FRAME B HEAT EXCHANGER		FRAME 3 HEAT EXCHANGER		FRAME 4 HEAT EXCHANGER		FRAME 5 HEAT EXCHANGER	
		lb	kg	lb	kg	lb	kg	lb	kg	lb	kg
Isolation Valves		70	32	70	32	115	52	70	32	70	32
Suction Elbow	P Compressor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Q Compressor	159	72	187	85	184	83	N/A	N/A	N/A	N/A
	R Compressor	179	81	237	108	232	105	N/A	N/A	N/A	N/A
Discharge Elbow/ Muffler	P Compressor	N/A	N/A	N/A	N/A	N/A	N/A	584	265	584	265
	Q Compressor	597	271	597	271	597	271	N/A	N/A	N/A	N/A
	R Compressor	747	339	747	339	747	339	N/A	N/A	N/A	N/A
Vaporizer and Oil Sump		830	376	830	376	830	376	830	376	830	376
Economizer		542	246	542	246	542	246	174	79	174	79

NOTE(S):

a. To determine compressor frame size, refer to Fig. 1.

Table 25 — VFD (Variable Frequency Drive) Weight Table

DRIVE TYPE	COMPRESSOR	VOLTAGE/Hz	AMPERAGE (A)	WEIGHT (lb)
Std. Tier	P	380/400/415/50 and 480/60	230	998
			335, 445	1200
		575/60	269	1200
	Q/R	380/400/415/50 and 480/60	230	998
			335, 445	1200
LF2	Q/R	380-415 50/60	440	1400
			520, 608	1800
		440-480 50/60	440	1500
			520, 608	1800

Table 26 — 23XRV Waterbox Cover Weights, Frames 3,4,5 — English (lb)[a,b]

WATERBOX DESCRIPTION	COOLER						CONDENSER					
	Frame 3		Frame 4		Frame 5		Frame 3		Frame 4		Frame 5	
	Victaulic Nozzles	Flanged	Victaulic Nozzles	Flanged	Victaulic Nozzles	Flanged	Victaulic Nozzles	Flanged	Victaulic Nozzles	Flanged	Victaulic Nozzles	Flanged
NIH 1 Pass Cover, 150 psig	282	318	148	185	168	229	282	318	148	185	168	229
NIH 2 Pass Cover, 150 psig	287	340	202	256	222	276	287	340	191	245	224	298
NIH 3 Pass Cover, 150 psig	294	310	472	488	617	634	294	310	503	519	628	655
NIH Plain End, 150 psig	243	243	138	138	154	154	225	225	138	138	154	154
MWB End Cover, 150 psig	243/315	243/315	138/314	138/314	154/390	154/390	225/234	225/234	138/314	138/314	154/390	154/390
NIH 1 Pass Cover, 300 psig	411	486	633	709	764	840	411	486	633	709	764	840
NIH 2 Pass Cover, 300 psig	411	518	626	733	760	867	411	578	622	729	727	878
NIH 3 Pass Cover, 300 psig	433	468	660	694	795	830	433	468	655	689	785	838
NIH Plain End, 300 psig	291	291	522	522	658	658	270	270	522	522	658	658
MWB End Cover, 300 psig	445/619	445/619	522/522	522/522	658/658	658/658	359/474	359/474	522/522	522/522	658/658	658/658

NOTE(S):

a. Rows with two entries list nozzle end and return end weights.
b. Weight for NIH 2-pass cover, 150 psig (1034 kPa), is included in the heat exchanger weights shown in Tables 20-22.

LEGEND

NIH — Nozzle-in-Head
MWB — Marine Waterbox

Table 27 — 23XRV Waterbox Cover Weights, Frames 3,4,5 — SI (kg)[a,b]

WATERBOX DESCRIPTION	COOLER						CONDENSER					
	Frame 3		Frame 4		Frame 5		Frame 3		Frame 4		Frame 5	
	Victaulic Nozzles	Flanged	Victaulic Nozzles	Flanged	Victaulic Nozzles	Flanged	Victaulic Nozzles	Flanged	Victaulic Nozzles	Flanged	Victaulic Nozzles	Flanged
NIH 1 Pass Cover, 1034 kPa	128	144	67	84	76	104	128	144	67	84	76	104
NIH 2 Pass Cover, 1034 kPa	130	154	92	116	101	125	130	154	87	111	102	135
NIH 3 Pass Cover, 1034 kPa	133	141	214	221	280	288	133	141	228	235	285	297
NIH Plain End, 1034 kPa	110	110	63	63	70	70	102	102	63	63	70	70
MWB End Cover 1034 kPa	110/143	110/143	63/142	63/142	70/177	70/177	102/106	102/106	63/142	63/142	70/177	70/177
NIH 1 Pass Cover, 2068 kPa	186	220	287	322	347	381	186	220	287	322	346	381
NIH 2 Pass Cover, 2068 kPa	186	235	284	332	344	393	186	235	282	331	330	398
NIH 3 Pass Cover, 2068 kPa	196	212	299	315	361	376	196	212	297	313	356	380
NIH Plain End 2068 kPa	132	132	237	237	298	298	122	122	237	237	298	298
MWB End Cover 2068 kPa	202/281	202/281	237/237	237/237	298/298	298/298	163/215	163/215	237/237	237/237	298/298	298/298

NOTE(S):

a. Rows with two entries list nozzle end and return end weights.
b. Weight for NIH 2-pass cover, 150 psig (1034 kPa), is included in the heat exchanger weights shown in Tables 20-22.

LEGEND

NIH — Nozzle-in-Head
MWB — Marine Waterbox

Table 28 — 23XRV Waterbox Cover Weights, Frames A/B — English (lb)[a]

WATERBOX DESCRIPTION	COOLER FRAMES A AND B		CONDENSER FRAMES A AND B	
	Victaulic Nozzles	Flanged	Victaulic Nozzles	Flanged
NIH,1-Pass Cover 150 psig	217	244	242	274
NIH,2-Pass Cover 150 psig	172	265	191	298
NIH,3-Pass Cover 150 psig	228	245	261	277
NIH/Marine Plain End, 150 psig	157	157	173	173
MWB Cover, 150 psig	296	296	332	332
NIH,1-Pass Cover 300 psig	217	271	242	312
NIH,2-Pass Cover 300 psig	172	301	191	334
NIH,3-Pass Cover 300 psig	228	263	261	295
NIH/Marine Plain End, 300 psig	157	157	173	173
MWB Cover, 300 psig	296	296	332	332

NOTE(S):

a. Weight for NIH 2-pass cover, 150 psig (1034 kPa), is included in the heat exchanger weights shown in Tables 20-22.

LEGEND

NIH — Nozzle-in-Head
MWB — Marine Waterbox

Table 29 — 23XRV Waterbox Cover Weights, Frames A/B — SI (kg)[a]

WATERBOX DESCRIPTION	COOLER FRAMES A AND B		CONDENSER FRAMES A AND B	
	Victaulic Nozzles	Flanged	Victaulic Nozzles	Flanged
NIH,1-Pass Cover 1034 kPa	98	111	110	124
NIH,2-Pass Cover 1034 kPa	78	120	87	135
NIH,3-Pass Cover 1034 kPa	103	111	118	126
NIH/Marine Plain End, 1034 kPa	71	71	78	78
MWB Cover, 1034 kPa	134	134	151	151
NIH,1-Pass Cover 2068 kPa	98	123	110	142
NIH,2-Pass Cover 2068 kPa	78	137	87	151
NIH,3-Pass Cover 2068 kPa	103	119	118	134
NIH/Marine Plain End, 2068 kPa	71	71	78	78
MWB Cover, 2068 kPa	134	134	151	151

NOTE(S):

a. Weight for NIH 2-pass cover, 150 psig (1034 kPa), is included in the heat exchanger weights shown in Tables 20-22.

