AquaEdge®
19MV Two-Stage High-Efficiency Semi-Hermetic Centrifugal Liquid Chillers with Greenspeed® Intelligence, PIC6 Controls, and R-134a/R-513A
50/60 Hz

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.

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

⚠ DANGER

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

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

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

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

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

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

DO NOT VALVE OFF any safety device.

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

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

⚠ WARNING

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

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

a. Shut off electrical power to unit.
b. Recover refrigerant to relieve all pressure from system using both high-pressure and low pressure ports.
c. 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.
d. 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.
e. Carefully un-sweat remaining tubing stubs when necessary. Oil can ignite when exposed to torch flame.

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

(Warnings continued on next page.)

⚠ WARNING

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

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

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

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

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

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

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

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

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

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

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

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

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

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

DO NOT install relief devices in series or backwards.

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

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

⚠ WARNING

MAGNETIC FIELD HAZARD

Units equipped with the permanent magnet motor option contain rotors with powerful magnetic fields. Permanent magnet motor rotors, when removed from the stator, expose surrounding personnel and equipment to powerful magnetic fields which may cause serious health hazards to persons with pacemakers or defibrillators, hearing aids, metal implants, or other implanted electronic medical devices, and may impact other electronic devices such as mobile phones or smartwatches, watches, credit cards, etc. Persons in a risk group should consult a physician prior to compressor disassembly. Failure to follow these procedures may result in personal injury or death.

⚠ WARNING

The magnetic bearings have UPS power supply that provides control power. Before service or repair work starts disconnect the UPS and verify with voltage meter that there is no power present.

⚠ WARNING

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

⚠ CAUTION

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

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

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

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

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

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

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

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

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

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

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

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

INTRODUCTION

Prior to initial start-up of the 19MV unit, those involved in the start-up, operation, and maintenance should be thoroughly familiar with these instructions and other necessary job data. Procedures in this manual are arranged in the sequence required for proper chiller start-up and operation. This book also outlines the control system for those involved in the start-up, operation and maintenance of the unit before performing start-up procedures. It is intended to be used in combination with the 19MV Semi-Hermetic Centrifugal Liquid Chillers Controls Operation and Troubleshooting manual that describes the controls in detail.

⚠ CAUTION

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

⚠ CAUTION

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

⚠ CAUTION

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

⚠ CAUTION

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

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

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

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

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

ABBREVIATIONS AND EXPLANATIONS

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

Frequently used abbreviations in this manual include:

AWG — American Wire Gage
BMS — Building Management System
BPHX — Braised Plate Heat Exchanger
CCN — Carrier Comfort Network®
DCIB — Digital Control Interface Board
DVM — Digital Volt-Ohmmeter
ECDW — Entering Condenser Water
ECW — Entering Chilled Water
EMS — Energy Management System
EXV — Electronic Expansion Valve
HMI — Human Machine Interface
HVIB — High Voltage Interface Board
I/O — Input/Output
ICP — Interstage Compressor Piping
IGBT — Insulated-Gate Bipolar Transistor
IGV — Inlet Guide Vane
IOB — Input Output Board
LCDW — Leaving Condenser Water
LCW — Leaving Chilled Water
LED — Light-Emitting Diode
MAWP — Maximum Allowable Working Pressure
MBC — Magnetic Bearing Controller
NSTV — Network Service Tool V
OLTA — Overload Trip Amps
PIC — Product Integrated Controls
PPE — Protective Personal Equipment
PWM — Pulse Width Modulating
RLA — Rated Load Amps
RMS — Root Mean Square
SCCR — Short Circuit Current Rating
SCR — Silicon Controlled Rectifier
SIOB — Starfire 2 Input Output Board
UPS — Uninterruptible Power Supply
VFD — Variable Frequency Drive
VPF — Variable Primary Flow

CHILLER FAMILIARIZATION (Fig. 1 and 2)

Chiller Information Nameplate

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

System Components

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

Evaporator

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

Condenser

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

Economizer Option

The 19MV system utilizes a BPHX to transfer heat from the main stream of liquid refrigerant to a smaller stream of refrigerant, which has been brought to an intermediate pressure by use of an EXV. The intermediate pressure refrigerant leaves the BPHX as a superheated vapor and flows into the second stage end of the compressor. The heat removed by the vaporized refrigerant in the economizer allows the liquid refrigerant in the evaporator to absorb more heat when it evaporates and benefits the overall cooling efficiency cycle. See Fig. 3 for economizer assembly details.

19 MV – 4 1 N 4 1 N 3 6 9 E 7 5 –

Description
19 — High Efficiency Semi-Hermetic Centrifugal Liquid Chiller

MV — Model Designation

Bearing Option
– — Magnetic Bearing

Evaporator Frame Size
3 — Frame 3
4 — Frame 4
5 — Frame 5

Evaporator Length
1 — 11 Foot (3.4 m) Length
3 — 13 Foot (4 m) Length

Evaporator Pass Arrangement and Tube Count
L — 2 pass, 3/4" tube, Lowest Tube Count
M — 2 pass, 3/4" tube, Medium Tube Count
N — 2 pass, 3/4" tube, Highest Tube Count

X — 2 pass, 1" tube, Lowest Tube Count
Y — 2 pass, 1" tube, Medium Tube Count
Z — 2 pass, 1" tube, Highest Tube Count

Condenser Frame Size
3 — Frame 3
4 — Frame 4
5 — Frame 5

Condenser Length
1 — 11 Foot (3.4 m) Length
3 — 13 Foot (4 m) Length

Condenser Pass Arrangement and Tube Count
K — 2 pass, 3/4" tube, Lowest Tube Count
L — 2 pass, 3/4" tube, 2nd Lowest Tube Count
M — 2 pass, 3/4" tube, 2nd Highest Tube Count
N — 2 pass, 3/4" tube, Highest Tube Count

Special Code
– — Standard
S — Special

Voltage Code

Code	Volts-Phase-Hertz
3 —	380-3-60
4 —	416-3-60
5 —	460-3-60
9 —	400-3-50

Motor Code
3 — Smallest HP
5 — Medium HP
7 — Large HP

Economizer Option
E — Economizer Included
N — No Economizer

Compressor Impeller Diameter Code
9

Compressor Shroud Code
3
4
5
6
7
8

Compressor Frame Size
3 — 300-700 Nominal Tons (1,055-2,462 kW)

Fig. 1 — 19MV Chiller Model Number Identification

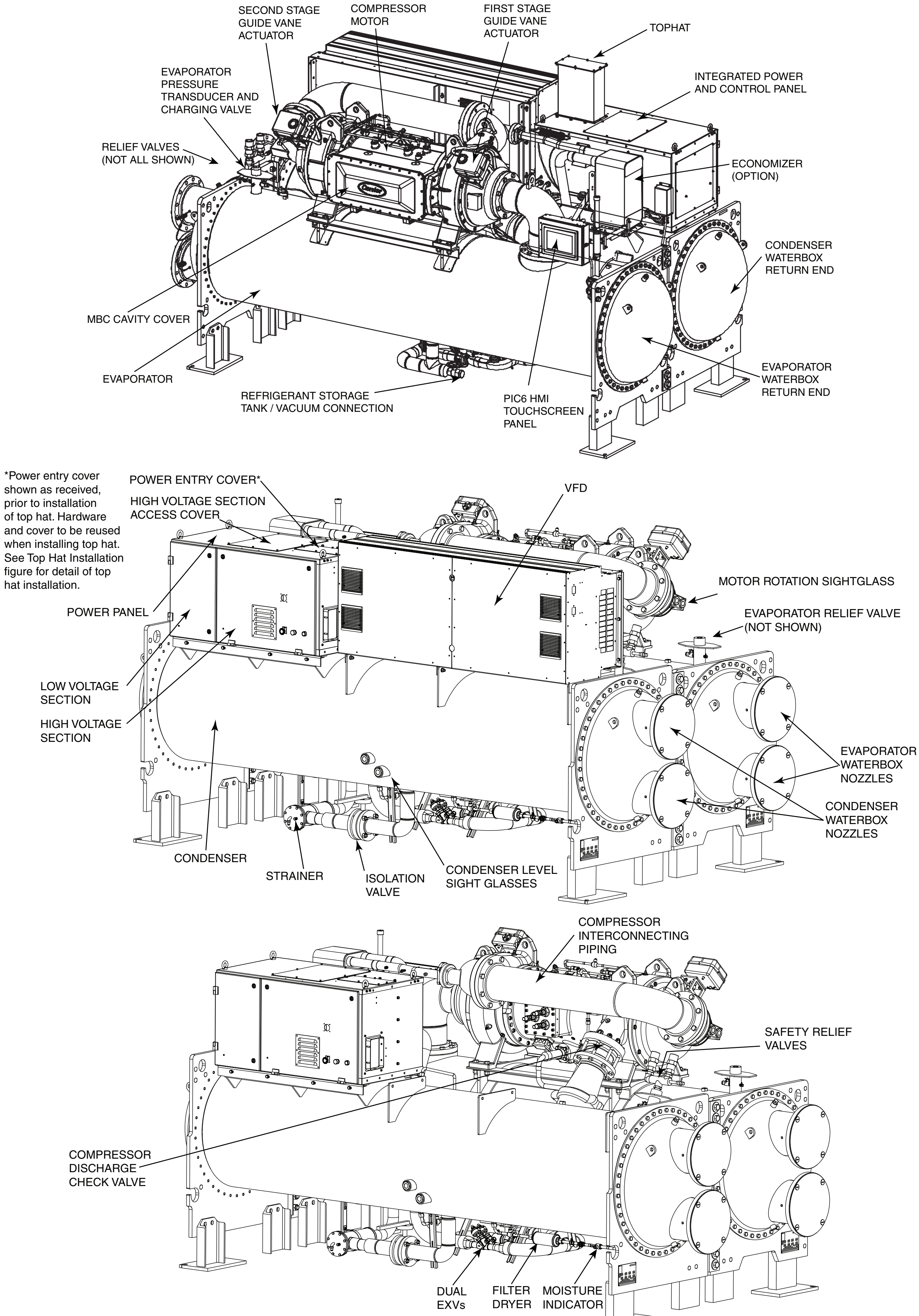


Fig. 2 — Typical 19MV Compressor Chiller Components

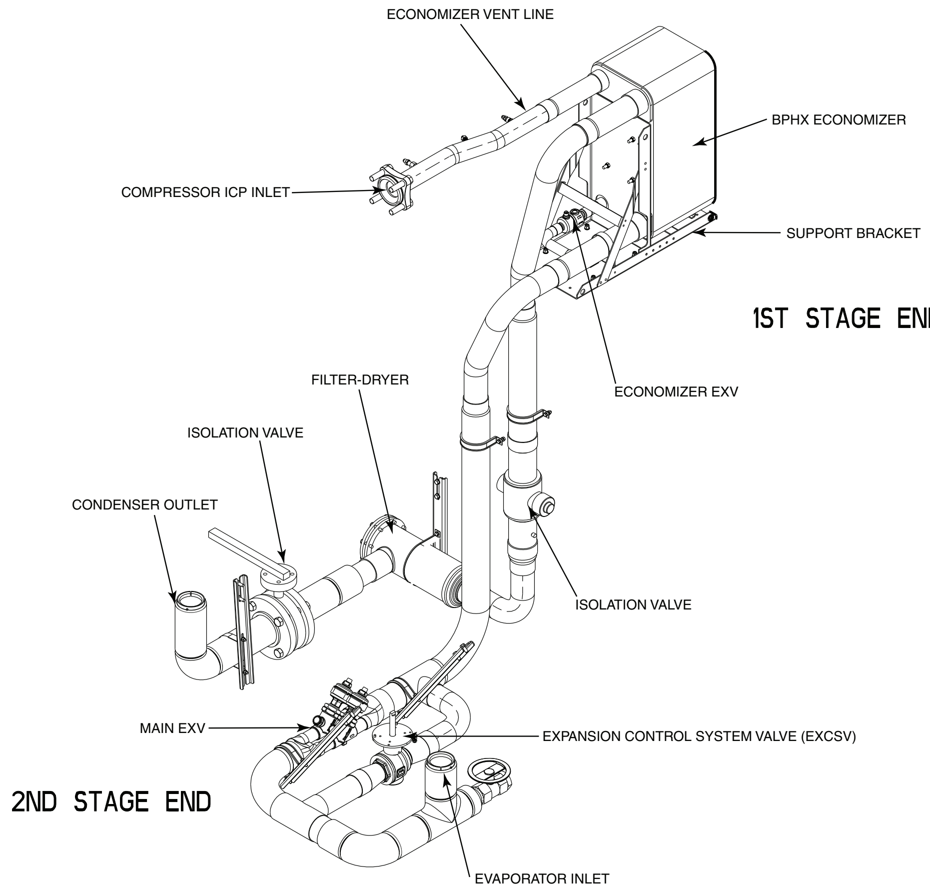


Fig. 3 — Typical 19MV Economizer Assembly Detail

Motor-Compressor

This component maintains system temperature and pressure differences and moves the heat-carrying refrigerant from the evaporator to the condenser. The 19MV chiller utilizes a two-stage back to back direct drive configuration with Interior Permanent Magnet (IPM) motor and active magnetic bearings.

Variable Frequency Drive (VFD)

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

Chiller Power Panel

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

- Communication with PIC6 touch screen
- Communication with UPS
- Communication with VFD
- Sensor input and outputs
- Actuators control
- Communication with MBC

PIC6 Touch Screen HMI

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

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

Magnetic Bearing Controller (MBC)

The 19MV compressor uses active magnetic bearings in place of traditional rolling element bearings, which eliminates the need for a lubrication system. The magnetic bearings are controlled by a dedicated Magnetic Bearing Controller (MBC), which communicates with the overall system PIC via Modbus communication. Information available from the MBC on the PIC HMI includes calibration status, clearance check values, drop counts, shaft speed, and shaft "orbit" (location) statistics. Due to the high sampling rate of the MBC as compared to the PIC, the orbit statistics provide a good approximation of shaft location in real time. For more detailed bearing information and diagnostics a direct PC connection can be made to the MBC using an Ethernet connection from the MBC board. If this is required consult Carrier Service Engineering.

UPS

A Uninterrupted Power Supply module (UPS) with Modbus card is installed within the 19MV power panel. In the event of a power failure, the UPS provides power to chiller control components during power loss events in order to safely bring the levitated shaft to rest on the touch down bearings. If the power interruption is short, the UPS also supports fast restart of the chiller upon power restoration. The UPS communicates battery and power supply status to the PIC through Ethernet (Modbus IP) communication.

Expansion Control System

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

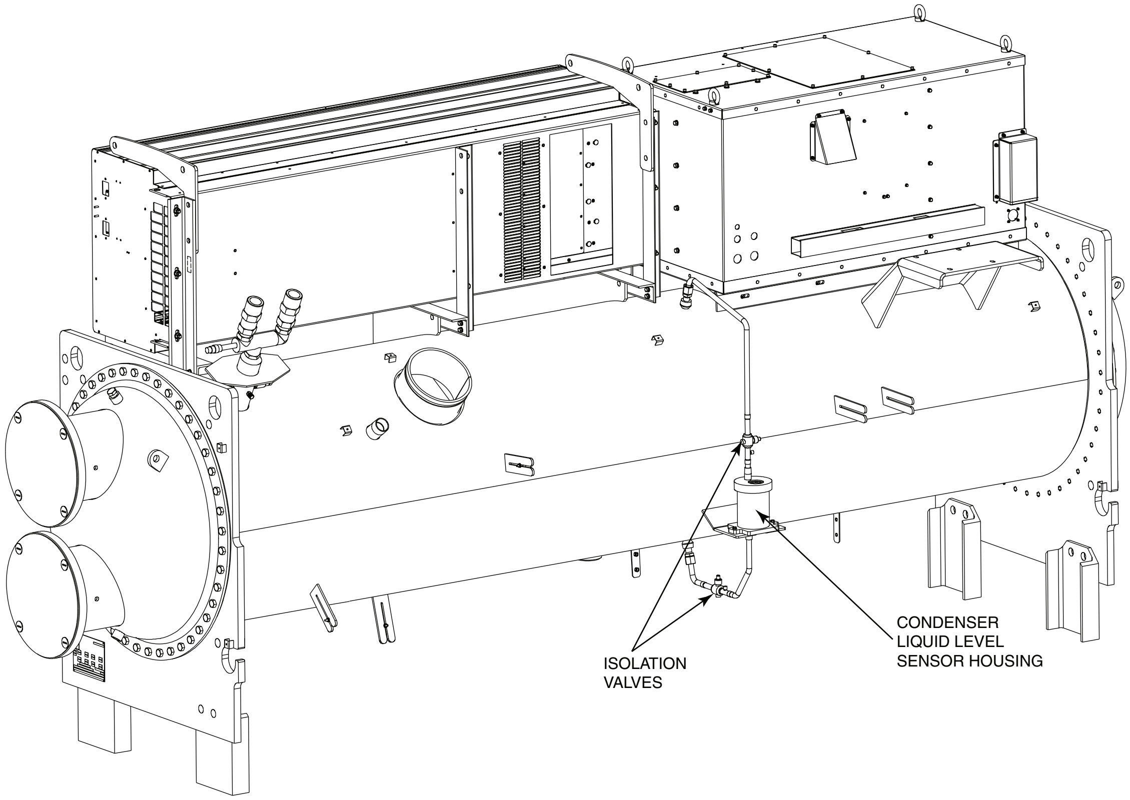


Fig. 4 — Typical 19MV Liquid Level Assembly Detail

REFRIGERATION CYCLE

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

After taking heat from the water, the refrigerant vapor is compressed by a back-to-back compression connected by means of interstage piping. Compression adds heat energy and the refrigerant is quite warm (typically 98 to 102°F [37 to 40°C]) when it is discharged from the compressor into the condenser.

Relatively cool (typically 65 to 90°F [18 to 32°C]) water flowing into the condenser tubes removes heat from the refrigerant, and the vapor condenses to liquid. The liquid drains from the bottom of the condenser and, for units equipped with economizer option, flows into the high pressure side of the BPHX.

At the outlet of the high pressure side of the BPHX a small portion of refrigerant is separated from the main stream, brought to a lower pressure by an EXV, and fed back through the low pressure side of the BPHX. As the two streams of refrigerant flow through the BPHX heat transfered from the main stream of refrigerant vaporizes the economizer stream. This vapor flows to the second stage of the compressor for greater cycle efficiency. The amount of vapor introduced to the second stage is determined by an EXV which meters the flow of vapor to maintain a specified vapor superheat.The cooled liquid flows out of the economizer and into the expansion control system and at this point the cycle is the same with or without the optional economizer. The expansion control system will meter the refrigerant follow into the evaporator for best system performance. See Fig. 5-6 for the refrigeration cycle diagram for economized and non-economized systems.

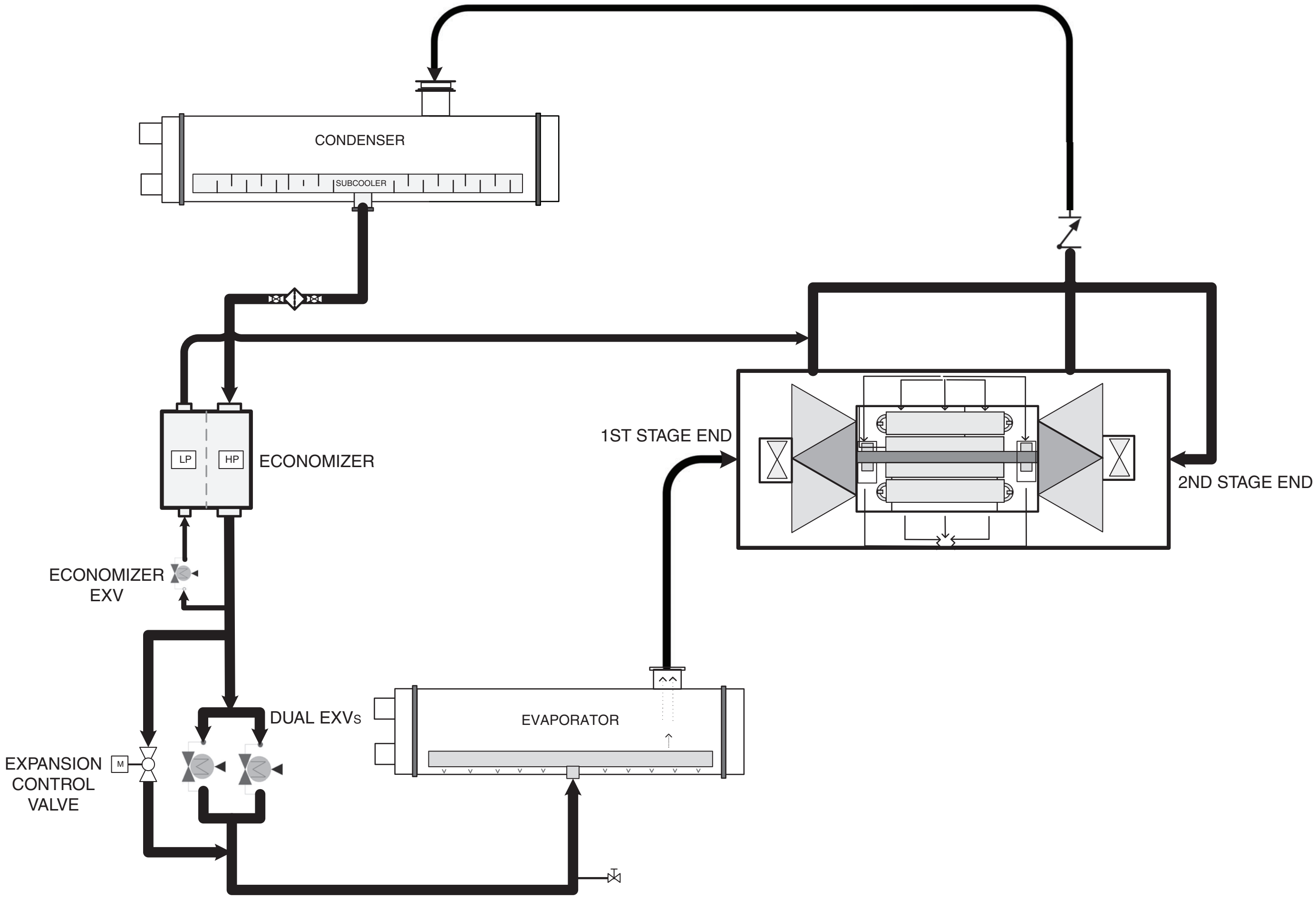


Fig. 5 — Refrigeration Cycle — 19MV Oil-free Compressor with Economizer

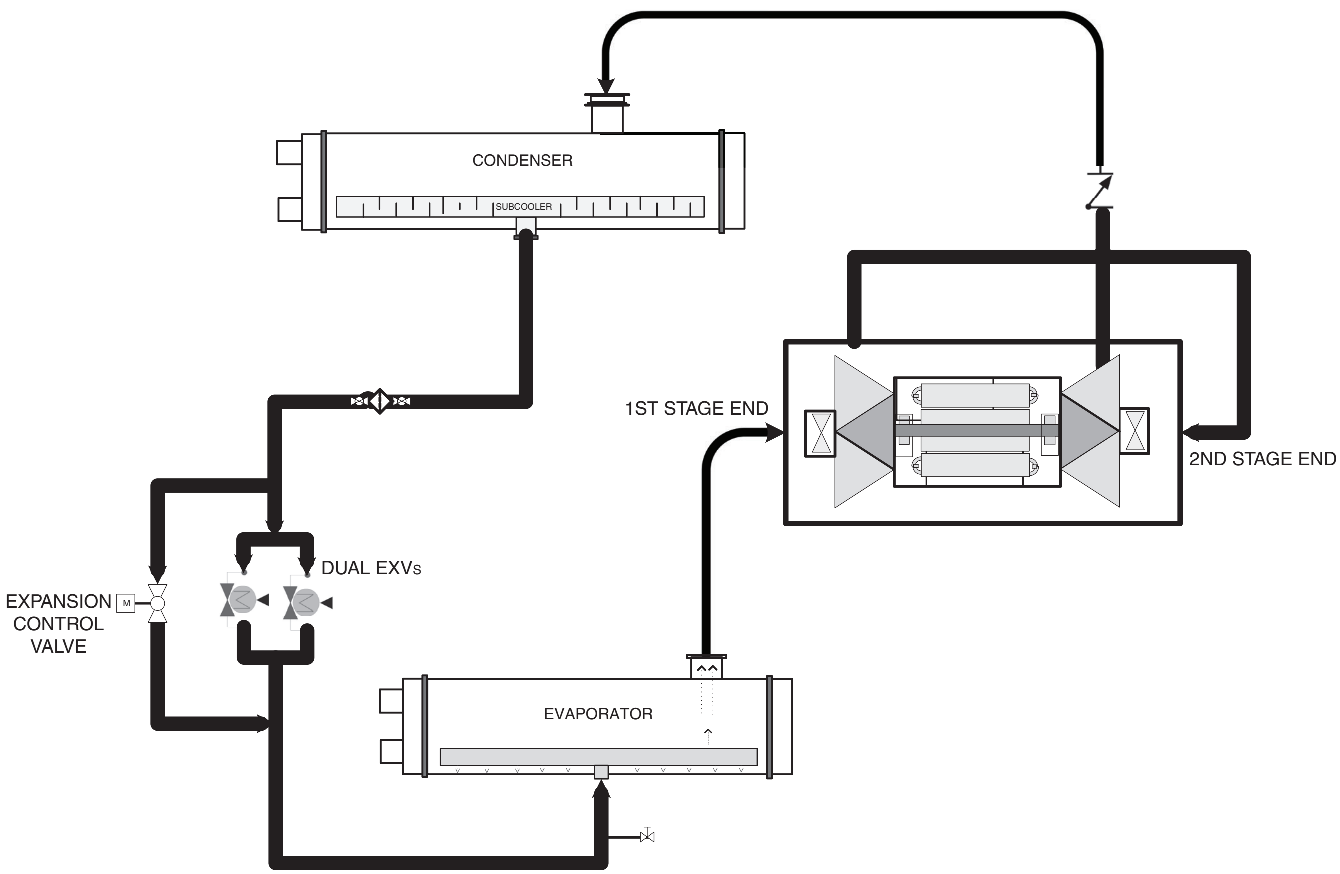


Fig. 6 — Refrigeration Cycle — 19MV Oil-free Compressor without Economizer

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

Motor Cooling System

The motor and compressor bearings are cooled by liquid refrigerant taken from the bottom of the condenser shell. Refrigerant flow is maintained by the pressure differential that exists due to compressor operation. After exiting the condenser shell, the refrigerant flows through a moisture indicating sight-glass and an in-line filter drier. There is a ball valve positioned on each side of above components for ease of service. After this the refrigerant is split into several streams which are directed over the motor windings, thrust bearing, and radial bearings by spray nozzles. When the chiller is operating there should be turbulent two phase flow of refrigerant visible in the sight glass. The refrigerant collects in the bottom of the motor casing and is then drained back into the evaporator through the motor refrigerant drainline. The motor is protected by temperature thermistors embedded in the stator windings An increase in motor winding temperature past the motor override set point (200°F [93.3°C]) enables the capacity inhibit function. The inhibit is released when the temperature is below the motor override set point. If the motor temperature is greater than compressor motor override temperature plus 10°F (5.5°C) the capacity override will stay active until all the motor winding temps are less than the motor override setpoint minus 2°F (1.1°C). Note that unit will shut down if any motor temperature sensor exceeds 220°F (104.4°C). See Fig. 7.

