

Start-Up, Operation, and Maintenance Instructions

SAFETY CONSIDERATIONS

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.

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

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

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

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

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

- Shut off electrical power to unit.
- Recover or isolate refrigerant from system using high-pressure and low pressure ports as appropriate. Note that R-1233zd(E) will be less than atmospheric pressure until a temperature of about 65°F (18.5°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.
- Cut component connection tubing with tubing cutter and remove component from unit.
- Carefully unsweat remaining tubing stubs when necessary.

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.

(Warnings continued on next page.)

⚠ WARNING

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.

⚠ 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 water-box 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.

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INTRODUCTION

Prior to initial start-up of the 19DV 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 19DV Semi-Hermetic Centrifugal Liquid Chillers Controls Operation and Troubleshooting manual that describes PIC5 controls in detail.

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 PIC5 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.

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.

ABBREVIATIONS AND EXPLANATIONS

Frequently used abbreviations in this manual include:

CCN	— Carrier Comfort Network®
ECDW	— Entering Condenser Water
ECW	— Entering Chilled Water
EMS	— Energy Management System
HMI	— Human Machine Interface
I/O	— Input/Output
LCDW	— Leaving Condenser Water
LCW	— Leaving Chilled Water
LED	— Light-Emitting Diode
OLTA	— Overload Trip Amps
PIC5	— Product Integrated Controls Plus
RLA	— Rated Load Amps
SCR	— Silicon Controlled Rectifier
SI0B	— Starfire 2 Input Output Board
TXV	— Thermostatic Expansion Valve
VFD	— Variable Frequency Drive

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

CHILLER FAMILIARIZATION (Fig. 1 and 2)

Chiller Information Nameplate — The information nameplate is located on the left side of the chiller control panel.

System Components — The main components include the cooler and condenser heat exchangers in separate vessels, motor-compressor, refrigerant, lubrication package, control panels, PIC5 Touch Screen HMI, economizer, VFD, and purge system.

Evaporator — This vessel is located underneath the compressor. The cooler is maintained at lower temperature/pressure so evaporating refrigerant can remove heat from water flowing through its internal tubes. Water is flowing through the tube internals 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. It contains a metering device that regulates the flow of refrigerant into the economizer.

Economizer — This chamber reduces the refrigerant pressure to an intermediate level between the evaporator and condenser vessels. In the economizer, vapor is separated from the liquid, the separated vapor flows to the second stage of the compressor, and the liquid flows into the cooler. The energy removed from the vaporized refrigerant in the economizer allows the liquid refrigerant in the cooler to absorb more heat when it evaporates and benefits the overall cooling efficiency cycle. It contains a float assembly that regulates the flow of refrigerant into the evaporator.

Motor-Compressor — This component maintains system temperature and pressure differences and moves the heat-carrying refrigerant from the cooler to the condenser. The 19DV utilizes a two-stage back to back direct drive configuration.

Purge Unit — A small independent condensing unit with compressor, separator, regenerative carbon filters, heater and vacuum pump. The purge extracts gas from condenser (or from compressor if unit is not in operation) and purifies it by removing non-condensable gases and any water vapor that may be present.

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.

Refrigerant Lubrication System — This system provides lubrication to the compressor bearing by means of a refrigerant pump.

Chiller Control Panel — This control panel includes the input and output boards (IOB), 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:

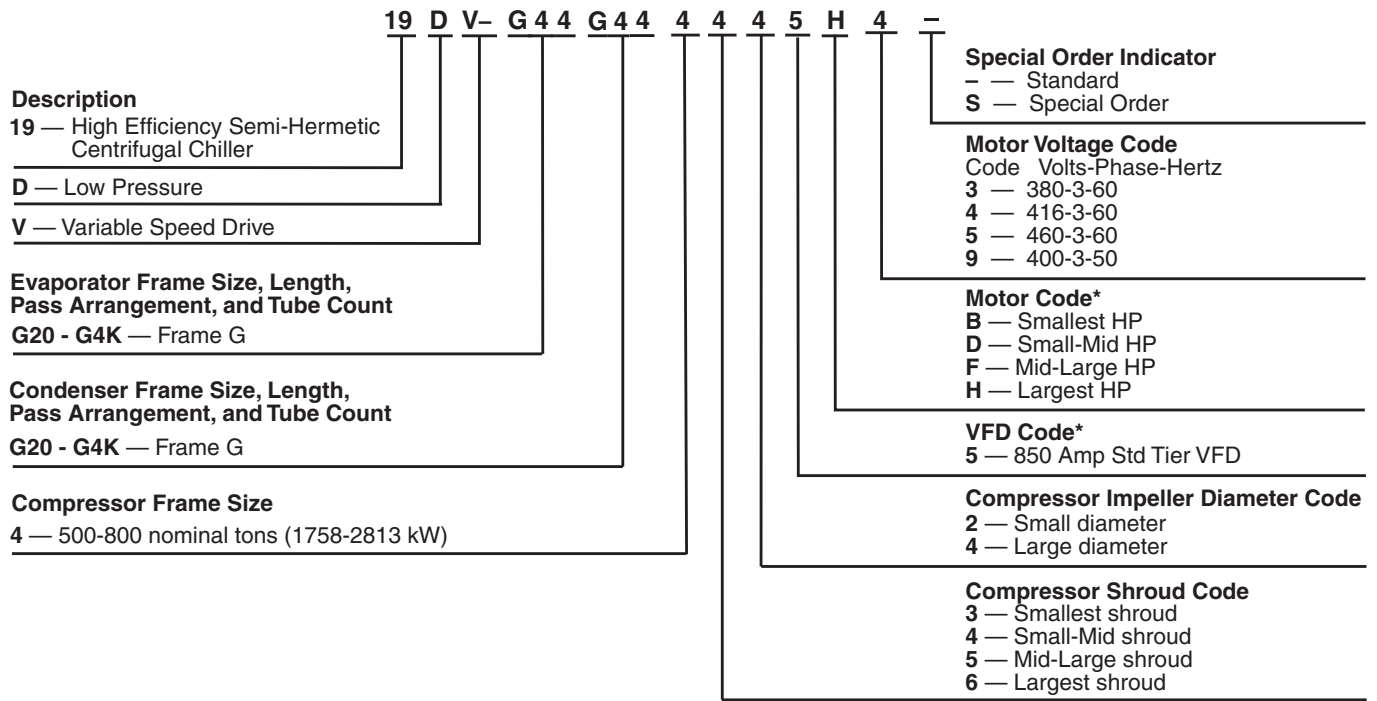
- Communication with PIC5 touch screen
- Communication with purge panel
- Communication with VFD
- Sensor input and outputs
- Actuators control
- Refrigerant pump control

Purge Control Panel — The purge panel includes the input and output boards, control transformer, relays, and fuse. It provides the power distribution and protection to the electrical components which installed in the purge system and has the following functions:

- Communication with PIC5 touch screen
- Sensor input and outputs
- Solenoid valve control
- Control of purge compressor, vacuum pump, heater, and fan.

PIC5 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 system



*Refer to 19DV NG E-Cat Builder for motor and VFD size details.

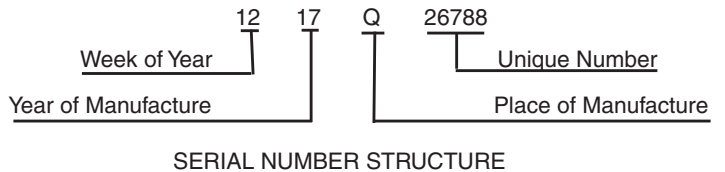


Fig. 1 — 19DV Chiller Model Number Identification

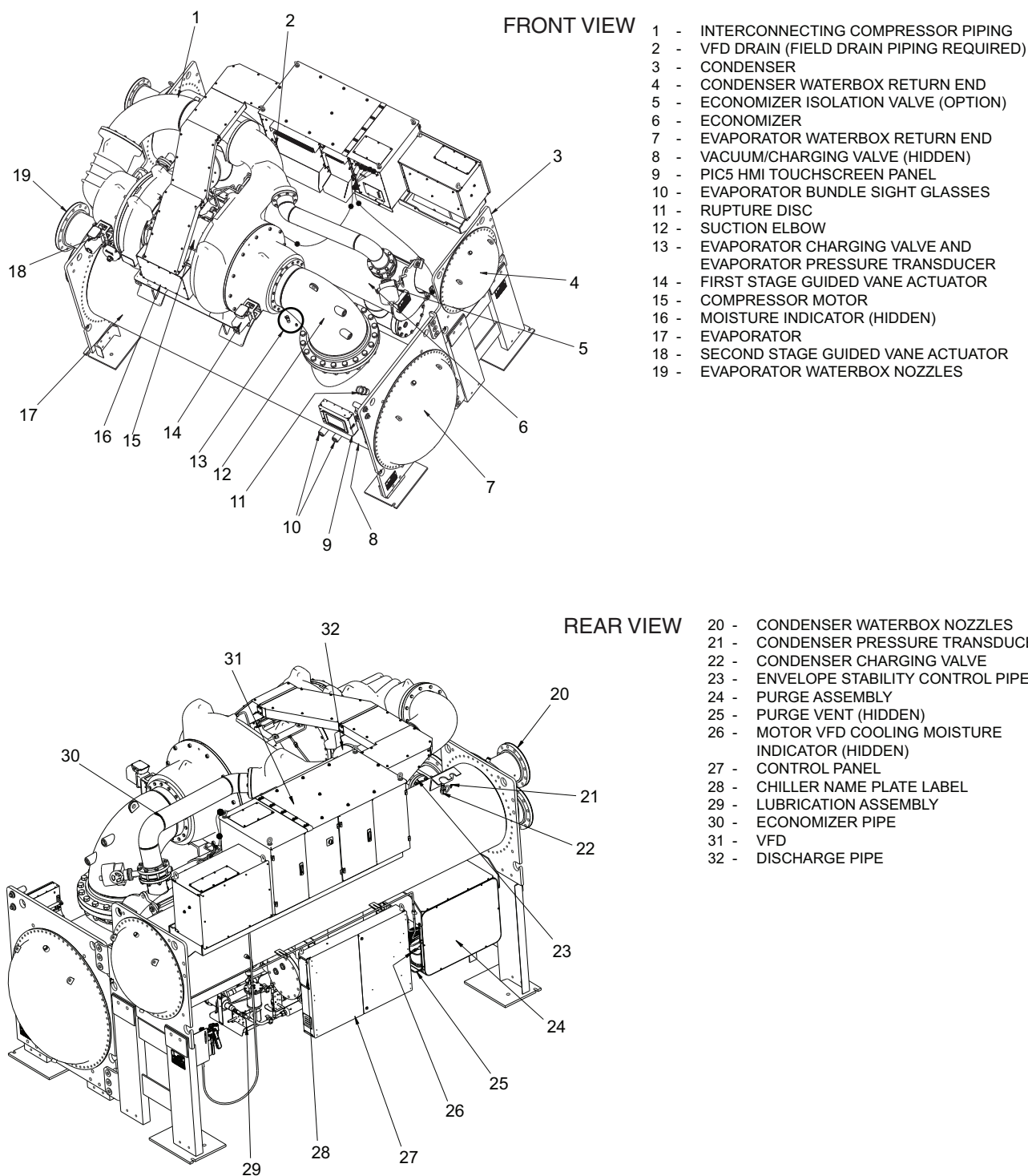


Fig. 2 — Typical 19DV 500-800 Ton Two-Stage Compressor Chiller Components (DV4 Shown)

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 into a high side float valve chamber between the condenser and the economizer. The refrigerant is then metered into the economizer. In the economizer, due to lower pressure, as liquid enters the

chamber, some liquid will flash into a vapor and cool the remaining liquid. The separated vapor flows to the second stage of the compressor for greater cycle efficiency. The second stage guide vane on the compressor acts as a pressure regulating device to stabilize operating conditions. At part load the second stage guide vane will back up gas flow and thereby raises the economizer pressure to allow appropriate refrigerant flow from economizer to the compressor.

The cooled liquid left in the economizer flows through a low side float valve and then into the evaporator. The float valve forms a liquid seal to keep vapor from entering the evaporator. The refrigerant is now at a temperature and pressure at which the cycle began. Fig. 3 summarizes the refrigeration cycle.

The 19DV unit utilizes R-1233zd(E) refrigerant. At atmospheric pressure its boiling point is 65.5°F (18.6°C). The result is that at normal operating conditions the evaporator typically will be in a vacuum condition and the condenser will operate at a pressure above atmospheric pressure. Unit near room temperature will be close to atmospheric pressure.

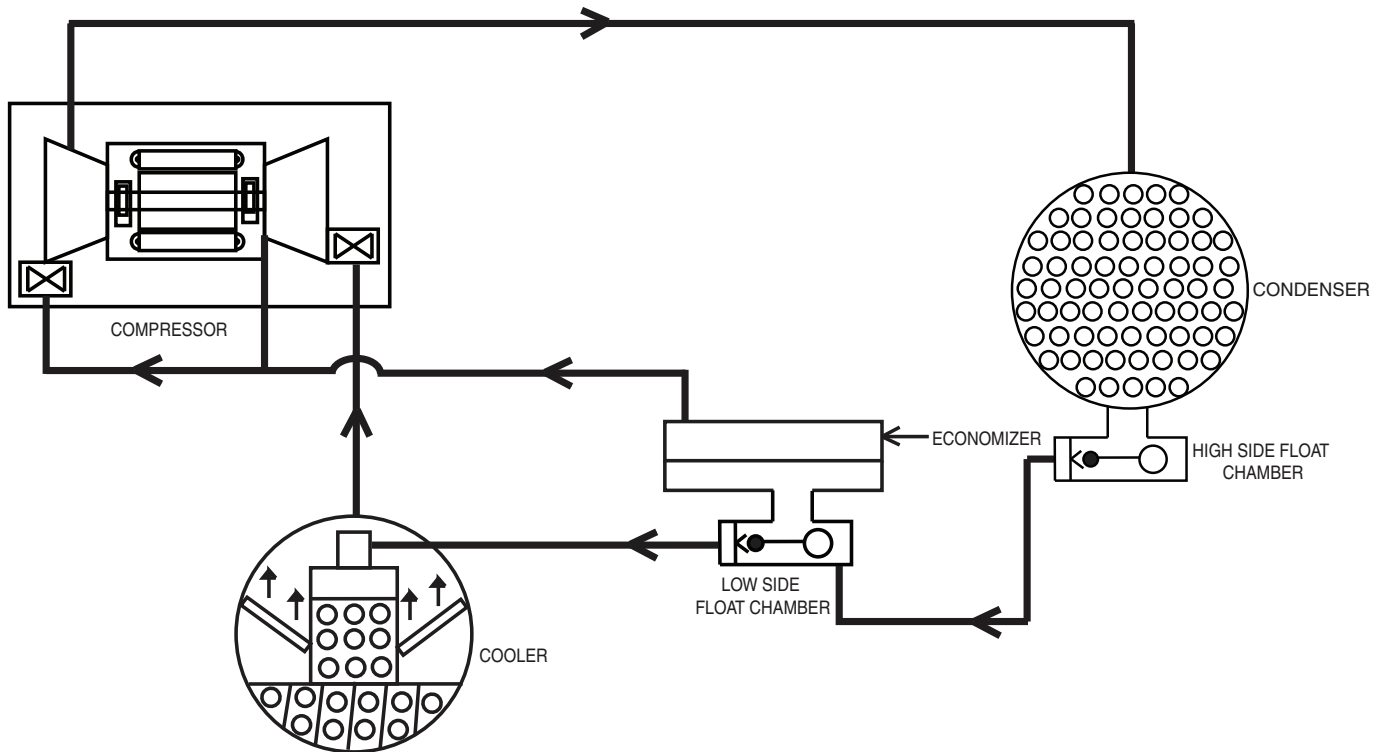


Fig. 3 — Refrigeration Cycle — 19DV Two-Stage Compressor

⚠ 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 cooler 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 and low lift options. 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).