LEGEND

NIH — Nozzle-in-Head
MWB — Marine Waterbox

Table 30 — Optional Storage Tank and/or Pumpout System Electrical Data

VOLTS-PH-Hz	MAX RLA	LRA
208/230-3-50/60	15.8	105.0
460-3-60	7.8	52.0
400-3-50	7.8	52.0

LEGEND

LRA — Locked Rotor Amps
RLA — Rated Load Amps

Table 31 — 23XRV Compressor Torque Specification Chart

LOCATION/USAGE	DESCRIPTION	PART NO.	TORQUE	
			ft-lb	Nm
Hermetic Term, Outlet Casing Sub-Assembly Motor Side Seal Installation	M5 X 0.8 X 16LG SHCS GR 12.9	8TR0115	5-7	7-9
Inlet Seal Installation	M5 X 0.8 X 30LG SHCS GR 12.9	8TR0116	5-7	7-9
	M5 X 0.8 X 60LG SHCS GR 12.9	8TR0117	5-7	7-9
Bearing Cover Installation	M10 X 1.5 X 40LG SHCS GR 12.9	8TR0303	50-55	68-75
Outlet Casing Process Bolts	M20 X 1.0 X 120LG SHCS GR 12.9	8TR0304	430-450	583-610
Motor Terminal Cover Install and Lube Block	M12 X 1.75 X 50LG SHCS GR 12.9	8TR0120	90- 95	122-129
Motor Housing and Bearing Cover Installation	M20 X 2.5 X 80LG SHCS GR 12.9	8TR0122	430-450	583-610
Discharge Flange	M20 X 2.5 X 310LG HHCS GR 12.9	8TR0381	430-450	583-610
Motor Stator Sub-Assembly	Set Screw M10 X 1.5 X 30	8TC0089C	30-35	41-47
Bearing Cover Lube Plug	1/4″ NPTF	8TC0290C	20-25	27-34
Rotor Caps and Male Axial Seal	M6 X 1.0 X 25LG SHCS GR 12.9	8TQ0189	7-9	9-12
Plug Installation	3/8″ SAE (9/16 Thread)	8TC0107C	17-9	23-26
	3/8″ SAE (9/16 Thread)	8TR0106	17-9	23-26
Rotor Housing	3/4″ SAE (11/16 Thread)	8TC0109C	83-92	112-125
Motor Housing Air Gap Check	7/8″ SAE (13/16 Thread)	8TR0128	92-103	125-140
Motor Installation	13/16″, Terminal Pin Body	HY85AA062	45-55	61-75
	5/8″, Term Nut, Mtr Lead, Term Nut	HY85AA062	40-45	54-61
Motor Rotor (Special)	M16 X 2 X 70LG HHCS GR 10.9	8TR0121	17-22	23-30
Lube Cover Plate Installation Valve Pad Installation	M12 X 1.75 X 30LG SHCS GR 12.9	8TC1044	87-93	118-126
Economizer Cover	5/8″ — 11UNC X 1.88″ LG HHCS GR 8	8TR0238	185-195	251-264
Lube Block and Bearing Cover Plate	1/8″ – 27 NPT (Brass) Orifice	8TR0357	4-6	5-8
Lube Block	3/8″ SAE (9/16 Thread) Choke Orifice	8TR0358	17-19	23-26
Suction and Discharge Covers	7/8″ – 9 UNC X 2″ LG HHCS GR 8	8TR0363	430-450	583-610
Terminal Pins	M5 X 0.8 X 24LG SHCS GR 12.9	8TR0395	5-7	7-9
Discharge Cover	M20 X 2.5 X 247LG HHCS GR 12.9	ITQ0406	430-450	583-610
	M20 X 2.5 X 260LG HHCS GR 12.9	ITQ0045	430-450	583-610
	1″ — 8UNC X 3″ LG HHCS GR 5	AA06BR419	430-450	583-610
Economizer Shipping Plate	M12 X 1.75 X 35LG HHCS	8TB0396	90-110	122-149
	O-Ring Plug (7/16-20 Thread)	05GA501762	10-12	14-16

LEGEND

GR — Grade
HHCS — Hex Head Cap Screw
LG — Long
SAE — Society of Automotive Engineers
SHCS — Socket Head Cap Screw
UNC — Unified Coarse Thread

ABBREVIATION LISTING			
ALE	CHILLER ALERT	REM_CON	REMOTE CONTACT INPUT
ALM	CHILLER ALARM	R_RESET	REMOTE RESET
AUTO_DEM	AUTO DEMAND LIMIT INPUT	SIOB	STANDARD INPUT OUTPUT BOARD
AUTO_RES	AUTO CHILLED LIQUID RESET	TR	TRANSFORMER
CB	CIRCUIT BREAKER	VAP_HEAT	VAPORIZER HEATER
CDGT	COMPRESSOR DISCHARGE TEMPERATURE	VAP_TEMP	VAPORIZER TEMPERATURE
CDWP	CONDENSER WATER PUMP	EXV	EXPANSION VALVE
CHWP	CHILLED WATER PUMP	RUN_STAT	RUN STATUS
COND_EWP	CONDENSER LEAVING WATER PRESSURE		
COND_FL	COND WATER FLOW MEASUREMENT		
COND_FS	COND WATER FLOW SWITCH		
COND_LIQ_LVL	CONDENSER LIQUID LEVEL		
COND_LWP	CONDENSER LEAVING WATER PRESSURE		
COND_P	CONDENSER PRESSURE		
CR_TEMP	COMMON RETURN TEMPERATURE		
CS_TEMP	COMMON SUPPLY TEMPERATURE		
DISCH_P	DISCHARGE PRESSURE		
ECW	ENTERING CHILLED WATER TEMPERATURE		
ECDW	ENTERING CONDENSER WATER TEMPERATURE		
ECON_P	ECONOMIZER PRESSURE		
ECON_GAS	ECONOMIZER GAS TEMPERATURE		
EVAP_EWP	EVAPORATOR ENTERING WATER PRESSURE		
EVAP_FL	EVAPORATOR FLOW MEASUREMENT		
EVAP_FS	EVAPORATOR FLOW SWITCH		
EVAP_LWP	EVAPORATOR LEAVING WATER PRESSURE		
EVAP_P	EVAPORATER PRESSURE		
EVAP_T	EVAPORATER TEMPERATURE		
E_STOP	EMERGENCY STOP		
ES	ETHERNET SWITCH		
HDPV_OUT	HEAD PRESSURE OUTPUT		
HDPV_OU2	HEAD PRESSURE OUTPUT 2		
HGBP	HOT GAS BYPASS		
HP_SWITCH	HIGH PRESSURE SWITCH		
ICE_CON	ICE BUILD CONTACT		
IOB	INPUT OUTPUT BOARD		
LCW	LEAVING CHILLED WATER TEMPERATURE		
LCDW	LEAVING CONDENSER WATER TEMPERATURE		
MTRW	MOTOR WINDING TEMPERATURE		
PRI_OIL_HEAT	PRIMARY OIL HEATER		
SEC_OIL_HEAT	SECONDARY OIL HEATER		
OIL_PUMP	OIL PUMP		
OILT_SMP	OIL SUMP TEMPERATURE		
OILP_DIS	OIL DISCHARGE PRESSURE		
OILP_SMP	OIL SUMP PRESSURE		
PS	POWER SUPPLY		
REF_LEAK	REFRIGERANT LEAK		

SYMBOL LEGEND	
	TERMINAL BLOCK
	PRESSURE TRANSDUCER
	THERMISTOR
	COIL
	NO CONTACT
	PRESSURE SWITCH
	PANEL SUPPLIER WIRING
	FACTORY WIRING
	CIRCUIT BREAKER
	GROUND
	CABLE
	FEMALE CONNECTOR
	MALE CONNECTOR
	FIELD WIRING
	NC CONTACT

WIRE COLOR LEGEND	
BLK	BLACK
BLU	BLUE
BRN	BROWN
GRN	GREEN
GRY	GREY
ORG	ORANGE
PNK	PINK
RED	RED
VIO	VIOLET
WHT	WHITE
YEL	YELLOW

NOTES:

1. FIELD-SUPPLIED CONTROL CONDUCTORS TO BE AT LEAST 18AWG (AMERICAN WIRE GAGE) OR LARGER. THE CONTROL CABINET SHOULD ONLY BE USED FOR LOW VOLTAGE FIELD WIRING (50-V MAXIMUM.)
2. EACH DIGITAL OUTPUT LOOP SHALL BE LIMITED TO A MAXIMUM OF 1A AC RMS STEADY-STAT @ 24VAC. LIGHT LOAD RELAY IS RECOMMENDED AND THE COIL VOLTAGE OF RELAY IS 24VAC. POWER SUPPLY SHALL BE PROVIDED BY CUSTOMER FUSED TRANSFORMER.
3. EACH DISCRETE INPUT LOOP IS POWERED BY INTERNAL 24VAC POWER SUPPLY. FIELD OPTIONAL CONTACTS OR SWITCH MUST HAVE 24VAC RATING, MAX CURRENT IS 60MA. NOMINAL CURRENT IS 10MA. SWITCHES WITH GOLD PLATED BIFURCATED CONTACTS ARE RECOMMENDED.
4. THE ANALOG INPUTS SUPPORT 5K/10K NTC THERMISTORS, 0/4-20MA SENSORS AND 5VDC SENSORS. FOR DETAILS REFER TO THE CONTROLS, OPERATIONS, AND TROUBLE SHOOTING MANUAL AND MATCH WITH SOFTWARE.
5. EACH ANALOG OUTPUT LOOP SUPPORTS 0/4-20MA OR 0/2-10VDC VOLTAGE OUTPUT. THE ANALOG OUTPUT LOOP IS POWERED BY IOB BOARD. DO NOT SUPPLY EXTERNAL POWER. FOR DETAILS REFER TO THE CONTROLS, OPERATIONS, AND TROUBLE SHOOTING MANUAL AND MATCH WITH SOFTWARE.
6. DRY TYPE CONTACT, RATED SWITCHING LOAD 230VAC/5A OR 24VDC/5A .