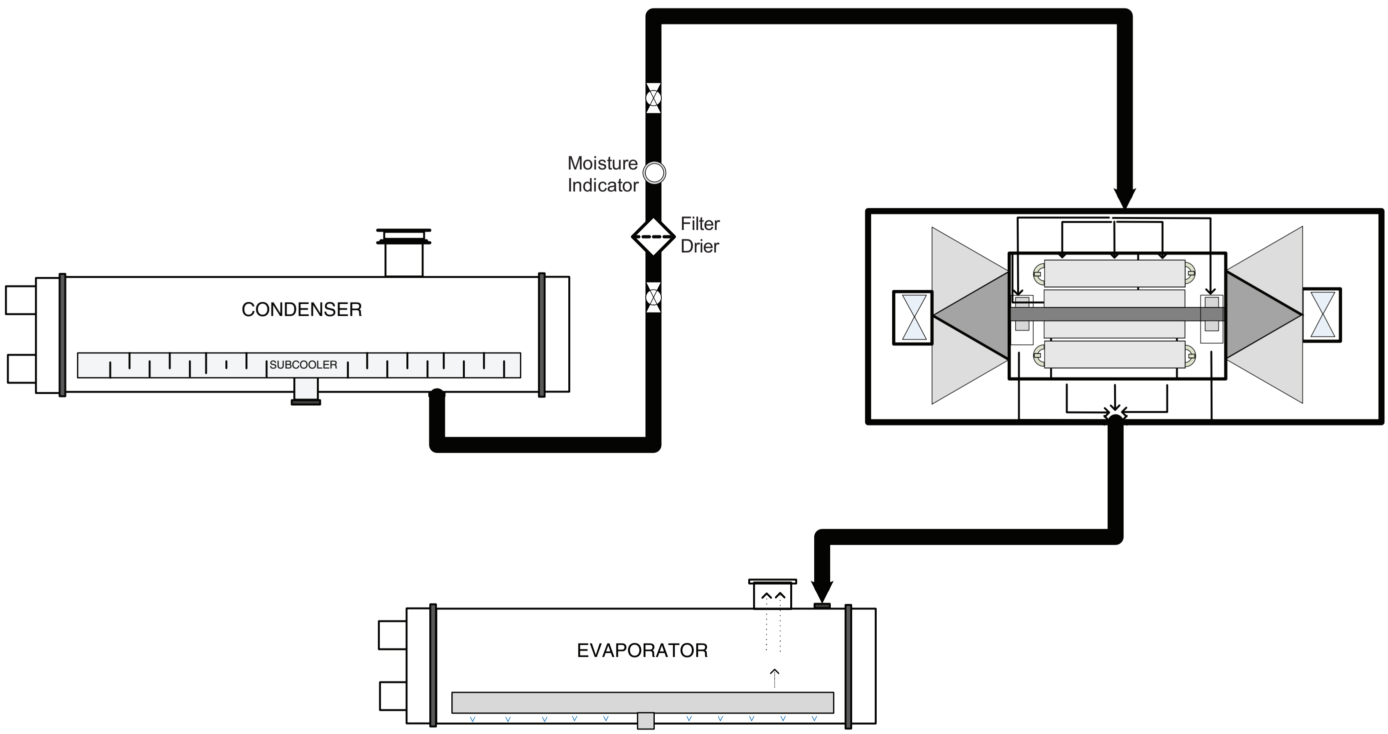


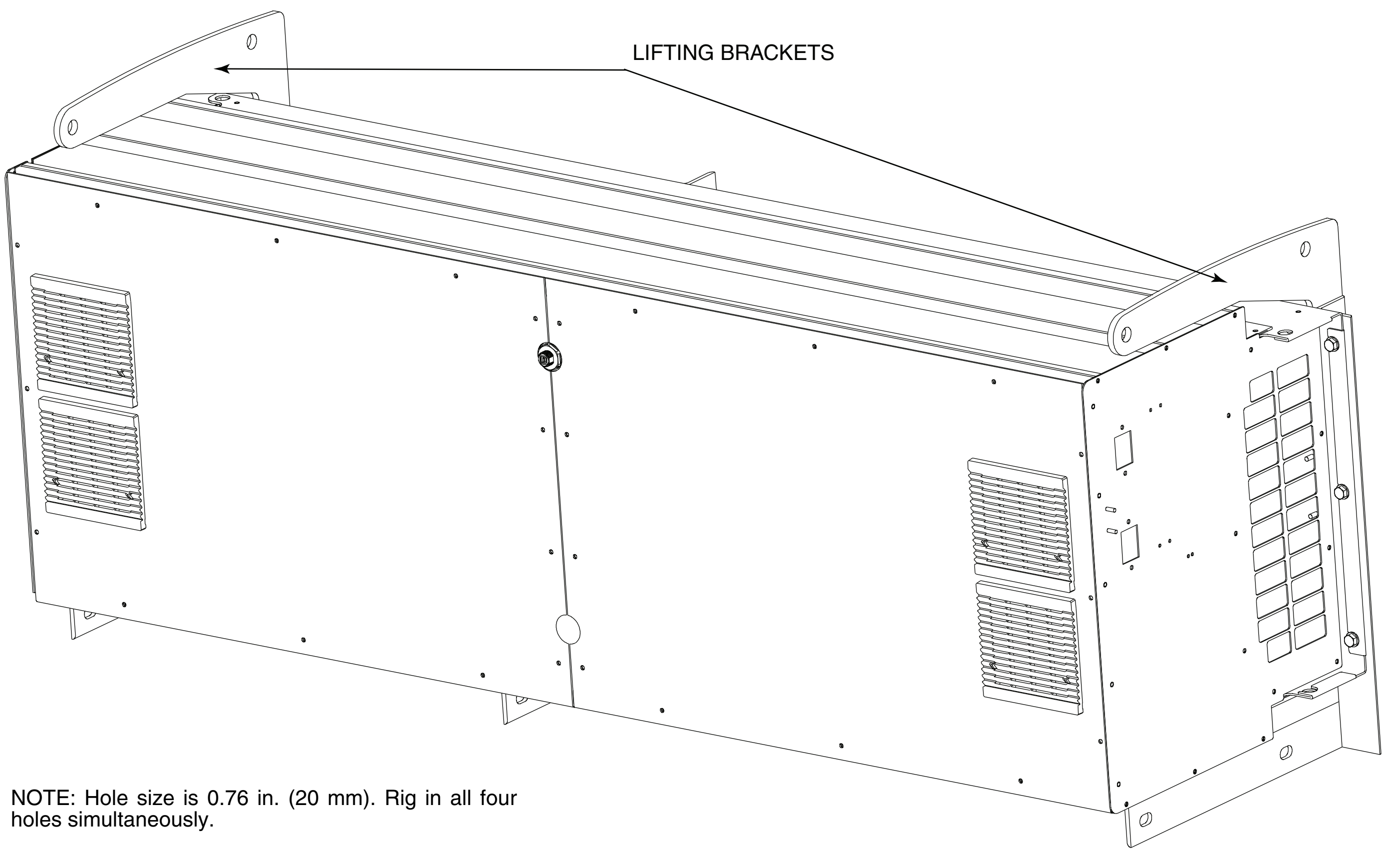
Fig. 7 — Motor Cooling System with Filter Dryer and Moisture Indicator (Standard)

VFD

The 19MV unit mounted starters are Danfoss FC102 VFDs family for standard tier and Rockwell PF755TL for high tier. The VFDs are used to run Carrier's Interior Permanent Magnet (IPM), gear-less compressors family. The VFD, power panel, and control panel are mounted on the chiller. See manufacturer VFD specific information and VFD schematics. The drives are designed to operate in an ambient range of up to 104°F (40°C) without de-rating the VFD. Consult Engineering for ambient temperatures greater than this value. Both manufacturer's drives are designed to allow service to repair the units without removing them from the chiller. For standard tier drives, line reactors are offered as an option to improve the units' reliability and harmonics. The optional high tier drives have an active front end. The high tier VFDs meet IEEE-519 < = 5% iTHD at the common point of coupling. Volt and amp meters are offered on both standard and high tier VFDs. See Fig. 8.

The following drives are used with 19MV units:

Drive	Approximate Weight	
	lb	kg
DD395 (N200)	325	148
DD480 (N250)	325	148
DD588 (N315)	325	148
DE658 (N355)	700	318
DE745 (N400)	700	318
DE800 (N450)	700	318
DE990 (N560)	750	341



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

Fig. 8 — VFD Lifting Brackets

CONTROLS

Definitions

ANALOG SIGNAL

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

DISCRETE SIGNAL

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

General

The 19MV centrifugal liquid chiller contains a microprocessor based control center that monitors and controls all operations of the chiller. The microprocessor control system matches the cooling capacity of the chiller to the cooling load while providing state-of-the-art chiller protection. The system controls cooling load within the set point plus the dead band by sensing the leaving chilled water or brine temperature and regulating the inlet guide vanes and compressor speed. The guide vane is a variable flow pre-whirl assembly that controls the refrigeration effect in the evaporator by regulating the amount of refrigerant vapor flow into the compressor. An increase in guide vane opening increases capacity. A decrease in guide vane opening decreases capacity. The microprocessor-based control center protects the chiller by monitoring the digital and analog inputs and executing capacity overrides or safety shutdowns, if required. The variable frequency drive (VFD) allows compressor start-up and capacity control by modulating the motor frequency based on the operating condition.

PIC6 System Components

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

Table 1 — Major Controls Components and Panel Locations

PIC6 COMPONENT	PANEL LOCATION
Variable Frequency Drive (Standard Tier, High Tier)	Top of condenser
Magnetic Bearing Controller (MBC)	Side of compressor
Uninterrupted Power Supply (UPS)	Power panel, high voltage section
Remote Monitoring	Power panel, low voltage section
Power Panel	On condenser, first stage end
HMI	Side of cooler, first stage end

NOTE: For detailed information about the PIC6 HMI (human machine interface), see the 19MV with PIC6 Controls Operation and Troubleshooting manual.

START-UP/SHUTDOWN/RECYCLE SEQUENCE

Local Start/Stop Control

Local start-up (or manual start-up) is initiated by pressing the gray Start/Stop icon on the HMI interface. See Fig. 9.

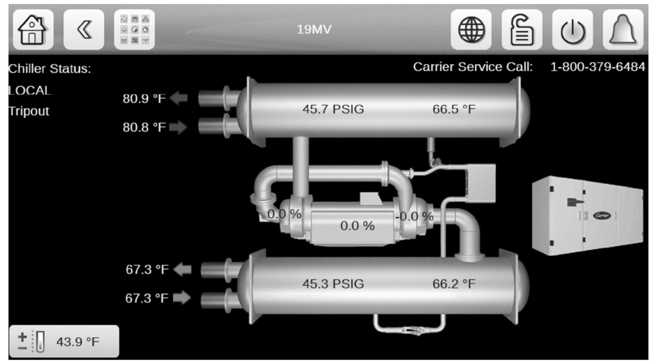


Fig. 9 — Chiller Start/Stop Icon

This initiates the PIC6 starting sequence by displaying the list of operating modes. Press Local On to initiate start-up. See Fig. 10.

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

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

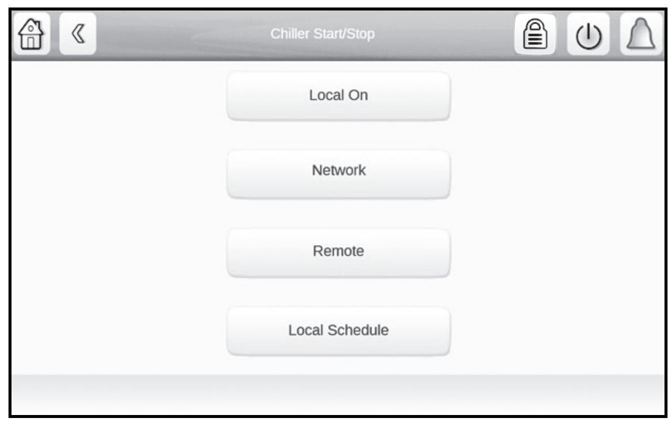


Fig. 10 — Local On

Once 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 2 shows appropriate Prestart Alerts/Alarms conditions. If a test is not successful, the start-up is delayed or aborted. If the prestart tests are successful, the PIC6 will perform MBC pre-start checks. After the MBC checks are passed, the start-up will be in progress and the COMPRESSOR RUN STATUS will be "Startup." The system will send a command for the MBC to levitate the compressor shaft. If the compressor is not ready or unable to levitate the shaft, startup will be aborted. If successful, the control will then energize the chilled water/brine pump relay.

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

If the water/brine temperature is high enough, the start-up sequence continues and checks the guide vane position. If the guide vanes are more than 4% open, the start-up waits until the PIC6 control system closes the vanes.

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

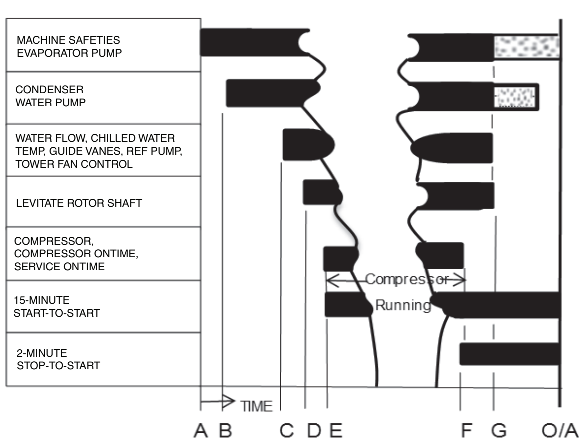
Failure to verify any of the requirements up to this point will result in the PIC6 control system aborting the start and displaying the applicable prestart alert alarm state number near the bottom of the home screen on the HMI panel. A prestart failure does not advance the *STARTS IN 12 HOURS* counter.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

The minimum time to complete the entire prestart sequence is approximately 185 seconds. See Fig. 11 for normal start-up timing sequence. See Table 2 for a list of prestart checks.

Table 2 — Prestart Checks

PRESTART CHECK CONDITION*	STATE NUMBER†
STARTS IN 12 HOURS ≥ 8 (not counting recycle restarts or auto restarts after power failure) and Frequent Start Option is not enabled. If Frequent Restart Option is enabled then STARTS IN 12 HOURS ≥ 24	Alert 100
COND PRESSURE ≥ COND PRESS OVERRIDE	Alert 102
# Recycle restarts in the last 4 hours > 5 if Frequent Start Option is not Enabled. RECYCLE RESTARTS LAST 1 HOURS > 4 if Frequent Start Option is Enabled.	Alert 103
MBC ALERT	Alert 106
MBC NOT READY TO LEVITATE	Alert 115
COMP MOTOR WINDING TEMP ≥ COMP MOTOR WINDING – 10°F (5.6°C)	Alarm 231
COMP DISCHARGE TEMPERATURE ≥ COMP DISCHARGE ALERT – 10°F (5.6°C)	Alarm 232
EVAP_SAT < refrig trip** + EVAP OVERRIDE DELTA T	Alarm 233
EVAP REFRIG LIQUID TEMP < refrig trip** + EVAP OVERRIDE DELTA T	
AVERAGE LINE VOLTAGE ≤ UNDERVOLTAGE THRESHOLD	Alarm 234
AVERAGE LINE VOLTAGE ≥ OVERVOLTAGE THRESHOLD	Alarm 235
GUIDE VANE 1 CALIBRATION NOT COMPLETED	Alarm 236
GUIDE VANE 2 CALIBRATION NOT COMPLETED	Alarm 238
EXCSV (EXPANSION CONTROL SYSTEM VALVE) CALIBRATION NOT COMPLETED	Alarm 242
POWER PANEL OVER TEMPERATURE	Alarm 243
MBC UNABLE TO LEVITATE	Alarm 456

* If Prestart Check Condition is True, then resulting State is as indicated in the State Number column.
† See the Controls Operation and Troubleshooting guide for alarm and alert codes.
** Refrig trip = 33°F (0.6°C) (water) or and configurable for (brine) applications.



A	START INITIATED: prestart checks are made; evaporator pump started.*
B	Condenser water pump started (1 second after A).
C	Water flows verified (5 seconds to 5 minutes maximum after B). Chilled water temperatures checked against control point. Guide vanes checked for closure. Tower fan control enabled.
D	Ref pressure verified (15 seconds minimum, 300 seconds maximum after C). Levitate rotor shaft and check 10s later that MBC indicates levitation successful.
E	Compressor motor starts; compressor on-time and service on-time start, 15-minute inhibit timer starts (10 seconds after D), total compressor starts advances by one, and the number of starts over a 12-hour period advances by one.
F	Shutdown initiated; Compressor motor stops; compressor on-time and service on-time stop, and 2-minute inhibit timer starts.
G	De-levitate rotor shaft and evaporator pumps de-energized (120 seconds after F). Condenser pump and tower fan control 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 E; minimum of 2 minutes after F).

* Auto Restart After Power Failure Timing sequence will be faster.

Fig. 11 — Control Timing Sequence for Normal Start-Up

Shutdown

The unit can be stopped locally using the HMI by pressing the green Start/Stop icon . The Unit Start/Stop screen is displayed. Press Confirm Stop (see Fig. 12).

Fig. 12 — Confirm Stop

Chiller shutdown begins if any of the following occurs:

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

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

Any time the compressor is directed to stop (except in the cases of a fault shutdown), the guide vanes are directed to close and VFD is directed to minimum speed for variable speed compressor, and the compressor shuts off when any of the following is true:

- PERCENT LOAD CURRENT (%) drops below the SOFT STOP AMPS THRESHOLD
- ACTUAL GUIDE VANE OPENING drops below 4%
- 4 minutes have elapsed after initializing stop.

When any one of the above conditions is true, the shutdown sequence stops the compressor by deactivating the compressor start relay. Then the guide vane shall be closed and stay at the fully closed position, MBC will de-levitate the shaft once the shaft has stopped rotating, and the chilled water/brine pump and condenser water pump will be shut down.

BEFORE INITIAL START-UP

Job Data Required

- list of applicable design temperatures and pressures (product data submittal) from the Equipment Sales Engineer who sold the equipment
- chiller certified prints
- wiring diagrams
- diagrams and instructions for special controls or options
- 19MV Installation Instructions

Equipment Required

- mechanic's tools (refrigeration)
- digital volt-ohmmeter (DVM)
- true RMS (root mean square) digital multimeter with clamp-on current probe or true RMS digital clamp-on ammeter rated for at least 575 vac and 1000 amps
- electronic refrigerant leak detector
- absolute pressure manometer or electronic micron gage (see Fig. 13)

Fig. 13 — Digital Vacuum Gage

Remove Shipping Packaging

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

Tighten All Gasketed Joints

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

Gasketed joints (excluding O-ring face seals*) may include joints at some or all of the following:

- Waterbox covers
- Compressor first suction elbow flanges (at compressor and at evaporator)
- BPHX discharge flange (option)
- Compressor discharge flange
- Isolation valve flanges (at condenser drain)
- ICP piping flanges

See Tables 3 and 4 for bolt torque requirements.

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

Table 3 — Bolt Torque Requirements, Foot Pounds

BOLT SIZE (in.)	SAE 2, A307 GR A HEX HEAD NO MARKS LOW CARBON STEEL		SAE 5, SOCKET HEAD OR HEX WITH 3 RADIAL LINES, OR SA499 MEDIUM CARBON STEEL		SAE 8, HEX HEAD WITH 6 RADIAL LINES OR SA354 GR BD MEDIUM CARBON STEEL	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
1/4	4	6	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 4 — 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

Table 5 — O-ring Face Seal Torque Requirements

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

Check Chiller Tightness

Figure 14 outlines the proper sequence and procedures for leak testing.

The 19MV chillers are shipped with a full refrigerant charge. Units may be ordered with refrigerant shipped separately, along with 15 psig (103 kPa) nitrogen holding charge in each vessel.

To determine if there are any leaks, the unit should be charged with refrigerant. Use an electronic leak detector to check all flanges and solder joints after the chiller is pressurized. If any leaks are detected, follow the leak test procedure (page 18).

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

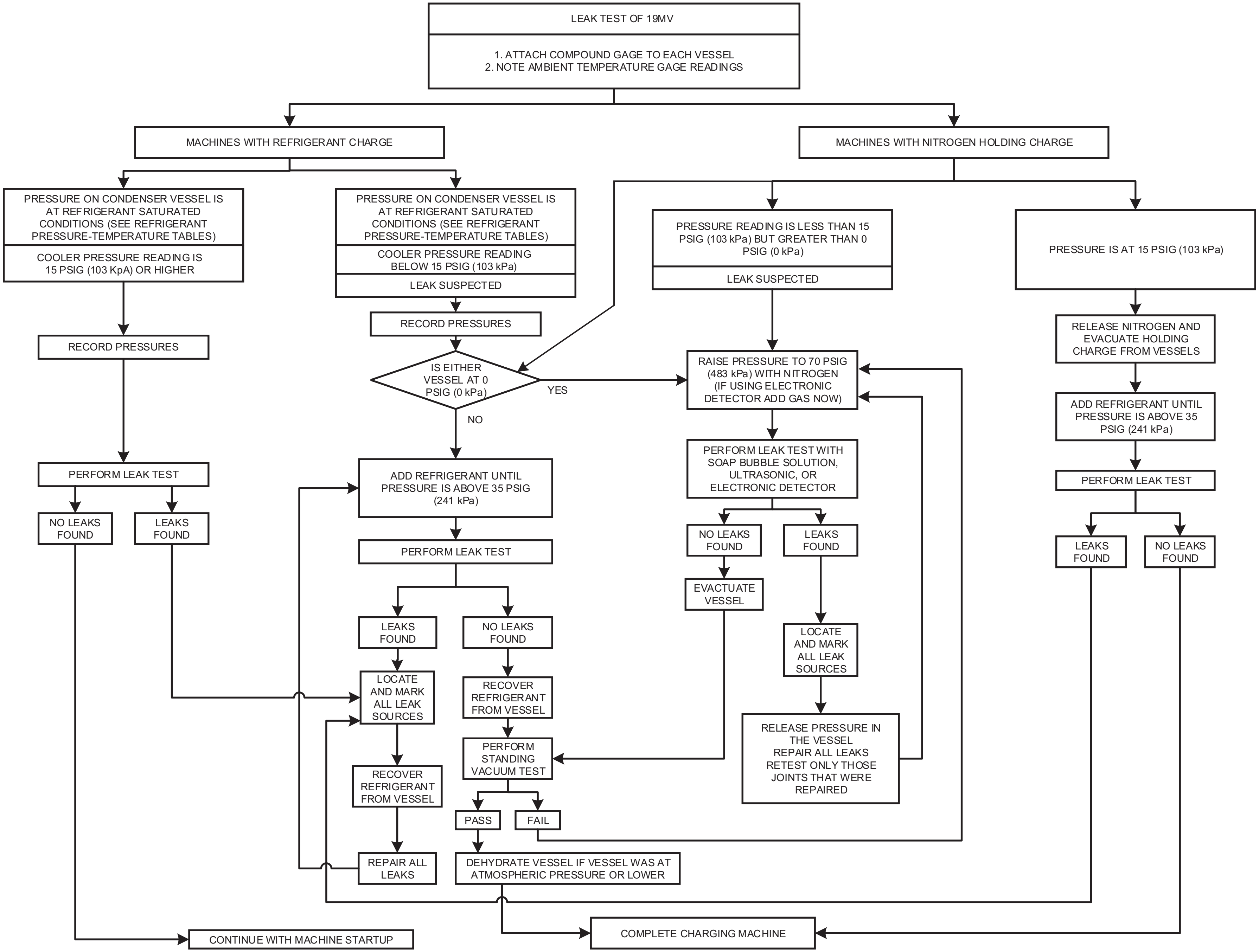


Fig. 14 — 19MV Leak Test Procedures

Perform MBC Calibration and Clearance Checks

The initial calibration of the active magnetic bearings is performed before the chiller is shipped from the Carrier facility. If it becomes necessary to recalibrate, then select the Motor-Compressor icon on the home screen, then press the up arrow to navigate to the MBC status page. Under “MBC Calibration” select the “start calibration” icon. See Fig. 15 and 16. The status of the calibration process will be displayed beneath the button. The results of the calibration are displayed on the calibration screen as well as saved to the MBC flash memory. The calibration process is done while the bearings are not levitated. It moves the shaft at high force around the available clearance.