REFRIGERANT LUBRICATION CYCLE

Summary — The 19DV Series chiller uses refrigerant to lubricate the bearings. The lubrication control is automatically controlled by the chiller controls. In normal RUN mode refrigerant is pumped by means of a refrigerant pump from the high side condenser float chamber to the bearings. Prior to

start-up liquid level in the high side condenser float chamber is maintained by pumping refrigerant liquid from the evaporator to the high side float chamber until level sensor is satisfied. If liquid high side float level is not satisfied the pump will move refrigerant from the evaporator to the condenser.

Figures 4 and 5 identify the refrigerant lubrication assembly. Supply refrigerant is pulled through a filter drier by the refrigerant pump and is pumped to the bearings through two protective filters and then returned to the evaporator.

There are two pressure sensors located across the refrigerant pump. During RUN mode a minimum of 12 psid is required for the refrigerant pump delta difference. An alert will trigger if this value is less than 13 psid while the machine is in normal operating mode. Consult the Controls Operation and Troubleshooting Manual for details.

Bearings — The 19DV motor-compressor assembly include two sets of purely refrigerant lubricated bearings. The motor shaft is supported by a combination set of journal bearing and roller element bearings on each end of compressor. The refrigerant lubrication pressure difference is defined as the bearing input pressure minus the bearing output pressure plus the Refrigerant Delta P Offset.

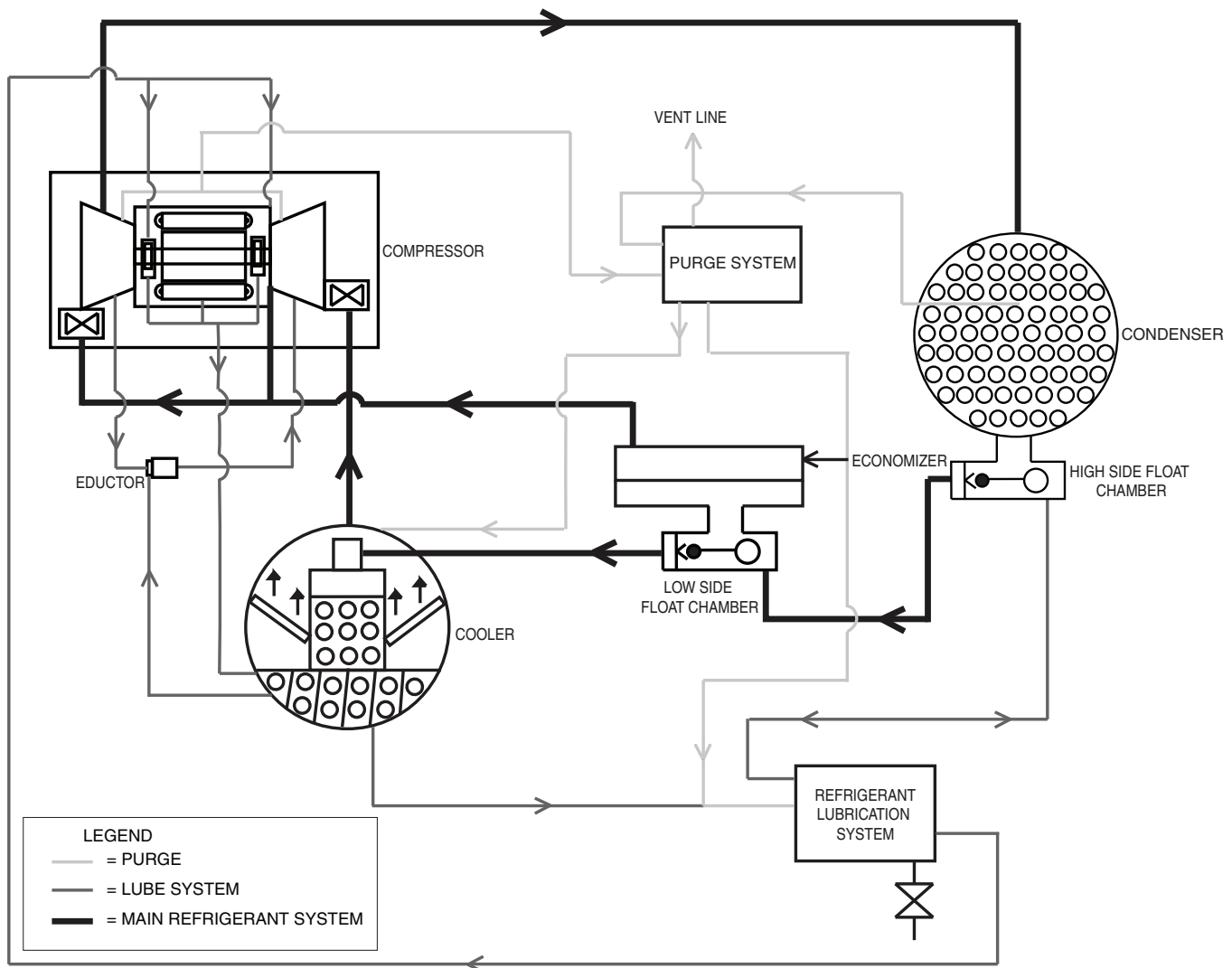


Fig. 4 — Refrigerant Lubrication Cycle

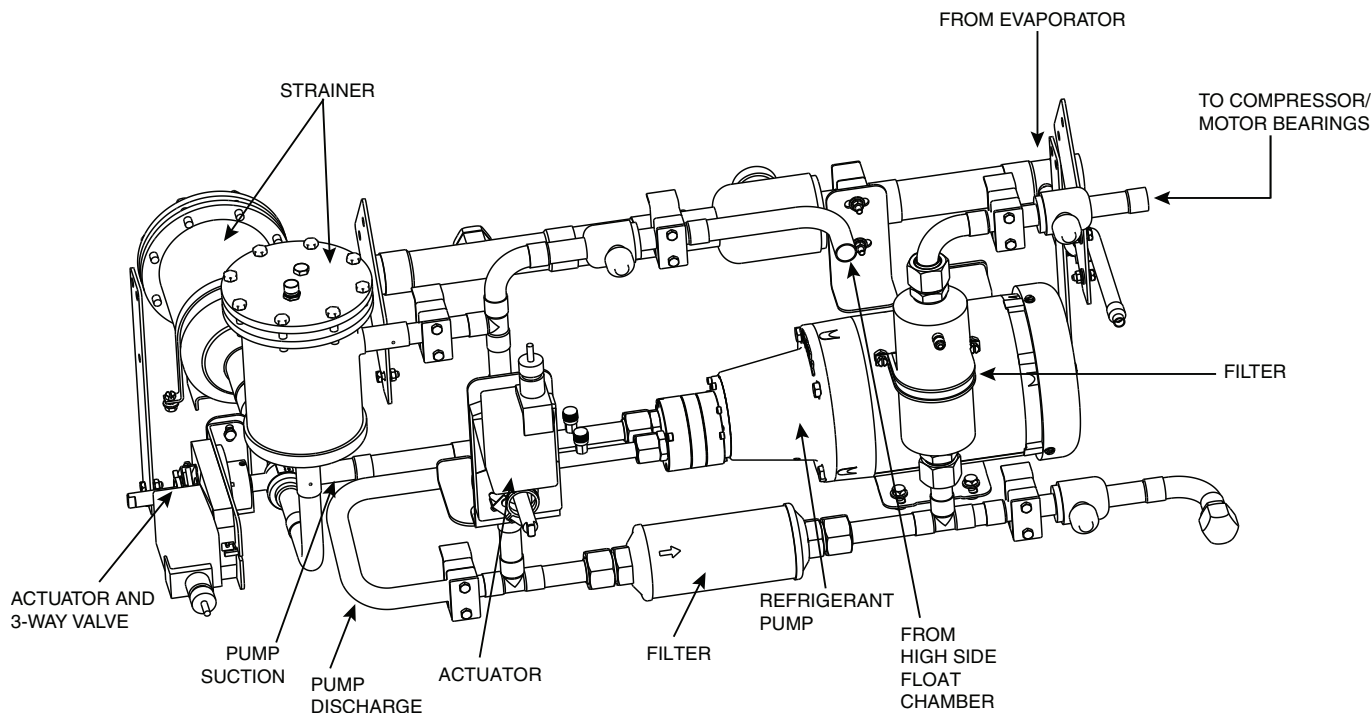


Fig. 5 — Refrigerant Lubrication Assembly

Inhibitor Reclaim System — The inhibitor reclaim system moves inhibitor from evaporator and returns it to the first stage suction inlet which allows it to be mixed in the system since it has a tendency to have higher concentration in the evaporator compared with the rest of the system. The reclaim is powered by an eductor driven by the gas pressure difference between first stage suction and discharge of second stage.

Motor Cooling System — The motor is cooled by liquid refrigerant taken from the bottom of the high side condenser float chamber. Refrigerant flow is maintained by the pressure differential that exists due to compressor operation. After the refrigerant flows past an isolation valve, an in-line filter drier, and a sight glass/moisture indicator, it is directed over the motor by spray nozzles. The refrigerant collects in the bottom of the motor casing and is then drained back into the cooler through the motor refrigerant drain line. The motor is protected by temperature thermistors embedded in the stator windings. An increase in motor winding temperature past the motor override set point overrides the temperature capacity control to hold, and if the motor temperature exceeds 10°F (5.5°C) above this set point, the controls close the inlet guide vanes. If the temperature rises above 122°F (50°C), the compressor shuts down. See Fig. 6.

VFD Cooling System — The VFD enclosure is sealed from the atmosphere to protect electronics from outside contaminants. Refrigerant is routed through a coil in the VFD enclosure to regulate enclosure temperature while still maintaining a temperature high enough to prevent condensation. VFD cooling line is branched off the motor cooling supply. The refrigerant is then drained back into the cooler through the motor/VFD drain line. Rectifier and inverter sections are air-cooled and protected by temperature sensors embedded in the inverter. An increase in inverter temperature past the override set point overrides the temperature capacity control to hold, and if the temperature exceeds 10°F (5.5°C) above this set point, the controls close the inlet guide vanes. If the temperature rises above 144°F (80°C), the compressor shuts down. See Fig. 6.

VFD — All 19DV units are equipped with a VFD to operate the centrifugal hermetic compressor motor. The VFD

and control panel are the main field wiring interfaces for the installing contractor. The VFD and control panel are mounted on the chiller. See Manufacturer VFD specific information and VFD schematics.

VFD model 32VS is designed to operate in an ambient range of up to 104°F (40°C). The drive has two circuit boards.

The Digital Control Interface Board (DCIB) controls the fans for cooling operation, IGBTs, measures three phase line current, controls temperature input and cooling solenoid, controls outputs for pilot relays, and controls SAIA communication.

The High Voltage Interface Board (HVIB) steps down incoming voltage to 24 VAC and sends this to the DCIB for monitoring. The HVIB measures DC Bus voltage, controls the pre-charge circuit, and controls SCR gating. It contains watchdog LED to confirm DC Bus potential is depleted.

Should the drive need to be removed the 4 lifting lugs should be utilized. See Fig. 7. 32VS 850A weight is approximately 1500 lbs. The drive is compatible with the Network Service Tool V (NSTV).

Purge System — The purge system is located under the condenser. See Fig. 8. It has two gas inlets coming from condenser and compressor. When chiller is running, the condenser line is active/open and non-condensable gas will pulled out from condenser and when chiller is idle the compressor line is active and non-condensables are pulled out from compressor volute. This is implemented due to non-condensable gas density being less than refrigerant and therefore it will accumulate at the highest point when chiller is not running.

In the purge tank the purge gas is cooled by a separate integral R-134a cooling system. The cooling system consists of an compressor, an air cooled condenser coil, an expansion valve, and a cooling coil in purge tank. Cooling the purge gas results in condensation of R-1233zd(E) vapor as it touches the coil resulting in a vacuum which the result that more refrigerant is pushed to the coil. As the purge tank fills up with refrigerant it will be drained through the purge drain to the refrigerant pump assembly. See Fig. 9.