Carrier	23XR_PIC6_SCHEMATIC		REV.
	2000767952	SH. 1 OF 7	C

Fig. 62 — 23XRV Controls Schematic

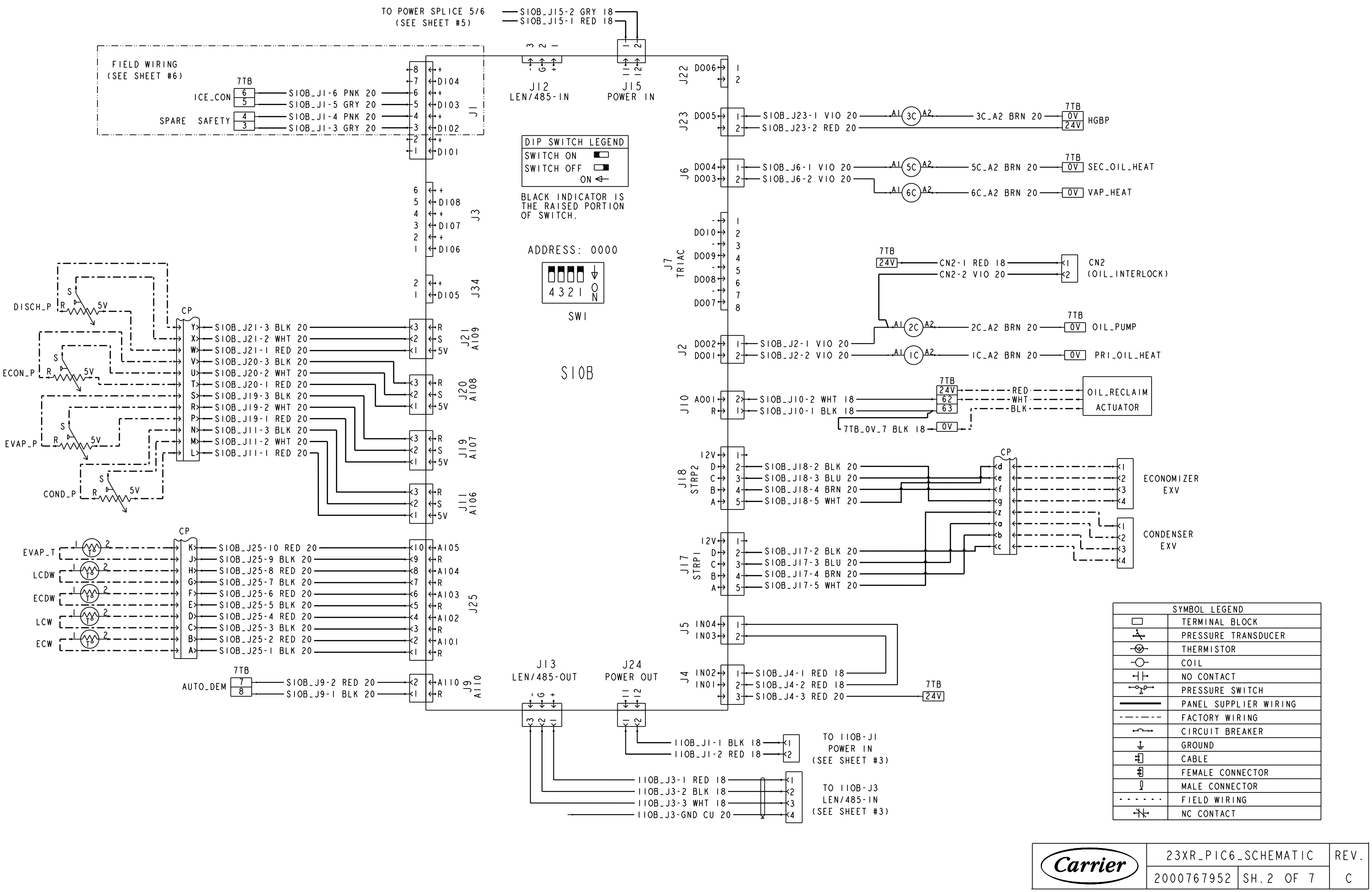


Fig. 62 — 23XRV Controls Schematic (cont)

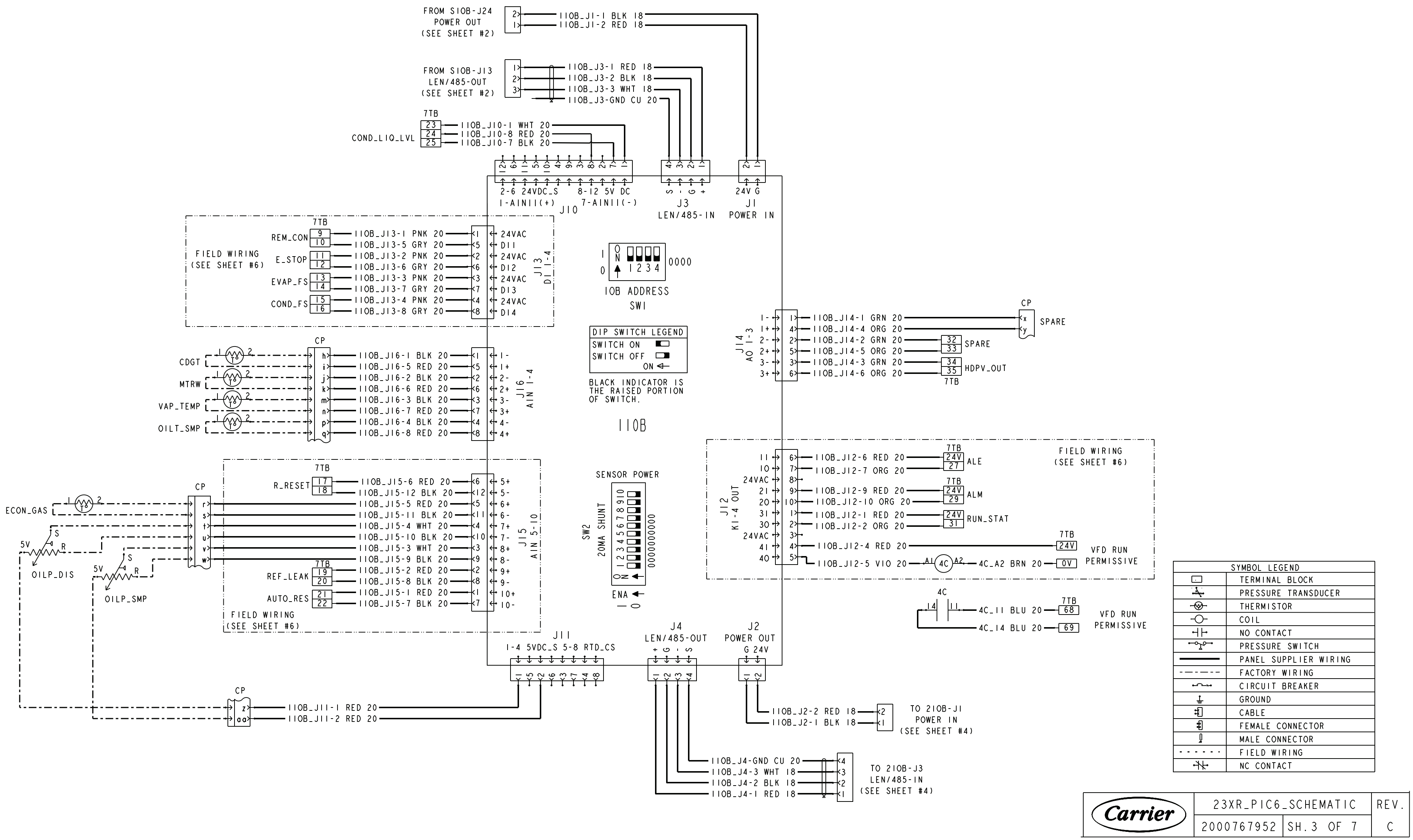


Fig. 62 — 23XRV Controls Schematic (cont)

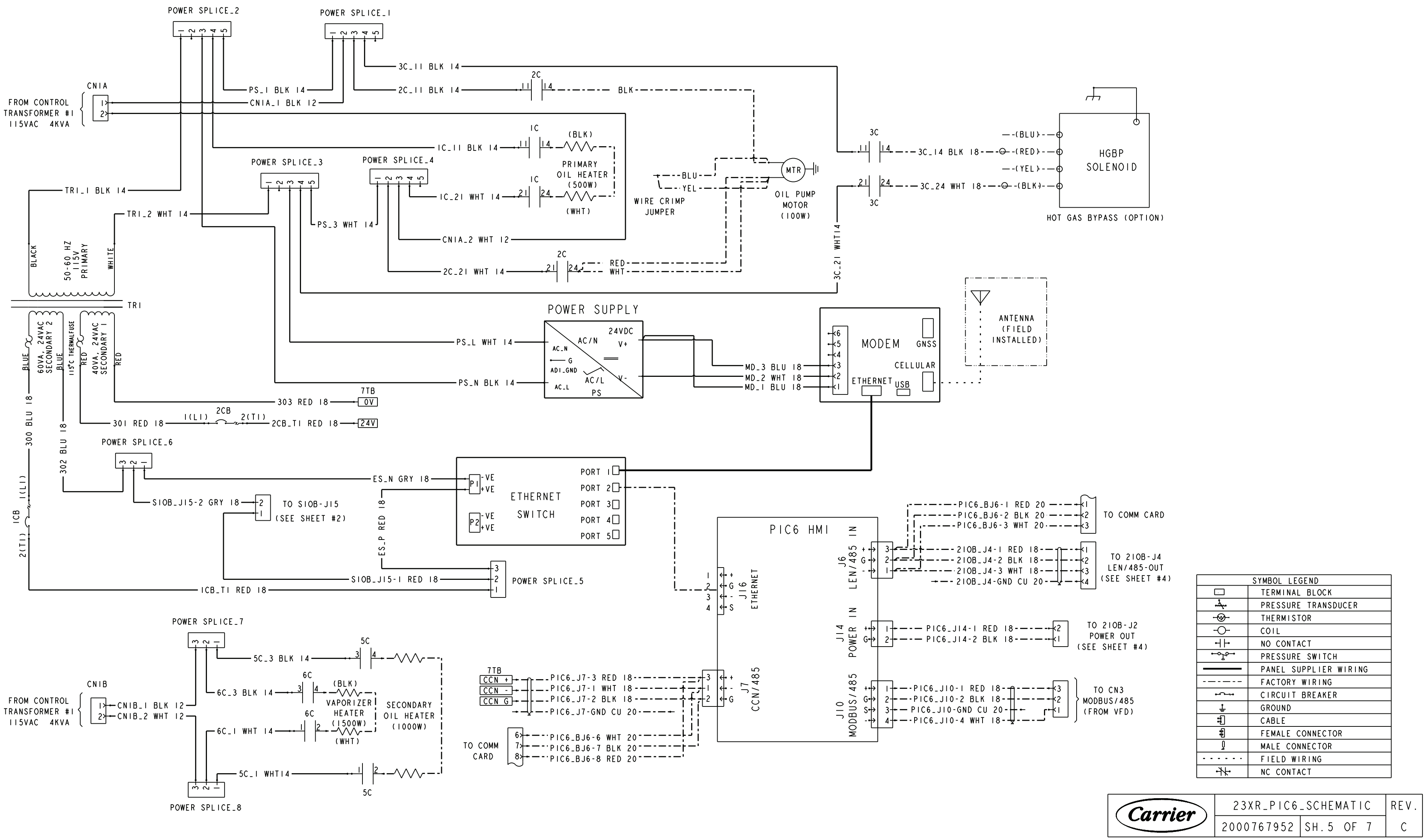


Fig. 62 — 23XRV Controls Schematic (cont)