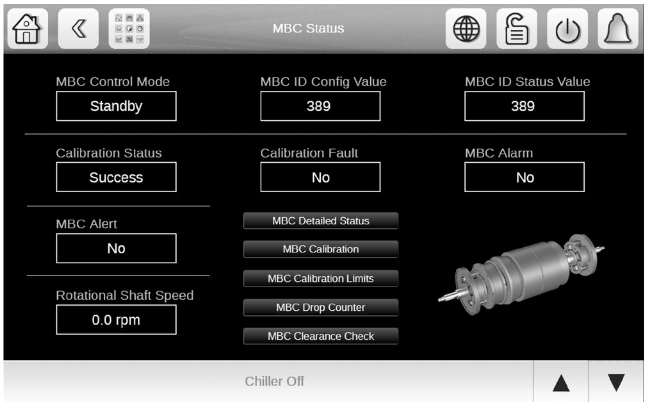


Fig. 15 — MBC Status Page

The first calibration will be performed in the chiller factory. In the field MBC calibration is required when:

- After replacement of MBC
- After replacement of magnetic bearing, aux bearing, or amplifier components.
- If PIC6 displays an Average-Gap-Change warning.

NOTE: Calibration cannot be performed if chiller is in vacuum condition. Quick test function must be enabled to perform a calibration.

The MBC performs clearance checks with the shaft levitated. It will check radially in 8 directions and axially forward and backward. Recorded changes are a measure of the health/wear of the auxiliary bearings. A manual clearance check can be performed by selecting "MBC Clearance Check" from the MBC Status screen. The clearance check is initiated when the "Start Manual" icon is selected in the MBC Clearance Check screen (Fig. 16). Note that Quick Test must be Enabled in order complete a MBC clearance test or MBC calibration.

Clearance checks needs to be performed, recorded, and included in commissioning paperwork for baseline purpose when:

- Unit is commissioned (base line purpose)
- If the MBC registers a drop of the rotor

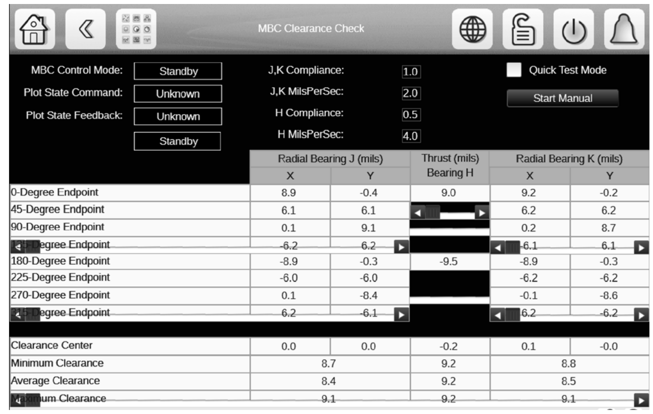


Fig. 16 — MBC Calibration Screen

The PIC will automatically initiate a clearance check upon unit startup if:

- an increase in the shaft drop count is detected
- The speed sensor option is disabled
- The unit is configured for the option "clearance check on startup"

The MBC Clearance Check screen contains information of the data captured from the clearance check procedure. Radial Bearing J is the first stage end radial magnetic bearing (RMB). The H bearing is the thrust magnetic bearing (TMB) located on the first stage end. Finally, the K bearing is the second stage radial magnetic bearing.

Check Motor Cooling Valves

Before initial startup verify that the two isolation valves on either side of the filter-dryer and moisture indicator are in the open position. On initial startup monitor the motor winding temperatures to verify proper cooling.

EXV Strainer Refrigerant Isolation Valves

Before startup, confirm the two refrigerant isolation valves for the EXV strainer are open.

UPS

The UPS is shipped from the factory with the battery disconnected. When power is available for charging the battery, open the high voltage section of the power panel and remove the cover of the UPS by pulling it outwards (Fig. 17). Once cover is removed connect red wires to the red plug and black wires to the black plug. The battery requires 12 hours to fully charge.

After periods of storage or inactivity, the UPS battery may reduce in charge. Before initial startup, apply power to the UPS, observe charge level, and, if necessary, allow UPS to charge fully before attempting startup.

NOTE: It may take up to 12 hours to fully charge the UPS batteries. Manufacturer’s estimated UPS shelf life is 6 months.

NOTE: If battery is replaced, it should be logged in the UPS menu located in the Configuration Menu. A battery replacement alert or alarm will be cleared once the replacement is logged.

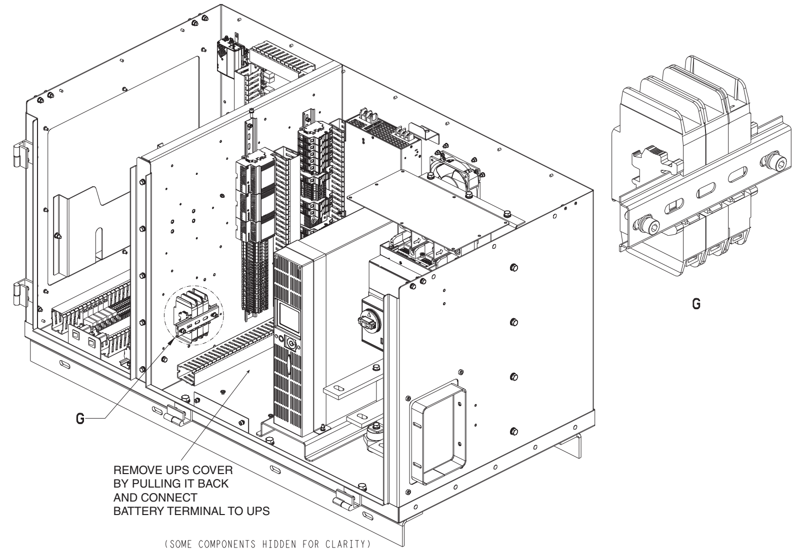


Fig. 17 — UPS Cover Location

Refrigerant Tracer

Carrier recommends the use of an environmentally acceptable refrigerant tracer for leak testing with an electronic refrigerant detector. Ultrasonic leak detectors can also be used if the chiller is under pressure.

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

⚠ WARNING

Do not use air or oxygen as a means of pressurizing the chiller. Mixtures of R-134a/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 the refrigerant, Carrier recommends the following leak test procedure. Refer to Tables 6 and 7 for refrigerant pressure/temperature values.

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

⚠ CAUTION

Never charge liquid refrigerant into the chiller if the pressure in the chiller is less than 35 psig (241 kPa) for R-134a/R-513A 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 to 7.
2. If the pressure readings are abnormal for the chiller condition:
   a. Prepare to leak test chillers shipped with refrigerant (Step 2h).
   b. Check for large leaks by connecting a nitrogen bottle and raising the pressure to 30 psig (207 kPa). Soap test all joints. If the test pressure holds for 30 minutes, prepare the test for small leaks (Steps 2g and 2h).
   c. Plainly mark any leaks that are found.
   d. Release the pressure in the system.
   e. Repair all leaks.
   f. Retest the joints that were repaired.
   g. After successfully completing the test for large leaks, remove as much nitrogen, air, and moisture as possible, given the fact that small leaks may be present in the system. Follow the dehydration procedure outlined in the section "Chiller Dehydration" on page 21.
   h. Slowly raise the system pressure to a maximum of 160 psig (1103 kPa) but no less than 35 psig (241 kPa) for R-134a/R-513A by adding refrigerant (below 35 psig refrigerant must be added as a gas). Proceed with the test for small leaks (Steps 3 to 9).
3. Check the chiller carefully with an electronic leak detector or soap bubble solution.
4. Leak Determination — If an electronic leak detector indicates a leak, use a soap bubble solution, if possible, to confirm. Total all leak rates for the entire chiller. Leakage at rates greater than 0.1% of the total charge per year must be repaired. Note the total chiller leak rate on the start-up report.
5. If no leak is found during the initial start-up procedures, complete the transfer of refrigerant gas from the storage tank to the chiller. Retest for leaks.
6. If no leak is found after a retest:
   a. Transfer the refrigerant to the storage tank and perform a standing vacuum test as outlined in the section "Standing Vacuum Test" on page 20.
   b. If the chiller fails the standing vacuum test, check for large leaks (Step 2b).
   c. If the chiller passes the standing vacuum test, dehydrate the chiller. Follow the procedure in the section "Chiller Dehydration" on page 21. Charge the chiller with refrigerant.
7. If a leak is found after a retest, pump refrigerant back into storage tank or, if isolation valves are present, pump refrigerant into the non-leaking vessel. See the section See "PUMPOUT AND REFRIGERANT TRANSFER PROCEDURES" on page 33.
8. Transfer the refrigerant until the chiller pressure is at 18 in. Hg (40 kPa absolute).
9. Repair the leak and repeat the procedure, beginning from Step 2h, to ensure a leak-tight repair. (If the chiller is opened to the atmosphere for an extended period, evacuate it before repeating the leak test.)

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

Table 6 — Pressure — Temperature (F)

TEMPERATURE (F)	HFC-134a PRESSURE (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 7 — Pressure — Temperature (C)

TEMPERATURE (C)	HFC-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

Standing Vacuum Test

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

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

Check the Installation

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

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

Inspect Wiring

⚠ WARNING

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

⚠ CAUTION

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

⚠ WARNING

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

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

Chiller Dehydration

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

⚠ CAUTION

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

⚠ WARNING

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

Dehydration can be done at room temperatures. Using a cold trap (Fig. 18) may substantially reduce the time required to complete the dehydration and is recommended should the unit be exposed to liquid moisture. The higher the room temperature, the faster dehydration takes place. At low room temperatures, a very deep vacuum is required to boil off any moisture and heating of the water in the water circuits of the chiller to approximately 100°F (38°C) may be required.

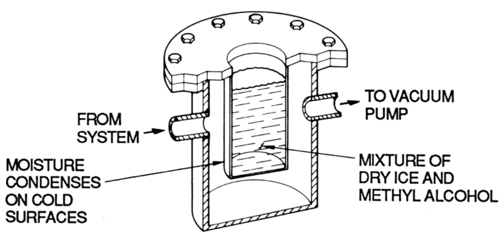


Fig. 18 — Dehydration Cold Trap

Perform dehydration as follows:

1. Connect a high capacity vacuum pump (5 cfm [.002 m^3/s] or larger is recommended) to the refrigerant vacuum/charging valve (Fig. 2). Tubing from the pump to the chiller should be as short in length with a minimum diameter of 0.5 in. (13 mm) and as large in diameter as possible to provide least resistance to gas flow.
2. Use an absolute pressure manometer or a electronic micron gage to measure the vacuum. Open the shutoff valve to the vacuum indicator only when taking a reading. Leave the valve open for 3 minutes to allow the indicator vacuum to equalize with the chiller vacuum.
3. If the entire chiller is to be dehydrated, open all isolation valves (if present).
4. With the chiller ambient temperature at 60°F (15.6°C) or higher, operate the vacuum pump until the manometer reads 185 psig (1275 kPa), or a vacuum indicator reads 35°F (1.7°C). Operate the pump an additional 2 hours.
5. Do not apply a greater vacuum than 29.73 in. Hg vac (755.1 mm Hg) or go below 33°F (0.56°C) on the wet bulb vacuum indicator. At this temperature and pressure, isolated pockets of moisture can turn into ice. The slow rate of evaporation (sublimation) of ice at these low temperatures and pressures greatly increases dehydration time.
6. Valve off the vacuum pump, stop the pump, and record the instrument reading.
7. After a 2-hour wait, take another instrument reading. If the reading has not changed, dehydration is complete. If the reading indicates vacuum loss, repeat Steps 4 and 5.
8. If the reading continues to change after several attempts, perform a leak test (maximum 160 psig [1103 kPa] pressure). Locate and repair the leak, and repeat dehydration.
9. Once dehydration is complete, the evacuation process can continue. The final vacuum prior to charging the unit with refrigerant should in all cases be 29.9 in. Hg (500 microns, 0.07 kPa [abs]) or less.

Inspect Water Piping

Refer to piping diagrams provided in the certified drawings and the piping instructions in the 19MV Installation Instructions manual. Inspect the piping to the evaporator and condenser. Be sure that the flow directions are correct and that all piping specifications have been met.

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

⚠ CAUTION

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

Check Safety Valves

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

The standard 19MV relief devices are set to relieve at 185 psig (1275 kPa) chiller design pressure.

Ground Fault Troubleshooting

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

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

⚠ CAUTION

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

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

   Perform a megohm test from each terminal to ground. The megohm value should be greater than 20 megohm. Note that if a megohm test is performed between the terminals it will show a direct short and is not a valid test because of the 3 terminal motor internal delta configuration.

Carrier Comfort Network Interface

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

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

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

Table 8 — Manufacturers and Cable Numbers

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

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

Table 9 — Recommended Color Code

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

⚠ WARNING

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

⚠ WARNING

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

Charge Refrigerant into Chiller

⚠ CAUTION

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

⚠ CAUTION

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

The standard chiller is shipped with the refrigerant already charged in the vessels. However, the chiller may be ordered with a nitrogen holding charge of 15 psig (103 kPa). Evacuate the nitrogen from the entire chiller, and charge the chiller from refrigerant cylinders. The full refrigerant charge in the 19MV chiller will vary with chiller components and design conditions. An approximate charge may be determined by adding the condenser, evaporator, and economizer charge (as applicable). Obtain refrigerant charge information from unit nameplate or from sales documents/E-Cat.

CHILLER EQUALIZATION WITHOUT A PUMPOUT UNIT

⚠ CAUTION

When equalizing refrigerant pressure on the 19 series chiller after service work or during the initial chiller start-up, *do not use the discharge isolation valve to equalize.* A charging hose (connected between the charging valves on top of the cooler and condenser) should be used as the equalization valve. Failure to follow this procedure may damage equipment.

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

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

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

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

TRIMMING REFRIGERANT CHARGE

The 19 Series chiller is shipped with the correct charge for the design duty of the chiller. Trimming the charge can best be accomplished when the design load is available. To trim the charge, check the temperature difference between the leaving chilled water temperature and cooler refrigerant temperature at full load design conditions. If necessary, add or remove refrigerant to bring the temperature difference to design conditions or minimum differential. Obtain refrigerant charge information from unit nameplate or from sales documents/E-Cat.

Software Configuration

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

See the 19MV with PIC6 Controls Operation and Troubleshooting manual for instructions on using the PIC6 interface to configure the 19MV unit. As the unit is configured, all configuration settings should be written down. A log, such as the one shown starting on page CL-1, provides a list for configuration values.

HOME SCREEN

The home screen is the first screen shown after switching the unit on. See Fig. 19. Note the Globe and Lock icons.

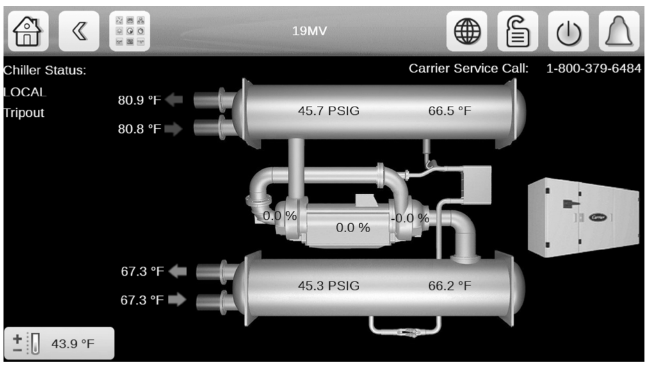


Fig. 19 — Home Screen

The Globe icon on the Home screen allows access to language and measurement settings. See Fig. 20.

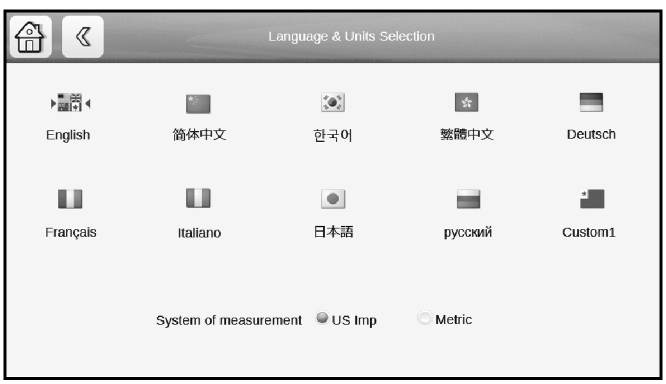


Fig. 20 — Language and Units Selection Screen

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

The Lock icon on the Home screen allows access to the password menu and displays current software version. See Fig. 21.

Fig. 21 — Login Screen

CHANGE THE SET POINTS

To access the set point screen, press the lock icon on the Main Menu. In the User Login menu, enter the password (default USER password = 1111), and click accept. The screen will then default back to the home screen. See Fig. 19. The Service Login access is reserved for access to equipment service tables.

The Main Menu screen is displayed. See Fig. 22 and 23. Press the Setpoint Table icon.

Fig. 22 — Main Menu, Page 1

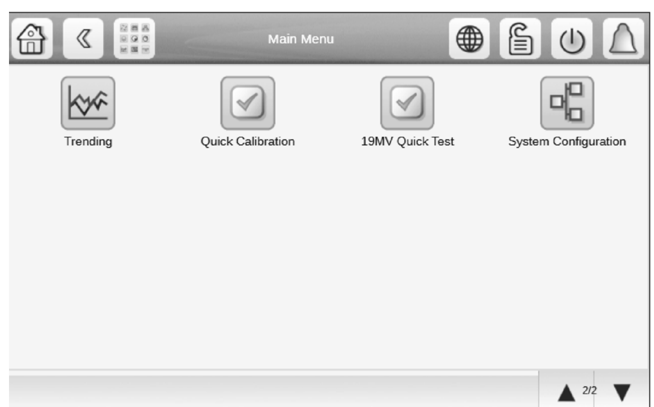


Fig. 23 — Main Menu, Page 2

The Setpoint screen is displayed. See Fig. 24. Set the base demand limit, and either the LCW set point or the ECW set point. To set a value, press the appropriate set point, enter the value, and press OK. For more information, see the PIC6 Control User Manual.

Fig. 24 — Setpoint Menu

INPUT THE LOCAL OCCUPIED SCHEDULE

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

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

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

INPUT SERVICE CONFIGURATIONS

See Fig. 25 for 19MV Configuration Tables. For specific values for the following configurations, refer to the chiller performance data or job-specific data sheet:

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

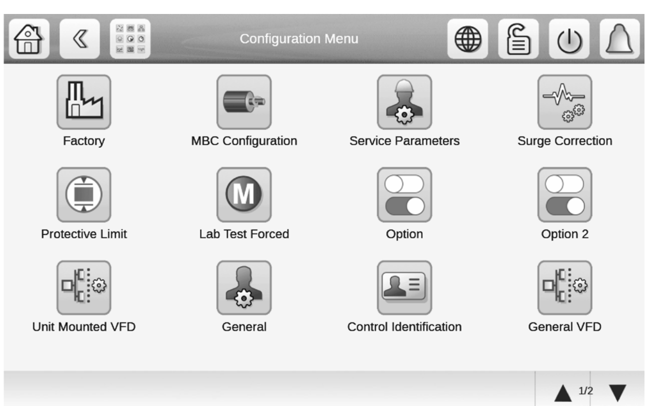


Fig. 25 — 19MV Configuration Tables, Page 1 (Factory Login View)

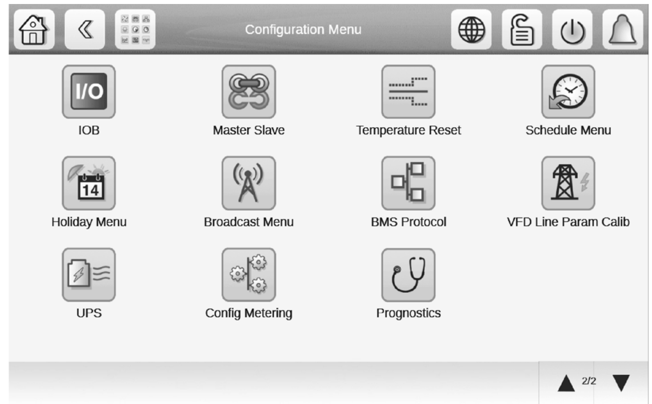


Fig. 26 — 19MV Configuration Tables, Page 2 (Factory Login View)

PASSWORD

A user password must be entered to access the Set Point or other common user tables. See Fig. 27. User password can be changed from the General Configuration Menu. USER CONFIGURATION allows change of the User access password. The default User password is 1111.

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

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

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

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

NOTE: This option reduces the cybersecurity protection of the chiller controls.

Fig. 27 — 19MV Config Tables

INPUT TIME AND DATE

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

MODIFY CONTROLLER IDENTIFICATION IF NECESSARY

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

CONFIGURE TABLES

Access the related tables through MAIN MENU CONFIGURATION MENU (Fig. 25) to modify or view job site parameters shown in 19MV Configuration tables. Tables 10-19 should be verified or configured during startup/commissioning. Consult chiller nameplates as indicated. Tables 10-19 include typical parameters; for the complete list of parameters, consult the Initial Start-up Checklist in this manual or 19MV Controls Operation and Troubleshooting Manual.

Table 10 — Factory Parameters

DESCRIPTION	RANGE	DEFAULT	VALUE
Chiller type	0 to 4	0	4=19MV
Lubrication type	0 to 2	0	2=Mag Bearing
VFD/Starter Option	0 to 9	0	job specific
Unit Type	0 to 1	0	0=Cool Only
Refrig type	0 to 2	0	job specific
Chilled Medium Type	0 to 1	0	0
Cond Shell Side MAWP	0 to 1	0	0=185 psi
Country Code	0 to 999	86	01
Activate Swift Rst Opt	Yes/No	No	No
Activate Freq Start Opt	Yes/No	Yes	Yes

Table 11 — MBC Configuration
Main Menu→Configuration Menu→MBC Configuration

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Calibration on Powerup	Disable/Enable		Disable	Disable
Auto Clearance Check	Disable/Enable		Enable	Enable
Clearance Fail Criteria	0 to 100	%	7.5	7.5
Auto Levitation	Yes/No		Yes	Yes
Shutdown de-Levi delay	60 to 600	sec	60	60
Speed Signal Alarm Delta	0 to 50	%	10	10
Speed Signal Alert Delta	0 to 20	%	5	5
Shaft Displacement Limit	4 to 10	mils	6.0	6.0
Speed Sensor Option	Yes/No		Enable	Enable

Table 12 — Service Parameters Table
Menu→Configuration Menu→Service Parameters [SERVICE1]

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE*
Atmospheric Pressure	8 to 15	PSI	14.5	job specific
IGV2 Deg @ IGV1 20 Deg	10 to 40	deg	37	37
IGV2 Deg @ IGV1 30 Deg	10 t0 50	deg	45	45
GV2 Deg @ IGV 50 Deg	10 to 80	deg	67	67
Enable Excessive Starts	0 to 1	NA	No	job specific

* Most Service Parameters do not require any change from default. Adjust as required.

Table 13 — Surge Correction Config
Menu→Configuration Menu→Surge Correction

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Surge Line Configuration	0 to 2	NA	0	2=PR Table
Surge Profile Step	0 to 2	^F	0	0
Surge Profile Offset	0 to 5	^F	0	0

Table 14 — Option Configuration
Main Menu →Configuration Menu→Option [CONF_OPT]

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Frequent Restart Option	Disable/Enable		Enable	job specific
EXCSV Selection 0=Disable, 1=Surge, 2= Low Load, 3= Comb		NA	1	job specific
EXCSV Open IGV Position	0.5 to 10	%	5	job specific
EXCSV Close IGV Position	1.5 to 20	%	10	job specific
EXCSV off DT Low Load	0.5 to 10	^F	4	job specific
EXCSV on DT Low Load	0.5 to 10	^F	2	job specific

Table 15 — Option 2
Main Menu→Configuration Menu→Option 2 [CONF_OPT2]

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
IOB3 Option	Yes/No		No	job specific
IOB4 Option	Yes/No		No	job specific
Water Pressure Option 0=No, 1=Wtr Flow PD TRD (pressure transducer) 2 = Wtr Flow PD MTR (4-20 mA flow meter)				
Water Flow Measurement 0=No, 1=Wtr Flow Mtr (4-20 mA flow meter) 2=Wtr Flow PD (pressure transducer)				
Water Flow Determination 0=No, Sat Temp, 1=Flow Switch, 2=WTR Flow PD				

Table 16 — Unit Mounted VFD
Main Menu→Configuration Menu→Unit Mounted VFD [CFGUMVFD]

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Compressor Speed 100%	47 to 450	Hz	50	Nameplate
Rated Line Voltage	200 to 13800	Volts	460	Nameplate
Motor Nameplate current	10 to 2000	Amps	200	Nameplate
Motor Rated Load Current	10 to 2000	Amps	200	Nameplate
Motor Nameplate RPM	0 to 15000	rpm	3000	Nameplate
Motor Rated Torque (NM)	0.1 to 10000		200	Nameplate
Motor Nameplate KW	0 to 5600	kW	1500	Nameplate
Increase Ramp Time	5 to 120	sec	30	30
Decrease Ramp Time	5 to 120	sec	30	30
Switch Frequency (kHz)	0 to 16	kHz	5	Nameplate
Stator Resistance (RS)	0.001-140	Ohm	0.010	Nameplate
d-axis Inductance (Ld)	0 to 1000	mH	0.010	Nameplate
q-axis Inductance (Lq)	0 to 1000	mH	0.010	Nameplate
Back EMF at 1000 Rpm	1 to 9000	Volts	10	Nameplate
Switch Frequency (KHz)	0 to 16	kHz	5	Nameplate
PM Motor Para Download	Disable/Enable		Disable	
Stator Resistance (Rs)	0 to 16	kHz	5	
d-asix Inductance (d)	0 to 16	kHz	5	
q-axis inductance (q)	0 to 16	kHz	5	
Back EMF at 1000 RPM	0 to 16	kHz	5	

Table 17 — General VFD Config
Main Menu→Configuration Menu→General VFD [CFGGEVFD]

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
VFD Gain	0.1 to 1.5	0.75	0.75	
VFD Max Speed Percent	90 to 110	100	100	
VFD Min Speed Percent	45 to 89	%	70	45
VFD Start Speed Percent	65 to 100	%	100	job site
VFD Current Limit	0 to 99999	Amps	250	103% of Motor RLA or Max VFD Output Current

Table 18 — UPS
Main Menu→Configuration Menu→UPS [Table CFG_UPS]

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
UPS Option	Disable/Enable	NA	Enable	1
Battery Replacement Done	No/Yes		Yes	
Battery Threshold	0 to 100	%	70	60
Battery Minimum Runtime	0 to 600	sec	240	240
Battery Test Duration	0 to 600	sec	240	240
Power Failure Max Number	0 to 100		10	5
Over Temp Duration	0 to 600	sec	60	60

Table 19 — Config Metering
Main Menu→Configuration Menu→Config Metering [CFGMETER]

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Cond Liquid Level Determination 0=Capacity Percent, 1=Setpoint	0 to 1		0	
Liquid level SP-Cap 0%		%	0.5	0.5
Liquid level SP-Cap 25%		%	1.0	1.0
Liquid level SP-Cap 50%		%	1.5	1.5
Liquid level SP- Cap 75%		%	2.0	2.0
Liquid level SP- Cap 100%		%	2.1	2.1
Low SST Set Point		°F	34	34
Eco EXV Option	Disable/Enable		Enable	
Eco EXV Active Threshold		%	0	
Eco Superheat SP		^F	10	
EXCSV Option	Disable/Enable		Enable	
EXCSV Activate Threshold		%	95	95
EXCSV Deactivate Threshold		%	15	15
EXCSV Open Time		sec	60	60
EXCXV Close Time		sec	120	120
EXCSV Open Step			5	5
EXCSV Close Step			5	5

Field Set Up and Verification

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

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

LABEL LOCATIONS

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

- Surge Parameters — Located inside the HMI chiller control panel.
- Chiller identification nameplate — Located on the left side of the power panel. See Fig. 28.
- VFD Nameplate data - located on the right side of the VFD. See Fig. 28.