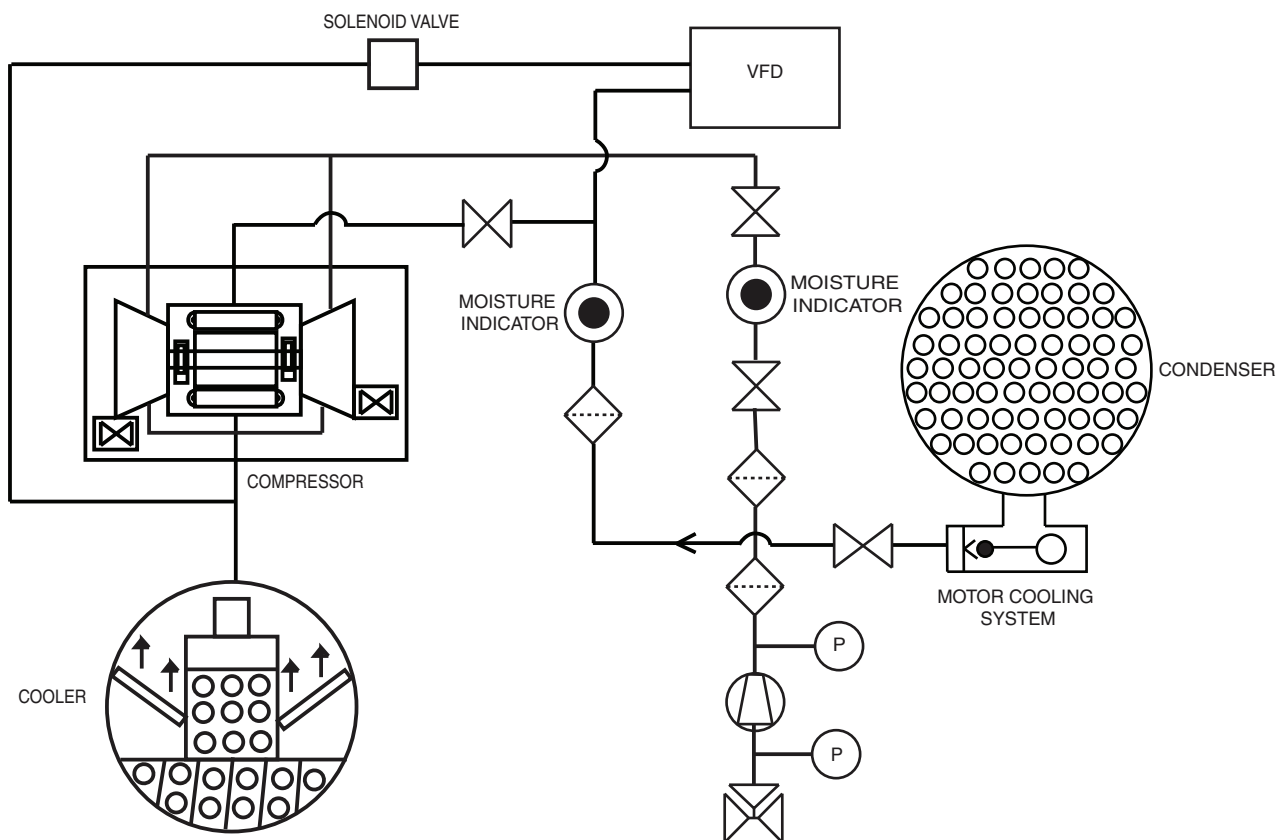


Fig. 6 — Motor/VFD Cooling System

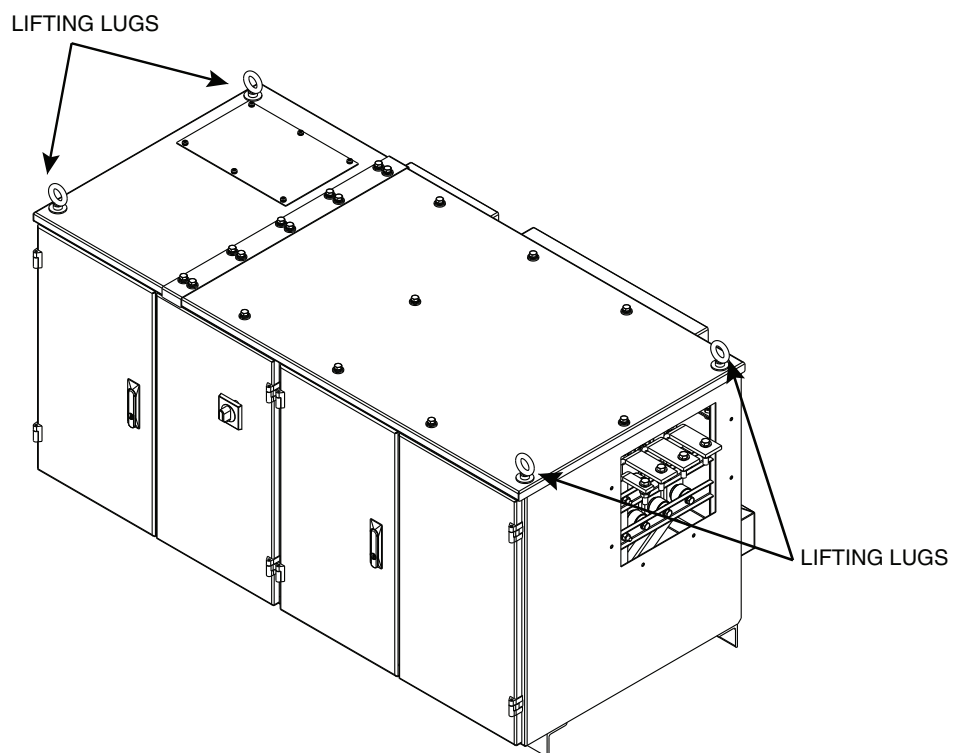


Fig. 7 — 32VS 850A

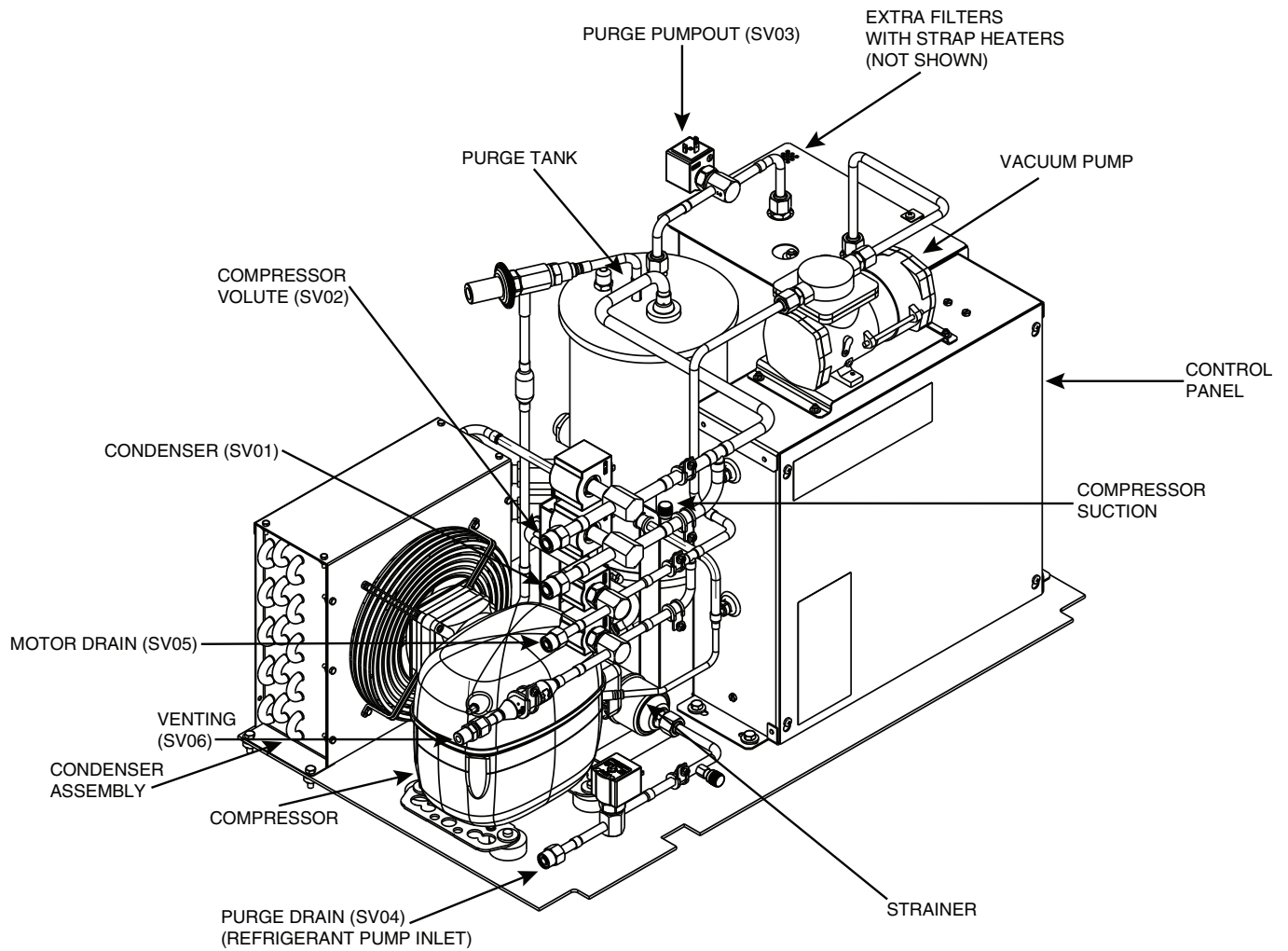


Fig. 8 — Purge System

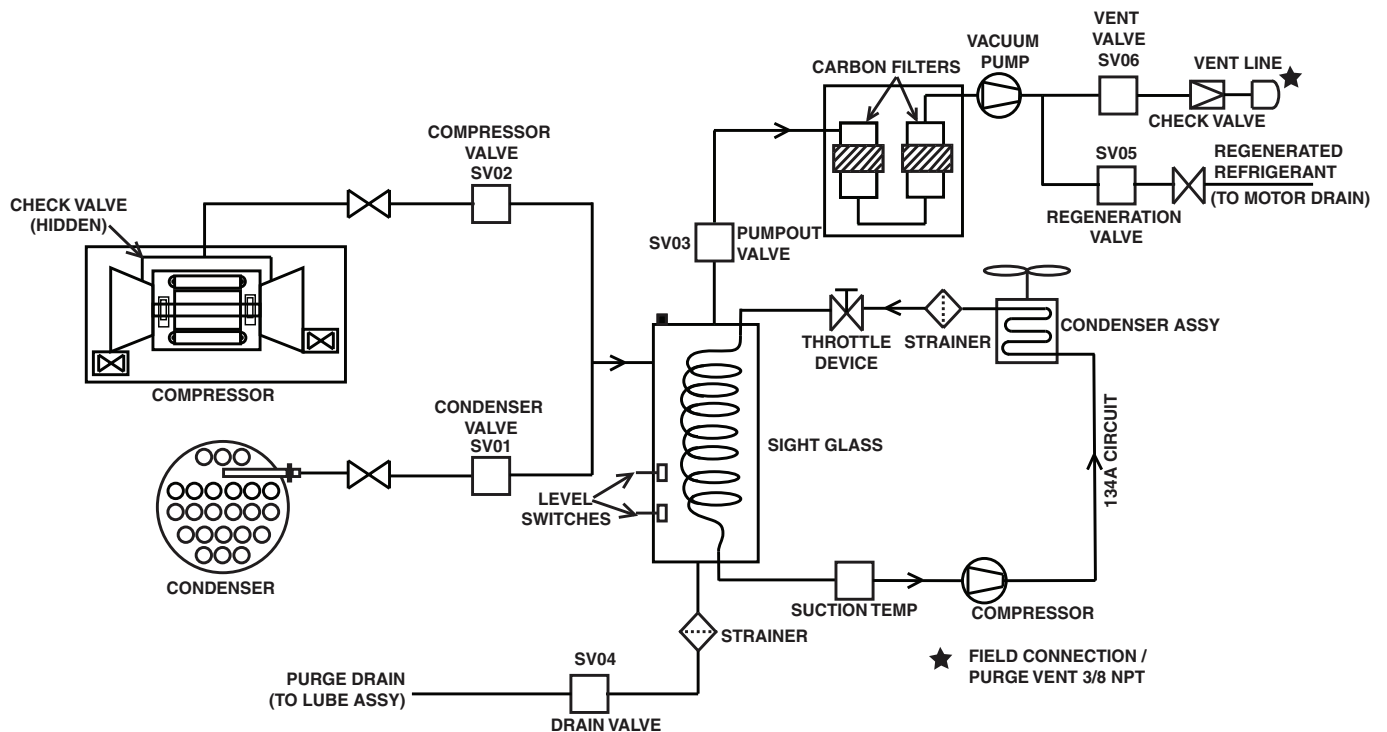


Fig. 9 — Purge Tank

Non-condensables that comes into contact with the cold coil in the purge tank will not condense and will accumulate at the top of the purge tank. When the controls sense that there is sufficient non-condensable gas in the purge tank, the control will open the pumpout valve, activate the purge evacuation pump, and force the gas through the active carbon filters. To capture any remaining refrigerant the gas is routed through two active carbon filters that will absorb any remaining refrigerant. As the carbon filters becomes saturated the system will regenerate the filters by applying heat to the filters while under vacuum and then disperse the regenerated refrigerant back to the cooler while releasing the non-condensables to atmosphere.

The 19DV purge control is automatic. Purge control should be active when purge inlet temperature (evaporator refrigerant liquid temp when chiller compressor OFF or condenser saturated temperature when chiller compressor ON) is greater than purge active temperature set point (65°F default [18.3°C]).

If chiller compressor is running, condenser solenoid valve should be opened to purge refrigerant from condenser.

If chiller compressor is not running, open the compressor solenoid valve to purge refrigerant from compressor. If Purge Comp Suction Temp is less than purge compressor off temp (default to 4°F [-15.5°C]) and the refrigerant level flag is ON, close compressor solenoid valve, condenser solenoid valve, and open pump out solenoid valve. Purge vent valve and purge vacuum pump shall be kept ON for about 10s. After 10s discharge, pump out solenoid valve, purge vent valve, and purge vacuum pump shall be kept OFF. Condenser solenoid valve shall be opened if chiller compressor is running or compressor solenoid valve shall be opened if chiller compressor is not running. After 10s discharge, it will start 20s delay. Then, check purge compressor suction temperature again; if it is less than 6°F (-14°C), it will continue cycle as before.

If refrigerant level in the purge tank is high (both PGLE_HI and PGLE_LO are ON), or purge compressor suction temperature is less than 12°F (-11°C) and PGLE_LO is ON, then drainage solenoid valve should be opened to drain refrigerant from purge tank to evaporator (open SV04, SV01, SV02 when chiller is off, open SV04, SV01 when chiller is on). After PGLE_LO is OFF, keep drain process for another 1s, then set the refrigerant level flag to ON. If purge level in the purge tank is low (both PGLE_HI and PGLE_LO are OFF), drainage solenoid valve should be closed.

If pump out solenoid valve is accumulated ON for 100 minutes, purge system should do regeneration process for reg_tim minutes (default = 120 minutes - 19DV Configuration Menu), regardless whether purge is active. When regeneration process active, the Purge Regeneration Valve and Purge Heater should be on for reg_tim minutes, purge vacuum pump should be on for 3 minutes and then 10 minutes off, alternating during reg_tim minutes.

Upon regeneration completion, purge system will wait for another 4 hours to let carbon filter cool down before it will operate normally.

 **WARNING**

The main circuit breaker (if equipped) on the front of the starter disconnects the main motor power only. Power may be still energized for other circuits. Always check wiring diagrams before initiating any work on the chiller and follow applicable lock-out/tag-out procedures. Failure to disconnect power will result in personal injury.

**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

CONTROLS

Definitions

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

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

General — The 19DV 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 deadband 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 cooler 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 shut-downs, if required. The variable frequency drive (VFD) allows compressor start-up and capacity control by modulating the motor frequency based on the operation condition.

PIC5 System Components — The chiller control system is called the PIC5 (Product Integrated Control 5). See Table 1. As with previous PIC versions, the PIC5 system controls the operation of the chiller by monitoring all operating conditions. The PIC5 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 pump providing compressor bearing lubrication and can interface with auxiliary equipment such as pumps and cooling tower fans to turn them on when required. It continually checks all safeties to prevent any unsafe operating condition. It regulates the envelope control valve for stabilized aerodynamic operation, if installed. The PIC5 controls offer an operator trending function to help the operator monitor the chiller status more easily and for critical compressor motor protection. The PIC5 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 PIC5 Components and Panel Locations

PIC5 COMPONENT	PANEL LOCATION
Variable Frequency Drive	Top of condenser
Purge Panel	Under condenser
Remote Monitoring	Control Panel

NOTE: For detailed information about the PIC 5 HMI (human machine interface), see the 19DV with PIC 5 Controls Operation and Troubleshooting manual.

HMI interface. See Fig. 10.

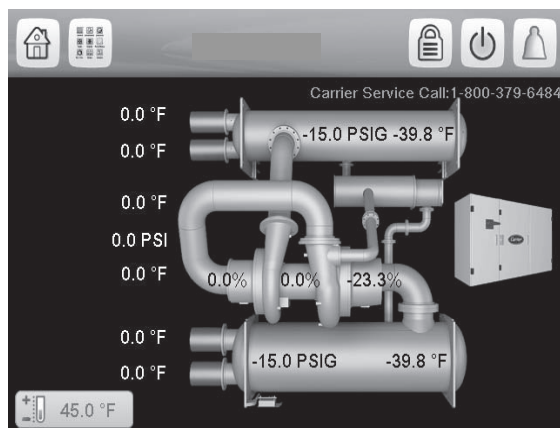


Fig. 10 — Chiller Start/Stop Icon

This initiates the PIC5 starting sequence by displaying the list of operating modes. Press Local On to initiate start-up. See Fig. 11.