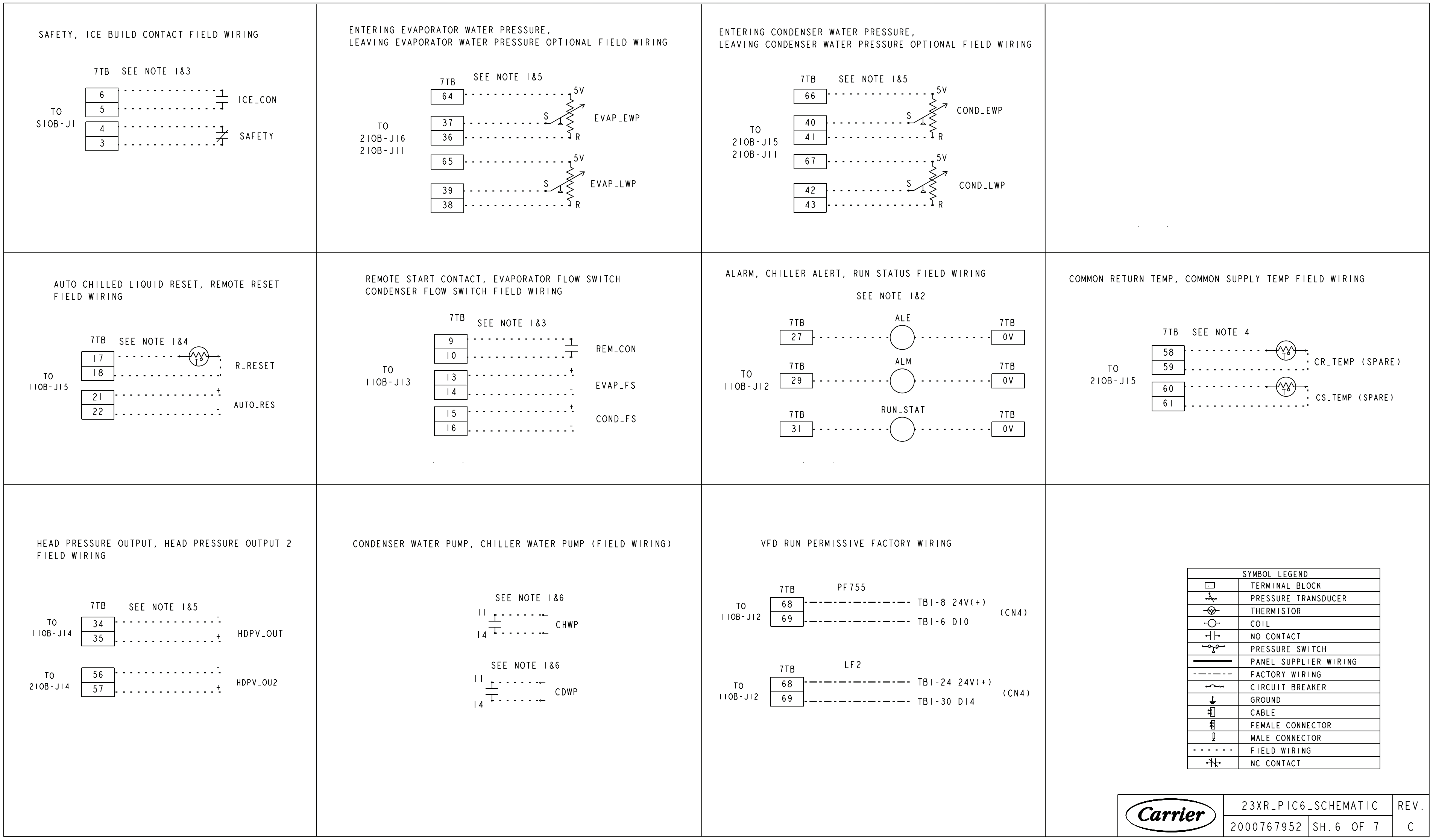


Fig. 62 — 23XRV Controls Schematic (cont)

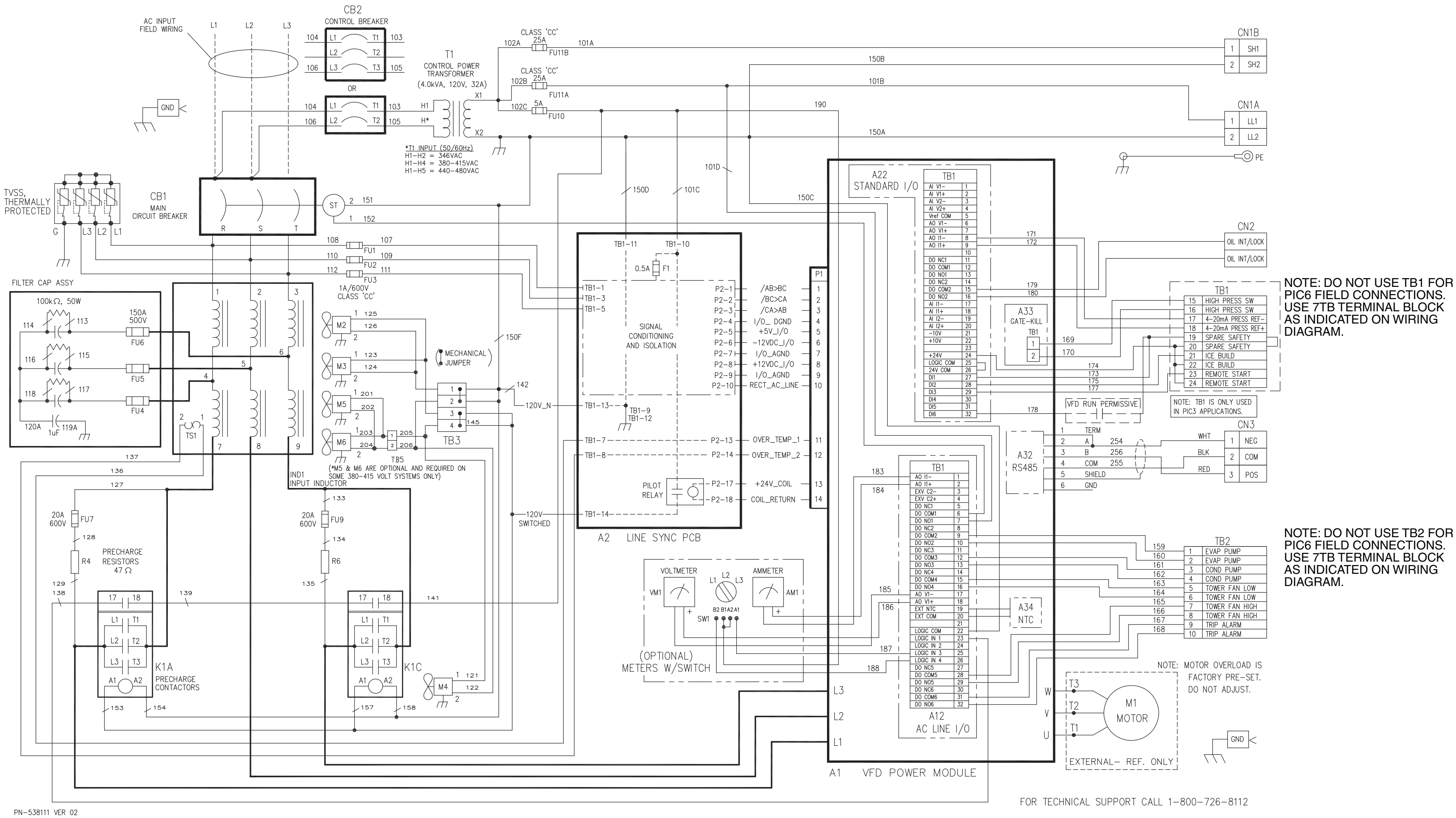
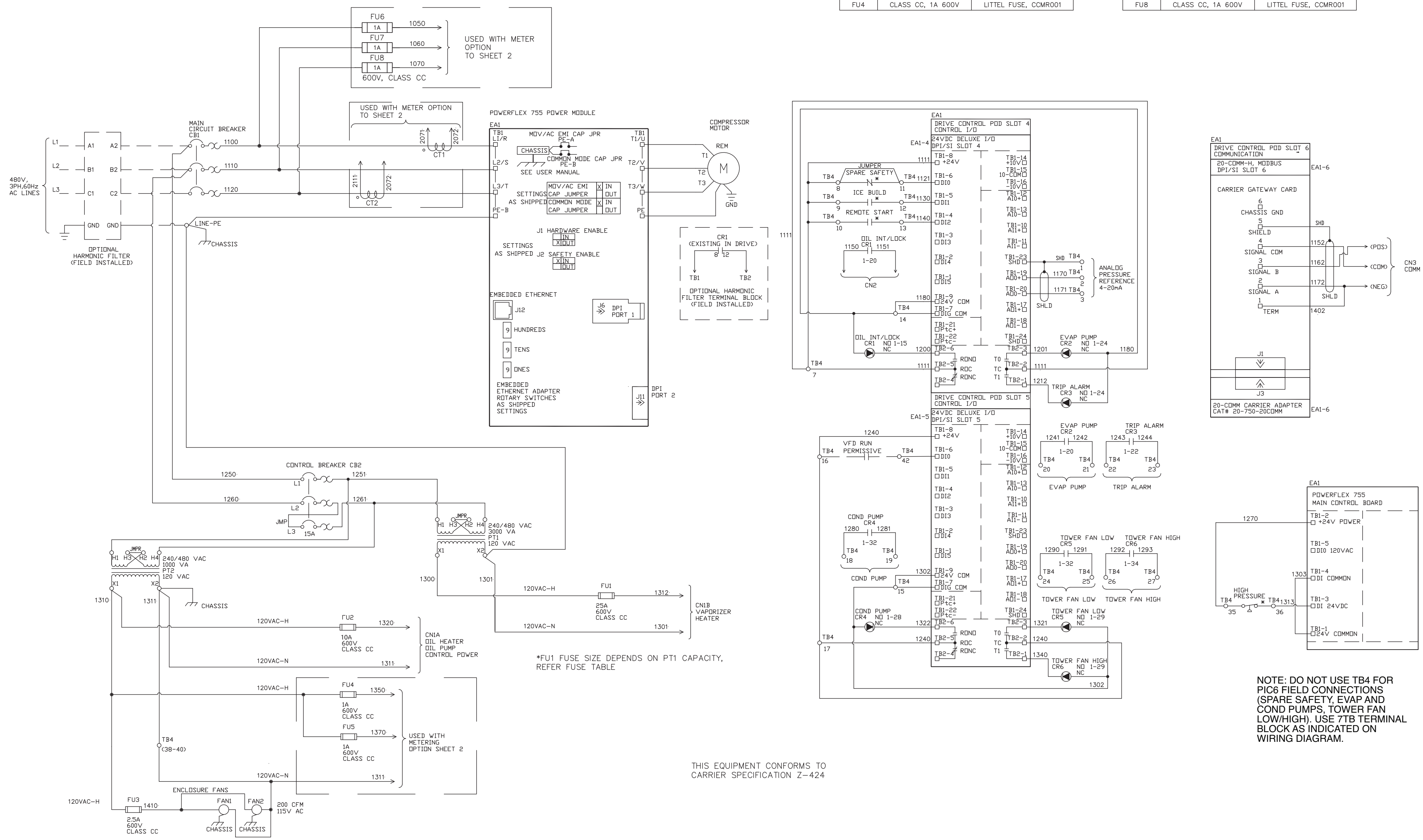