MODIFY EQUIPMENT CONFIGURATION IF NECESSARY

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

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

See the 19MV with PIC6 Controls Operation and Troubleshooting guide for more details about these functions; see the Control Panel Schematic for field wiring.

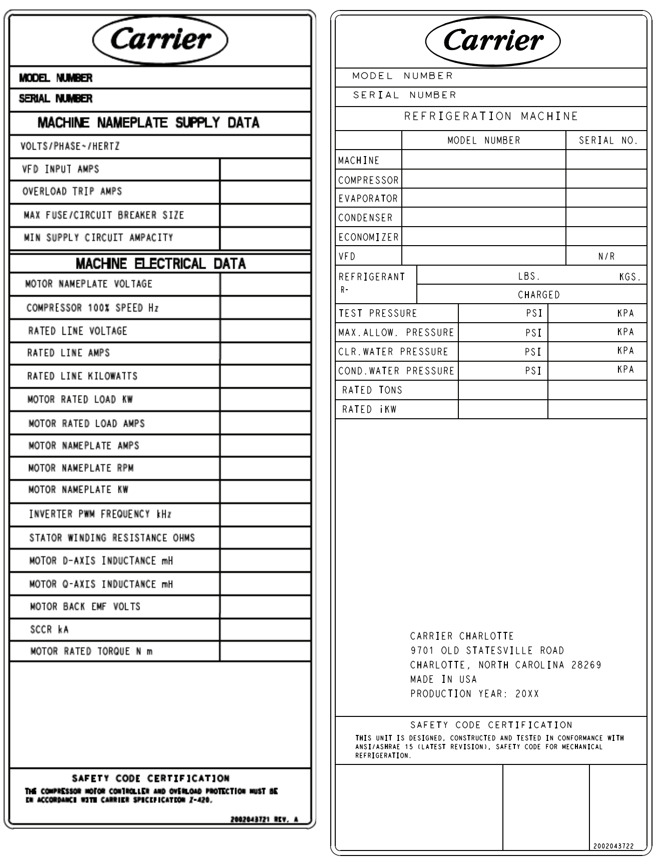


Fig. 28 — Machine Identification Nameplate and VFD Electrical Nameplate

Perform a Controls Test (Quick Test)

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

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

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

When the controls test is finished the test stops and the QUICK TEST menu displays. If a specific automated test procedure is not completed, access the particular control test to test the function when ready. Disable Quick Test feature when testing is complete. For information about calibration, see the sections Checking Pressure Transducers, page 44, and High Altitude Locations, page 45.

OPTIONAL EVAPORATOR AND CONDENSER PRESSURE TRANSDUCER AND WATERSIDE FLOW DEVICE CALIBRATION

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

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

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

2. Disconnect the transducer in question from its Schrader fitting for evaporator or condenser transducer calibration. For pump pressure or bearing pressure or flow device calibration keep transducer in place.

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

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

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

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

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

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

OPTIONAL THERMAL DISPERSION FLOW SWITCH CALIBRATION

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

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

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

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

HYDRAULIC STATUS

The HYDRAULIC STATUS screen (access from the Main Menu) provides a convenient way to detect if any of the evaporator/condenser pressure switches (if installed) are in need of calibration. See Fig. 29-31 for the hydraulic status menu. With no flow the water delta should read 0 kPa. If it does not, the value may be set to zero using PRESSURE SENSOR CALIB located in the Maintenance Menu. See Fig. 32 for the pressure sensor calibration menu. High end calibration is not necessary. The water temperature sensors should also be calibrated during the commissioning of the chiller. The goal is to have the entering/leaving water temperature sensors displaying the same value when water is flowing and the chiller is not in operation.

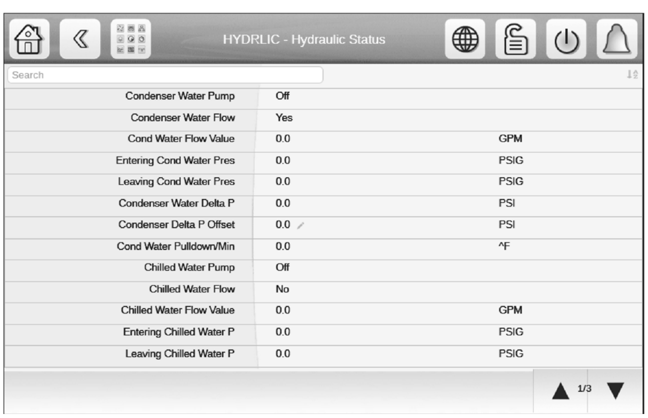


Fig. 29 — Hydraulic Status Menu, Page 1

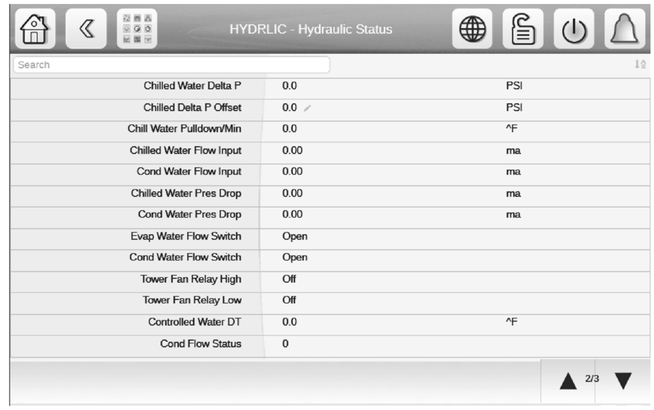


Fig. 30 — Hydraulic Status Menu, Page 2

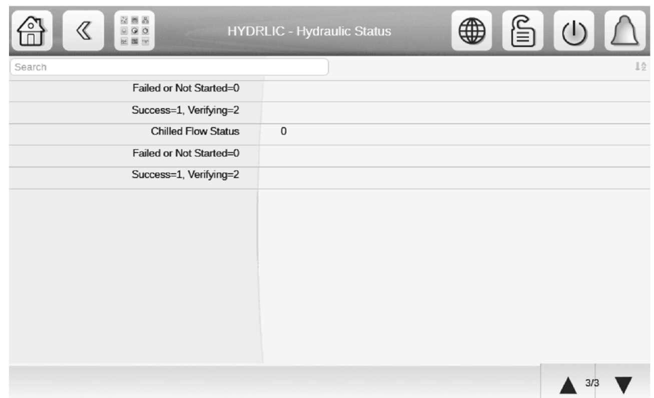


Fig. 31 — Hydraulic Status Menu, Page 3

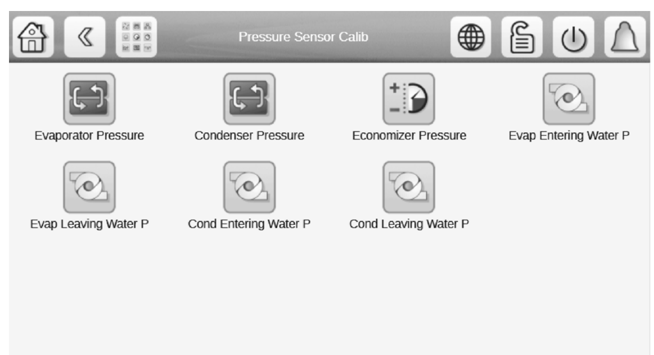


Fig. 32 — Pressure Sensor Calibration Menu

INITIAL START-UP

Preparation

Before starting the chiller, verify:

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

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

NOTE: UPS battery supplier recommends to charge the battery for 12 hours prior to use. Battery pack will charge when power is applied to the VFD. If this cannot be accommodated and it has been 6 months or more since the chiller manufacture date, then replacement batteries should be available at startup. To replace batteries, remove power to unit, allow capacitors to discharge, open high voltage power panel section, remove UPS cover, disconnect wires to cables, remove screws to battery section, pull out batteries and replace. See Fig. 33 for detailed battery replacement steps.

A battery discharge test should be performed after every battery replacement to establish new battery health. This can be done from the 19MV quick test menu. Every battery replacement should also be logged in the UPS configuration menu.

⚠ CAUTION

Do not permit water or brine that is warmer than 110°F (43°C) to flow through the evaporator or condenser. Refrigerant overpressure may discharge through the relief device and result in the loss of refrigerant charge.

REPLACING THE BATTERY

Replacement of batteries located in an OPERATOR ACCESS AREA.
When replacing batteries, replace with the same number and type of batteries.

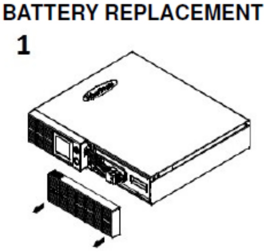
CAUTION! Risk of Energy Hazard, 24V, maximum 18 Ampere-hour battery. Before replacing batteries, remove conductive jewelry such as chains, wristwatches, and rings. High energy conducted through these materials could cause severe burns.

CAUTION! Do not dispose of batteries in a fire. The batteries may explode.

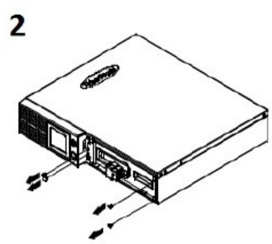
CAUTION! Do not open or mutilate batteries. Released material is harmful to the skin and eyes. It may be toxic.

CAUTION! **RISK OF EXPLOSION IF BATTERY IS REPLACED BY AN INCORRECT TYPE. DISPOSE OF USEI BATTERIES ACCORDING TO LOCAL REGULATIONS**

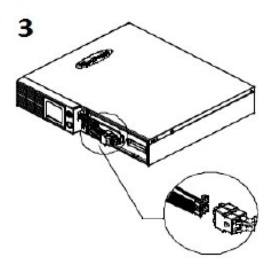
BATTERY REPLACEMENT PROCEDURE:



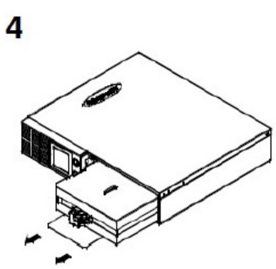
1. Remove the right side front panel.



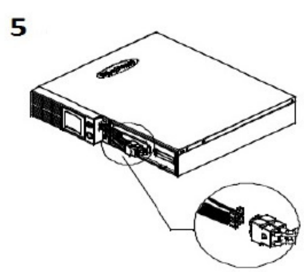
2. Remove four screws from battery compartment cover and remove the cover completely from unit.



3. Disconnect the black and red cable.



4. Insert the new battery pack. Assemble the screws, cover, cable, and front panel in reverse sequence of steps 1-3.



5. Install the replacement batteries by connecting the red and black wire to the same color wires from the battery pack. Recharge the unit for at least 8 hours to ensure the UPS performs expected runtime.

REMINDER: Batteries are consider HAZARDOUS WASTE and must be disposed of properly. Most retailers that sell lead-acid batteries collect used batteries for recycling, as required by local regulations.

Fig. 33 — Replacing the Battery

Check Motor Rotation

1. Close the starter enclosure door.
2. Apply 3-phase power to drive.
3. The VFD checks for proper phase rotation as soon as power is applied to the starter and the PIC6 controls power up.
4. An alarm message will appear on the HMI screen if the phase rotation is incorrect. If this occurs reverse any 2 of the 3 incoming power leads to the starter and reapply power. The motor is now ready for a rotation check.
5. When the VFD is energized and the motor begins to turn, check for counterclockwise motor rotation through second stage sight glasses. See Fig. 34.

> IMPORTANT: Do not check motor rotation during coastdown. Rotation may have reversed during equalization of vessel pressures.

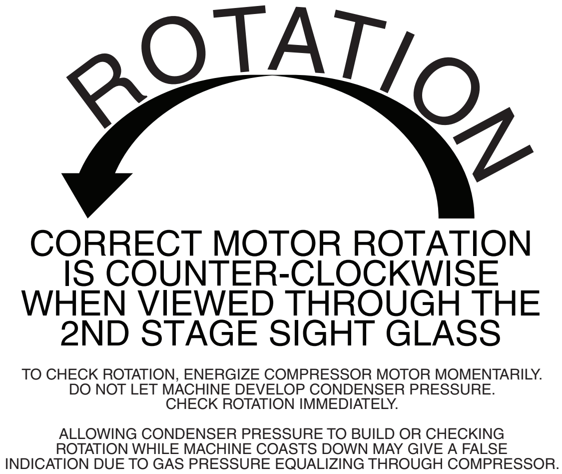


Fig. 34 — Correct Motor Rotation

To Prevent Accidental Start-Up

A chiller STOP override setting may be entered to prevent accidental start-up during service or whenever necessary. From the Main Menu, access the General Parameters Menu and use the down arrow to reach Stop Override on the GENUNIT table. Change Stop Override to Yes; then execute the command by touching the lightning button. The message "ALM-276 Protective Limit - Stop Override" will appear in the Home Screen message area. To restart the chiller, access the same screen and change the Stop Override option to No.

Check Chiller Operating Condition

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

Instruct the Customer Operator(s)

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

EVAPORATOR-CONDENSER

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

MOTOR COMPRESSOR ASSEMBLY

Guide vane actuator, transmission, motor cooling system, temperature and pressure sensors, sight glasses, motor temperature sensors, MBC, and compressor serviceability.

ECONOMIZER

BPHX and economizer EXV. Pressure transducer and temperature sensor location.

CONTROL SYSTEM

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

AUXILIARY EQUIPMENT

Starters and disconnects, separate electrical sources, pumps, and cooling tower.

DESCRIBE CHILLER CYCLES

Refrigerant, motor cooling, and liquid reclaim.

REVIEW MAINTENANCE

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

SAFETY DEVICES AND PROCEDURES

Electrical disconnects, relief device inspection, and handling refrigerant.

CHECK OPERATOR KNOWLEDGE

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

REVIEW MANUALS

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

OPERATING INSTRUCTIONS

Operator Duties

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

Prepare the Chiller for Start-Up

Follow the steps described in the Initial Start-Up section, page 30.

To Start the Chiller

1. Start the water pumps, if they are not automatic.
2. Press the Start/Stop icon on the HMI home screen to start the system. If the chiller is in the OCCUPIED mode and the start timers have expired, the start sequence will start. Follow the procedure described in the Start-Up/Shutdown/Recycle Sequence section, page 12.

Check the Running System

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

1. The moisture indicator sight glass on the refrigerant motor cooling line should indicate single phase refrigerant flow and a dry condition.
2. The condenser pressure and temperature varies with the chiller design conditions. Typically the pressure will range from 60 to 135 psig (390 to 950 kPa). with a corresponding temperature range of 60 to 105°F (15 to 41°C). The condenser entering water temperature should be controlled below the specified design entering water temperature to save on compressor kilowatt requirements.

3. Evaporator pressure and temperature also will vary with the design conditions. Typical pressure range will be between 29.5 and 40.1 psig (203.4 and 276.4 kPa), with temperature ranging between 34 and 45°F (1.1 and 7.2°C).
4. The active electrical demand setting can be overridden to limit the compressor kW, or the pulldown rate can be decreased to avoid a high demand charge. It may be necessary to demand limit chiller. Base Demand Limit % is set at the Setpoint Menu in the Main Menu. Demand limit is based on chiller amps and kW is based on configured Demand Limit Source in ***Main Menu→ Configuration Menu→ General***. Pulldown rate can be based on load rate or temperature rate and is viewed at ***Main Menu→ Configuration Menu→ General***. Configuration of the actual ramping rate is done in the Service Parameters Menu (***Main Menu→ Configuration Menu→ Service Parameters***) where either Amps/KW Ramp per minute or Temperature Ramp per minute can be adjusted to slow down the chiller response.

To Stop the Chiller

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

The unit can be stopped manually using the HMI by pressing the green Start/Stop icon. The Unit Start/Stop screen is displayed. Press Confirm Stop. The compressor will then follow the normal shutdown sequence as described in the Start-Up/Shutdown/Recycle Sequence section on page 12. The chiller is now in the OFF control mode.

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

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

After Limited Shutdown

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

Preparation for Extended Shutdown

The refrigerant should be transferred into the pumpout storage tank (if supplied; see “PUMPOUT AND REFRIGERANT TRANSFER PROCEDURES” on page 33) to reduce chiller pressure and the possibility of leaks. Maintain a holding charge of 5 to 10 lb (2.27 to 4.5 kg) of refrigerant or nitrogen to prevent air from leaking into the chiller.

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

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

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

After Extended Shutdown

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

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

If charge was removed, recharge the chiller by transferring refrigerant from the pumpout storage tank (if supplied). Follow the Pumpout and Refrigerant Transfer Procedures section on page 33. Observe freeze-up precautions.

Carefully make all regular preliminary and running system checks.

Cold Weather Operation

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

Manual Guide Vane Operation

It is possible to manually operate the guide vanes in order to check control operation or to control the guide vanes in an emergency. Manual operation is possible by overriding the target guide vane position. Forcing the guide vanes is only possible in the Lab Test Forced factory menu.

NOTE: Manual control overrides the configured pulldown rate during start-up and permits the guide vanes to open at a faster rate. Motor current above the electrical demand setting, capacity overrides, and chilled water temperature below the control point override the manual target and close the guide vanes. For descriptions of capacity overrides and set points, see the 19MV Controls Operation and Troubleshooting guide.

Refrigeration and Service Log

A refrigeration log (as shown in Fig. 35), is a convenient checklist for routine inspection and maintenance and provides a continuous record of chiller performance. It is also an aid when scheduling routine maintenance and diagnosing chiller problems.

Keep a record of the chiller pressures, temperatures, and liquid levels on a sheet similar to the one in Fig. 35. Automatic recording of data is possible by exporting the data from the PIC6 controller. Contact a Carrier representative for more information.

REFRIGERATION LOG CARRIER 19MV SEMI-HERMETIC CENTRIFUGAL REFRIGERATION MACHINE

PLANT______________________ MACHINE MODEL NO.______________________ MACHINE SERIAL NO. ______________________

DESCRIPTION			DATE				
EVAPORATOR	REFRIGERANT	PRESSURE SAT					
		LIQUID TEMP					
	WATER	FLOW					
		TEMP IN					
		TEMP OUT					
CONDENSER	REFRIGERANT	PRESSURE					
		TEMP SAT					
		LEVEL					
	WATER	FLOW					
		TEMP IN					
		TEMP OUT					
COMPRESSOR	CAPACITY	GV1 ACTUAL POS					
		GV2 ACTUAL POS					
DRIVE TRAIN	MOTOR	RUNNING AMPS					
		TEMPERATURE					
	VFD	ACTUAL SPEED					
MCB	CLEARANCE CHECK VALUES	TAKE PICTURE OF THE "MCB CLEARANCE CHECK" SCREEN FOR FUTURE REFERENCE.					

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

Fig. 35 — Refrigeration and Service Log

PUMPOUT AND REFRIGERANT TRANSFER PROCEDURES

Preparation

The 19MV chiller system may include an optional pumpout storage tank, pumpout system, or pumpout compressor. The refrigerant can be pumped for service work to either the chiller compressor vessel or chiller condenser vessel by using the optional pumpout system. If a pumpout storage tank is supplied, the refrigerant can be isolated in the storage tank. The following procedures describe how to transfer refrigerant from vessel to vessel and perform chiller evacuation.

⚠ CAUTION

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

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

⚠ CAUTION

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

⚠ DANGER

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

⚠ CAUTION

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

Operating the Optional Pumpout Unit

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

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

1. The display on the chiller control panel is suitable for determining refrigerant-side pressures and low (soft) vacuum. To assure the desired range and accuracy when measuring evacuation and dehydration, use a quality vacuum indicator or manometer. This can be placed on the Schrader connections on each vessel by removing the pressure transducer.
2. To determine pumpout storage tank pressure, a 30 in. Hg vacuum –0-400 psi (101-0-2758 kPa) gage is attached to the storage tank.

⚠ CAUTION

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

POSITIVE PRESSURE CHILLERS WITH STORAGE TANKS

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

⚠ CAUTION

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

Transfer Refrigerant from Pumpout Storage Tank to Chiller

⚠ WARNING

During transfer of refrigerant into and out of the 19XR storage tank, carefully monitor the storage tank level gage. Do not fill the tank more than 90% of capacity to allow for refrigerant expansion. Overfilling may result in damage to the tank and personal injury.

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

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

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

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

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

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

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

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

   k. Turn off pumpout condenser water.

Transfer the Refrigerant from Chiller to Pumpout Storage Tank

1. Equalize refrigerant pressure.
   a. Valve positions:

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

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

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

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

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

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

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

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

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

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

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

   g. Turn off the pumpout condenser water.
4. Establish vacuum for service. To conserve refrigerant, operate the pumpout compressor as described in Step 3e

until the chiller pressure is reduced to 18 in. Hg vacuum (41 kPa absolute).

This operation can be done in Automatic or On mode. In Automatic mode, the compressor will stop automatically at approximately 15 in. Hg vacuum (51 kPa absolute).

CHILLERS WITH ISOLATION VALVES

Transfer All Refrigerant to Chiller Condenser Vessel

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

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

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

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

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

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

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

Transfer All Refrigerant to Chiller Cooler Vessel

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

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

   c. Equalize refrigerant in the chiller cooler and condenser.
   d. Turn off chiller water pumps and pumpout condenser water.
   e. Turn on pumpout compressor to push refrigerant out of the chiller condenser.
   f. When all liquid is out of the chiller condenser, close valve 11 and any other liquid isolation valves on the chiller.
   g. Turn off the pumpout compressor.
2. Evacuate gas from chiller condenser vessel.
   a. Turn on chiller water pumps.
   b. Make sure that liquid line service valves 3 and 4 are closed and valves 2 and 5 are open.

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

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

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

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

Return Refrigerant to Normal Operating Conditions

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

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

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

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

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

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

9. Turn off chiller water pumps.

DISTILLING THE REFRIGERANT

1. Transfer the refrigerant from the chiller to the pumpout storage tank as described in the Transfer the Refrigerant from Chiller to Pumpout Storage Tank section on page 34.
2. Equalize the refrigerant pressure.
   a. Turn on chiller water pumps and monitor chiller pressures.
   b. Close pumpout and storage tank valves 2, 4, 5, and 10, and close chiller charging valve 7; open chiller isolation valve 11 and any other chiller isolation valves, if present.
   c. Open pumpout and storage tank valves 3 and 6; open chiller valves 1a and 1b.

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

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

b. Open valve 2.

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

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

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

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

GENERAL MAINTENANCE

Refrigerant Properties

The standard refrigerant for the 19MV chiller is HFC-134a/R-513A. At normal atmospheric pressure, HFC-134a/R-513A will boil at –14°F (–25°C)/-28°F (–33°C) and must, therefore, be kept in pressurized containers or storage tanks. The refrigerant is practically odorless when mixed with air and is noncombustible at atmospheric pressure. Read the Material Safety Data Sheet and the latest ASHRAE Safety Guide for Mechanical Refrigeration to learn more about safe handling of this refrigerant.

⚠ DANGER

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

Adding Refrigerant

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

⚠ CAUTION

Always ensure to have water flow and lock out the compressor when transferring refrigerant. Liquid refrigerant may flash into a gas and cause possible freeze-up and damage to the unit when the chiller pressure is below 35 psig (241 kPa) for HFC R-134a or 39 psig (268 kPa) for R-513A.

Adjusting the Refrigerant Charge

If the addition or removal of refrigerant is required to improve chiller performance, follow the procedures given under the Trim Refrigerant Charge section, page 38.

Refrigerant Leak Testing

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

Leak Rate

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

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

Test After Service, Repair, or Major Leak

If all the refrigerant has been lost or if the chiller has been opened for service, the chiller or the affected vessels must be pressure tested and leak tested. Refer to the Leak Test Chiller section on page 18 to perform a leak test.

⚠ WARNING

HFC-134a/HFO-513A should not be mixed with air or oxygen and pressurized for leak testing. In general, this refrigerant should not be present with high concentrations of air or oxygen above atmospheric pressures, because the mixture can undergo combustion.

TESTING WITH REFRIGERANT TRACER

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

TESTING WITHOUT REFRIGERANT TRACER

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

TO PRESSURIZE WITH DRY NITROGEN

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

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

Repair Leaks, Retest, Standing Vacuum Test

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

After retesting and finding no leaks, apply a standing vacuum test. Then dehydrate the chiller. Refer to the Standing Vacuum Test and Chiller Dehydration sections (pages 20 and 21) in the Before Initial Start-Up section.

Checking Guide Vanes

During normal shutdown, when the chiller is off, the guide vanes are closed. Complete the following steps to adjust position if required (see Fig. 36 and 37):

1. Remove the set screw in the guide vane coupling.
2. Loosen the holddown bolts on the guide vane actuator.
3. Pull the guide vane actuator away from the suction housing.
4. If required, rotate the guide vane shaft fully clockwise for first stage and counterclockwise for second stage and spot-drill the guide vane actuator shaft. Spot-drilling is necessary when the guide vane actuator sprocket set screws on the guide vane actuator shaft need to be re-seated. (Remember: Spot-drill and tighten the first set screw before spot-drilling for the second set screw.)