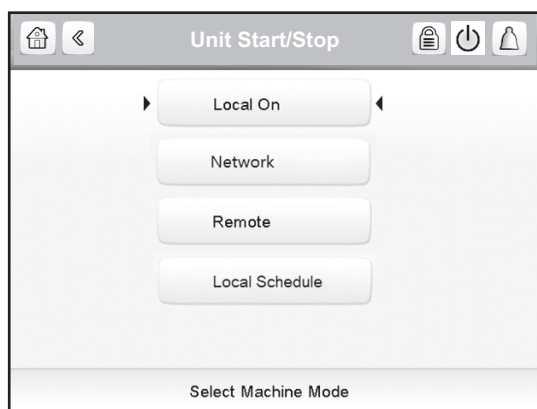


Fig. 11 — Local On

NOTE: 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.

Once local start-up begins, the PIC5 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 tests are successful, the start-up will be in progress and the COMPRESSOR RUN STATUS shall be “Startup.” The control shall then energize the chilled water/brine pump relay.

Five seconds later, the condenser pump relay energizes. Thirty seconds later the PIC5 control system monitors the chilled water and condenser water flow devices and waits until the *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 PIC5 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 PIC5 control system closes the vanes. If the vanes are closed and the refrigerant pump pressure difference is less than 2.5 psid (17.2 kPa), the refrigerant pump relay energizes. The PIC5 control system then waits until the refrigerant pressure (REF PRESS VERIFY TIME, operator-configured, default of 40 seconds) reaches 12 psid (82.7 kPa). After refrigerant pressure is verified, if high side float chamber has adequate liquid level refrigerant pump will be kept ON for 20 seconds for pre-lube; if not, refrigerant pump will be kept ON pumping refrigerant from evaporator to the high side float chamber until liquid level is satisfied. Upon pre-lube satisfied the compressor start relay is energized.

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 PIC5 control system aborting the start and displaying the applicable prestart alert alarm state number near the bottom of the home screen on the HMI panel. A prestart failure does not advance the *STARTS IN 12 HOURS* counter. Any failure after the ICR 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.

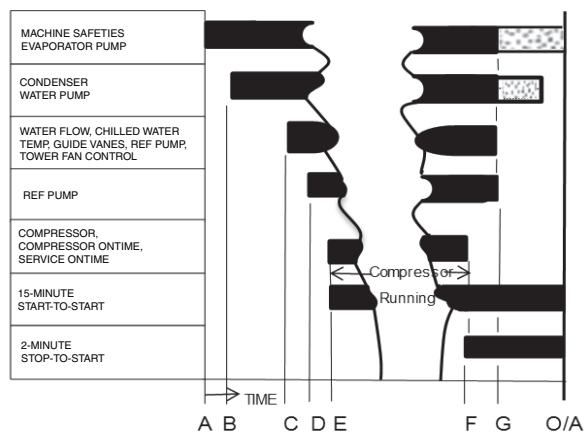
The minimum time to complete the entire prestart sequence is approximately 185 seconds. See Fig. 12 for normal start-up timing sequence. See Table 2 for a list of prestart checks.

Lubrication Control — For the 19DV system, refrigerant is used to lubricate and cool the compressor bearings. The refrigerant lubrication system includes refrigerant pump pressure transducers, control valves, filters, liquid level switch and inhibitor reclaim system. See Fig. 13 for the lube assembly schematic.

When the chiller is powered on, the controller will maintain liquid level in condenser float chamber. If liquid level is low, refrigerant will be pumped from cooler to condenser high side float chamber until the liquid level switch is ON. Once the operator pushes the start button, the system will go into prestart check process.

When Refrigerant Pump request is on for pre-lube and the bearing pressure difference is OK for start, if cooler temperature plus leaving condenser water temperature is less than 10°F (-12.2°C), pump refrigerant from Cooler to Condenser until compressor is ON. Else, if cooler temperature plus leaving condenser water is equal or larger than 10°F (-12.2°C), pump refrigerant from condenser to bearing and drain to condenser until compressor is ON.

During pre-lubrication, if the bearing pressure difference is less than 8 psid (55.2 kPa) for 8 seconds continuously, the chiller will shut down. To proceed to start-up, the bearing pressure difference needs to exceed 12 psid (82.7 kPa) during the pressure verification time. The compressor will run after the pre-lubrication process. Refrigerant from the high side condenser float chamber will be pumped to bearings and will drain to cooler. When chiller shuts down, the condenser control valve will be opened and the refrigerant evaporator control valve will open (3-way valve will connect evaporator to pump suction). This position allows refrigerant to be pumped from cooler to condenser high side float chamber. When the chiller is OFF, always open cooler control valve. During running, if compressor is ON and the bearing pressure difference is less than 10 psid (68.9 kPa) for 10 seconds continuously, the chiller will shut down.



A	START INITIATED: prestart checks are made; cooler pump started.*
B	Condenser water pump started (5 seconds after A).
C	Water flows verified (30 seconds to 5 minutes maximum after B). Chilled water temperatures checked against control point. Guide vanes checked for closure. Refrigerant pump started; tower fan control enabled.
D	Ref pressure verified (15 seconds minimum, 300 seconds maximum after C).
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	Refrigerant pump and cooler pumps de-energized (120 seconds after F). Condenser pump and tower fan control may continue to operate if condenser pressure is high. Cooler 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. 12 — Control Timing Sequence for Normal Start-Up

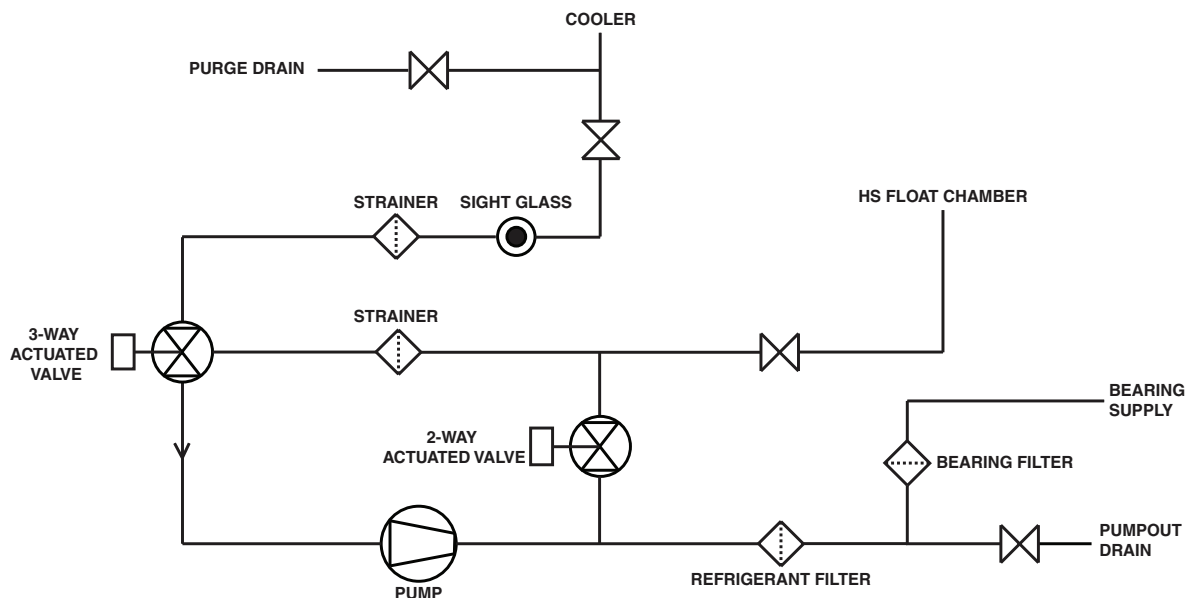


Fig. 13 — Lube Assembly Schematic

Table 2 — Prestart Checks

PRESTART CHECK CONDITION*	STATE NUMBER†
STARTS IN 12 HOURS ≥ 8 (not counting recycle restarts or auto restarts after power failure)	Alert – 100
COND PRESSURE $\geq$ COND PRESS OVERRIDE – 20 psi	Alert – 102
#RECYCLE RESTARTS LAST 4 HOURS > 5	Alert – 103
COMP BEARING TEMP $\geq$ COMP BEARING ALERT – 10°F (5.6°C)	Alarm – 230
COMP MOTOR WINDING TEMP $\geq$ COMP MOTOR WINDING – 10°F (5.6°C)	Alarm – 231
COMP DISCHARGE TEMPERATURE $\geq$ COMP DISCHARGE ALERT – 10°F (5.6°C)	Alarm – 232
EVAP_SAT $<$ Evap trip point** + EVAP OVERRIDE DELTA T	Alarm – 233
EVAP REFRIG LIQUID TEMP $<$ Evap trip point** + EVAP OVERRIDE DELTA T	Alarm – 233
AVERAGE LINE VOLTAGE $\leq$ UNDERVOLTAGE THRESHOLD††	Alarm – 234
AVERAGE LINE VOLTAGE $\geq$ OVERVOLTAGE THRESHOLD††	Alarm – 235
CHECK FOR GUIDE VANE 1 CALIBRATION	Alarm – 236
CHECK FOR GUIDE VANE 2 CALIBRATION	Alarm – 238

* 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.

** Evap trip point = 33°F (0.6°C) (water) or EVAP REFRIG TRIP-POINT (brine).

†† Condition ignored for Eaton/Rockwell VFDs.

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. 14).

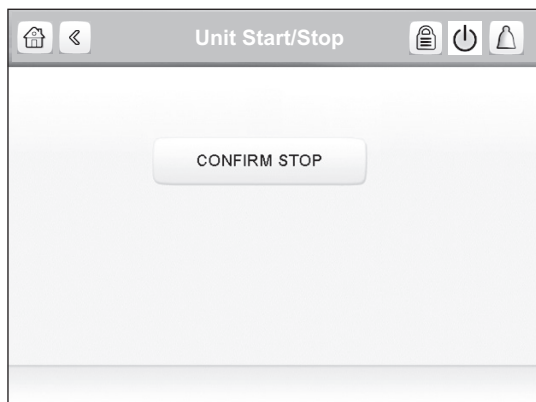


Fig. 14 — Confirm Stop

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, the refrigerant pump relay will be turned off after 120 seconds post lube, 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)
- chiller certified prints
- VFD details and wiring diagrams
- diagrams and instructions for special controls or options
- 19DV Installation Instructions

Equipment Required

- hose and container/injector tool with one end capable of connecting to 1/2-in. female NPT evaporator charging valve (for Carrier Inhibitor injection)
- 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 480 vac
- electronic leak detector

- absolute pressure manometer or electronic micron gage (see Fig. 15)
- drum charging valve (unless refrigerant bottles already have charging valves)
- charging hose



Fig. 15 — Digital Vacuum Gage

Remove Shipping Packaging — Remove any packaging material from the unit, VFD, and control panels.

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-rings) may include joints at some or all of the following:

- Waterbox covers
- Compressor first suction elbow flanges (at compressor and at the cooler)
- Compressor secondary suction flanges (at compressor and low side float chamber)
- Compressor discharge flange
- Cooler inlet line spacer (both sides)
- Envelope control flange (both sides of valve)
- ICP piping flange
- High and low side float chamber covers

See Tables 3 and 4 for bolt torque requirements.

Check Chiller Tightness — Figure 16 outlines the proper sequence and procedures for leak testing.

The 19DV chillers are shipped without the refrigerant charge. The chiller is shipped with a 15 psig (103 kPa) dry nitrogen-holding charge.

If the 15 psig factory nitrogen charge is present, then release pressure and proceed to pull a deep vacuum on the unit. Vacuum should be pulled through 1 1/2-in. female NPT located under bottom of first stage side of the evaporator. Upon completion of pulling the required vacuum the chiller can be charged with refrigerant. The 1/2-in. charging valve on top of the evaporator shell should be used for charging by lifting charge cylinder and gravity feed into the evaporator. The chiller should be charged with refrigerant. If the holding charge is not present, the chiller must be examined for leaks. To test for leaks add a small refrigerant holding charge to unit and pressurize with nitrogen up to 20 psig to determine and correct the origin of the leak. Use an electronic leak detector to check all flanges and solder joints after the chiller is pressurized. If the 15 psig factory nitrogen charge is present, then release pressure and proceed to pull a vacuum on the unit.

The chiller should be charged with refrigerant. 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. Any piping weights are to be separately supported.

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

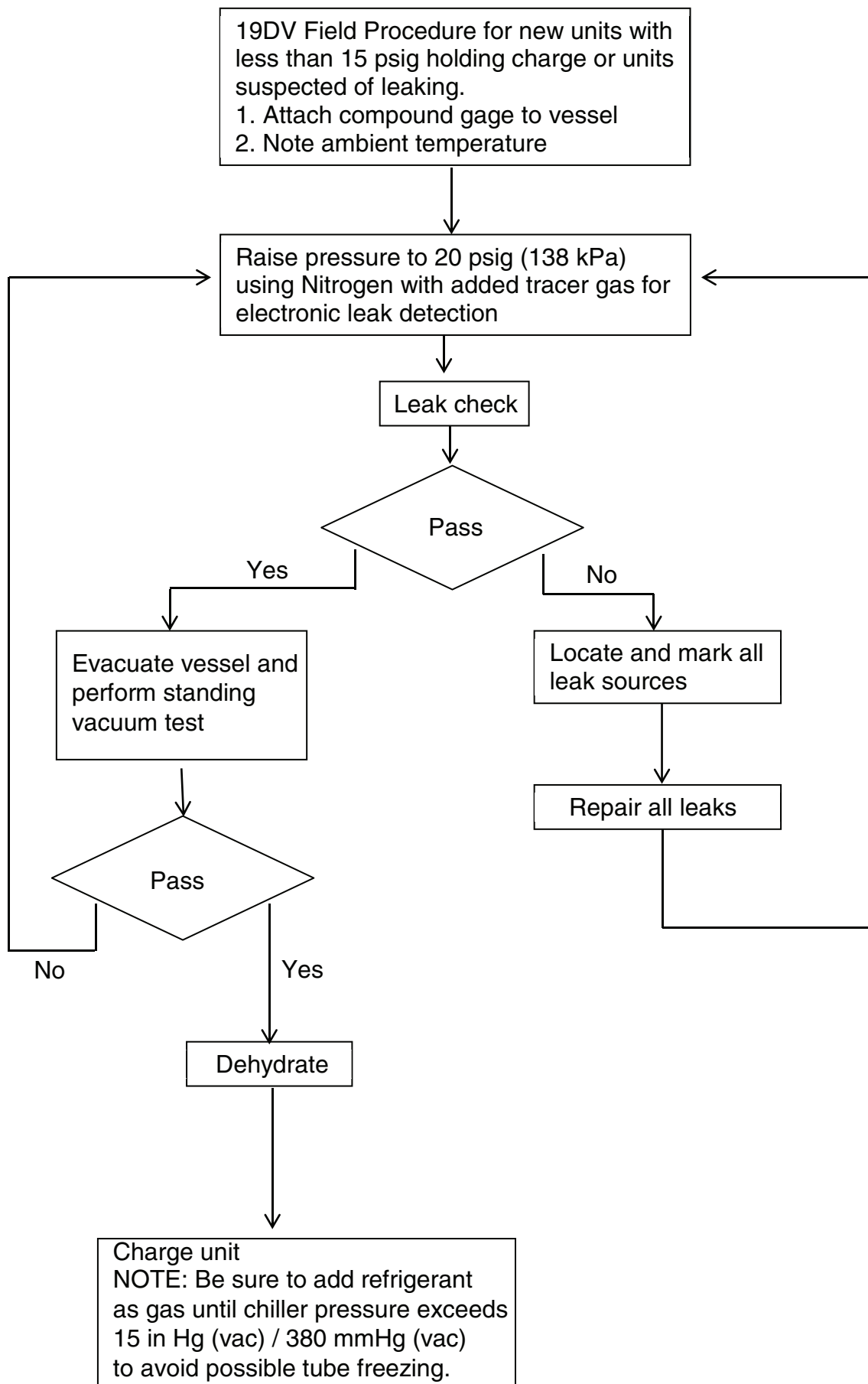


Fig. 16 — 19DV Leak Test Procedures

Refrigerant Tracer — Carrier recommends the use of an environmentally acceptable refrigerant tracer for leak testing with an electronic detector.