Fig. 63 — 23XRV VFD Schematic (LF-2)

MAIN CIRCUIT BREAKER/DRIVE RATING TABLE			
HP	UNIT RATING	MAIN CIRCUIT BREAKER CB1	DRIVE FRAME SIZE
300HP	361A	600A	7
400HP	477A	600A	7

FUSE TABLE		
REF	FUSE DESCRIPTION	SUPPLIER & PART NUMBER
FU1	CLASS CC, 15/25A 600V	LITTEL FUSE CCMR015/CCMR025
FU2	CLASS CC, 25A 600V	LITTEL FUSE, CCMR025
FU3	CLASS CC, 2.5A 600V	LITTEL FUSE, CCMR02.5
FU4	CLASS CC, 1A 600V	LITTEL FUSE, CCMR001

FUSE TABLE		
REF	FUSE DESCRIPTION	SUPPLIER & PART NUMBER
FU5	CLASS CC, 1A 600V	LITTEL FUSE, CCMR001
FU6	CLASS CC, 1A 600V	LITTEL FUSE, CCMR001
FU7	CLASS CC, 1A 600V	LITTEL FUSE, CCMR001
FU8	CLASS CC, 1A 600V	LITTEL FUSE, CCMR001



NOTE: DO NOT USE TB4 FOR PIC6 FIELD CONNECTIONS (SPARE SAFETY, EVAP AND COND PUMPS, TOWER FAN LOW/HIGH). USE 7TB TERMINAL BLOCK AS INDICATED ON WIRING DIAGRAM.

Fig. 64 — 23XRV VFD Schematic (Rockwell Standard Tier VFD)

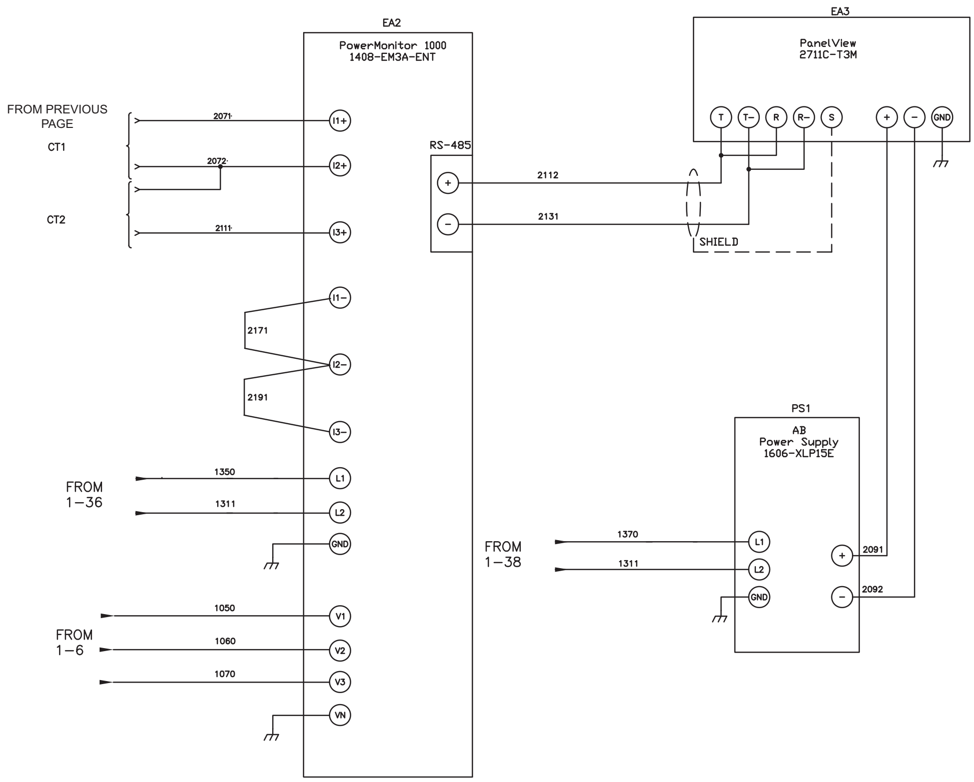
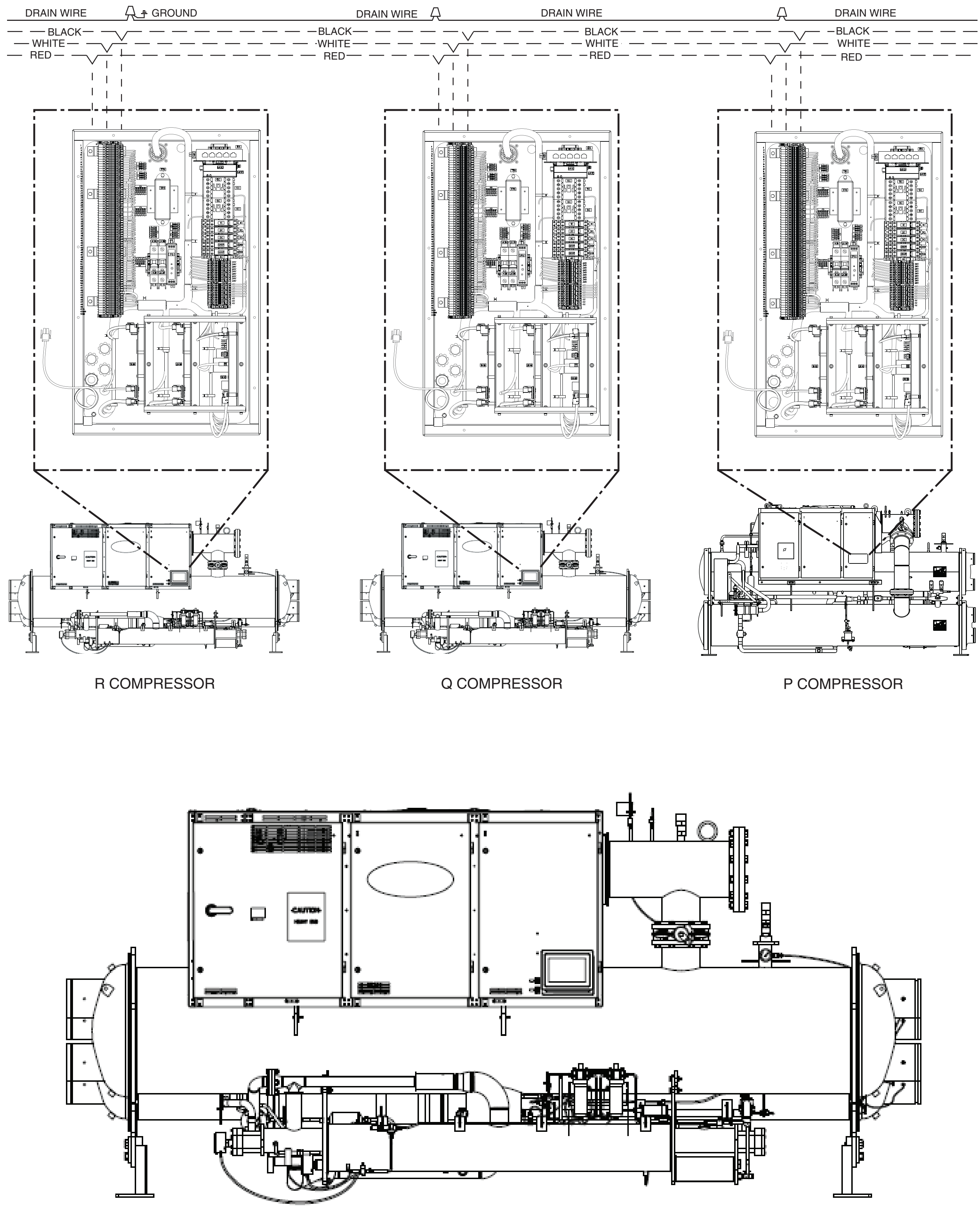


Fig. 64 — 23XRV Controls Schematic (Rockwell Standard Tier VFD Shown) (cont)