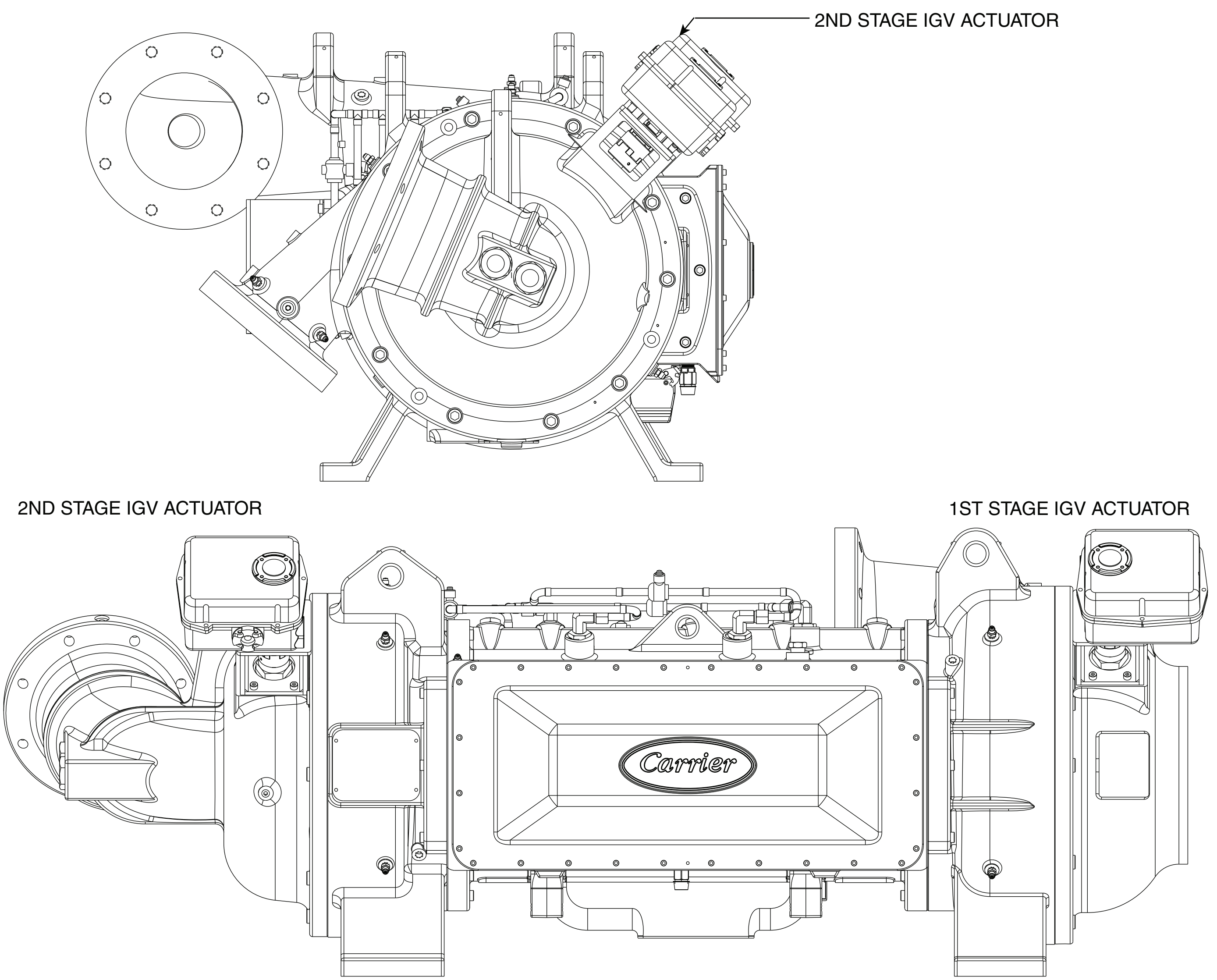
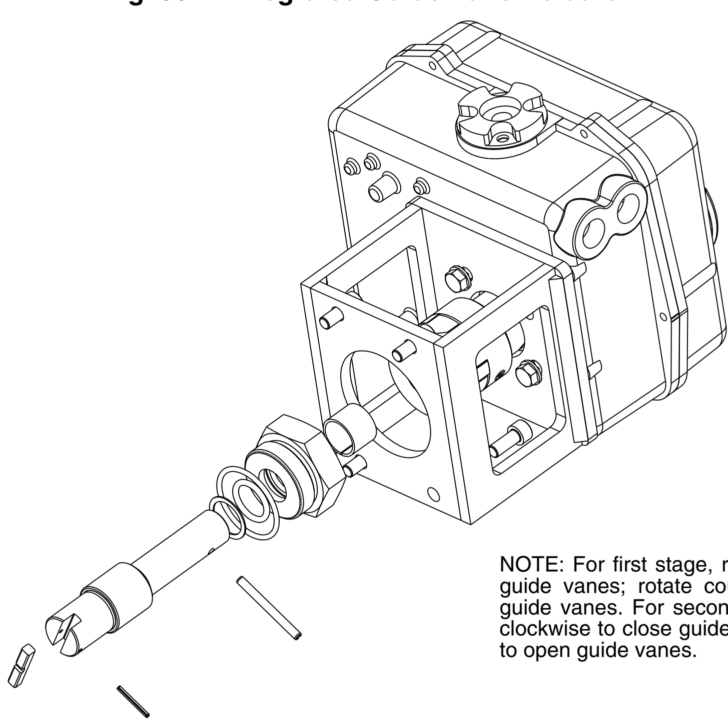


Fig. 36 — Integrated Guide Vane Actuator



NOTE: For first stage, rotate coupling clockwise to close guide vanes; rotate coupling counterclockwise to open guide vanes. For second stage, rotate coupling counter-clockwise to close guide vanes; rotate coupling clockwise to open guide vanes.

Fig. 37 — Guide Vane Actuator Detail

Trim Refrigerant Charge

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

To remove any excess refrigerant, follow the procedure in "Transfer the Refrigerant from Chiller to Pumpout Storage Tank" on page 34.

SCHEDULED MAINTENANCE

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

Run Times

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

Inspect the Power Panel

Maintenance consists of general cleaning and tightening of connections. Vacuum the control cabinets to eliminate dust build-up. If the chiller control malfunctions, refer to the Troubleshooting Guide section on page 41 for control checks and adjustments.

⚠ WARNING

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

Changing Refrigerant Filters

Change the refrigerant main EXV strainer cartridge and motor cooling filter drier on an annual basis or when the chiller is opened for repairs. The filters can be isolated so they can be changed with refrigerant remaining in the chiller. Change strainers/filters by closing isolation valves and recover the trapped refrigerant. The EXV filter cartridge can be replaced by opening the bolted end of the strainer housing. Similarly the motor cooling in-line filter can be replaced by slowly opening the flare fitting with a wrench and back-up wrench to relieve pressure and then replacing with new in-line filter. Follow good service practice and evacuate the disturbed areas after filter/strainer replacement.

Inspect Safety Relief Devices and Piping

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

As a minimum, the following maintenance is required.

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

Compressor Bearing Maintenance

The biggest risk to the 19MV compressor is damage incurred from contact between the shaft and auxiliary roller bearings at high rotational speeds. The number of high-speed drops that occur is kept in the MBC menu (MBC Drop Counter), and should be checked regularly to detect when any new high-speed shaft contact has occurred. If the PIC detects an increase in fast contact revolutions, it will automatically conduct a clearance check on the next unit startup. A clearance check can also be manually initiated any time from the MBC home screen (so long as the unit is not running). See Fig. 38. For more detailed information, it may be necessary to access the MBC board directly. See Fig. 39 for details regarding accessing the MBC cavity. A desiccant packet is mounted to the inside of the MBC cavity cover to protect the electronic control boards from potential humidity that may enter the cavity. If the cover is removed for maintenance the packet should be replaced.

⚠ CAUTION

Maintaining a dry environment inside of the MBC cavity is important to protect the MBC board electronics. Any time it is necessary for the MBC cavity to be opened, replace the desiccant pack.

If drop count is exceeded, the auxiliary bearings will need to be replaced immediately. When the drop counter is within 2000 revolutions of its limit contact Carrier service engineering to schedule maintenance to avoid unexpected down time. Ensure to revise the drop count limits to keep track of bearing wear. The drop counter monitors the number of full revolutions the motor shaft makes while it is in contact with the auxiliary bearings. It increments when the shaft is rotating at over 2675 rpm while de-levitated. New auxiliary bearings are rated for 7000 revolutions.

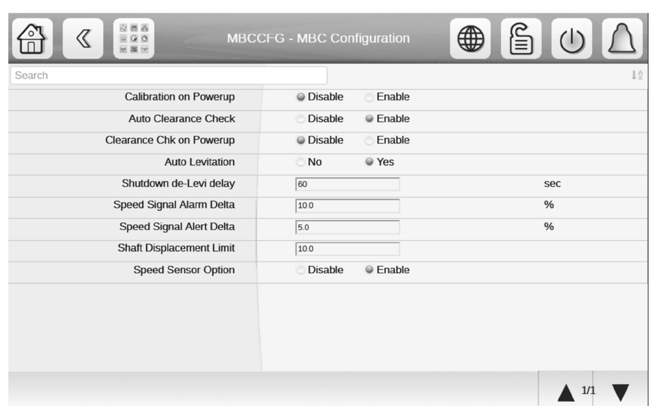


Fig. 38 — MBCCFG - MBC Configuration Screen

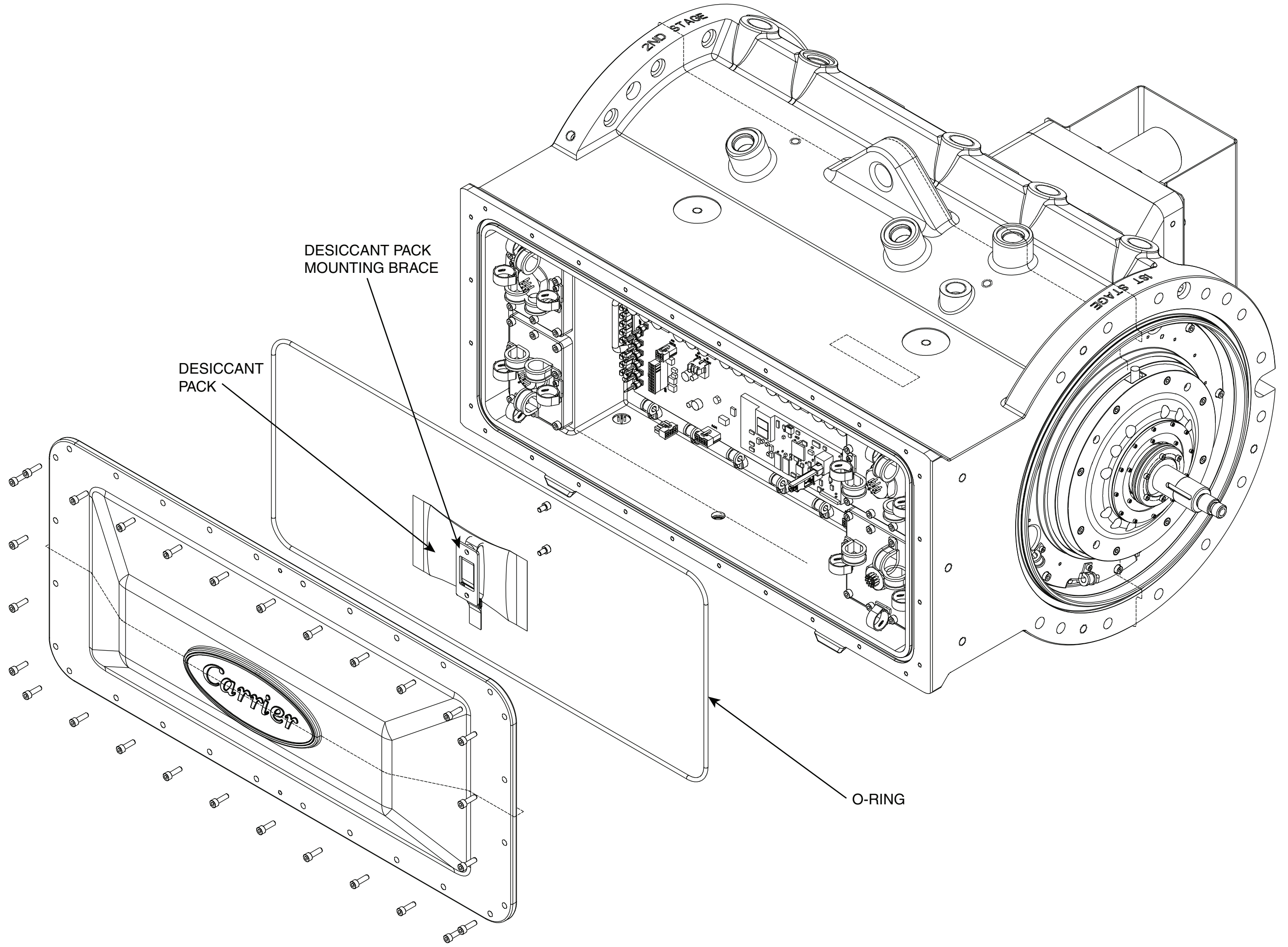


Fig. 39 — MBC Cavity Details

Inspect Heat Exchanger Tubes and Flow Devices

EVAPORATOR AND OPTIONAL FLOW DEVICES

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

CONDENSER AND OPTIONAL FLOW DEVICES

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

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

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

Water Leaks

The refrigerant moisture indicator on the refrigerant motor cooling line along with the moisture indicator located on the main and economizer exv indicates whether there is water or air leakage during chiller operation. Water leaks should be repaired immediately.

⚠ CAUTION

The chiller must be dehydrated after repair of water leaks or damage may result. See Chiller Dehydration section, page 21.

Water Treatment

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

⚠ CAUTION

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

Inspect the VFD

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

⚠ CAUTION

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

⚠ CAUTION

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

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

⚠ WARNING

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

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

⚠ WARNING

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

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

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

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

⚠ CAUTION

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

Recalibrate Pressure Transducers

Once a year, the pressure transducers should be checked against a pressure gage reading. Check all pressure transducers: evaporator pressure, condenser pressure, refrigerant pump inlet pressure, refrigerant pump outlet pressure, bearing inlet pressure, bearing outlet pressure, and optional evaporator entering and leaving water pressure, as well as condenser entering and leaving water pressure. See Fig. 32.

Recalibrate Temperature Thermistors

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

Ordering Replacement Chiller Parts

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

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

TROUBLESHOOTING GUIDE

Overview

The PIC6 control system has many features to help the operator and technician troubleshoot a 19MV chiller.

- The HMI shows the chiller's actual operating conditions and can be viewed while the unit is running.
- The HMI default screen indicates when an alarm occurs. Once all alarms have been cleared (by correcting the problems), the HMI default screen indicates normal operation. For information about displaying and resetting alarms and a list of alert codes, see the 19MV with PIC6 Controls Operation and Troubleshooting manual.
- The Configuration menu screens display information that helps to diagnose problems with chilled water temperature control, chilled water temperature control overrides, surge algorithm status, and time schedule operation.
- The quick test and quick calibration feature facilitates the transducers, the guide vane actuator, EXVs, water pumps, tower control, and other on/off outputs while the compressor is stopped. It also has the ability to lock off the compressor and turn on water pumps for pumpout operation (Maintenance Menu). The HMI shows the temperatures and pressures required during these operations.
- If an operating fault is detected, an alarm indicator is displayed on the HMI default screen. A more detailed message — along with a diagnostic message — is also stored in the Current Alarms table.
- Review the Alarms History table to view other less critical events which may have occurred. Compare timing of relevant events and alarms.

For detailed information about alarms, see the 19MV with Controls Operation and Troubleshooting manual. Press the bell icon in the top right corner of the home screen to access current alarms and alarm history, and to reset alarms.

Checking Display Messages

The first area to check when troubleshooting the 19MV is the HMI display. Status messages are displayed at the bottom of the screen, and the alarm icon indicates a fault. For a complete list of alarms, see the 19MV with Controls Operation and Troubleshooting manual.

Checking Temperature Sensors

All temperature sensors are thermistor-type sensors. This means that the resistance of the sensor varies with temperature. All sensors have the same resistance characteristics. If the controls are on, determine sensor temperature by measuring voltage drop; if the controls are powered off, determine sensor temperature by measuring resistance. Compare the readings to the values listed in Tables 20 and 21.

RESISTANCE CHECK

Turn off the control power and, from the module, disconnect the terminal plug of the sensor in question. With a digital ohmmeter, measure sensor resistance between receptacles as designated by the wiring diagram. The resistance and corresponding temperature are listed in Tables 20 and 21. Check the resistance of both wires to ground. This resistance should be infinite.

VOLTAGE DROP

The voltage drop across any energized sensor can be measured with a digital voltmeter while the control is energized. Tables 20 and 21 list the relationship between temperature and sensor voltage drop (volts dc measured across the energized sensor). Exercise care when measuring voltage to prevent damage to the sensor leads, connector plugs, and modules. Sensors should also be checked at the sensor plugs.

⚠ CAUTION

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

CHECK SENSOR ACCURACY

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

Note that the PIC6 control module, MAINTENANCE menu, offers a temperature sensor calibration feature where the sensor temperature can be offset. Note that only the four water temperatures can be calibrated. To use this feature, place the sensor at 32°F (0°C) or other known temperature. Read the raw temperature and calculate offset based on the reading seen in the TEMP_CAL menu. Enter and execute the offset, which cannot exceed ± 2°F (1.2°C).

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

An additional thermistor, factory installed in the bottom of the evaporator barrel, is displayed as Evap Refrig Liquid Temp on the TEMPERATURES display screen. This thermistor provides additional protection against a loss of water flow.

MOTOR TEMPERATURE SENSORS

See Fig. 40 for the location and wiring of the two motor temperature sensors.

Table 20 — Thermistor Temperature (F) vs. Resistance/Voltage Drop

TEMPERATURE (F)	PIC 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 21 — Thermistor Temperature (C) vs. Resistance/Voltage Drop

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

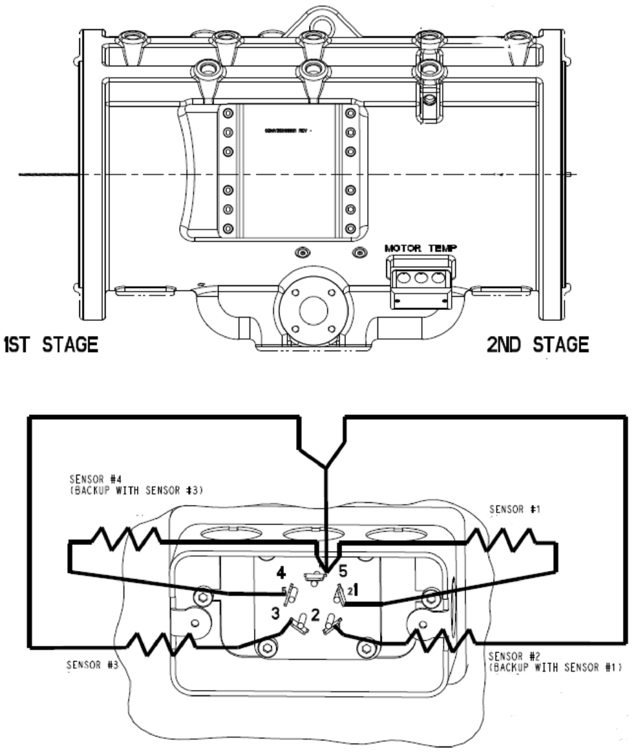


Fig. 40 — Motor Housing Temperature Sensors

Checking Pressure Transducers

There are 4 factory-installed pressure transducers measuring refrigerant pressure: refrigerant pump suction, bearing inlet pressure, bearing outlet pressure, and economizer vapor discharge pressure. With the IOB4 option installed there are field options to install evaporator and condenser entering and leaving pressure transducers.

These transducers can be calibrated if necessary. It is necessary to calibrate at initial start-up, particularly at high altitude locations, to ensure the proper refrigerant temperature/pressure relationship. Each transducer is supplied with 5 vdc power. If the power supply fails, a transducer voltage reference alarm occurs. If the transducer reading is suspected of being faulty, check the 5V Sensor Power Monitor voltage. It should be 5 vdc ± 0.5 v as displayed in ***Maintenance Menu* → *Maintenance Others***, where all the transducer voltages are shown. Recalibrate and replace the transducer if correct voltage is being supplied, but displayed values are incorrect. Additionally, check that any external inputs have not been grounded.

TRANSDUCER REPLACEMENT

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

⚠ WARNING

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

EVAPORATOR AND CONDENSER PRESSURE TRANSDUCER CALIBRATION

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

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

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

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

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

3. Access the PRESSURE or (if water side pressure) HYDRAULIC STATUS screen and view the particular transducer reading. To calibrate pressure or waterside flow device, view the particular reading. It should read 0 psig (0 kPa). If the reading is not 0 psig (0 kPa), but within ± 5 psig (35 kPa), the value may be set to zero from the Maintenance Menu while the appropriate transducer parameter is highlighted. The value will now go to zero.
4. If the transducer value is not within the calibration range, the transducer returns to the original reading. If the pressure is within the allowed range (noted above), check the voltage ratio of the transducer. To obtain the voltage ratio, divide the voltage (dc) input from the transducer by the supply voltage signal or measure across the positive (+ red) and negative (– black) leads of the transducer. The input to reference voltage ratio must be between 0.80 and 0.11 for the software to allow calibration. Rotate the waterside flow pressure device from the inlet nozzle to the outlet nozzle and repeat this step. If rotating the waterside flow device does not allow calibration, pressurize the transducer until the ratio is within range. Then attempt calibration again.
5. Installation of pressure transducers into water nozzles using flushable dirt leg trap is suggested; see Fig. 41. Pressures can be calibrated between 100 and 250 psig (689.5 and 1723.7 kPa) by attaching a regulated 250 psig (1724 kPa) pressure (usually from a nitrogen cylinder). For calibration, access the Pressure Sensor Calibration Menu from the Maintenance Menu and calibrate the appropriate sensor.

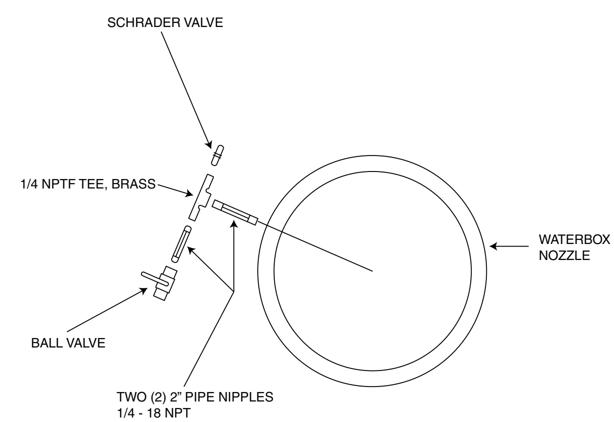


Fig. 41 — Suggested Installation of Pressure Transducers into Water Nozzles Using Flushable Dirt Leg Trap

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

The EXV motor winding resistance can be checked by removal of the EXV plug. The resistance across coil I should be 52 Ohm (±10%) and the resistance across coil II should be 52 Ohm (± 10%). See Fig. 42.

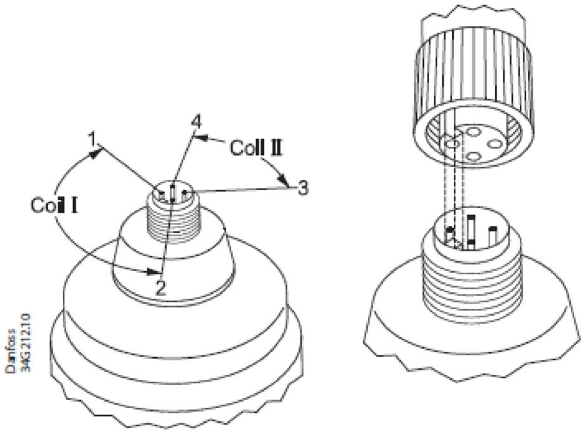


Fig. 42 — EXV Coil Check

Condenser Level

Float level is measured by 0-5V proportional float sensor. Float sensor is located inside float level sensor housing (Fig. 4). Condenser sub-cooler liquid level can also be verified through the sightglasses on the outboard side of the condenser. The resistance across the sensor red (vdc) and black (ground) wire should read approximately 1650 ohm in unpowered state. The sensor voltage output between white (output) and black (ground) wire is proportional to red-black voltage depending on float location on stem.

High Altitude Locations

Because the chiller is initially calibrated at sea level, it is necessary to recalibrate the pressure transducers if the chiller has been moved to a high altitude location. Note that Atmospheric Pressure can be adjusted in the Service Parameters Menu (located in the Configuration Menu).

Quick Test and 19MV Quick Test

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

Quick Calibration

Use this menu to calibrate IGVs and EXCSV valve.

End of Life and Equipment Disposal

This equipment has an average design life span of 25 years and is constructed of primarily steel and copper. Content of control panels includes but is not limited to common electrical components such as fuses, starters, circuit breakers, wire, capacitors and printed circuit boards. Prior to disposal it will be necessary to remove all fluids such as water, refrigerant, and oil (if applicable) using the current industry guidelines for recovery/disposal. In addition electrical components may need to be collected for recovery and recycling as per local directives.

Physical Data

Tables 22-27 and Fig. 43-49 provide additional information on component weights, compressor fits and clearances, physical and electrical data, and wiring schematics for the operator's convenience during troubleshooting.