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

⚠ WARNING

Do not use air or oxygen as a means of pressurizing the chiller. Mixtures of HFO R-1233zd(E) and air at elevated pressure 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 Table 5 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 15 in. Hg (vac) / 380 mm Hg (vac) for HFO R-1233zd(E). Charge as a gas only, with the cooler and condenser pumps running, until this pressure is reached, using PUMPDOWN/LOCKOUT (located in the Maintenance menu) and END LOCKOUT mode on the PIC5 control interface. 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 9.
2. If the pressure readings are abnormal for the chiller condition:
 - a. Prepare to leak test chiller.
 - b. For cooling machines, check for leaks by connecting a nitrogen bottle with added tracer to allow for electronic leak detection if possible; otherwise, soap bubble solution is to be used. Raise the pressure to 20 psig (138 kPa). If electronic leak detector is available, ensure small amount of tracer material is added.
 - 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 (note suggested test pressure is 20 psig (138 kPa); maximum allowable test pressure 45 psig (310 kPa).

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 should be repaired. Local regulation governs the requirements for when repair of leaks become mandatory. Note the total chiller leak rate as well as the full charge amount 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. Recover any gas used for leak detection purposes as required per local jurisdiction.
6. If no leak is found after a retest:
 - a. Perform a standing vacuum test as outlined in the Standing Vacuum Test section, below.
 - b. If the chiller fails the standing vacuum test, repeat leak test and repair.
 - c. If the chiller passes the standing vacuum test, dehydrate the chiller. Follow the procedure in the Chiller Dehydration section, page 20. Charge the chiller with refrigerant.
7. 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 cooler and condenser water circuits to approximately 100°F (38°C) which corresponds to a pressure of approximately 14.40 psig (99.3 kPa).

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.

Table 5 — HFO R-1233zd(E) Pressure and Temperature

TEMP.		PRESSURE						
F	C	PSIA	PSIG	IN HG	KPAG	KPA ABS	MMHG (VAC)	% VACUUM
20.0	-6.7	5.16	-9.54	-19.4	-65.8	35.6	493.5	65
22.0	-5.6	5.43	-9.27	-18.9	-63.9	37.4	479.4	63
24.0	-4.4	5.72	-8.98	-18.3	-61.9	39.4	464.6	61
26.0	-3.3	6.01	-8.69	-17.7	-59.9	41.5	449.3	59
28.0	-2.2	6.32	-8.38	-17.1	-57.8	43.6	433.3	57
30.0	-1.1	6.64	-8.06	-16.4	-55.6	45.8	416.7	55
32.0	0.0	6.98	-7.72	-15.7	-53.2	48.1	399.3	53
34.0	1.1	7.33	-7.37	-15.0	-50.8	50.5	381.3	50
36.0	2.2	7.69	-7.01	-14.3	-48.3	53.0	362.6	48
38.0	3.3	8.06	-6.64	-13.5	-45.8	55.6	343.2	45
40.0	4.4	8.45	-6.25	-12.7	-43.1	58.3	323.0	42
42.0	5.6	8.86	-5.84	-11.9	-40.3	61.1	302.0	40
44.0	6.7	9.28	-5.42	-11.0	-37.4	64.0	280.2	37
46.0	7.8	9.72	-4.98	-10.1	-34.3	67.0	257.6	34
48.0	8.9	10.17	-4.53	-9.2	-31.2	70.1	234.2	31
50.0	10.0	10.64	-4.06	-8.3	-28.0	73.4	209.9	28
52.0	11.1	11.13	-3.57	-7.3	-24.6	76.7	184.8	24
54.0	12.2	11.63	-3.07	-6.2	-21.2	80.2	158.7	21
56.0	13.3	12.15	-2.55	-5.2	-17.6	83.8	131.7	17
58.0	14.4	12.69	-2.01	-4.1	-13.8	87.5	103.8	14
60.0	15.6	13.25	-1.45	-2.9	-10.0	91.4	74.9	10
62.0	16.7	13.83	-0.87	-1.8	-6.0	95.4	45.0	6
64.0	17.8	14.43	-0.27	-0.6	-1.9	99.5	14.0	2
66.0	18.9	15.05	0.35	0.7	2.4	103.7	—	—
68.0	20.0	15.69	0.99	2.0	6.8	108.1	—	—
70.0	21.1	16.34	1.64	3.3	11.3	112.7	—	—
72.0	22.2	17.03	2.33	4.7	16.0	117.4	—	—
74.0	23.3	17.73	3.03	6.2	20.9	122.2	—	—
76.0	24.4	18.46	3.76	7.6	25.9	127.2	—	—
78.0	25.6	19.20	4.50	9.2	31.1	132.4	—	—
80.0	26.7	19.98	5.28	10.7	36.4	137.7	—	—
82.0	27.8	20.77	6.07	12.4	41.9	143.2	—	—
84.0	28.9	21.59	6.89	14.0	47.5	148.9	—	—
86.0	30.0	22.44	7.74	15.8	53.4	154.7	—	—
88.0	31.1	23.31	8.61	17.5	59.4	160.7	—	—
90.0	32.2	24.21	9.51	19.4	65.6	166.9	—	—
92.0	33.3	25.13	10.43	21.2	71.9	173.3	—	—
94.0	34.4	26.08	11.38	23.2	78.5	179.8	—	—
96.0	35.6	27.06	12.36	25.2	85.2	186.6	—	—
98.0	36.7	28.07	13.37	27.2	92.2	193.5	—	—
100.0	37.8	29.10	14.40	29.3	99.3	200.7	—	—
102.0	38.9	30.17	15.47	31.5	106.7	208.0	—	—
104.0	40.0	31.26	16.56	33.7	114.2	215.5	—	—
106.0	41.1	32.39	17.69	36.0	122.0	223.3	—	—
108.0	42.2	33.54	18.84	38.4	129.9	231.3	—	—
110.0	43.3	34.73	20.03	40.8	138.1	239.5	—	—
112.0	44.4	35.95	21.25	43.3	146.5	247.9	—	—
114.0	45.6	37.20	22.50	45.8	155.1	256.5	—	—
116.0	46.7	38.48	23.78	48.4	164.0	265.3	—	—
118.0	47.8	39.80	25.10	51.1	173.1	274.4	—	—
120.0	48.9	41.16	26.46	53.9	182.4	283.8	—	—
122.0	50.0	42.54	27.84	56.7	192.0	293.3	—	—
124.0	51.1	43.97	29.27	59.6	201.8	303.1	—	—
126.0	52.2	45.42	30.72	62.6	211.8	313.2	—	—
128.0	53.3	46.92	32.22	65.6	222.1	323.5	—	—
130.0	54.4	48.45	33.75	68.7	232.7	334.1	—	—

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

⚠ CAUTION

Do not start or megohm-test the compressor motor 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 starter 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. 17) 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.

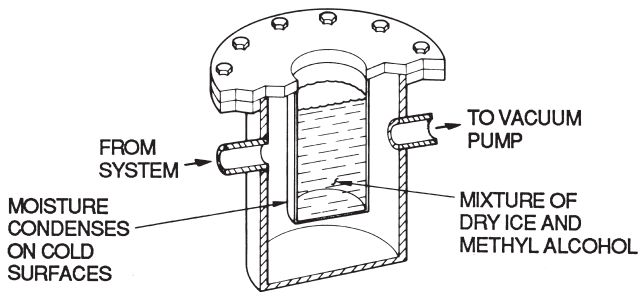


Fig. 17 — Dehydration Cold Trap

Perform dehydration as follows:

1. Connect a high capacity vacuum pump (5 cfm [.002 m³/s] or larger is recommended) to the refrigerant vacuum/charging valve (Fig. 2). Tubing from the pump to the chiller should be as short in length with a minimum diameter of 0.5 in. (13 mm) and as large in diameter as possible to provide least resistance to gas flow.
2. Use an absolute pressure manometer or a electronic micron gage to measure the vacuum. Open the shutoff valve to the vacuum indicator only when taking a reading. Leave the valve open for 3 minutes to allow the indicator vacuum to equalize with the chiller vacuum.
3. If the entire chiller is to be dehydrated, open all isolation valves (if present).
4. With the chiller ambient temperature at 60°F (15.6°C) or higher, operate the vacuum pump until the manometer reads 29.8 in. Hg (vac), -14.63 psig (-100.9 kPag), or a vacuum indicator reads 35°F (1.7°C). Operate the pump an additional 2 hours.

Do not apply a greater vacuum than 29.82 in. Hg vac (757.4 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.

5. Valve off the vacuum pump, stop the pump, and record the instrument reading.
6. 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.
7. If the reading continues to change after several attempts, perform a leak test (maximum 45 psig [310 kPa] pressure). Locate and repair the leak, and repeat dehydration.
8. 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 19DV Installation Instructions manual. Inspect the piping to the cooler and condenser. Be sure that the flow directions are correct and that all piping specifications have been met.

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

⚠ CAUTION

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

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 19DV relief devices are set to relieve at 57 psig (393 kPa) chiller design pressure. To avoid potential rupture the chiller should never be pressurized above 45 psig (310 kPa) for any testing purpose.

Inspect Wiring

⚠ WARNING

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

⚠ CAUTION

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

1. Examine the wiring for conformance to the job wiring diagrams and all applicable electrical codes.
2. Compare the ampere rating on the VFD nameplate to rating on the compressor nameplate.
3. Check and record voltage across power wires to the VFD; measure phase to phase and phase to ground. Validate against VFD nameplate.
4. Ensure that VFDs are protected by fused disconnects or circuit breakers as per electrical code.

5. Ensure all electrical equipment and controls are properly grounded in accordance with job drawings, certified drawings, and all applicable electrical codes.
6. 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. Carrier must maintain pump control for freeze protection algorithm.
7. For machines that are being serviced (not required for new startups supplied by factory), test the chiller compressor motor and its power lead insulation resistance with an insulation tester such as a megohmmeter. (Use a tester rated for motor voltage.)

⚠ CAUTION

Disconnect leads to VFD prior to megohm test. The voltage generated from the tester can damage VFD components.

- 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 on a field-installed starter 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.

Check Purge Compressor Operation — Enter Quick Test menu (under Main Menu), select "Quick Test Purge Comp." Connect a pressure gage to purge compressor inlet Schrader valve (suction is top fitting). The purge system is shown in Fig. 18. The reading should be about 0 to 0.5 psig (0 to 3.5 kPa). If not, please adjust the purge expansion valve in the R-134a purge compressor circuit until the reading is correct.

NOTE: This step should only be performed if the purge is not working correctly. The installation of the gage will result in a loss of refrigerant and the charge of R-134a is a very small quantity affecting the operation of the purge. The charge should be weighed into this circuit using a charging cylinder or similar device.

NOTE: CLOCKWISE ROTATION OF EXPANSION VALVE ADJUSTMENT SCREW INCREASES THE PRESSURE SETTING AND COUNTERCLOCKWISE ROTATION DECREASES PRESSURE SETTING.

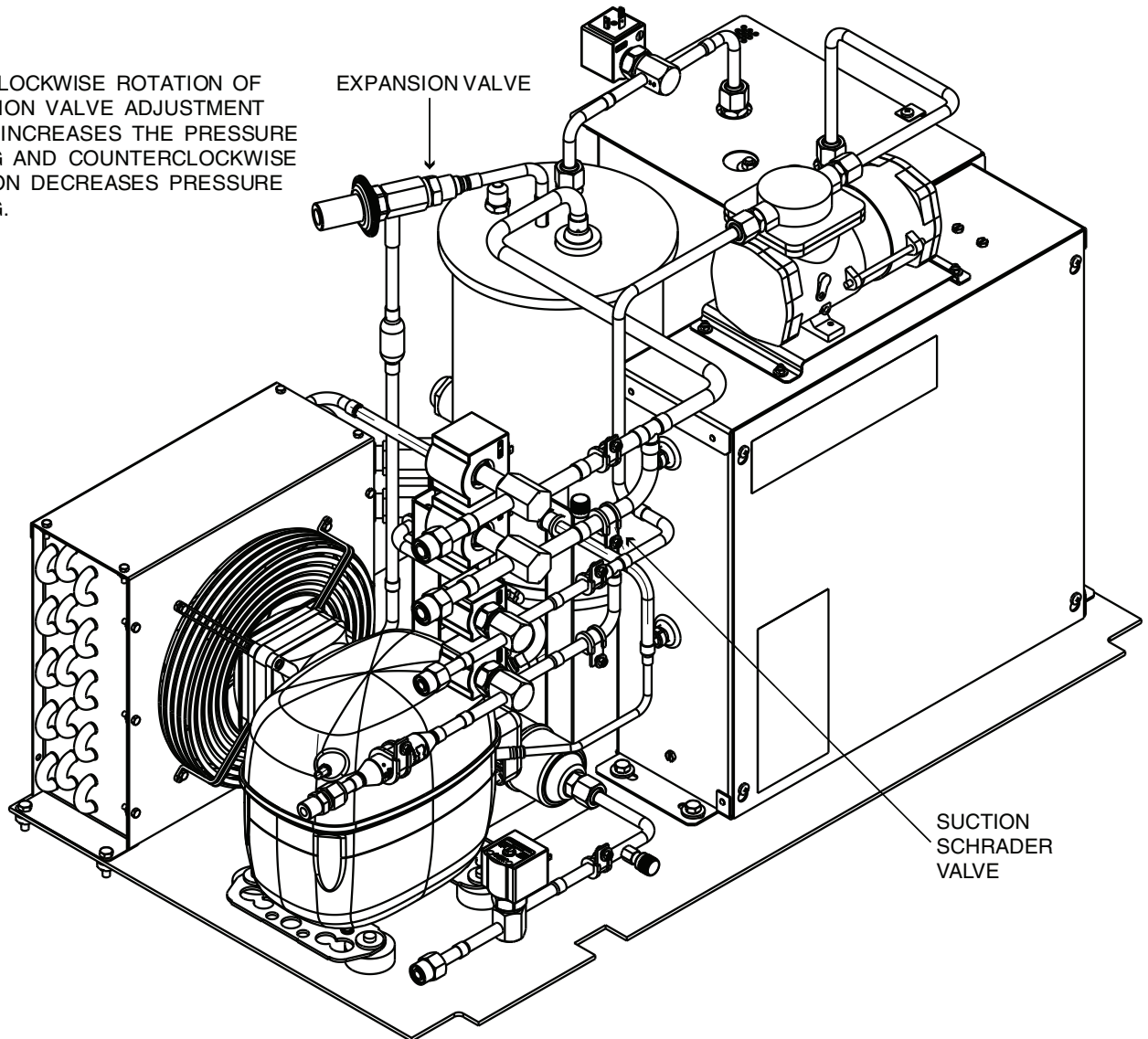


Fig. 18 — Purge System

Checking the Installation — Use the following instructions to verify the condition of the installation:

1. Turn off, lock out, and tag the input power to the drive.
2. Wait a minimum of 5 minutes for the DC bus to discharge.
3. All wiring should be installed in conformance with the applicable local, national, and international codes (e.g., NEC/CEC).
4. Remove any debris, such as metal shavings from the enclosure.
5. Check that there is adequate clearance around the machine.
6. Verify that the wiring to the terminal strip and the power terminals is correct and that no external voltage potential are connected to any of the inputs.
7. Verify that all of the VFD power module circuit board connectors are fully engaged and taped in place.
8. Check that the wire size is within terminal specifications and that the wires are tightened properly and adequately supported.
9. Check that specified branch circuit protection is installed and correctly rated.
10. Check that the incoming power is within $\pm 10\%$ of chiller nameplate voltage.
11. Verify that a properly sized ground wire 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.