LEGEND

———	Factory Wiring
- - - -	Field Wiring

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

Fig. 65 — CCN Communication Wiring for Multiple Chillers (Typical)

APPENDIX A — PIC6 SCREEN AND MENU STRUCTURE

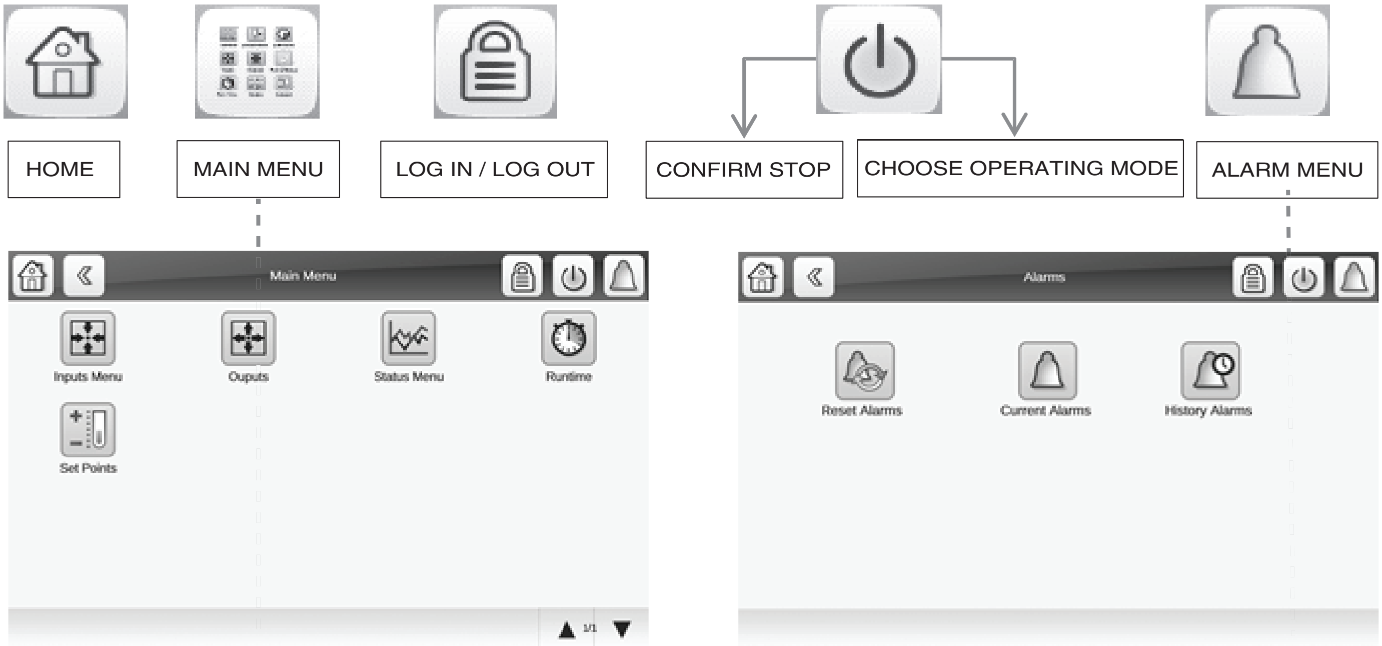


Fig. A — Screen Structure, Basic Level (All) Access (No Password Required)

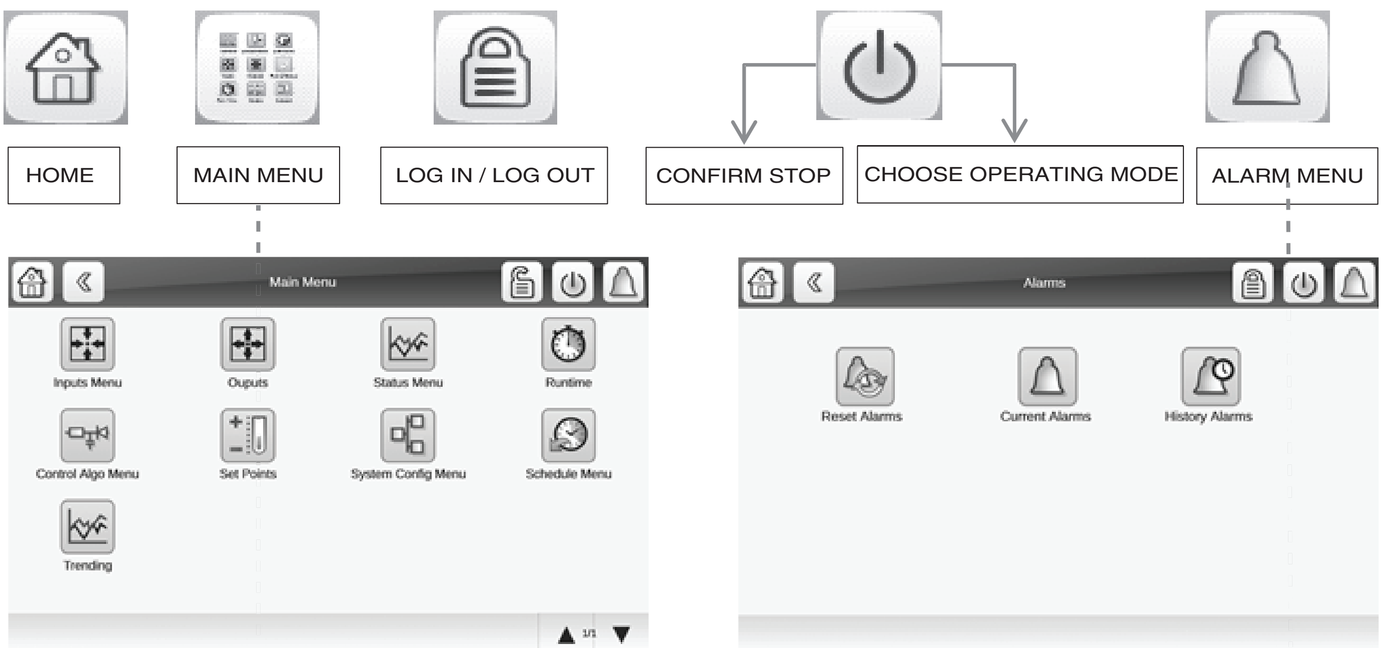


Fig. B — Screen Structure, User Level Access (User Password 1111 Required)

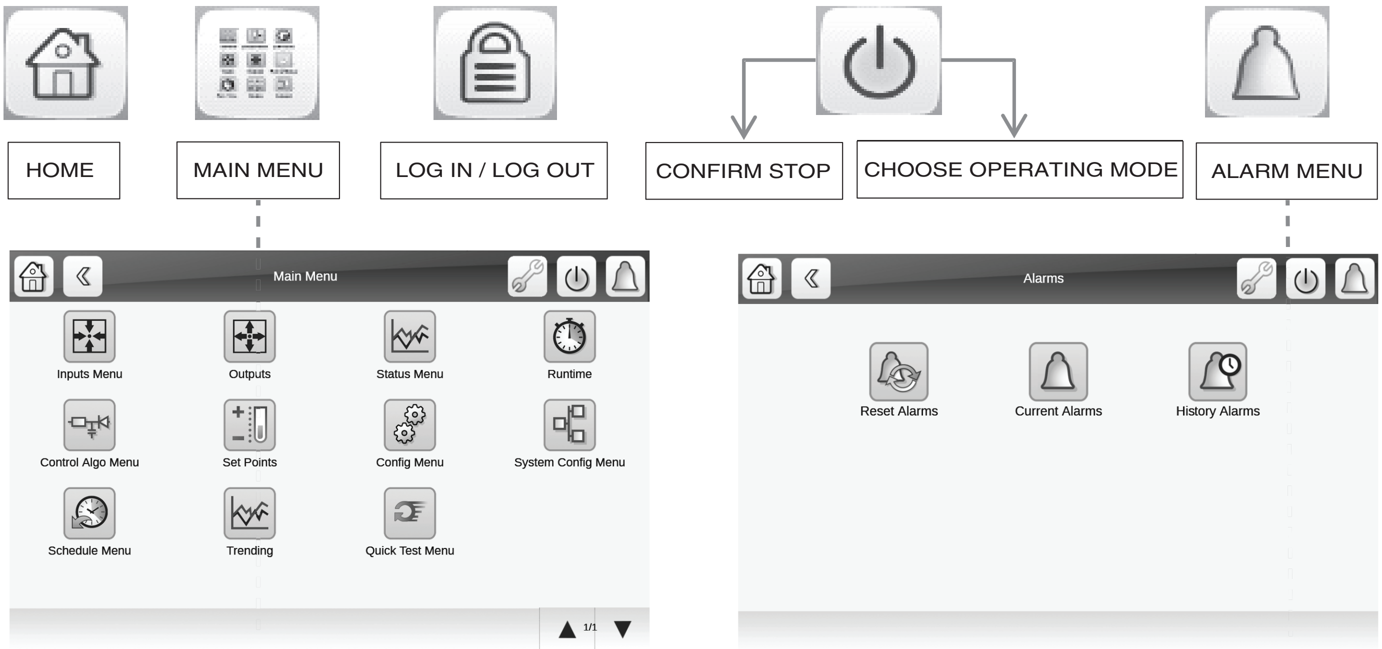


Fig. C — Screen Structure, Service Level Access (Service Password 1234 or 3333 Required)