Table 22 — Component Weights

STANDARD COMPONENTS	kg	lb
SUCTION PIPE ASSEMBLY (INCLUDES FLANGES)	110	243
INTERSTAGE PIPING (FROM FLANGE TO FLANGE)	134	295
DISCHARGE PIPING	43	94
NON-ECONOMIZED SYSTEM COPPER TUBING	150	331
HMI PANEL	22	48
POWER PANEL	241	531
DANFOSS D2H VFD	126	277
DANFOSS E1H VFD	295	650
DANFOSS E2H VFD	318	701
VFD CABLE	50	110
VFD CABLE TRAY	124	273
WIRING	20	44
RELIEF VALVE	18	40
EXPANSION CONTROL VALVE	19	42

OPTIONAL COMPONENTS	kg	lb
ECONOMIZER BYPASS AND VALVE	217	478
ISOLATION VALVE	100	220

Table 23 — 19MV Compressor and Motor Weights*

MOTOR CODE	ENGLISH			SI		
	Compressor Weight† (lb)	Stator and Housing Weight (lb)	Rotor and Shaft Weight (lb)	Compressor Weight† (kg)	Stator and Housing Weight (kg)	Rotor and Shaft Weight (kg)
3	2674	963	148	1213	437	67
5	2674	1073	148	1213	487	67
7	2674	1184	148	1213	537	67

* Total compressor weight is the sum of the compressor aerodynamic components (compressor weight column), stator, rotor, and end bell cover weights.

† Compressor aerodynamic component weight only, motor weight not included. Applicable to standard compressors only.

Table 24 — MV Evaporator and Condenser Weights*

EVAPORATOR FRAME AND BUNDLE SIZE	DRY RIGGING WEIGHT		CONDENSER FRAME AND BUNDLE SIZE	DRY RIGGING WEIGHT	
	lb	kg		lb	kg
31E - 31N	4331	1965	31C - 31N	5518	2503
33E - 33N	4662	2115	33C - 33N	6101	2767
31R - 31Z	4592	2083			
33R - 33Z	4955	2248			
41E - 41N	6353	2882	41C - 41N	7095	3218
43E - 43N	7031	3189	43C - 43N	7863	3567
41R - 41Z	7099	3220			
43R - 43Z	7912	3589			
51E - 51N	7323	3322	51C - 51N	7614	3454
53E - 53N	8150	3697	53C - 53N	8485	3849
51R - 51Z	6306	2860			
53R - 53Z	6907	3133			

* Dry Rigging Weight includes standard 0.025-in. wall tubes and 150-lb 2-pass NIH covers. No refrigerant charge is included in the weight.

NOTES:
1. Evaporator weight includes 2-pass Victaulic dished heads.
2. Condenser weight includes the high side float chamber, discharge pipe, and 2-pass Victaulic dished heads; does not include economizer weight.
3. Actual evaporator refrigerant charge weight is calculated based on pass and nozzle arrangement as well as selected capacity. Therefore charge weight is not included in this publication. Charge weight for condenser and economizer are for reference only. User must consult unit name plate or the as-sold performance sheet or E-Cat selection sheet in order to obtain accurate refrigerant charge information.

Table 25 — 19MV Economizer Weight

FRAME	NUMBER OF PLATES	ASSEMBLY WEIGHT (lb)	ASSEMBLY WEIGHT (kg)
3 - 5	**130**	379	172

NOTE: Economizer assembly weight includes BPHX, economizer tubing and EXV, economizer mounting bracket, and piping/tubing from liquid line and from economizer to compressor.

Table 26 — MV Nozzle-in-Head Waterbox Weights

DESIGN PRESSURE [psig]	FRAME SIZE	WATER PASSES	EVAPORATOR NIH STEEL WEIGHT (RIGGING)				CONDENSER NIH STEEL WEIGHT (RIGGING)			
			kg		lb		kg		lb	
			Flanged	Victaulic	Flanged	Victaulic	Flanged	Victaulic	Flanged	Victaulic
150	3	2	108	84.4	238.10	186.07	108	84.4	238.10	186.07
		2 return	55.7	—	122.80	—	55.7	—	122.80	—
	4	2	116.2	92.6	256.18	204.15	108	84.4	238.10	186.07
		2 return	55.7	—	122.80	—	55.7	—	122.80	—
	5	2	141	107	310.85	235.89	141	107	310.85	235.89
		2 return	70.4	—	155.21	—	70.4	—	155.21	—

LEGEND

NIH — Nozzle in Head

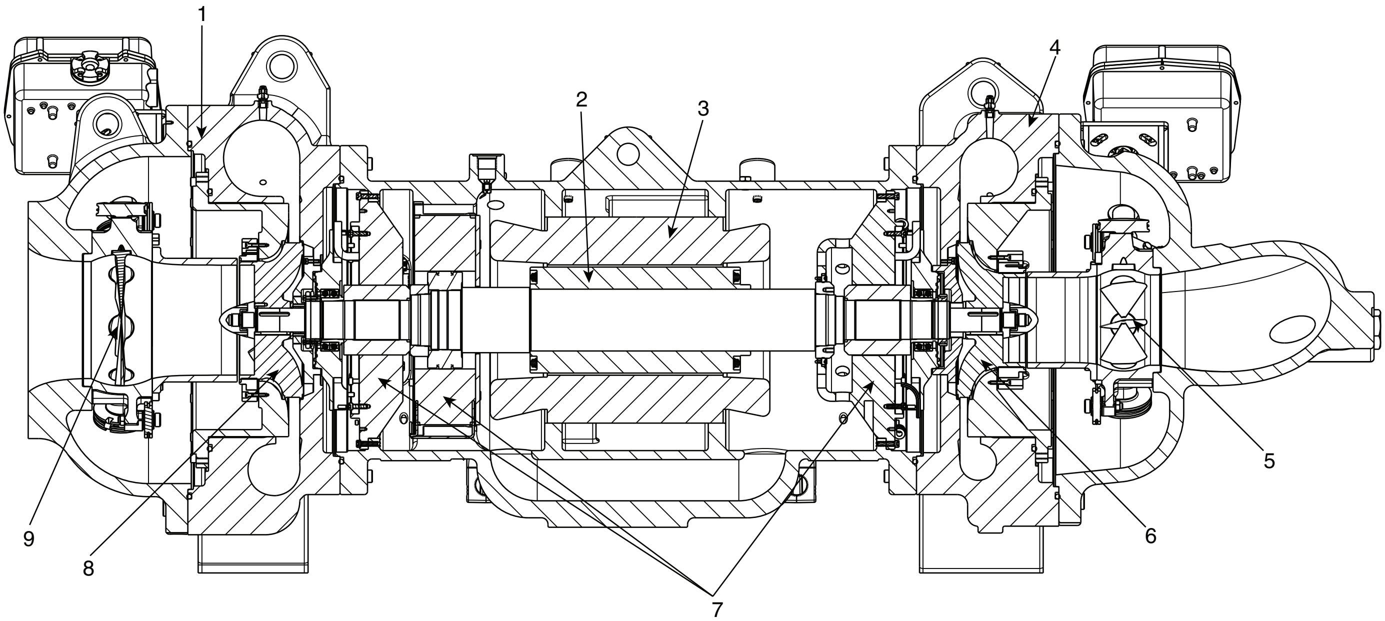
Table 27 — MV Marine Waterbox Weights

DESIGN PRESSURE [psig]	FRAME SIZE	WATER PASSES	EVAPORATOR MWB STEEL WEIGHT (RIGGING)				CONDENSER MWB STEEL WEIGHT (RIGGING)			
			kg		lb		kg		lb	
			Flanged	Victaulic	Flanged	Victaulic	Flanged	Victaulic	Flanged	Victaulic
150	3	2	166	166	159	159	166	166	159	159
		2 return	—	—	—	—	—	—	—	—
	4	2	428	428	205	205	449	449	205	205
		2 return	—	—	—	—	—	—	—	—
	5	2	576	556	242	242	542	542	226	226
		2 return	—	—	—	—	—	—	—	—

LEGEND

MWB — Marine Waterbox

NOTE: This table is the additional weight adder compared to 150-lb unit with NIH covers.



LEGEND
1 — First Stage Volute
2 — Permanent Magnet Motor Rotor
3 — Motor Stator
4 — Second Stage Volute
5 — Second Stage Inlet Guide Vane
6 — Second Stage Impeller
7 — Magnetic Bearing System
8 — First Stage Impeller
9 — First Stage Inlet Guide Vane

Fig. 43 — 19MV Compressor Components

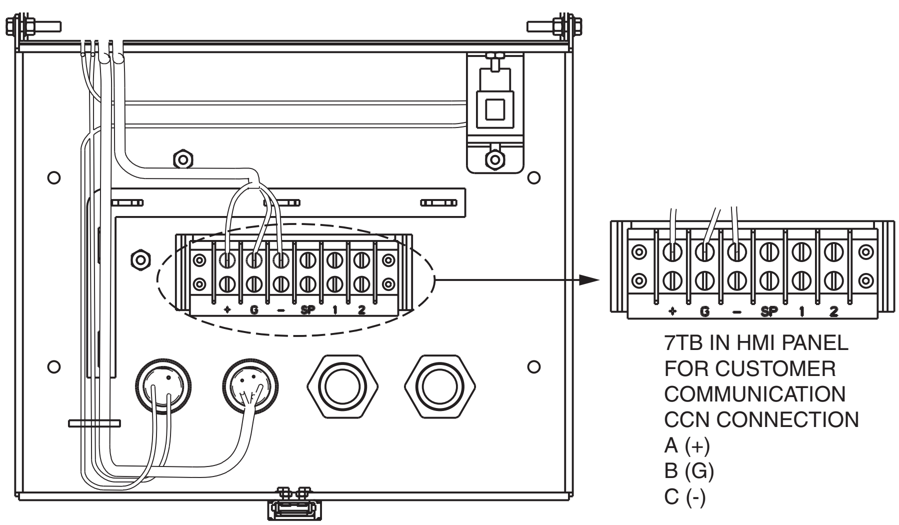


Fig. 44 — HMI Panel

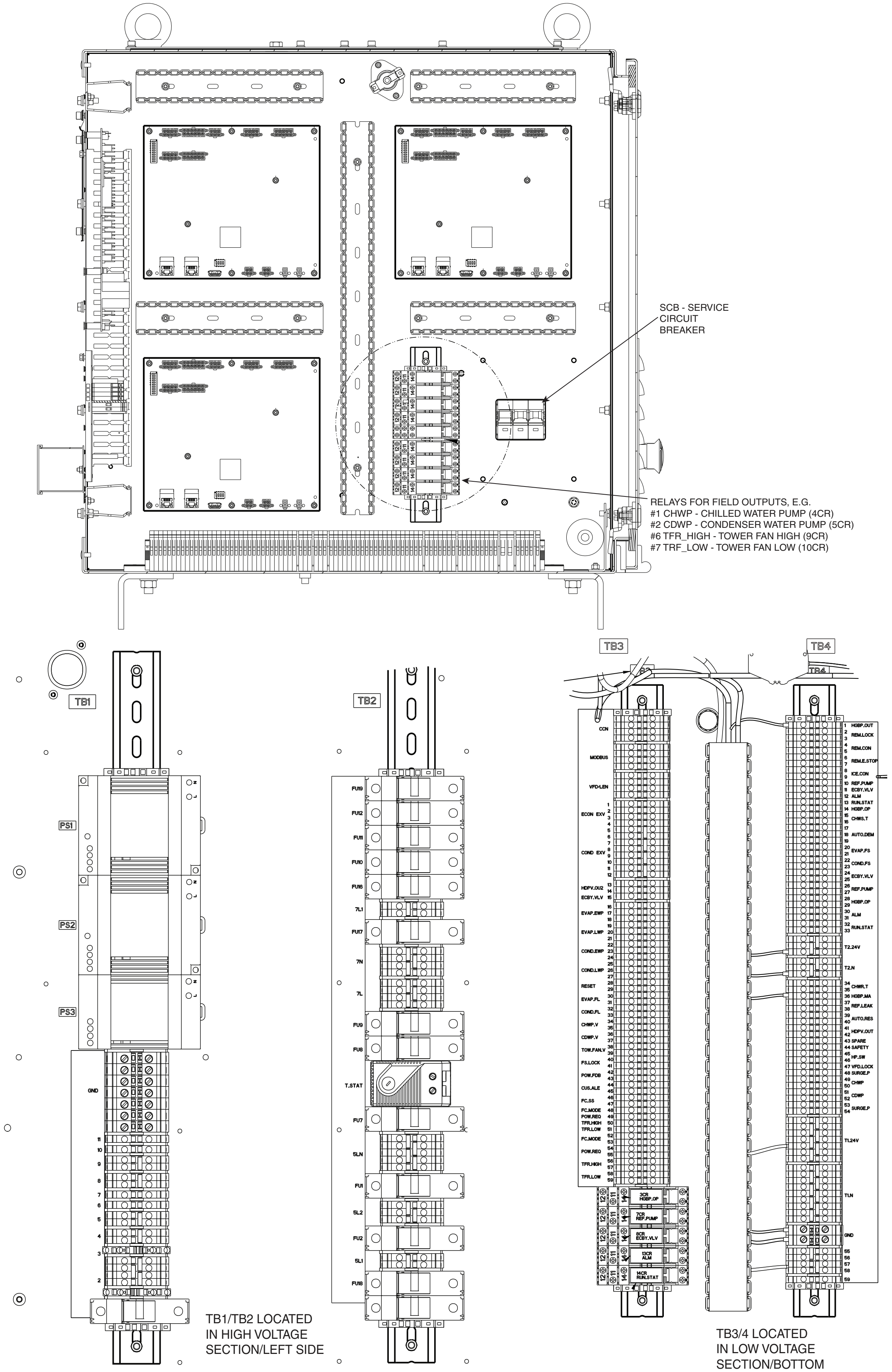


Fig. 45 — Control Panel Layout

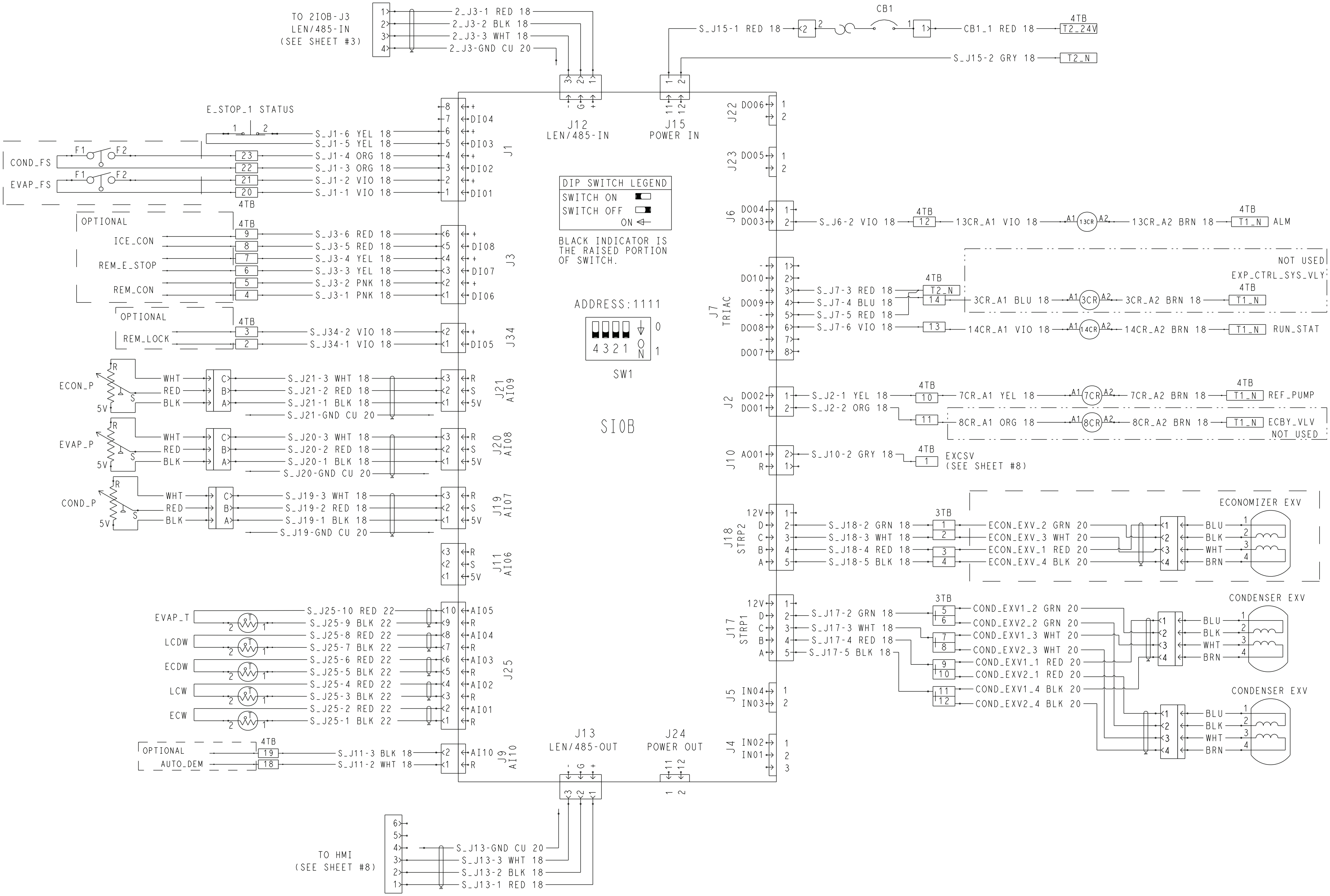

TO 2IOB-J3
LEN/485-IN
(SEE SHEET #3)
2_J3-1 RED 18
2_J3-2 BLK 18
2_J3-3 WHT 18
2_J3-GND CU 20
CB1
S_J15-1 RED 18
CB1_1 RED 18
4TB
T2_24V
S_J15-2 GRY 18
T2_N
J12
LEN/485-IN
J15
POWER IN
E_STOP_1 STATUS
S_J1-6 YEL 18
S_J1-5 YEL 18
S_J1-4 ORG 18
S_J1-3 ORG 18
S_J1-2 VIO 18
S_J1-1 VIO 18
COND_FS
EVAP_FS
DI04
DI03
DI02
DI01
J1
OPTIONAL
ICE_CON
REM_E_STOP
REM_CON
S_J3-6 RED 18
S_J3-5 RED 18
S_J3-4 YEL 18
S_J3-3 YEL 18
S_J3-2 PNK 18
S_J3-1 PNK 18
DI08
DI07
DI06
J3
REM_LOCK
S_J34-2 VIO 18
S_J34-1 VIO 18
DI05
J34
DIP SWITCH LEGEND
SWITCH ON
SWITCH OFF
ON
BLACK INDICATOR IS THE RAISED PORTION OF SWITCH.
ADDRESS:1111
SW1
SIOB
ECON_P
S_J21-3 WHT 18
S_J21-2 RED 18
S_J21-1 BLK 18
S_J21-GND CU 20
J21 AI09
EVAP_P
S_J20-3 WHT 18
S_J20-2 RED 18
S_J20-1 BLK 18
S_J20-GND CU 20
J20 AI08
COND_P
S_J19-3 WHT 18
S_J19-2 RED 18
S_J19-1 BLK 18
S_J19-GND CU 20
J19 AI07
J11 AI06
EVAP_T
LCDW
ECDW
LCW
ECW
S_J25-10 RED 22
S_J25-9 BLK 22
S_J25-8 RED 22
S_J25-7 BLK 22
S_J25-6 RED 22
S_J25-5 BLK 22
S_J25-4 RED 22
S_J25-3 BLK 22
S_J25-2 RED 22
S_J25-1 BLK 22
AI05
AI04
AI03
AI02
AI01
J25
AUTO_DEM
S_J11-3 BLK 18
S_J11-2 WHT 18
AI10
J9 AI10
J13
LEN/485-OUT
J24
POWER OUT
TO HMI
(SEE SHEET #8)
S_J13-GND CU 20
S_J13-3 WHT 18
S_J13-2 BLK 18
S_J13-1 RED 18
J22 DO06
J23 DO05
J6 DO04 DO03
S_J6-2 VIO 18
13CR_A1 VIO 18
13CR_A2 BRN 18
T1_N
ALM
NOT USED
EXP_CTRL_SYS_VLV
J7 TRIAC
DO10
DO09
DO08
DO07
S_J7-3 RED 18
S_J7-4 BLU 18
S_J7-5 RED 18
S_J7-6 VIO 18
3CR_A1 BLU 18
3CR_A2 BRN 18
14CR_A1 VIO 18
14CR_A2 BRN 18
RUN_STAT
J2 DO02 DO01
S_J2-1 YEL 18
S_J2-2 ORG 18
7CR_A1 YEL 18
7CR_A2 BRN 18
REF_PUMP
8CR_A1 ORG 18
8CR_A2 BRN 18
ECBY_VLV
NOT USED
J10 AO01
S_J10-2 GRY 18
EXCSV
(SEE SHEET #8)
J18 STRP2
S_J18-2 GRN 18
S_J18-3 WHT 18
S_J18-4 RED 18
S_J18-5 BLK 18
3TB
ECON_EXV_2 GRN 20
ECON_EXV_3 WHT 20
ECON_EXV_1 RED 20
ECON_EXV_4 BLK 20
ECONOMIZER EXV
BLU
BLK
WHT
BRN
J17 STRP1
S_J17-2 GRN 18
S_J17-3 WHT 18
S_J17-4 RED 18
S_J17-5 BLK 18
COND_EXV1_2 GRN 20
COND_EXV2_2 GRN 20
COND_EXV1_3 WHT 20
COND_EXV2_3 WHT 20
COND_EXV1_1 RED 20
COND_EXV2_1 RED 20
COND_EXV1_4 BLK 20
COND_EXV2_4 BLK 20
CONDENSER EXV
CONDENSER EXV
J5 IN04 IN03
J4 IN02 IN01