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.

1. Examine the wiring for conformance to the job wiring diagrams and all applicable electrical codes.
2. Connect a voltmeter across the power wires to the VFD and measure the phase to phase and phase to ground voltage. The voltage imbalance for these two measurements should be consistent. If not, confirm the power supply to the chiller is a wye configuration with solidly grounded neutral. Compare this reading to the voltage rating on the compressor and VFD nameplates.
3. Compare the ampere rating on the VFD enclosure nameplate to the rating on the compressor nameplate.
4. The VFD must be wired to components and terminals required for PIC5 refrigeration control. Check line side power and control components shown on the certified prints.
5. Ensure that fused disconnects or circuit breakers have been supplied to the VFD.
6. Ensure all electrical equipment and controls are properly grounded in accordance with the job drawings, certified drawings, and all applicable electrical codes.

7. 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 19DV unit must maintain pump control through the IOBs/Carrier Control Panel for freeze prevention algorithm.
8. Verify tightness of all wiring connections on the high and low voltage terminal blocks in the VFD enclosure.
9. 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.

WARNING

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

VFD PROTECTION AND OTHER INCOMING WIRING

1. Verify that the branch disconnects or other local disconnects are open and properly tagged out.
2. Verify that the branch circuit protection and AC input wiring to the starter are in accordance with NEC (National Electrical Code) and all other applicable local codes.
3. Verify that the fuses are per the field wiring diagram.
4. Verify that the incoming source does not exceed the SCCR (short circuit current rating) of the equipment marking.
5. Verify the power lugs in the starter/VFD and branch protection are properly secured. Inspect the ground cable and ensure it is properly connected at the branch and to the ground lug in the starter.
6. Verify the conduit for the power wiring is securely connected to the starter flanged cover and runs continuously to the branch protection.
7. Ensure the control and signal wires are in separate conduits from any power wiring greater than 24v.

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 lock-out/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. With the tester connected to the motor leads, take 10-second and 60-second megohm readings as follows:
Tie terminals 1, 2, and 3 together and test between the group and ground.
3. 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.

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, Teflon¹, or polyethylene. An aluminum/polyester 100% foil shield and an outer jacket of PVC, PVC/nylon, chrome vinyl, or Teflon with a minimum operating temperature range of -4°F to 140°F (-20°C to 60°C) is required. See Table 6 for cables that meet the requirements.

Table 6 — 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 7 is recommended.

Table 7 — Recommended Color Code

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

⚠ 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.

1. Teflon is a registered trademark of DuPont.

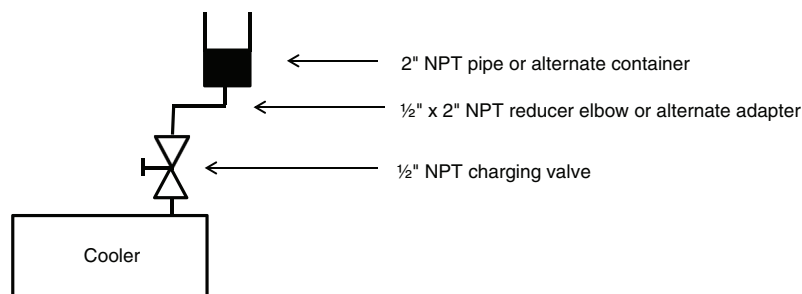


Fig. 19 — Inhibitor Addition

⚠ 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.

Inhibitor Charge — The inhibitor charge is included with the 19DV unit supplied by the factory. See Fig. 19 for field inhibitor addition assuming compressor running and negative cooler pressure. The factory pulls a vacuum then closes the three (3) ball valves on the lubrication assembly as shown in Fig. 20. An inhibitor charge is then injected using one of the off-center Schrader valves on the cover of the strainer assembly. A yellow tag is located at each ball valve indicating NOT to open the valves until the unit has been charged with refrigerant to avoid inadvertently pulling the inhibitor out of the refrigerant system. A dose of Carrier inhibitor is supplied in the lubrication assembly by the factory. An additional dose is to be added in the field as part of chiller commissioning.

Suggested Procedure:

1. Locate inhibitor bottles strapped to the lube assembly by the factory (total supplied inhibitor quantity will be approximately 1 US Qt/1.0 L).
2. Ensure availability of appropriate PPE such as protective gloves/protective clothing/eye protection/face protection and wash thoroughly after handling.
3. After refrigerant has been added and the inhibitor factory charge has been allowed to mix with the refrigerant add the factory-supplied inhibitor through the evaporator refrigerant charging valve. The evaporator will be in a vacuum when unit is running so the inhibitor charge will be sucked in. See Fig. 19.
4. Refrigerant charge hose can be used for inhibitor charging purposes or a hard pipe creating a funnel using a 90 degree 2-in. x 1/2-in. NPT female elbow reducer along with a 2-in. NPT pipe to create a reservoir (add inhibitor as it is being sucked into the cooler and close 1/2-in. charging ball valve prior to air being sucked into chiller). Ensure that parts used to add inhibitor are clean to avoid any chiller contamination.

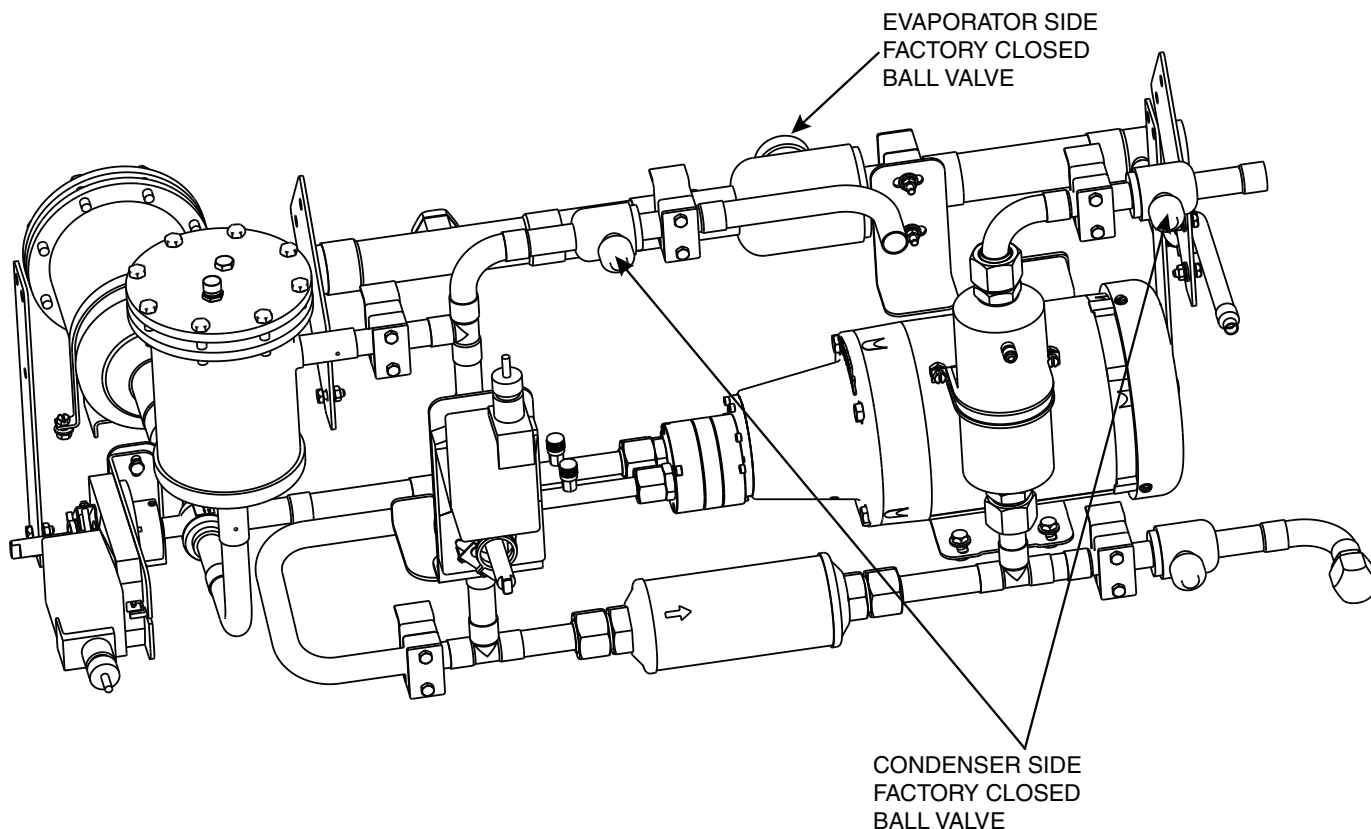


Fig. 20 — Factory Inhibitor Charge Isolation

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 19DV with PIC5 Controls Operation and Troubleshooting manual for instructions on using the PIC5 interface to configure the 19DV 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.

Charge Unit with Refrigerant

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

⚠ CAUTION

Always operate the condenser and chilled water pumps whenever charging, transferring, or removing refrigerant from the chiller. Always confirm that water flow is established. Failure to follow this procedure may result in equipment damage.

⚠ CAUTION

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

⚠ CAUTION

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

⚠ WARNING

Always charge refrigerant gas into unit until pressure exceeds water freeze temperature using PUMPDOWN/ LOCKOUT (located in the Maintenance menu) and TERMINATE LOCKOUT mode on the PIC5. Cooler and condenser water pumps must be running to prevent tube freezing.

For R-1233zd(E) water freeze point is exceeded at -15 in. Hg (-51 kPa).

All 19DV units are field charged. Charge the unit from refrigerant cylinders. Use Table 8 to find expected approximate charge by adding cooler and condenser charge together. Refer to unit nameplate and E-Cat output for certified values.

Prior to charging ensure the following:

- Standing vacuum test completed
- Only initiate refrigerant charging into a deep vacuum
- Adequate refrigerant supply is available as per unit nameplate.

With water pumps running, connect charging hose from refrigerant cylinder to chiller cooler charging valve. Start with charging gas until the pressure is greater than the above saturation pressure temperature to avoid refrigerant flashing and potential tube freezing. Once required pressure is reached switch

over to charge liquid by either lifting refrigerant cylinder above charging valve to allow for gravity feed or if charge isolated in storage tank using pumpout equipment suited for low pressure refrigerant.

After the machine has been started, adjust charge for optimum machine performance. Operate the chiller at design load and then add or remove refrigerant slowly until the difference between the leaving chilled water temperature and the cooler refrigerant temperature reaches design conditions or becomes a minimum. Do not overcharge.

Use the cooler sight glass (see Fig. 21) to determine the correct refrigerant at all times. During steady state operation at full load, the boiling pool tubes under compressor suction should be covered with liquid refrigerant. There is no benefit to a refrigerant liquid level higher than the tubes.

Table 8 — Refrigerant Charge

COMPRESSOR FRAME SIZE	CONDENSER HX DESIGNATION	EVAPORATOR HX DESIGNATION	R-1233ZD(E) CHARGE (±25 LBS [11 KG])
DV4	G22, G27, G2C, G2H	G20, G21, G22, G23, G24, G25, G26, G27, G28, G29, G2A, G2B, G2C, G2D, G2E, G2F, G2G, G2H, G2J, G2K	1455 lbs/660 Kg
	G23, G28, G2D, G2J	G20, G21, G22, G23, G24, G25, G26, G27, G28, G29, G2A, G2B, G2C, G2D, G2E, G2F, G2G, G2H, G2J, G2K	1447 lbs/656 Kg
	G24, G29	G20, G21, G22, G23, G24, G25, G26, G27, G28, G29, G2A, G2B, G2C, G2D, G2E, G2F, G2G, G2H, G2J, G2K	1444 lbs/655 Kg
	G2E, G2K	G20, G21, G22, G23, G24, G25, G26, G27, G28, G29, G2A, G2B, G2C, G2D, G2E, G2F, G2G, G2H, G2J, G2K	1439 lbs/653 Kg
	G42, G47, G4C, G4H	G40, G41, G42, G43, G44, G45, G46, G47, G48, G49, G4A, G4B, G4C, G4D, G4E, G4F, G4G, G4H, G4J, G4K	1650 lbs/748 Kg
	G43, G48, G4D, G4J	G40, G41, G42, G43, G44, G45, G46, G47, G48, G49, G4A, G4B, G4C, G4D, G4E, G4F, G4G, G4H, G4J, G4K	1640 lbs/744 Kg
	G44, G49	G40, G41, G42, G43, G44, G45, G46, G47, G48, G49, G4A, G4B, G4C, G4D, G4E, G4F, G4G, G4H, G4J, G4K	1637 lbs/743 Kg
	G4E, G4K	G40, G41, G42, G43, G44, G45, G46, G47, G48, G49, G4A, G4B, G4C, G4D, G4E, G4F, G4G, G4H, G4J, G4K	1631 lbs/740 Kg