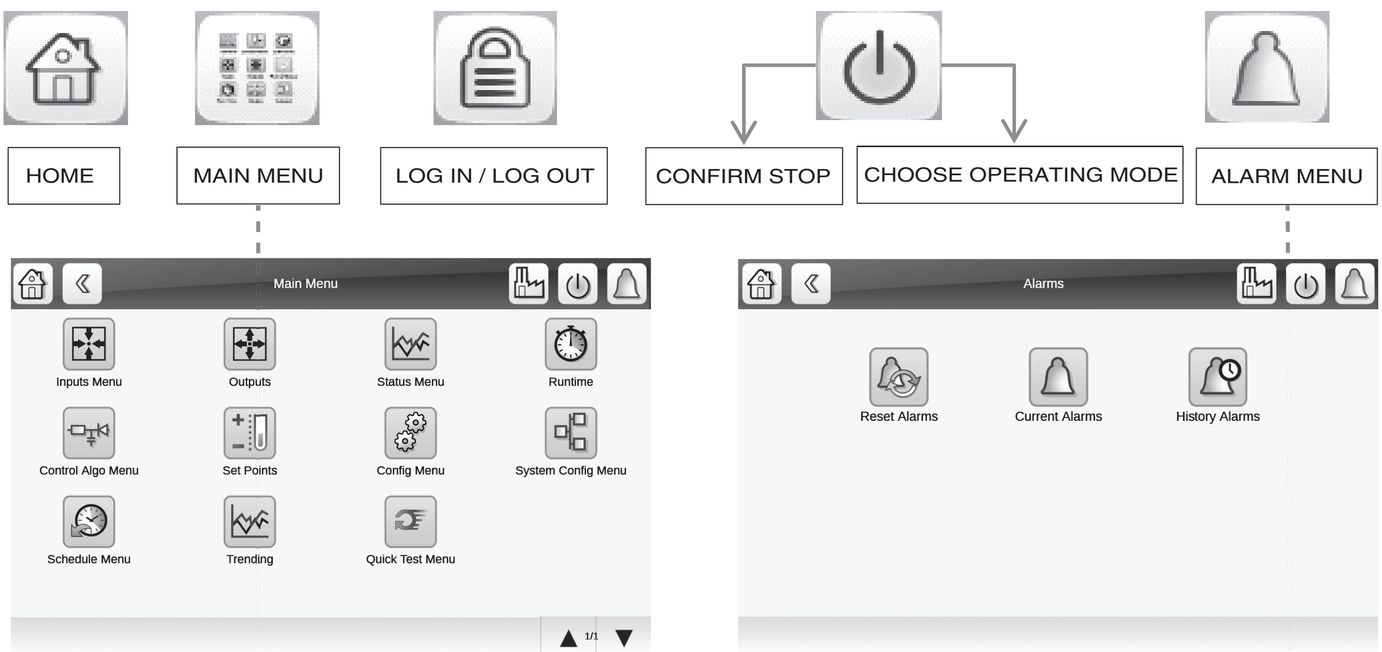


Fig. D — Screen Structure, Factory User Level Access (Factory Password Required; must be deciphered using QR Code after initial 48 hours of powerup)

Main Menu Description[a,b]

ICON	DISPLAYED TEXT[c]	LOWEST ACCESS LEVEL	ASSOCIATED TABLE
	Inputs Menu	Basic	Inputs Menu
	Outputs	Basic	OUTPUTS
	Status	Basic	Status
	Runtime	Basic	RUNTIME
	Control Algo Menu	User	Control Algorithm Menu
	Setpoint	Basic	SETPOINT
	Configuration Menu	Service or Factory	Configuration Menu
	System Configuration Menu	User, Service, or Factory	System Configuration Menu
	Schedule Menu	User	Occupancy Schedule
	Trending	User	TRENDING
	Quick Test Menu	Service	Quick Test Menu

NOTE(S):

a. In most cases User login does not gain access to all configurations screens in a given menu.
b. For more information on login access level see the Controls Operation and Troubleshooting manual.
c. Displayed text depends on the selected language (default is English).

APPENDIX B — MAINTENANCE SUMMARY AND LOG SHEETS

Always check the Optional Extended Warranty for specific maintenance requirements pertaining to that warranty.

23XRV Maintenance Interval Requirements

		WEEKLY	
Compressor	Check Oil Level.	**Controls**	Review Alarm/Alert History.
Cooler	None.	**Starter**	None.
Condenser	None.	**Oil Reclaim**	None.
		MONTHLY	
Compressor	None.	**Controls**	Perform Controls test.
Cooler	None.	**Starter**	None.
Condenser	None.	**Oil Reclaim**	None.
		FIRST YEAR	
Compressor	Send oil sample out for analysis. Leak test. Inspect inlet bearing oil orifice. (Orifice should be inspected whenever oil line is removed.) Change motor cooling line filter-drier.	**Controls**	Perform general cleaning. Tighten connections. Check pressure transducers against a gage. Check cooler thermistors against a standard known temperature. Recalibrate if necessary. Confirm accuracy of thermistors.
Cooler	Inspect and clean cooler tubes. Inspect relief valves. Leak test. Verify water pressure differential. Inspect water pumps and cooling tower. Perform eddy current test.	**Starter**	Perform general cleaning. Tighten connections. Change VFD refrigerant strainer.
Condenser	Replace refrigerant filter/drier. Inspect and clean condenser tubes. Inspect relief valves. Leak test. Verify water pressure differential. Inspect water pumps and cooling tower. Perform eddy current test.	**Oil Reclaim**	Inspect oil sump strainer (two-piece vaporizer) or Inspect first oil filter cartridge exiting the oil sump (one-piece vaporizer).
		ANNUALLY	
Compressor	Send oil sample out for analysis. Leak test. Perform vibration analysis. Meg-ohm test motor.	**Controls**	Perform general cleaning. Tighten connections. Check pressure transducers against a gage. Recalibrate if necessary. Confirm accuracy of thermistors.
Cooler	Inspect and clean cooler tubes. Inspect relief valves. Leak test. Verify water pressure differential. Inspect water pumps and cooling tower.	**Starter**	Perform general cleaning. Tighten connections. Change VFD refrigerant strainer.
Condenser	Inspect and clean condenser tubes. Inspect relief valves. Leak test. Verify water pressure differential. Inspect water pumps and cooling tower.	**Oil Reclaim**	None.
		EVERY 2 YEARS	
Compressor	Change oil filter, change motor cooling filter-drier.		
		EVERY 3-5 YEARS	
Compressor	None.	**Controls**	None.
Cooler	Eddy current tube test.	**Starter**	None.
Condenser	Inspect float valve and strainer. Eddy current tube test.	**Oil Reclaim**	Inspect oil sump strainer. Inspect oil sump heater.
		EVERY 10 YEARS	
Compressor	Change oil charge if yearly analysis not completed.	**Controls**	None.
Cooler	Perform eddy current test (every 5-10 years). Cooler tube cleaning.	**Starter**	None.
Condenser	Perform eddy current test. Condenser tube cleaning.	**Oil Reclaim**	None.
		SEASONAL SHUTDOWN	
Compressor	None.	**Controls**	Do not disconnect control power.
Cooler	Isolate and drain waterbox. It is best to remove waterbox cover from one end. Use compressed air to clear tubes. Alternatively if properly treated water and no chance of freezing the water system does not have to be drained, but the pumps should be engaged at least once a week as per water treatment company's directions.	**Starter**	None.
Condenser	Isolate and drain waterbox. It is best to remove waterbox cover from one end. Use compressed air to clear tubes. Alternatively if properly treated water and no chance of freezing the water system does not have to be drained, but the pumps should be engaged at least once a week as per water treatment company's directions.	**Oil Reclaim**	None.

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

23XRV Weekly Maintenance Log

Plant ____________________________Machine Serial No. ________________________________

Machine Model No. ________________Refrigerant Type __________________________________

DATE	OIL LEVEL	CHECK ALARMS / FAULTS	OPERATOR INITIALS	REMARKS

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

APPENDIX B — MAINTENANCE SUMMARY AND LOG SHEETS (CONT)

23XRV Maintenance Log for Monthly, Quarterly, and Annual Checks

MONTH			1	2	3	4	5	6	7	8	9	10	11	12
DATE			/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
OPERATOR														

UNIT SECTION	ACTION	UNIT	ENTRY											
COMPRESSOR	Change Oil Charge	yes/no												
	Record Oil Temperature	°F												
	Send Oil Sample Out for Analysis	yes/no												
	Perform Vibration Analysis	yes/no												
	Leak Test	ppm												
COOLER	Inspect and Clean Cooler Tubes	yes/no												
	Inspect Relief Valves	yes/no												
	Leak Test	PPM												
	Record Water Pressure Differential	PSI												
	Record Cooler Pressure	PSI												
	Record Entering and Leaving Water Temperature	°F												
	Inspect Water Pumps	yes/no												
CONDENSER	Leak Test	PPM												
	Inspect and Clean Condenser Tubes	yes/no												
	Record Water Pressure Differential (PSI)	PSI												
	Record Cooler Pressure	PSI												
	Record Entering and Leaving Water Temperature	°F												
	Inspect Water Pumps and Cooling Tower	yes/no												
	Inspect Relief Valves	yes/no												
	Replace Refrigerant Filter Drier	yes/no												
	Inspect Float Valve and Strainer	yes/no												
CONTROLS	General Cleaning and Tightening Connections	yes/no												
	Confirm Accuracy of Pressure Transducers	yes/no												
	Confirm Accuracy of Thermistors	yes/no												
	Perform Automated Controls Test	yes/no												
STARTER	General Tightening and Cleaning Connections	yes/no												
	Change VFD Refrigerant Strainer	yes/no												

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

Annually

APPENDIX B — MAINTENANCE SUMMARY AND LOG SHEETS (CONT)

23XRV Seasonal Shutdown Log

MONTH		1	2	3	4	5	6	7	8	9	10	11	12
DATE		/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
OPERATOR													

UNIT SECTION	ACTION	ENTRY											
COOLER	Isolate and Drain Waterbox												
	Remove Waterbox Cover from One End												
	Use Compressed Air to Clean Tubes												
CONDENSER	Isolate and Drain Waterbox												
	Remove Waterbox Cover from One End												
	Use Compressed Air to Clean Tubes												
CONTROLS	Do Not Disconnect Control Power												

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

INDEX

INITIAL START-UP CHECKLIST

FOR 23XRV VARIABLE SPEED SCREW CHILLER WITH GREENSPEED® INTELLIGENCE (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 Controls, Start-Up, Operation, Maintenance Instructions document.