Fig. 46 — SIOB

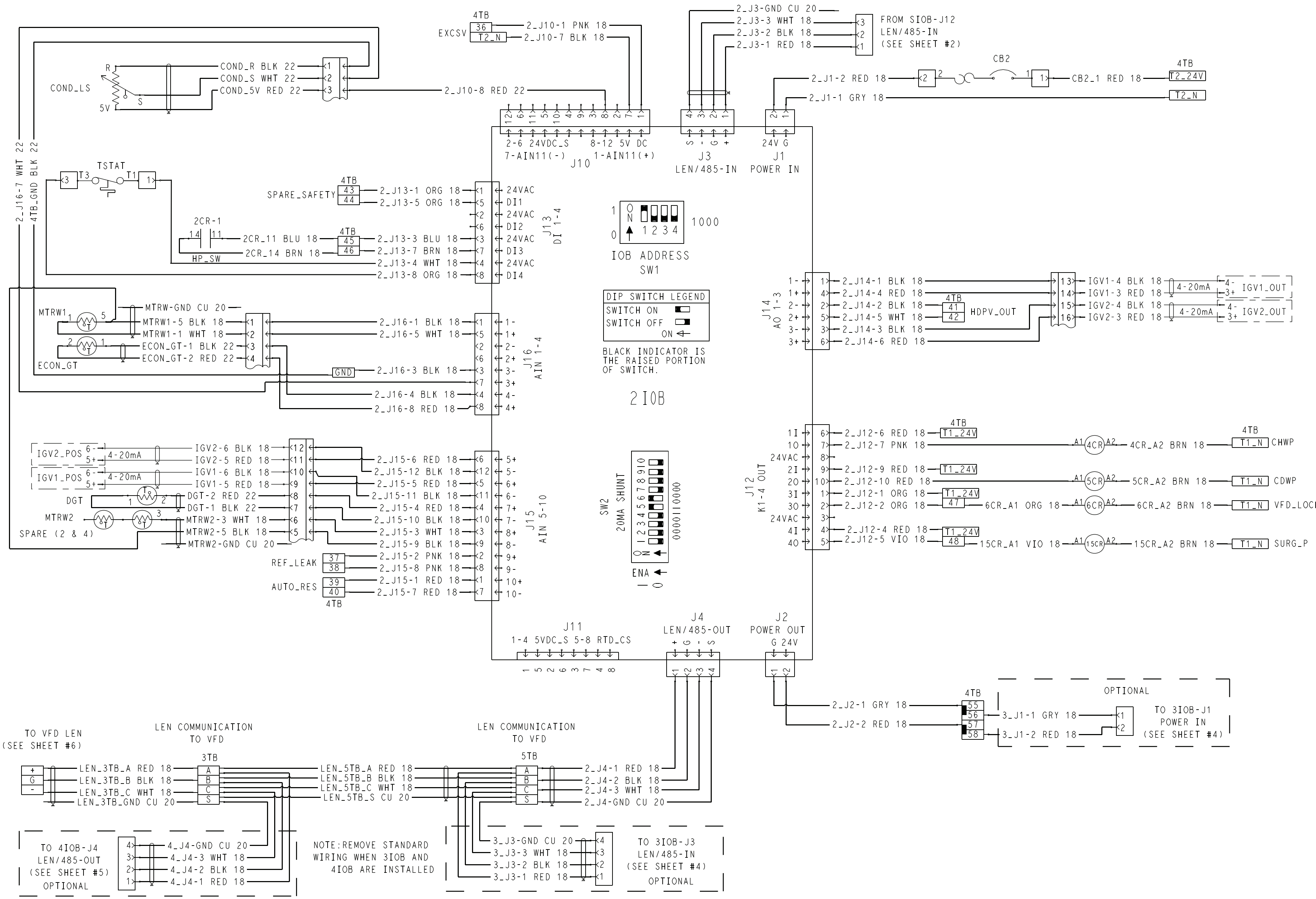

4TB
EXCSV
2_J10-1 PNK 18
2_J10-7 BLK 18
COND_LS
COND_R BLK 22
COND_S WHT 22
COND_5V RED 22
2_J10-8 RED 22
2_J3-GND CU 20
2_J3-3 WHT 18
2_J3-2 BLK 18
2_J3-1 RED 18
FROM SIOB-J12
LEN/485-IN
(SEE SHEET #2)
CB2
2_J1-2 RED 18
2_J1-1 GRY 18
CB2_1 RED 18
T2_24V
T2_N
2-6 24VDC_S
8-12 5V DC
7-AIN11(-)
1-AIN11(+)
J10
J3
LEN/485-IN
J1
POWER IN
24V G
TSTAT
2_J16-7 WHT 22
4TB_GND BLK 22
SPARE_SAFETY
2_J13-1 ORG 18
2_J13-5 ORG 18
2CR-1
2CR_11 BLU 18
2CR_14 BRN 18
HP_SW
2_J13-3 BLU 18
2_J13-7 BRN 18
2_J13-4 WHT 18
2_J13-8 ORG 18
J13
DI 1-4
IOB ADDRESS
SW1
1000
DIP SWITCH LEGEND
SWITCH ON
SWITCH OFF
ON
BLACK INDICATOR IS
THE RAISED PORTION
OF SWITCH.
2IOB
MTRW1
MTRW-GND CU 20
MTRW1-5 BLK 18
MTRW1-1 WHT 18
ECON_GT-1 BLK 22
ECON_GT-2 RED 22
ECON_GT
GND
2_J16-1 BLK 18
2_J16-5 WHT 18
2_J16-3 BLK 18
2_J16-4 BLK 18
2_J16-8 RED 18
J16
AIN 1-4
J14
AO 1-3
2_J14-1 BLK 18
2_J14-4 RED 18
2_J14-2 BLK 18
2_J14-5 WHT 18
2_J14-3 BLK 18
2_J14-6 RED 18
HDPV_OUT
IGV1-4 BLK 18
IGV1-3 RED 18
IGV2-4 BLK 18
IGV2-3 RED 18
4-20mA
IGV1_OUT
IGV2_OUT
IGV2_POS
IGV1_POS
IGV2-6 BLK 18
IGV2-5 RED 18
IGV1-6 BLK 18
IGV1-5 RED 18
DGT
DGT-2 RED 22
DGT-1 BLK 22
MTRW2
MTRW2-3 WHT 18
MTRW2-5 BLK 18
MTRW2-GND CU 20
SPARE (2 & 4)
2_J15-6 RED 18
2_J15-12 BLK 18
2_J15-5 RED 18
2_J15-11 BLK 18
2_J15-4 RED 18
2_J15-10 BLK 18
2_J15-3 WHT 18
2_J15-9 BLK 18
2_J15-2 PNK 18
2_J15-8 PNK 18
2_J15-1 RED 18
2_J15-7 RED 18
REF_LEAK
AUTO_RES
J15
AIN 5-10
SW2
20MA SHUNT
0000110000
ENA
J12
K1-4 OUT
2_J12-6 RED 18
2_J12-7 PNK 18
2_J12-9 RED 18
2_J12-10 RED 18
2_J12-1 ORG 18
2_J12-2 ORG 18
2_J12-4 RED 18
2_J12-5 VIO 18
T1_24V
4CR_A2 BRN 18
5CR_A2 BRN 18
6CR_A1 ORG 18
6CR_A2 BRN 18
15CR_A1 VIO 18
15CR_A2 BRN 18
T1_N
CHWP
CDWP
VFD_LOCK
SURG_P
J11
1-4 5VDC_S 5-8 RTD_CS
J4
LEN/485-OUT
J2
POWER OUT
G 24V
2_J2-1 GRY 18
2_J2-2 RED 18
OPTIONAL
3_J1-1 GRY 18
3_J1-2 RED 18
TO 3IOB-J1
POWER IN
(SEE SHEET #4)
TO VFD LEN
(SEE SHEET #6)
LEN COMMUNICATION
TO VFD
3TB
LEN_3TB_A RED 18
LEN_3TB_B BLK 18
LEN_3TB_C WHT 18
LEN_3TB_GND CU 20
LEN_5TB_A RED 18
LEN_5TB_B BLK 18
LEN_5TB_C WHT 18
LEN_5TB_S CU 20
5TB
2_J4-1 RED 18
2_J4-2 BLK 18
2_J4-3 WHT 18
2_J4-GND CU 20
TO 4IOB-J4
LEN/485-OUT
(SEE SHEET #5)
OPTIONAL
4_J4-GND CU 20
4_J4-3 WHT 18
4_J4-2 BLK 18
4_J4-1 RED 18
NOTE:REMOVE STANDARD
WIRING WHEN 3IOB AND
4IOB ARE INSTALLED
3_J3-GND CU 20
3_J3-3 WHT 18
3_J3-2 BLK 18
3_J3-1 RED 18
TO 3IOB-J3
LEN/485-IN
(SEE SHEET #4)
OPTIONAL

Fig. 47 — IOB2

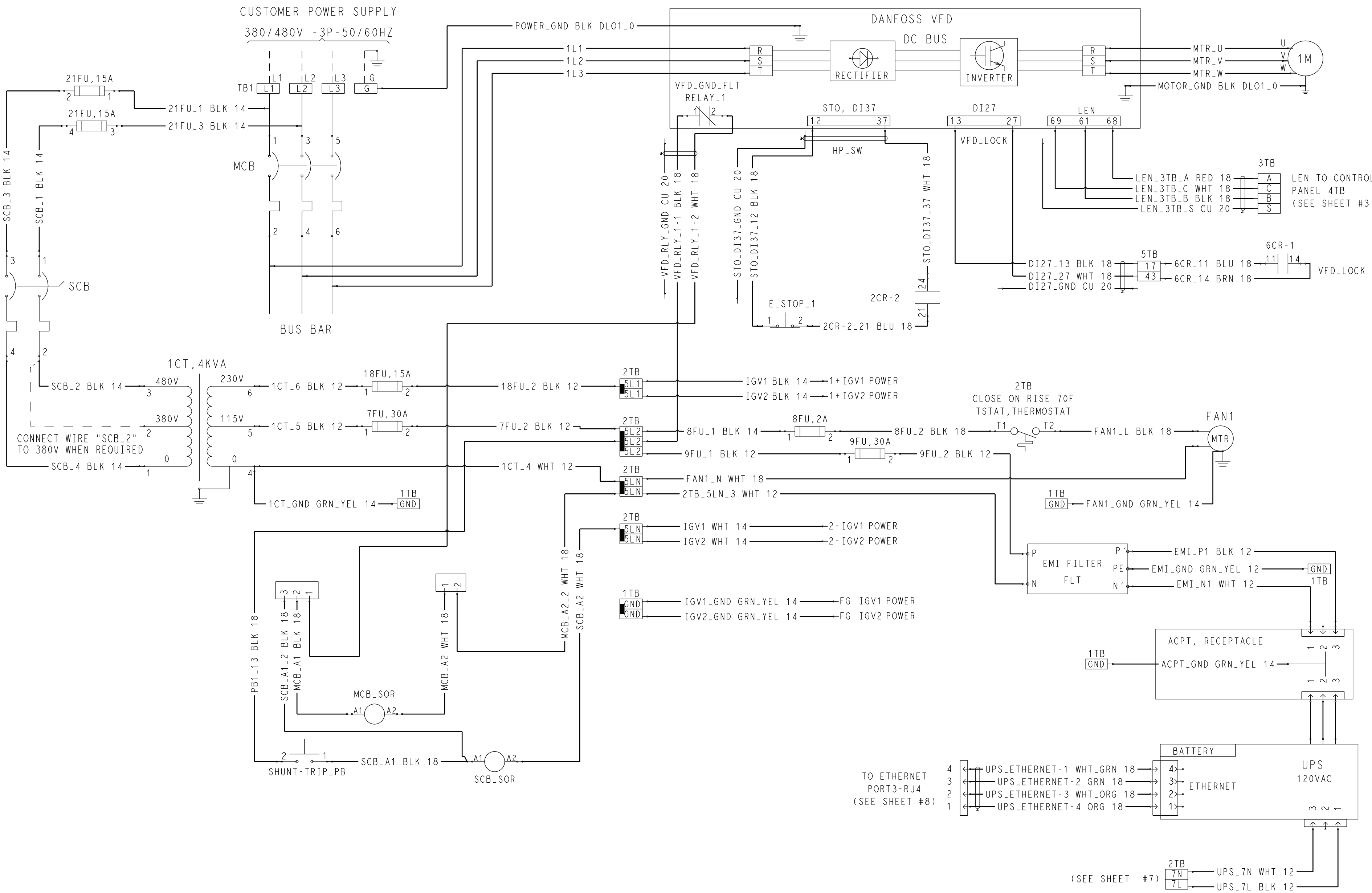


Fig. 48 — 19MV Auxiliary Controls Wiring

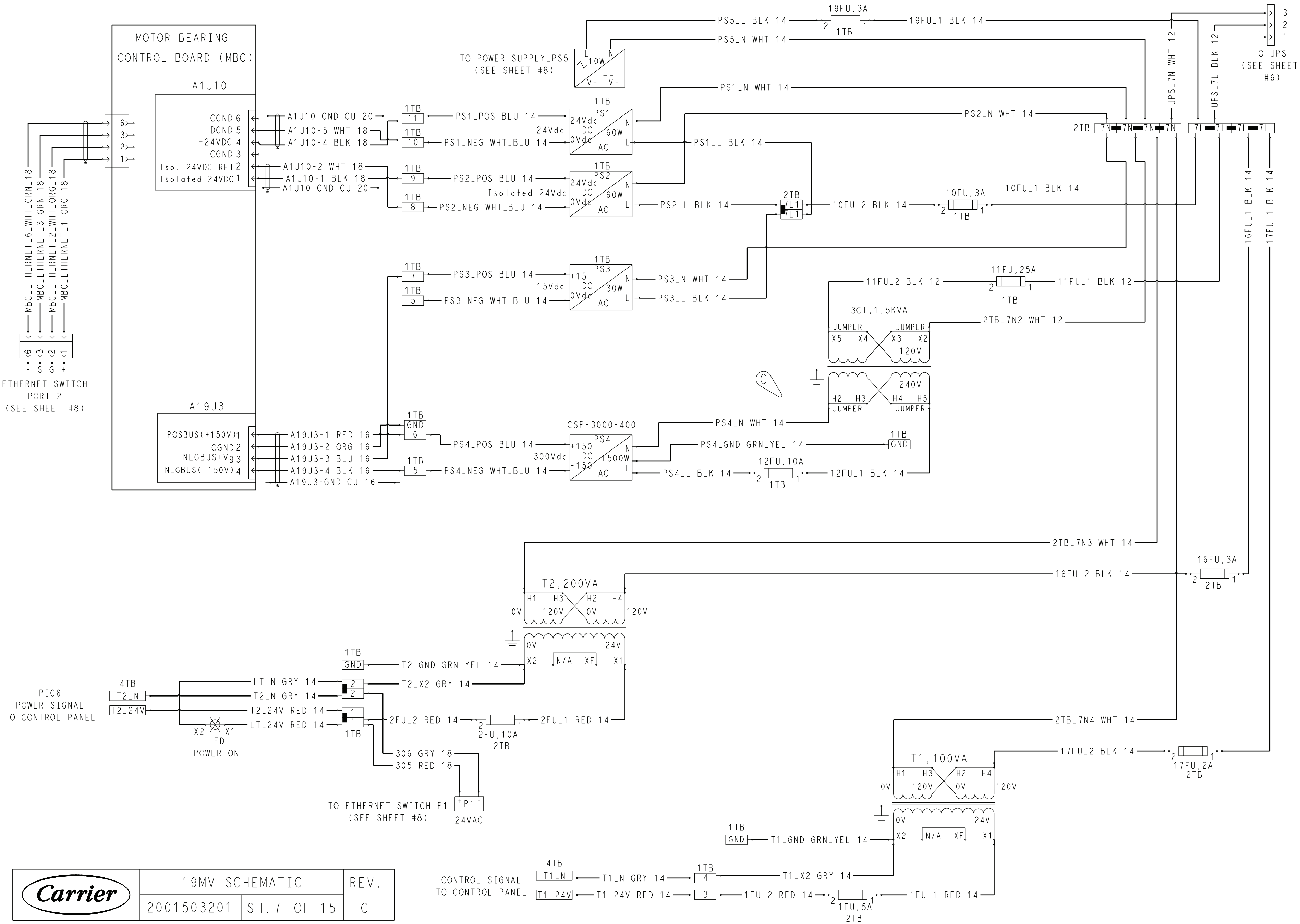


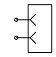
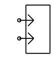
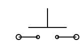
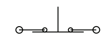
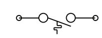
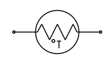
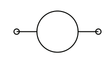
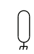
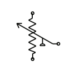
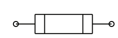
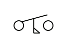
Fig. 49 — Motor Bearing Control Board Wiring

LEGEND FOR FIG. 46-49

Abbreviations

1-5TB	—	Terminal Block 1-5
2-4IOB	—	Carrier Input Output Board 2-4
ALM	—	Chiller Alarm Relay
AUTO_DEM	—	Auto Demand Limit Input
AUTO_RES	—	Auto Water Temp Reset
CB	—	Circuit Breaker
CDWP	—	Condenser Water Pump
CDWP_V	—	Condenser Water Pump (Variable Speed)
CHWP	—	Chilled Water Pump
CHWP_V	—	Chilled Water Pump (Variable Speed)
CHWR_T	—	Common Chilled Water Return Temperature
CHWS_T	—	Common Chilled Water Supply Temperature
COND_EWP	—	Entering Cond Water Pressure
COND_FL	—	Cond Water Flow Measurement
COND_FS	—	Cond Water Flow Switch
COND_LS	—	Liquid Level Condenser
COND_LWP	—	Leaving Cond Water Pressure
COND_P	—	Condenser Pressure
CT	—	Control Transformer
CUS_ALE	—	Customer Alert
DGT	—	Compressor Discharge Temperature
E_STOP	—	Remote Emergency Stop Input
ECBY_VLV	—	Not Used
ECDW	—	Entering Condenser Water Temperature
ECON_GT	—	Economizer Gas Temperature
ECON_P	—	Economizer Pressure
ECW	—	Entering Chilled Water Temperature
EVAP_EWP	—	Entering Evap Water Pressure
EVAP_FL	—	Evap Water Flow Measurement
EVAP_FS	—	Evap Water Flow Switch
EVAP_LWP	—	Leaving Evap Water Pressure
EVAP_P	—	Evaporator Pressure
EVAP_T	—	Evap. Refrigerant Liquid Temperature
EXCSV	—	Expansion Control System Valve Connections
FC_MODE	—	Not Used
FC_SS	—	Not Used
FS_LOCK	—	Fire Security Interlock
HDPV_OU2	—	Head Pressure Output 2
HMI	—	Human Machine Interface (Touch Screen)
HP_SW	—	High Pressure Switch
ICE_CON	—	Ice Build Contact
IGV1_OUT	—	Guide Vane 1 Analog Output
IGV1_POS	—	Guide Vane 1 Actual Position
IGV2_OUT	—	Guide Vane 2 Analog Output
IGV2_POS	—	Guide Vane 2 Actual Position
LCDW	—	Leaving Condenser Water Temperature
LCW	—	Leaving Chilled Water Temperature
MCB	—	Main Circuit Breaker
MCB_SOR	—	MCB Shunt Trip
MTRW1	—	Motor Winding Temperature 1
MTRW2	—	Motor Winding Temperature 2
PB	—	Push Button
POW_FDB	—	Power Request Feedback
POW_REQ	—	Power Request Output
PS	—	Power Supply
R_RESET	—	Remote Reset Sensor
REF_LEAK	—	Refrigerant Leak Sensor
REF_PUMP	—	Refrigerant Pump
REM_CON	—	Remote Contact Input
REM_E_STOP	—	Remote E-Stop
REM_LOCK	—	Chiller Lockout Input
RUN_STAT	—	Chiller Run Status
SCB	—	Service Circuit Breaker
SCB_SOR	—	SCB Shunt Trip
SIOB	—	Standard Input Output Board
SURGE_P	—	Surge Proximity
T1/2	—	Transformer 1/2
TFR_HIGH	—	Tower Fan High
TFR_LOW	—	Tower Fan Low
TOW_FAN_V	—	Tower Fan (Variable Speed)
VFD_LOCK	—	VFD Interlock

Symbols

	Terminal Block Connection
	Female Connector
	Male Connector
	Optional Wiring
	Normally Open (NO)
	Normally Closed (NC)
	Contact, NO
	Contact, NC
	Thermostat
	Thermistor
	Coil
	Cable
	Pressure Switch
	Pressure Transducer
	Fuse
	Circuit Breaker
	Flow Switch
	Ground

BLK	Black
BLU	Blue
BRN	Brown
CU	Copper
GRN	Green
GRY	Gray
ORG	Orange
RED	Red
WHT	White
YEL	Yellow
Y/G	Yellow/Green

APPENDIX A — PIC6 SCREEN AND MENU STRUCTURE

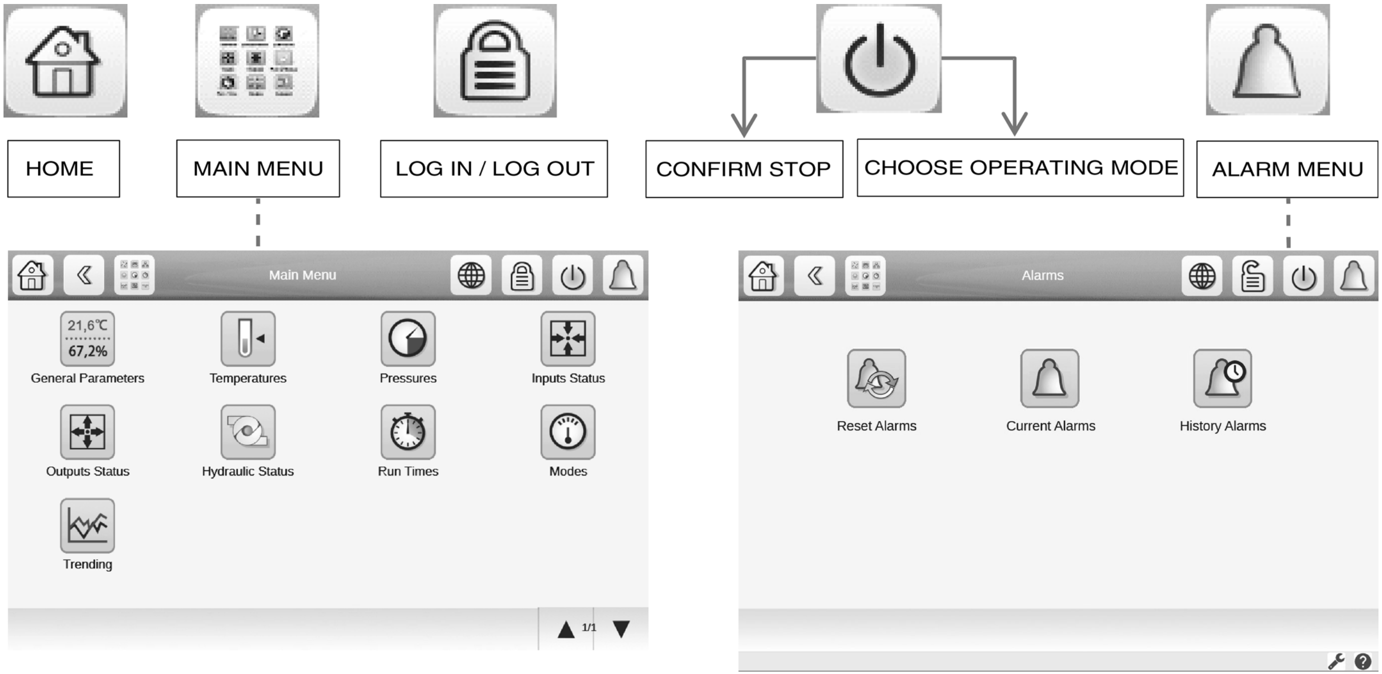


Fig. A — Screen Structure, Basic Level (All) Access (No Password Required)

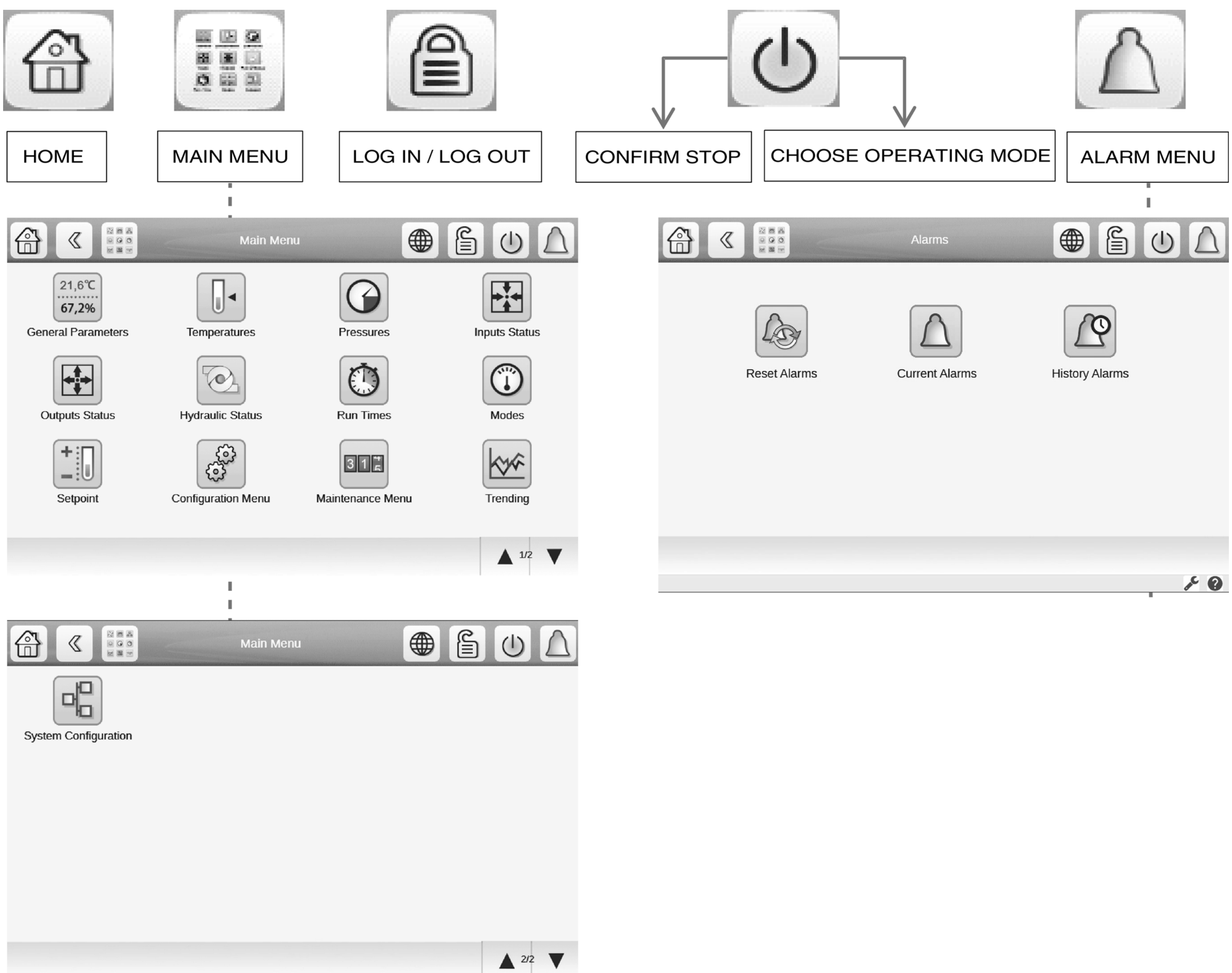


Fig. B — Screen Structure, User Level Access (User Password Required)