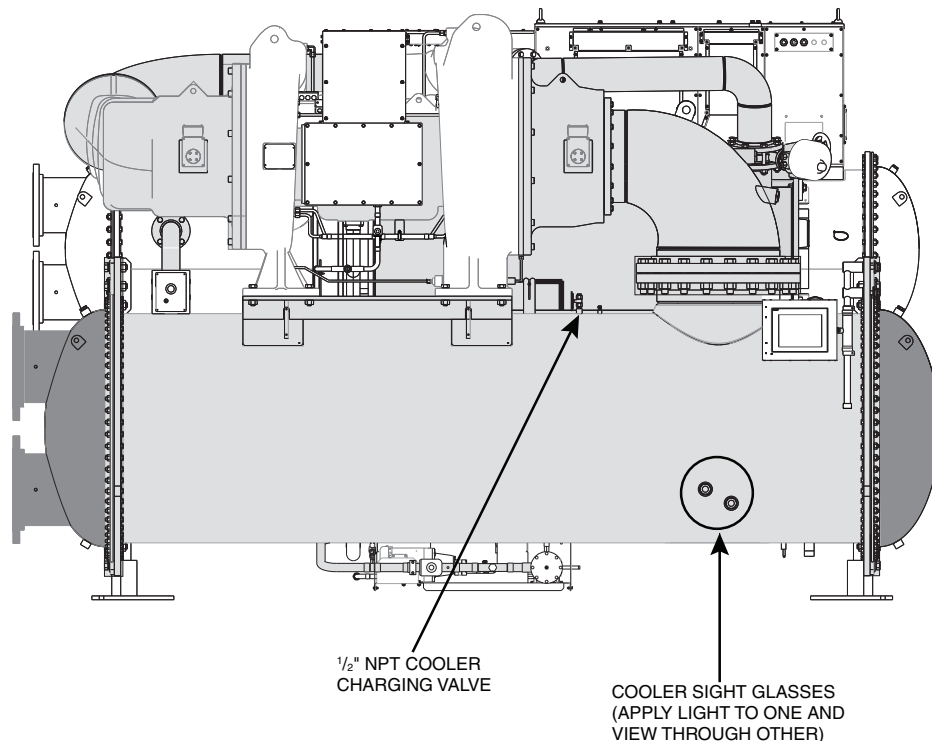
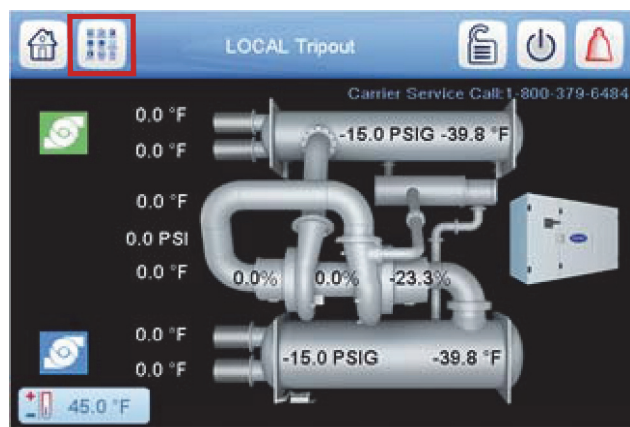


Fig. 21 — Cooler Charging Valve and Sight Glasses



19 Series PIC5+
SCG-ST-20M200400

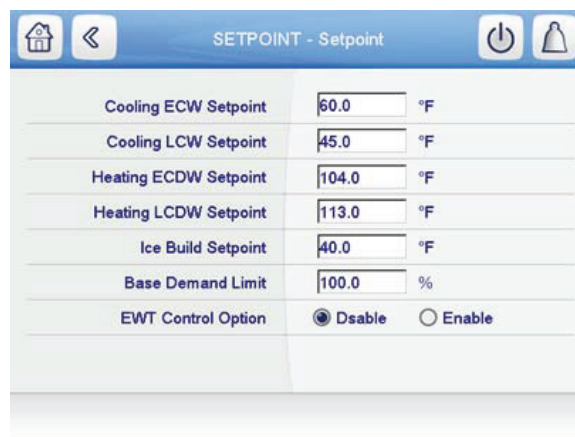
CHANGE THE SET POINTS — To access the set point screen, press the lock icon on the Main Menu, enter the password (default USER password = 1111), then press the Main Menu icon on the home screen. See Fig. 23.



The Main Menu screen is displayed. See Fig. 24. Press the Setpoint Table icon.



The Setpoint screen is displayed. See Fig. 25. 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 PIC5 Control User Manual.



INPUT THE LOCAL OCCUPIED SCHEDULE — Access the schedule screen 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. The Schedule Menu as well as the Holiday Menu can be reached through the Configuration Menu. 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.

For more information about setting time schedules, please refer to the PIC5 Control User Manual.

INPUT SERVICE CONFIGURATIONS — See Fig. 26 for 19DV 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

PASSWORD — PIC5 provides a smart factory password for better security and the password changes periodically. With a smart password, only authorized users can log into the controller factory tables to access key product configuration and maintenance data.

A 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.

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

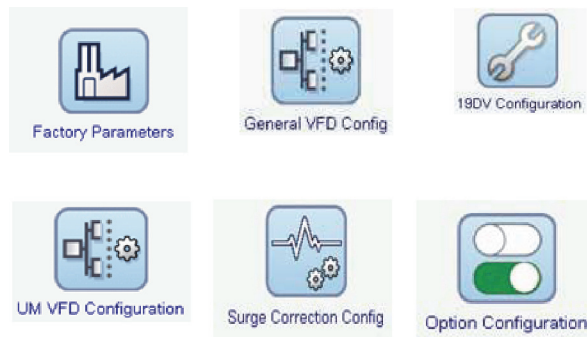


Fig. 26 — 19DV Configuration Tables



Fig. 27 — User Login Screen

INPUT TIME AND DATE — Set day and time and, if applicable, Holidays through MAIN MENU CONFIGURATION MENU and then select appropriate icon. 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.

NOTE: The date format is YY/MM/DD for English units and for SI units.

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 PIC5 Touch Screen module for future reference.

CONFIGURE TABLES — Access the related tables through MAIN MENU CONFIGURATION MENU (Fig. 26) to modify or view job site parameters shown in 19DV Configuration tables. Tables 9-15 should be verified or configured during startup/commissioning. Consult chiller nameplates as indicated.

Table 9 — Factory Parameters

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Factory Password	0 to 65535		4444	n/a
Chiller Type 19XR6/7=0, 19XR2-E/D/V=1, 19DV=2	0 to 2		0	2
Unit Type Cool Only=0, Heat Mach=1	0 to 1		0	Per selection
Comp (Single=0, Dual=1)	0 to 1		1	1
Chilled Medium Type Water/Brine	Water/Brine		Water	Per selection
Cond Shell Side MAWP 185PSI=0, 300PSI=1	0 to 1		1	n/a
19DV Comp Design Press 44PSI=0, 72PSI=1	0 to 1		0	1
Country Code	0 to 999		86	01
Free Cooling Option	No/Yes		No	Per selection
VFD Option No=0,FS VFD=1,Carrier=2, Rockwell LF2=3, Eaton=4, Rockwell STD=5	0 to 5		0	2
IOB3 Option (19XR2-E/D/V)	0 to 1		0	n/a
IOB4 Option	No/Yes		No	Yes
Guide Vane1 Type, Digital=0, Analog=1	0 to 1		0	1
VFD Feedback Voltage Sel, 0-5V=0, 0-10V=1	0 to 1		0	n/a
Marine Option	0 to 1		0	n/a
Power Request Option	0 to 1		0	n/a
Cont. Power Request	0 to 1		0	n/a
Purge System Option	Dsable/Enable		Dsable	Enable
Liquid Bypass Option	Dsable/Enable		Dsable	Per selection
Heat Reclaim Option No=0, Full=1, Partial=2	0 to 2		0	n/a

Table 10 — General VFD Config
Main Menu→Configuration Menu→General VFD Config [CFGGEVFD]

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
VFD Gain	0.10 to 1.50	-	0.75	0.75
VFD Max Speed Per	90.0 to 110.0	%	100	100
VFD Min Speed Per	45.0 to 89.0	%	70	60
VFD Start Speed Per	65.0 to 100.0	%	100	100
VFD Current Limit	0.0 to 99999.0	AMPS	250	Nameplate
VFD Load Current 20mA	10.0 to 5000.0	AMPS	200	n/a
Comp Frequency 100%	45.0 to 62.0	Hz	50	Nameplate
VFD Load Current Input	Enable/Dsable	-	Enable	Dsable

Table 11 — 19DV Configuration
Main Menu→Configuration Menu→19DV Configuration [Table = CFG_19DV]

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Motor Pole Pair	1, 2	-	1	1
IGV2 Travel Limit	30 to 100%	%	96	93.6
IGV2 minimum Degree	0 to 20	Degree	2	2
IGV2 Fully Open Degree	10 to 100	Degree	90	88
IGV2 Actuator Max Deg.	90 to 120	Degree	94	94
IGV2 Deg@IGV1 20 Deg	10 to 30	Degree	28.1	28.1
IGV2 Deg@IGV1 30 Deg	10 to 50	Degree	37.2	37.2
IGV2 Deg@IGV1 50 Deg	10 to 80	Degree	71.6	71.6
VFD Rate Speed Hz	10 to 200	Hz	80.5	80.5
Purge Regen Lasting Time	0 to 65535	minutes	120	120
Daily PG Pumpout Limit	20 to 200	minutes	50	50

Table 12 — UM VFD Config
Main Menu→Configuration Menu→UM VFD Configuration [CFGUMVFD]

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Compressor Speed 100%	47 to 110	Hz	50	Nameplate
Rated Line Voltage	200 to 13800	Volts	460	Nameplate
Motor Nameplate Current	10 to 1500	AMPS	200	Nameplate
Motor Rated Load Current	10 to 2000	AMPS	200	Nameplate
Motor Nameplate Voltage	200 to 13800	Volts	460	Nameplate
Motor Nameplate RPM	1500 to 3600	rpm	3000	Nameplate
Motor Nameplate KW	0 to 5600	KW	1500	Nameplate
Skip Frequency 1	0.0 to 102.0	Hz	30	30
Skip Frequency 2	0.0 to 102.0	Hz	30	30
Skip Frequency 3	0.0 to 102.0	Hz	30	30
Skip Frequency Band	0.0 to 102.0	Hz	0	0
Increase Ramp Time	5 to 60	sec	30	30
Decrease Ramp Time	5 to 60	sec	30	30
Line Voltage Imbalance%	1 to 10	%	10	10
Line Volt Imbalance Time	1 to 10	sec	10	10
Line Current Imbalance%	5 to 40	%	40	40
Line Current Imbal Time	1 to 10	sec	10	10
Motor Current Imbalance%	5 to 40	%	40	40
Motor Current Imbal Time	1 to 10	sec	10	10
Single Cycle Dropout	Dsable/Enable	-	Dsable	Dsable
PWM Switch Frequency 0=2 KHZ, 1=4 KHZ	0 to 1	-	0	1
Restore Defaults	No/Yes	-	No	No
LEN Comm Timeout	0 to 255	sec	10	10
Modbus Comm Timeout	0 to 255	sec	2	2
Gateway Modbus Baud Rate 4800=1, 9600=2, 19200=3, 38400=4	1 to 4	-	2	2

Table 13 — Surge Correction Config

DESCRIPTION	MENU NAME	RANGE	UNITS	DEFAULT	VALUE
Surge Line Configuration PR = 0, Delta T = 1	sgl_cfg	0 to 1	-	0	1
IGV1 Pos Configuration Degree =0, Percentage =1	gv1c_sel	0 to 1	-	0	0
Surge Delta Tmax	dts_max	0.0 to 150.0	^F	70	Nameplate
Surge Delta Tmin	dts_min	0.0 to 150.0	^F	45	Nameplate
PR at Full Load Opening	pr_ful	1.0000 to 5.0000	-	3	3
PR at Minimum Opening	pr_min	1.0000 to 5.0000	-	1.5	1.5
IGV1 Full Load Open Deg	gv1_dful	80 to 120.0	-	88	88
Sound Ctrl IGV1 Open Deg	gv1_dmed	10.0 to 40.0	-	27	27
IGV1 Minimum Open Deg	gv1_dmin	0.0 to 10.0	-	2	2
IGV1 Maximum Open Deg	gv1_dmax	90 to 120.0	-	109	94
IGV1 Minimum Position	gv1_pmin	0.0 to 100.0	%	5	5
IGV1 Full Load Position	gv1_pful	0.0 to 100.0	%	100	93.6
Envelop Line Offset	sgl_off	1.0 to 3.0	^F	2	1
Envelop Lower Deadband	sgl_loff	0.5 to 3.0	^F	1.5	1.5
Envelop Upper Deadband	sgl_hoff	0.1 to 3.0	^F	1.5	1.5
Surge Line Shape Factor	sgl_shfh	-1.000 to 0.000	-	-0.01	Nameplate
Sound Line Shape Factor	sgl_shfl	0.000 to 1.000	-	0.01	Nameplate
Envelop Speed Factor	sgl_spdf	0.00 to 3.00	-	2	Nameplate
Surge Delay Time	surg_del	0 to 120	sec	15	15
Surge Time Period	surge_t	7 to 10	min	8	8
Surge Delta Amps %	surge_a	5.0 to 40.0	%	20	20
GV1 Close Step Surge	gvstp_sg	1.0 to 3.0	%	2	2
VFD Speed Step Surge	vfdstpsg	1.0 to 5.0	%	1.5	1.5
EC Valve Step Surge	hgbpstsg	1.0 to 10.0	%	4	4
Surge Profile Offset	sgl_pro	0.00 to 5.0	^F	0	0
High Efficiency Mode	high_eff	Dsable/Enable	-	Enable	Enable
High Noise Alert	noi_alt	Dsable/Enable	-	Enable	Enable

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

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Auto Restart Option	Dsable/Enable	-	Dsable	Jobsite specific
Common Sensor Option	Dsable/Enable	-	Dsable	Jobsite specific
EC Valve Option No=0, Cont.=1, ON/OFF=2, mA=3	0 to 3	-	0	2 (if selected)
EC Selection Disable=0, Surge=1, Low Load=2, Comb=3	0 to 3	-	0	Jobsite specific
ECV Open IGV1 Position	0.5 to 10.0	%	5	5 (adjust as required)
ECV Close IGV1 Position	1.5 to 20.0	%	10	10 (adjust as required)
ECV Off DT for Low Load	0.5 to 10	^F	4	4 (adjust as required)
ECV On DT for Low Load	0.5 to 10	^F	2	2 (adjust as required)
ECV Low Load DB	0.5 to 2.0	^F	1	1 (adjust as required)
Head Pres Valve Option	Dsable/Enable	-	Dsable	Jobsite specific
Head Pres Delta P 0%	20 to 85	PSI	25	25 (adjust as required)
Head Pres Delta P 100%	20 to 85	PSI	50	50 (adjust as required)
Head Pressure Min Output	0 to 100	%	0	0 (adjust as required)
Tower Fan High Setpoint	55 to 105	°F	75	75 (adjust as required)
Refrig Leakage Option	Dsable/Enable	-	Dsable	Jobsite specific
Refrig Leakage Alarm mA	4 to 20	mA	20	20 (adjust as required)
Oil EXV Option	Dsable/Enable	-	Dsable	Dsable
Oil Temp High Threshold	100 to 140	°F	122	n/a
Oil Temp Low Threshold	90 to 130	°F	113	n/a
Gas Torque Factor	0.25 to 3.00	-	1	1
Guide Vane/SRD Factor	0.70 to 1.20	-	0.95	0.95
Power Recovery Timeout	0 to 60	min	15	15
Condenser Flush Alert	Dsable/Enable	-	Dsable	Dsable
Customer Alert Option	Dsable/Enable	-	Dsable	Jobsite specific
Ice Build Option	Dsable/Enable	-	Dsable	Jobsite specific
Ice Build Recycle	Dsable/Enable	-	Dsable	Jobsite specific
Ice Build Termin Source Temp=0, Contact=1, Both=2	0 to 2	-	0	Jobsite specific
Water Pressure Option No=0, Pres.=1, Pres.D=2	0 to 2	-	0	Jobsite specific
Water Flow Measurement No=0, Flow Meter=1, Water Pres. D=2	0 to 2	-	0	Jobsite specific
Water Flow Determination Sat Temp=0, Flow Switch=1	0 to 1	-	0	Jobsite specific
Water Flow at 4mA	0 to 200	GPS	0	(adjust as required)
Water Flow at 20mA	0 to 200	GPS	0	(adjust as required)
Evap Flow Rate Baseline	0 to 150	GPS	0	(adjust as required)
Evap Pres Drop Baseline	0 to 20	PSI	0	(adjust as required)
Cond Flow Rate Baseline	0 to 150	GPS	0	(adjust as required)
Cond Pres Drop Baseline	0 to 20	PSI	0	(adjust as required)
Water Pres Drop @20mA	10 to 40	PSI	10	(adjust as required)
Max Oil Pressure Diff	35 to 60	PSI	50	n/a
Oil Pump VFD Max Step	0 to 10	%	7	n/a
Vapor Source SV Delay	0 to 10	min	5	n.a
Vapor Source SV Option	Dsable/Engale	-	Dsable	n.a
Liquid Bypass Selection	Dsable/Enable	-	Dsable	Per selection
Purge On Idle Option	Dsable/Enable	-	Dsable	(adjust as required for force)
Evap Liquid Temp Opt	Dsable/Enable	-	Enable	n/a
Evap App Calc Selection Sat Temp=0, Ref Temp=1	0 to 1	-	1	1