MACHINE INFORMATION:

JOB NAME ______________________________ EQUIPMENT TAG / MARK FOR ____________________
JOB ADDRESS ____________________________ JOB NO. __________________________________
CITY _________________ STATE ______________ MODEL ___________________________________
ZIP __________________ S/N ____________________

REMOTE CONNECTIVITY (Applies to North America units only - CCS):

Complete Step 1 and send information by email to the Command Center as soon as possible when on site. The Command Center needs this data to onboard the chiller to the Carrier Smart Service portal.

Allow approximately 2 hours for the Command Center to complete this task. Unit testing cannot be completed without this step.

Note that warranty related to remote connectivity is not covered by the factory until the factory starts shipping modems that includes SIM cards. Contact the Technical Service Manager for effective date – target is first half of 2023.

Factory warranty is only applicable to the factory-installed parts and their connections. All other onboarding issues including requirements for higher dB antenna are outside the scope of standard factory warranty.

Step 1: Provide registration data below to Command Center Registration Data at EETSupport@carrier.com, or call 1-833-451-5766.

Jobsite Name: ________ ____

Job Street Address: ____

Jobsite City, State, Zip Code: ____

CCS Office: ____

CCS Market: ____

Carrier Contract or Job Number: ____

Jobsite Designation (e.g. Chiller 1 or alike for identification): ______________________

Model Number: ____

Full Serial Number: ____

Eht0 (J15) MAC Address: ____
(navigate to ***Main Menu → System Configuration → Ethernet Configuration***)

STOP – Send above information to EETSupport@carrier.com. ***Do not proceed*** to Step 2 until Command Center has advised by email that the chiller has been onboarded to Carrier Smart Service.

Step 2: After the Command Center has confirmed that the chiller has been onboarded:
Locate the FX30 modem in the control panel and verify if a SIM card is supplied. (Y/N) ________
If no, contact CCS; another programmed modem is required.

Step 3: For units with factory SIM card installed (Step 2 = Yes), the below information will have been factory configured. For units that must be field configured (Step 2 = No), follow CCS Standard Work.
Final configuration for Interface: Eth0 (PIC6 side port). HMI Path: ***Main Menu → System Configuration → Ethernet Configuration***.

MAC Address:	________________________	HMI Unique
IP Address:	________________________	Typical 169.254.101
NET Mask:	________________________	Typical 255.255.0.0
Gateway IP Address:	________________________	Typical 169.254.1.2

Step 4: Install antenna magnetic base to the outside of the control panel and route the antenna cable to CELL port of the FX30 modem.

Step 5: Verify that IOT certificate status = "Present".
HMI Path: ***Main Menu → System Configuration → Network Diagnostic***. (Y/N) ________
If no, the certificate must be loaded to proceed or other HMI must be used.

Step 6: Complete "Ping Test" to Modem. HMI Path: ***Main Menu → System Configuration → Network Diagnostic***. Type "Modem IP Address" (typically 169.254.1.2) into the "Server Address" of the "Network Diagnostic" menu. Select "eth0" as the "Interface" and then select "Run PING test". If PIC6 can connect to the modem the "PING Test Status" will change from "IN PROGRESS to "PASS".

Step 7: Complete "Ping Test" to Internet. HMI Path: ***Main Menu → System Configuration → Network Diagnostic***. Type 8.8.8.8 into the "Server Address" of the "Network Diagnostic" menu. Select "eth0" as the "Interface" and then select "Run PING test". If PIC6 can connect to the internet the "PING Test Status" will change from "IN PROGRESS to "PASS".
Passed Ping Test: (Y/N) ________
If no, call Smart Service Command Center.

Step 8: Complete "Cloud Test". HMI Path: ***Main Menu → System Configuration → Network Diagnostic***
Select "Run CLOUD Test". If PIC6 can connect to the modem the "Cloud Test Status" will change from "IN PROGRESS to "PASS".
Passed Cloud Test: (Y/N) ________
If no, call Smart Service Command Center.

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DESIGN CONDITIONS

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

From Chiller Nameplate: Line Voltage __________ Rated Line Amps ________ Overload Trip Amps ________
From VFD Nameplate: I.D. No.: ______________ Input Rating ________
VFD Serial Number ____
Mfd in ____ on ______________

REFRIGERANT: Type: ______ Charge ______

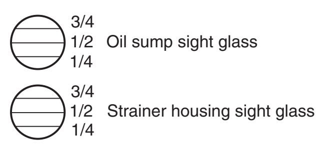
CARRIER OBLIGATIONS: Assemble. . . . . Yes ☐ ☐ No
Leak Test . . . . Yes ☐ ☐ No
Dehydrate . . . . Yes ☐ ☐ No
Charging . . . . Yes ☐ ☐ No
Operating Instructions ______________________ Hrs.

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?		

CHECK OIL LEVEL AND RECORD:



ADD OIL: Yes ☐ No ☐
Amount: __________________

RECORD PRESSURE DROPS: Cooler ________________ Condenser __________________

CHARGE REFRIGERANT: Initial Charge ________________ Final Charge After Trim ________________

INSPECT WIRING AND RECORD ELECTRICAL DATA:
Verify 6″ clearance surrounding all Control Center louvers Yes ☐ No ☐
Visually inspect down through top of power module for debris Yes ☐ No ☐
RATINGS:
Motor Voltage _________ Motor(s) Amps _________ Oil Pump Voltage _________ Starter LRA Rating _________
Line Voltages: Motor ______________ Oil Pump ____________ Controls/Oil Heater ____________
RECORD THE FOLLOWING POWER ON CHECKS:

Line Voltage: Phase - Phase	A-B:	B-C:	A-C:
Line Voltage: Phase - Ground	A-G:	B-G:	C-G:

What type and size of transformer supplies power to the unit?

Delta with No Ground	_____
Corner Grounded Delta	_____
Wye with Center Ground	_____
Wye with No Ground	_____
Transformer Size	_____kVa

FIELD-DISASSEMBLED CHILLERS ONLY:

Megger Test Motor if the VFD is removed from the chiller.

Check continuity T1 to T1, etc. (Motor to starter, disconnect motor leads T1, T2, T3.) Do not megger VFD; disconnect leads to motor and megger the leads.

MEGGER MOTOR	"PHASE TO PHASE"			"PHASE TO GROUND"		
	T1-T2	T1-T3	T2-T3	T1-G	T2-G	T3-G
10-Second Readings:						
60-Second Readings:						
Polarization Ratio:						

CONTROLS: SAFETY, OPERATING, ETC.

Verify parameters in VFD_conf screen. Yes ☐ No ☐

Perform Controls Test Yes ☐ No ☐

PIC6 CAUTION

COMPRESSOR MOTOR AND CONTROL CENTER **MUST** BE PROPERLY AND INDIVIDUALLY CONNECTED BACK TO THE EARTH GROUND IN THE STARTER (IN ACCORDANCE WITH CERTIFIED DRAWINGS).

Yes ____

Water/Brine Pump Control

Can the Carrier controls independently start the pumps?

Condenser Liquid Pump Yes ☐ No ☐

Chilled Liquid Pump Yes ☐ No ☐

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INITIAL START:

Check Position of all Valves: ________

Isolation Valves (See Fig. 2-4, 28-30, and 31)

VALVE	LOCATION	OPEN
Discharge	Under Muffler	________
Cooler Inlet	Next to economizer or under cooler	________
Hot Gas Bypass	Between cooler and condenser	________
Vaporizer Condenser Gas	Between cooler and condenser	________
Oil Pump	Next to oil pump inlet	________
Oil Filter	Downstream of oil filter	________
Oil Pressure Regulator	Under oil sump next to oil pressure regulator	________
Filter/Drier	Next to condenser float chamber	________
Filter/Drier	Under condenser near filter/drier	________
VFD Refrigerant Cooling Inlet	Under compressor discharge	________
VFD Refrigerant Cooling Drain	Between cooler and condenser	________
Relief Valve Three-Way Valves		
Cooler (if installed)	Fully Front Seated or Fully Back Seated	________
Condenser	Fully Front Seated or Fully Back Seated	________
Service Valves		**CLOSED**
Cooler Refrigerant Charging Valve	On cooler relief valve tree	________
Cooler Refrigerant Pumpout Valve	Under cooler	________
Condenser Refrigerant Charging Valve	On condenser relief valve tree	________
Condenser Refrigerant Pumpout Valve	On condenser float valve chamber	________
Oil Sump Charging/Drain Valve	Under oil sump	________

Start Liquid Pumps and Establish Liquid Flow ________

Oil Level OK and Oil Temperature OK ________ Oil Pressure ________

Restart Compressor, Bring Up To Speed. Shut Down. Any Abnormal Coastdown Noise? Yes* ☐ No ☐

*If yes, determine cause.

START MACHINE AND OPERATE. COMPLETE THE FOLLOWING:

A: Trim charge and record under Charge Refrigerant Into Chiller section on page 38.

B: Inspect refrigerant cooling lines for condensation (Q,R compressors only). See page 32.

C: Complete any remaining control calibration and record under Controls section (pages 17-61).

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

E: After machine has been successfully run and set up, shut down and mark shutdown oil levels.

F: Give operating instructions to owner's operating personnel. Hours Given: __________ Hours

G: Call your Carrier factory representative to report chiller start-up.
NOTE: To extend drive warranty, startup should be performed by a Certified Technician as applicable.

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

SIGNATURES:

Start-up Technician ________________________________ **Customer Representative** ________________________________

Date ________________________________ **Date** ________________________________

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