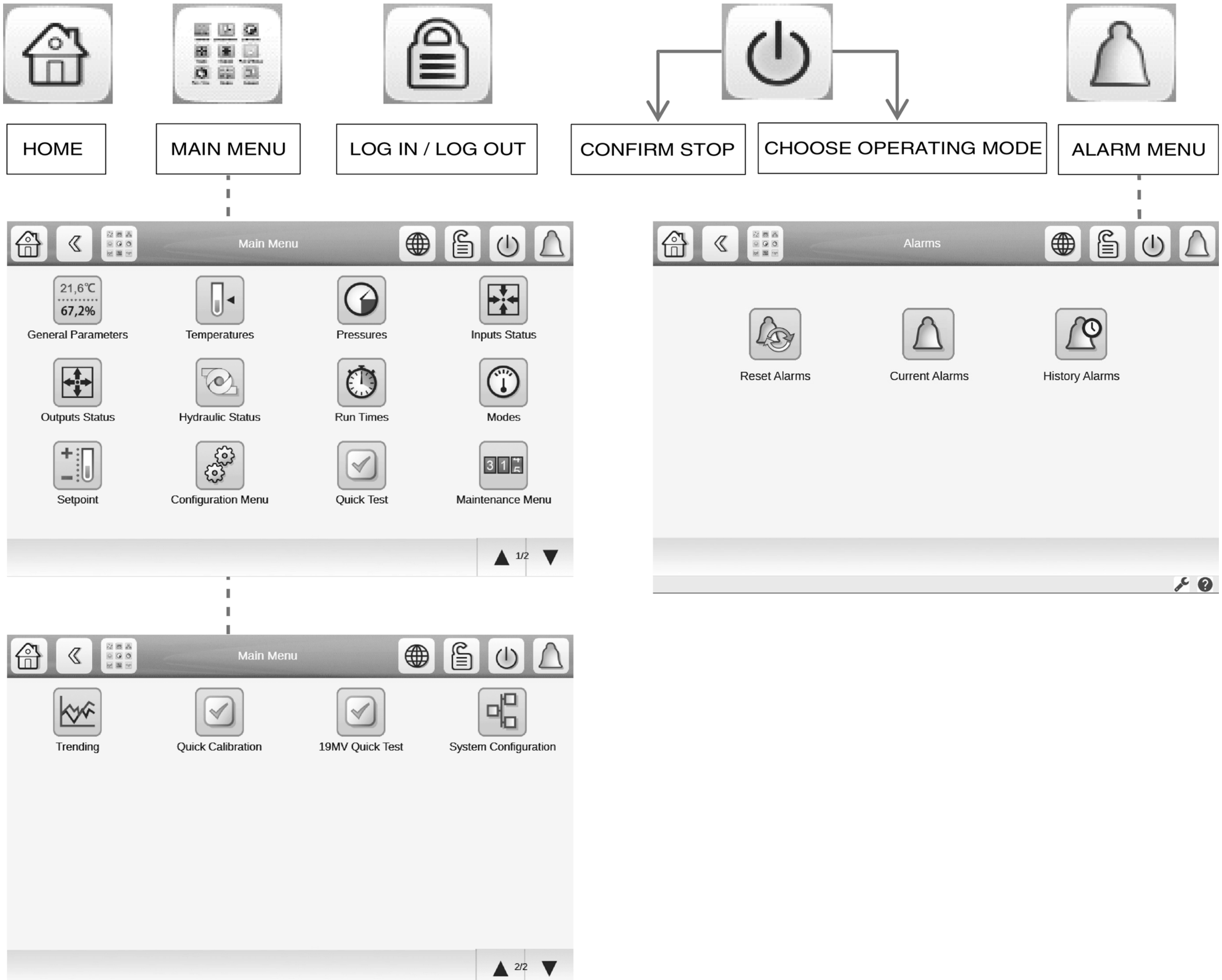


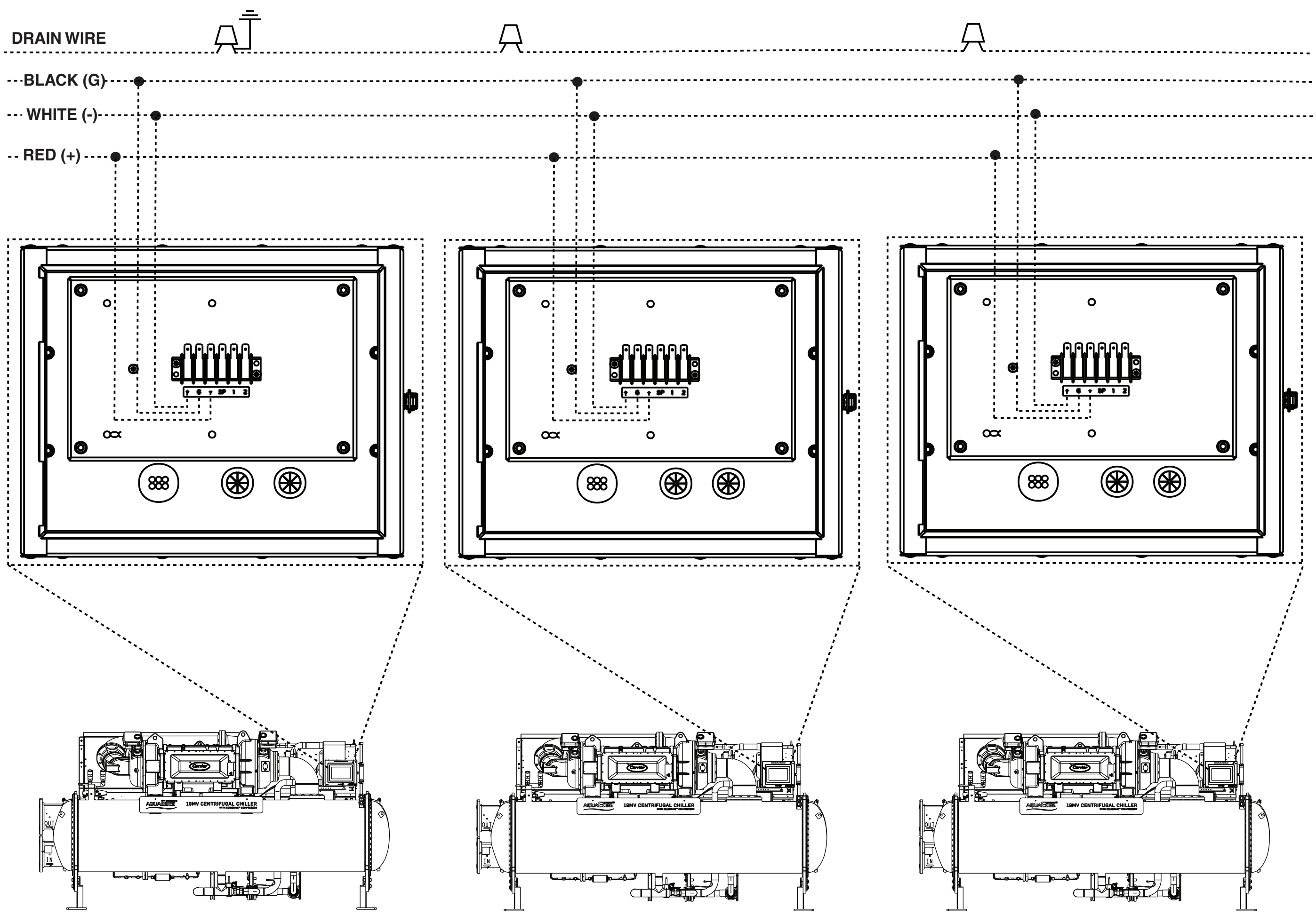
Fig. C — Screen Structure, Service / Factory Level Access Password Required

Main Menu Description

ICON	DISPLAYED TEXT*	ACCESS	ASSOCIATED TABLE†
	General Parameters	Basic, User, Factory	GENUINT
	Temperatures	Basic, User, Factory	TEMP
	Pressures	Basic, User, Factory	PRESSURE
	Inputs Status	Basic, User, Factory	INPUTS
	Outputs Status	Basic, User, Factory	OUTPUTS
	Hydraulic Status	Basic, User, Factory	HYDRLIC
	Run Times	Basic, User, Factory	RUNTIME
	Modes	Basic, User, Factory	MODES
	Set point	User, Factory	SETPOINT
	Configuration Menu	User (limited), Factory	CONFIG
	Quick Test	Factory	QCK_TEST
	Maintenance Menu	User, Factory	MAINTAIN
	Trending	Basic, User, Factory	TRENDING
	Quick Calibration	Factory	QCK_CALI
	19MV Quick Test	Factory	QCK_EOL
	System Configuration	User (limited), Factory	System Configuration

* Displayed text depends on the selected language (default is English).
† See the 19MV with PIC6 Controls Operation and Troubleshooting manual for table details.

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



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

APPENDIX C — MAINTENANCE SUMMARY AND LOG SHEETS

19MV Maintenance Interval Requirements

WEEKLY			
COMPRESSOR	None.	**CONTROLS**	Review PIC6 Alarm/Alert History.
EVAPORATOR	None.	**VFD**	None.
CONDENSER	None.	**UPS**	PIC6 automatically performs UPS Discharge Level test of the battery. Alert 117 will be active should the test fail. Should Alert 117 become active the battery will need to be replaced within 2 weeks. Upon replacement, the new battery must be acknowledged in the UPS Config menu (Battery Replacement Done = Yes). If no action is taken UPS Battery Replacement Alarm 481 will be active, resulting in chiller shutdown.
MONTHLY			
COMPRESSOR	None.	**CONTROLS**	None.
FIRST YEAR			
COMPRESSOR	Replace motor coolant line filter drier.	**EXVS**	Clean EXV strainers.
ANNUALLY			
COMPRESSOR	Change motor cooling line filter drier. Leak test. Replace desiccant packet inside MBC cavity.	**CONTROLS**	Perform general cleaning. Tighten connections. Check pressure transducers. Confirm accuracy of thermistors. Complete a MBC clearance check. Record MBC drop counts against the limit.
EVAPORATOR	Inspect and clean evaporator tubes. Confirm there is no foreign debris in the tubes or waterboxes from the water system. Inspect all pressure relief devices. Leak test. Verify water pressure differential. Inspect water pumps. Send refrigerant sample out for analysis. Replace liquid strainer in inhibitor reclaim line (closest to evaporator inlet).	**VFD**	Perform general cleaning. Tighten connections. Perform visual inspection of the capacitors located on the DC bus and inductors. Check cooling fan operation. Replace or clean air filter.
CONDENSER	Inspect and clean condenser tubes. Leak test. Verify water pressure differential. Inspect water pumps and cooling tower.	**POWER PANEL**	Perform general cleaning of air filter located in the door of the high voltage section. Filter mesh is made of washable aluminum. Verify that fan is operating. Fan exit is located on the back of the high voltage section. Fan will operate when enclosure temperature exceeds 70°F (21°C). Replace the motor coolant line filter drier.
EVERY 3 TO 5 YEARS			
COMPRESSOR	None.	**CONTROLS**	Replace UPS battery.
EVAPORATOR	Perform eddy current test.	**VFD**	None.
CONDENSER	Inspect EXVs and clean or replace strainers. Perform eddy current test.		
SEASONAL SHUTDOWN			
COMPRESSOR	None.	**CONTROLS**	None.
EVAPORATOR	Isolate and drain waterbox. Remove waterbox cover from one end. Use compressed air to clear tubes.	**VFD**	None.
CONDENSER	Isolate and drain waterbox. Remove waterbox cover from one end. Use compressed air to clear tubes.		

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

APPENDIX D — REMOTE CONNECTIVITY SETUP (BY CARRIER SERVICE)

Introduction

Cellular Remote Connectivity is a system developed by Carrier to remotely monitor a chiller. It consists of a PIC6 controller, ethernet switch, cellular modem, and an antenna. The option is included standard with all applied 19 Series equipment. For a new chiller there is a free period of operation with remote connectivity after commissioning. Attached documentation is based on use of Sierra wireless router/modem. This appendix describes typical commissioning steps required for a chiller supplied with the Remote Connectivity option. For support or when completed contact the Command Center at 1-833-257-6280 or email at EETSupport@carrier.com. Typical component interactions are shown in Fig. D.

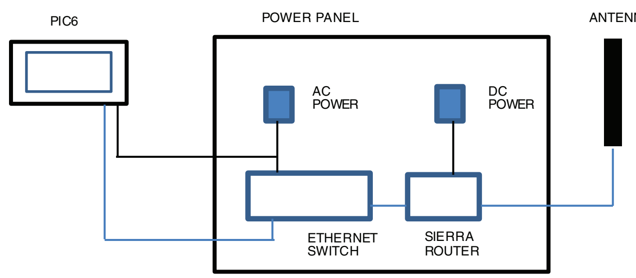


Fig. D — Remote Connectivity

Verification and Testing

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

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

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

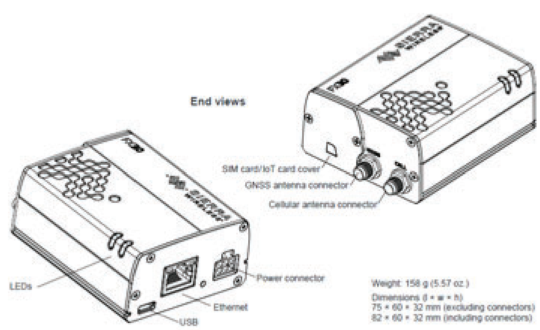


Fig. E — End Views of Remote Connectivity Hardware

3. Verify that a SIM card is installed (before power up).
4. Modem powers up when power is applied to chiller. The Power LED will be off when there is no power applied. The Power LED will be solid red when power is on and there is no cellular signal and solid green when attached to a cellular network. The User LED is not used. See Fig. F.
5. Navigate to PIC6 System Configuration→Ethernet Configuration and record the PIC6 MAC address of ETH0 (example 52:CC:00:02:11:C4).
6. Default ethernet IP address for the Sierra modem is 169.254.1.2. Set the interface for the PIC6 ethernet port which is going to be used to 169.254.101 for the first chiller and if multiple chillers increase last digit by one for each chiller. APPLY the setting in the PIC6 menu. Up to a total of 5 chillers can be installed to one modem (if required).

Fig. F — User LED and Power LED

7. For the PIC6 ethernet port which is going to be used ensure that Subnet mask is 255.255.0.0.
8. Navigate to the PIC6 System Configuration→Gateway/DNS Config menu. Set Gateway 0 IP to 169.254.1.2 and Gateway Destination/Mask to 0.0.0.0/0 and APPLY the changes.

   NOTE: Gateway 1 is generally not used in SmartService applications. However, presently you must set Gateway 1 to the same settings as Gateway 0 and apply the settings.
9. Set DNS Servers to 169.254.1.2 and APPLY the change; the status should show "DNS applied successfully".
10. Test connectivity (PIC6 System Configuration→Network Diagnostic:
    a. Run ping test to modem: Enter 169.254.1.2 into Server Address and select appropriate ethernet port. Then select "Run PING test". If the PIC6 can connect to the modem the PIC6 will display "In Progress" followed by "Pass".
    b. Run ping test to internet: Enter 8.8.8.8 into Serve Address and select appropriate ethernet port. Then select "Run PING test". If the PIC6 can connect to the modem the PIC6 will display "In Progress" followed by "Pass".
    c. Run could test to SmartService cloud. Note that if previous ping test has failed then this test will also fail. In addition verify on the PIC6 Network Diagnostic page that "IOT certificate status: Present" is noted near top of page. If the IOB certificate is not present, then it will have to be loaded. Contact Service Engineering or Technical Service Manager.
11. Verify Time, Date and Time Zone. PIC6 System Configuration→Date/Time Configuration.

Connect to SmartService

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

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

Jobsite Information:

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

Chiller data (for each chiller being onboarded):

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

INDEX

INITIAL START-UP CHECKLIST

FOR 19MV SEMI-HERMETIC TWO-STAGE CENTRIFUGAL LIQUID CHILLER

(Remove and use for job file.)

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

MACHINE INFORMATION:

NAME ____________________ SALES ORDER NO. ____________________

ADDRESS ____________________ MODEL ____________________

CITY ____________ STATE ____________ ZIP ____________ S/N ____________

DESIGN CONDITIONS:

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

CHILLER LINE SIDE: Volts ____________ FLA ____________ OLTA ____________

REFRIGERANT: Type: ______ Charge ______

CARRIER OBLIGATIONS:

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

START-UP TO BE PERFORMED IN ACCORDANCE WITH APPROPRIATE MACHINE START-UP INSTRUCTIONS

JOB DATA REQUIRED:

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

INITIAL MACHINE PRESSURE: ____________

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

RECORD ACTUAL PRESSURE DROPS Evaporator ____________ Condenser ____________

CHARGE REFRIGERANT: Initial Charge ____________ Final Charge After Trim ____________

INSPECT WIRING AND RECORD ELECTRICAL DATA:

RATINGS:

Motor Voltage _________ Motor RLA _________ Chiller LRA Rating _________

Actual Line Voltages: VFD ________ UPS Battery Charge ________% Battery Charge Level ________%

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

Record:

L1 to ground _______________

L2 to ground _______________

L3 to ground _______________

L1 to L2 _______________

L1 to L3 _______________

L2 to L3 _______________

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

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

VFD Manufacturer ____________________________ VFD Nameplate I.D. Number ____________________

VFD Serial Number ____________________________ VFD Nameplate Input Rating ____________________

Mfd in ____________________________ on ____________________

CONTROLS: SAFETY, OPERATING, ETC.

Perform Quick Calibration (Yes/No) ________

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

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

	Condenser Water Pump	Yes ☐	No ☐
	Chilled Water Pump	Yes ☐	No ☐
RUN MACHINE:	Do these safeties shut down machine?		
	Condenser Water Flow	Yes ☐	No ☐
	Chilled Water Flow	Yes ☐	No ☐
	Pump Interlocks (optional)	Yes ☐	No ☐

INITIAL START:

Line up all valves in accordance with instruction manual: ________

Start water pumps and establish water flow: ________

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

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

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

START MACHINE AND OPERATE. COMPLETE THE FOLLOWING:

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

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

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

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

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

SIGNATURES:

CARRIER TECHNICAL ____________________________ CUSTOMER REPRESENTATIVE ____________________________

DATE _______________ DATE _______________

CUT ALONG DOTTED LINE

CUT ALONG DOTTED LINE

19MV PIC6 SET POINT TABLE CONFIGURATION SHEET

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

PIC6 TOUCH SCREEN Software Version Number: ____________________

PIC6 TOUCH SCREEN Controller Identification: BUS: ____________________ ADDRESS: ____________________

19MV PIC6 TIME SCHEDULE CONFIGURATION SHEET PERIOD 1

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

19MV PIC6 TIME SCHEDULE CONFIGURATION SHEET PERIOD 2

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

19MV PIC6 TIME SCHEDULE CONFIGURATION SHEET PERIOD 3

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

19MV PIC6 FACTORY TABLE CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Chiller Type 19XR6/7=0,19XR2~E/D/V=1, 19DV=2, 19XRF=3, 19MV=4	0 to 4		4	
Lubrication Type Mag Bearing=2			2	
VFD/Starter Option Danfoss VFD=7			7	
Unit Type Cooler Only=0			0	
Ref Type R-134a=0, R-513A=1			0	
Chilled Medium Type	Water/Brine		Water	
Cond Shell Side MAWP 0=185 psi, 1=300 psi	0 to 1	psig	0	
Country Code	0 to 999		01	
Activate Swift Rst Opt	No/Yes		No	
Activate Freq Start Opt	No/Yes		Yes	

19MV PIC6 MBC CONFIGURATION TABLE CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Calibration on Power Up	Disable/Enable		Enable	
Auto Clearance Check	Disable/Enable		Enable	
Clearance Chk on Powerup	Disable/Enable		Enable	
Clearance Fail Criteria	0 to 100	%	7.5	
Auto Levitation	No/Yes		Yes	
Shutdown de-Levi delay	60 to 600	sec	60	
Speed Signal Alarm Delta	0 to 50	%	10	
Speed Signal Alert Delta	0 to 20	%	5	
Shaft Displacement Limit	4 to 10	mils	6	
Speed Sensor Option	Disable/Enable		Enable	

19MV PIC6 SERVICE PARAMETERS CONFIGURATION TABLE CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Atmospheric Pressure	8 to 15	psi	14.5	
GV1 Travel Limit	30 to 100	%	93.6	
GV1 Closure at Startup	0 to 4	%	4	
IGV2 Travel Limit	30 to 100	%	93.6	
IGV2 Minimum Degree	0 to 20	Deg.	2.0	
IGV2 Full Load Open Degree	10 to 100	Deg.	88.0	
IGV2 Actuator Max Deg	90 to 120	Deg.	94.0	
IGV2 Position @IGV1 20°	10 to 40	Deg.	37.0	
IGV2 Position @IGV1 30°	10 to 50	Deg.	45.0	
IGV2 Position @IGV1 50°	10 to 80	Deg.	67.0	
Maximum GV Movement	1 to 4	%	2	
Controlled Fluid DB	0.5 to 2	^F	1	
Derivated EWT Gain	1 to 3		2	
Proportional Dec Band	2 to 10		6	
Proportional Inc Band	2 to 10		6.5	
Demand Limit at 20 mA	10 to 100	%	40	
Demand Limit Prop Band	3 to 15	%	10	
Amps or KW Ramp per Min	5 to 20	%	5	
Temp Ramp per Min	1 to 10	^F	3	
Recycle Shutdown Delta T	0.5 to 4	^F	1	
Recycle Restart Delta T	2 to 10	^F	5	
Water Flow Verify Time	0.5 to 5	min	5	
Enable Excessive Starts	No/Yes		No	

CUT ALONG DOTTED LINE

CUT ALONG DOTTED LINE

19MV PIC6 CFGSURGE_SURGE CORRECTION CONFIG TABLE CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Surge Line Configuration PR=0, Delta T=1, PR Table=2	0 to 2		2	
Surge Line PR Offset%	1.5 to 7	%	3	
Surge Line PR Lower DB%	0 to 4.5	%	0	
Surge Line PR Upper DB%	0.2 to 4	%	2	
Surge Delay Time	0 to 120	sec	15	
Surge Time Period	7 to 10	min	8	
Surge Delta Amps %	5 to 40	%	10	
Rampdown Factor	0 to 1		0.1	
GV1 Close Step Surge	1 to 3	%	2	
VFD Speed Step Surge,	1 to 5	%	1.5	
EC Valve Step Surge	1 to 10	%	4	
Surge Profile Step	0 to 2	^F	0	
Surge Profile Offset	0 to 5	^F	0	
High Efficiency Mode	Disable/Enable		Enable	
GV Jumpover Option	Disable/Enable		Disable	
DTS Height Recycle Offset	0 to 3	^F	1	

19MV PIC6 CONF_OPT - Option CONFIG TABLE CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Frequent Restart Option	Disable/Enable		Enable	
Common Sensor Option	Disable/Enable		Disable	
EXCSV Selection 0=Disable, 1=Surge, 2=Low Load, 3=Comb	0 to 3		1	
EXCSV Open IGV Position	0.5 to 10	%	5	
EXCSV Close IGV Position	1.5 to 20	%	10	
ESCSV off DT Low Load	0.5 to 10	^F	4	
EXCSV on DT Low Load	0.5 to 10	^F	2	
EXCSV Low Load DB	0.5 to 2	^F	1	
Head Pres Valve Option	Disable/Enable		Disable	
Head Pres Delta P 0%	0 to 85	psi	25	
Head Pres Delta P 100%	0 to 85	psi	50	
Head Pressure Min Output	0 to 100	%	0	
Head Pressure Deadband	0 to 10	psig	1	suggested value is 0
Tower Fan High Setpoint	55 to 105	^F	75	
Refrig Leakage Option	Disable/Enable		Disable	
Refrig Leakage Alarm mA	4 to 20	mA	20	
Customer Alert Option	Disable/Enable		Enable	
Ice Build Option	Disable/Enable		Disable	
Evap Liquid Temp Opt	Disable/Enable		Enable	
Evap App Calc Selection 0=Sat Temp, 1= Ref Temp	0 to 1		1	
Cond Liquid Level Option 0=Gems225, 1=Gems3125, 2=Sporlan	0 to 2		1	

19MV PIC6 CONFOPT2 - Option2 CONFIG TABLE CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
IOB3 Option	No/Yes		No	
IOB4 Option	No/Yes		No	
Water Pressure Option 0=No 1=Wtr Flow PD Transducer 2=Wtr Flow PD Meter	0 to 2		0	
Water Flow Measurement 0=No 1= WTR Flow Meter 2=Wtr Flow PD	0 to 2		0	
Water Flow Determination 0=Sat Temp 1=Switch 2=Wtr Flow PD	0 to 2		0	

19MV PIC6 CFGUMVFDUM VFD CONFIGURATION TABLE CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Compressor Speed 100%	47 to 450	Hz	50	
Rated Line Voltage	200 to 13800	Volts	460	
Motor Nameplate Current	10 to 2000	AMPS	200	
Motor Rated Load Current	10 to 2000	AMPS	200	
Motor Nameplate RPM	0 to 15000	rpm	3000	
Motor Rated Torque (NM)	0.1 to 10000	NM	200	
Motor Nameplate KW	0 to 5600	kW	1500	
Increase Ramp Time	5 to 120	sec	30	
Decrease Ramp Time	5 to 60	sec	30	
Switch Frequency (kHz)	0 to 16	kHz	5	
PM Motor Para Download	Disable/Enable		Disable	
Stator Resistance (Rs)	0.0010 to 140	Ohm	0.0010	
d-axis Inductance (Ld)	0 to 1000	Henry	0.010	
q-axis Inductance (Lq)	0 to 1000	Henry	0.010	
Back EMF at 1000 RPM	1 to 9000	V	10	

19MV PIC6 GENCONF - General CONFIG TABLE CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Stop to Start Delay	0 to 15	min	1	
Start to Start Delay	0 to 45	min	1	
Demand Limit Type **0=Base Demand, 1=4 to 20mA**	0 to 1		0	
Pulldown Ramp Type **0=Temp, 1=Load**	0 to 1		1	
Demand Limit Source **0=Amps, 1=KW**	0 to 1		0	
Reboot PIC6	No/Yes		No	

19MV PIC6 CFGGEVFD_GENERAL VFD CONFIG TABLE CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
VFD Gain	0.1 to 1.5		0.75	
VFD Max Speed Per	90 to110	%	100	
VFD Min Speed Per	65 to 89	%	70	
VFD Start Speed Per	45 to 100	%	100	
VFD Current Limit	0 to 99999	AMPS	250	

19MV PIC6 RESETCFG - Temperature Reset CONFIG TABLE CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Temp Reset Type **0=No, 1=4 to 20mA,** **2=Remote Temp, 3=Water DT**	0 to 3		0	
Degrees Reset at 20mA	–30 to 30	^F	10	
Maximum Deg Temp Reset	–30 to 30	^F	10	
Remote Temp Full Reset	–40 to 245	^F	65	
Remote Temp No Reset	–40 to 245	^F	85	
Deg Reset Water DT Full	–30 to 30	^F	10	
Controlled DT Full Reset	0 to 15	^F	0	
Controlled DT No Reset	0 to 15	^F	10	

19MV PIC6 CFG_UPS - UPS CONFIG TABLE CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
UPS Option	Disable/Enable		Disable	
Battery Replace Done	No/Yes		Yes	
Battery Threshold	0 to 100	%	70	
Battery Minimum Runtime	0 to 600	sec	240	
Battery Test Duration	0 to 600	sec	240	
Power Failure Max Number	0 to 100	%	50	
Over Temp Duration	0 to 600	sec	60	

CUT ALONG DOTTED LINE

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19MV PIC6 CFGMETER - Config Metering TABLE CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Eco EXV Option	Disable/Enable	NA	Enable	
Cond Liquid Level Determination 0=Capacity Percent, 1=Setpoint	0 to 1		0	
Liquid level SP-Cap 0%		%	0.5	
Liquid level SP-Cap 25%		%	1.0	
Liquid level SP-Cap 50%		%	1.5	
Liquid level SP- Cap 75%		%	2.0	
Liquid level SP- Cap 100%		%	2.1	
Low SST Set Point		°F	34	
Eco EXV Option	Disable/Enable		Enable	
Eco EXV Active Threshold		%	0	
Eco Superheat SP		^F	10	
EXCSV Option	Disable/Enable		Enable	
EXCSV Activate Threshold		%	95	
EXCSV Deactivate Threshold		%	15	
EXCSV Open Time		sec	60	
EXCXV Close Time		sec	120	
EXCSV Open Step			5	
EXCSV Close Step			5	

19MV PIC6 SETPOINT TABLE CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Cooling ECW Setpoint	15 to 120	°F	60	
Cooling LCW Setpoint	–12.2 to 48.9	°F	45	
Base Demand Limit	10.0 to 100.0	%	100.0	
EWT Control Option	Disable/Enable		Disable	

CUT ALONG DOTTED LINE

CUT ALONG DOTTED LINE