Table 15 — Service Parameters Table
Menu→Configuration Menu→Service Parameters [SERVICE]

DESCRIPTION	MENU NAME	RANGE	DEFAULT	UNITS	VALUE*
Service Password	ser_pass	0 to 65535	2222	-	
Atmospheric Pressure	atom_pre	8 to 15	14.5	PSI	
GV1 Travel Limit	gv1_lim	30 to 100	80.7	%	
GV1 Closure at Startup	gv1stpos	0 to 40	4	%	
Controlled Fluid DB	ctrl_db	0.5 to 2	1	^F	
Derivative EWT Gain	ewtdgain	1 to 3	2	-	
Proportional Dec Band	gv1decdb	2 to 10	6	-	
Proportional Inc Band	gv1incdb	2 to 10	6.5	-	
Maximum GV Movement	max_gv	1.0 to 4.0	2	%	
Demand Limit At 20 mA	dem_20ma	10 to 100	40	%	
Demand Limit Prop Band	dem_pdb	3 to 15	10	%	
Amps or KW Ramp per Min	ldramprt	5 to 20	5	%	
Temp Ramp per Min	tmramprt	1 to 10	3	^F	
Recycle Shutdown Delta T	rcysh_dt	0.5 to 4	1	^F	
Recycle Restart Delta T	rcyst_dt	2 to 10	5	^F	
Damper Valve Act Delay	dmp_dly	1 to 5	2	min	
Damper Valve Close DB	dmp_cldb	2 to 10	5	PSI	
Damper Valve Open DB	dmp_opdb	10 to 20	13	PSI	
Damper Action Delta T	dmp_dt	4 to 10	7	^F	
Lub Press Verify Time	oilpvr_t	15 to 300	40	sec	
Soft Stop Amps Threshold	sf_st_th	40 to 100	70	%	
Water Flow Verify Time	wflow_t	0.5 to 5	5	min	
Power Calibration Factor	mbb_pfcl	0.5 to 2	1	-	
Enable Excessive Starts	ex_start	No/Yes	No	-	
Purge Active Temp SP	pgt_set	30 to 90	65	-	
Oil Stir Cycle(19XR6/7) No Stir=0, 30s/30m=1, 1m/4h=2, Comb. 0&1=3	oilstiro	0 to 3	1	-	

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

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 the VFD values match the chiller parameter labels and Chiller Builder design data sheet. The VFD values can be located 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 control panel. (See Fig. 28.)
- VFD Nameplate data - located on the right side of the VFD.

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
- Auto restart option (Enable/Disable)
- Remote contact option (Enable/Disable)

See the 19DV with PIC5 Controls Operation and Troubleshooting guide for more details about these functions; see the Control Panel Schematic for field wiring.

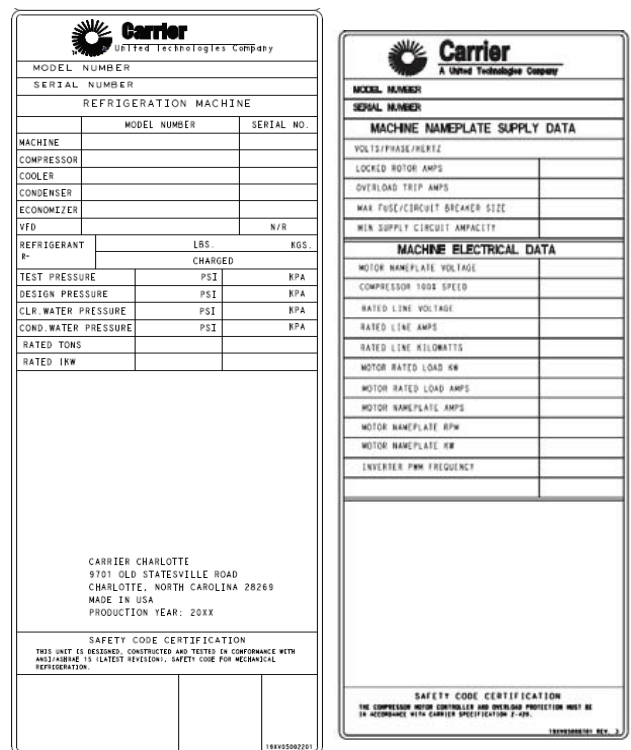


Fig. 28 — Machine Identification Nameplate and VFD Electrical Nameplate

Perform a Controls Test (Quick Calibration/Quick Test) — 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 go Main Menu → Quick Test and verify operation on desired components. Note that this is a very useful feature for troubleshooting. (The QUICK TEST screens can only be accessed when the chiller is in STOP mode.) 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, no alarms showing, and voltage should be within $\pm 10\%$ of rating plate value. Each test asks the operator to confirm the operation is occurring and whether or not to continue. 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.

NOTE: The refrigerant pump test will not energize the pump if cooler pressure is below -13 psig (-90 kPa).

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 the Quick Test feature when testing is complete. For information about calibration, see the sections Checking Pressure Transducers, page 49, and High Altitude Locations, page 50.

COOLER AND CONDENSER PRESSURE TRANSDUCER AND WATERSIDE FLOW DEVICE CALIBRATION (Waterside Device Optional with IOB Inputs Available) — 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 10 psig (68.9 kPa) - 30 psig (206.8 kPa). To calibrate these transducers:

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

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

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

NOTE: If the cooler or condenser vessels are at 0 psig (0 kPa) 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 cooler pressure, condenser pressure, economizer pressure, pump inlet pressure, pump outlet pressure, bearing inlet pressure, bearing outlet pressure).

To calibrate a device, view the particular reading on the screen. It should read 0 kPa. If the reading is not 0 kPa, but within 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 REF PUMP DELTA P or 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.

4. A high pressure point can be calibrated between 10-30 psig (68.9 -206.8 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 PIC5 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 depress 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 cooler/condenser pressure switches (if installed) are in need of calibration. See Fig. 29 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. 30 for the pressure sensor calibration menu. High end calibration is not necessary.



Fig. 29 — Hydraulic Status Menu

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

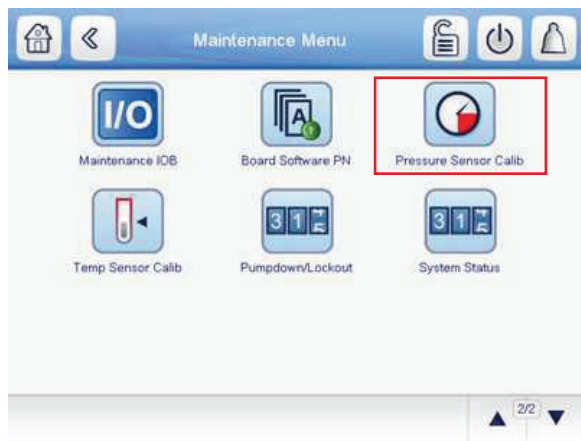


Fig. 30 — Pressure Sensor Calibration Menu

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. Carrier inhibitor is located and available to be added through evaporator charging valve.
5. 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.

CAUTION

Do not permit water or brine that is warmer than 150°F (65°C) to flow through the cooler or condenser. Refrigerant overpressure may discharge through the relief device and result in the loss of refrigerant charge (applicable only with standard CLT rupture disk).

6. Access the PUMPDOWN/LOCKOUT feature from the Maintenance Menu. Press the End Lockout button on the touch screen and accept the “press OK to Terminate Lockout?” prompt. The unit is reset to operating mode. The chiller is locked out at the factory in order to prevent accidental start-up.

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 PIC5 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. Go to Main Menu, Quick Test and Enable Quick Test following by enable Motor Rotation Check. This starts the following sequence:
 - a. Fully open the first IGV.
 - b. Open evaporator control valve, condenser drain valve, close condenser control valve, and evaporator control valve. Run refrigerant pump for 30 seconds.

- c. Start the motor and ramp to 5 Hz in 10 seconds.
- d. Once the motor speed reaches 5 Hz, stop motor.
- e. Stop refrigerant pump 1 minute after motor speed reaches 5 Hz, then reset all 4 refrigerant lubrication valves to close.
- f. Three minutes after motor speed reaches 5 Hz, close first IGV.

Status can be followed in Quick test as Check State IDLE=0, PreLub=1, Rotat=2, PosLub=3, End=4.

6. When the VFD is energized and the motor begins to turn, check for clockwise motor rotation through first stage sight glasses. See Fig. 31.

IMPORTANT: Do not check motor rotation during coast-down. Rotation may have reversed during equalization of vessel pressures.



CORRECT MOTOR ROTATION IS CLOCKWISE WHEN VIEWED THROUGH SUCTION PIPE LEADING TO COMPRESSOR 1ST STAGE SIGHT GLASS

TO CHECK ROTATION, ENERGIZE COMPRESSOR MOTOR MOMENTARILY. DO NOT LET MACHINE DEVELOP CONDENSER PRESSURE. CHECK ROTATION IMMEDIATELY.

ALLOWING CONDENSER PRESSURE TO BUILD OR CHECKING ROTATION WHILE MACHINE COASTS DOWN MAY GIVE A FALSE INDICATION DUE TO GAS PRESSURE EQUALIZING THROUGH COMPRESSOR.

Fig. 31 — Correct Motor Rotation

Check Refrigerant Lube

1. In Quick Test the refrigerant lube pressure can be checked. Open Evaporator CV, then run the refrigerant pump. Pressure drop across the refrigerant pump must exceed 8 psig (55 kPa). If pressure drop is negative, check the pump rotation. If pressure drop is below 8 psig (55 kPa), check for clogged filter drier or bearing supply filter.
2. Press the Stop button and listen for any unusual sounds from the compressor as it coasts to a stop.

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

COOLER-CONDENSER — High side float chamber, relief devices, refrigerant charging valve, temperature sensor locations, pressure transducer locations, Schrader fittings, water-boxes 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, and compressor serviceability.

COMPRESSOR LUBRICATION SYSTEM — Valves, dryers and filters, liquid level switch and inhibitor reclaim system.

ECONOMIZER — Float valve, drain valve, Schrader fitting, damper valve.

CONTROL SYSTEM — CCN and LOCAL start, reset, menu, softkey functions, HMI operation, occupancy schedule, set points, safety controls, and auxiliary and optional controls.

PURGE — Check for potential leaks by monitoring purge hours in RUNTIME. Note changes over time.

AUXILIARY EQUIPMENT — Starters and disconnects, separate electrical sources, pumps, and cooling tower.

DESCRIBE CHILLER CYCLES — Refrigerant, motor cooling, lubrication, 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 THE START-UP, OPERATION, AND MAINTENANCE MANUAL.

FINE TUNING VPF (VARIABLE PRIMARY FLOW) SURGE PREVENTION — Figures 32-35 show how the parameters defined below will affect the configured surge line. The menu can be found under MAIN MENU → CONFIGURATION MENU → SURGE CORRECTION CONFIG.

NOTE: Before tuning surge prevention, check for VFD (variable frequency drive) speed limitation or capacity overrides. If the source of low capacity is found in one of these places, do not proceed with an attempt to tune the Surge Prevention configurations.

If capacity is not reached
and

1. ACTUAL GUIDE VANE POSITION < GUIDE VANE TRAVEL RANGE

and

2. SURGE PREVENTION ACTIVE = YES (can be identified in MAIN MENU → MAINTENANCE MENU → SURGE CORRECTION)

and

3. PERCENT LINE CURRENT < 100%

then the surge line is probably too conservative.

Note the following parameters from HMI when maximum ACTUAL LINE CURRENT is achieved:

- EVAPORATOR REFRIGERANT TEMP
- EVAPORATOR PRESSURE

- CONDENSER REFRIG TEMP
- CONDENSER PRESSURE
- ACTUAL GUIDE VANE POSITION
- ACTUAL LINE CURRENT

The ACTIVE DELTA TSAT and the CALC REF DELTA TSAT can be monitored on the MAINTENANCE MENU → SURGE CORRECTION screen. When ACTUAL DELTA TSAT exceeds CALC REF DELTA TSAT + ENVELOPE LINE OFFSET surge prevention will occur.

If ACTUAL GUIDE VANE POSITION is less than 30%, then increase SURGE DELTA TSMIN in steps of 2°F (1.2°C) until one of the three conditions listed above no longer applies. Do not change SURGE DELTA TSMAX.

If ACTUAL GUIDE VANE POSITION is greater than 60%, then increase SURGE DELTA TSMAX in steps of 2°F (1.2°C) until cooling capacity is reached or one of conditions listed above no longer applies. Do not change SURGE/HGBP DELTA TSMIN.

If ACTUAL GUIDE VANE POSITION is more than 30% AND less than 60%, then:

1. Increase SURGE DELTA TSMIN in steps of 2°F (1.2°C).
2. Increase SURGE DELTA TSMAX in steps of 2°F (1.2°C).
3. Repeat Steps 1 and 2 until one of the conditions listed above no longer applies.

NOTE: DELTA TSMIN should seldom need to be increased more than 10 degrees above the selection program value. Likewise, DELTA TSMAX rarely requires more than a 2°F (1.2°C) increase.

If surge is encountered then the controls surge prevention algorithm surge line is probably too optimistic or high. Note following parameters from HMI at surge:

- EVAPORATOR REFRIGERANT TEMP
- EVAPORATOR PRESSURE
- CONDENSER REFRIG TEMP
- CONDENSER PRESSURE
- ACTUAL GUIDE VANE POSITION
- AVERAGE LINE CURRENT

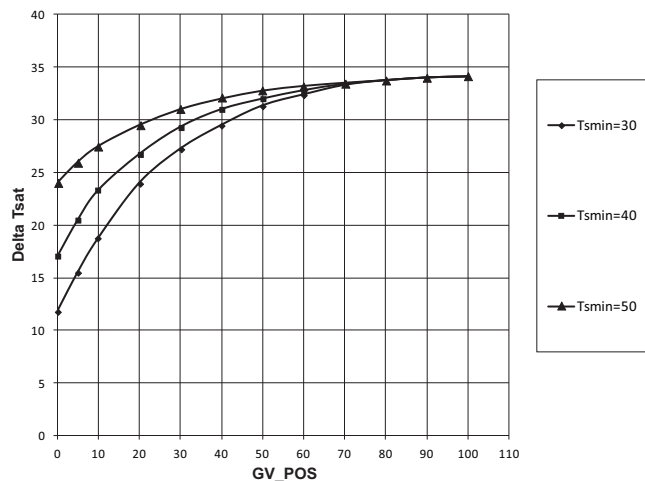


Fig. 32 — Effect of SURGE DELTA TSMIN on Surge Prevention

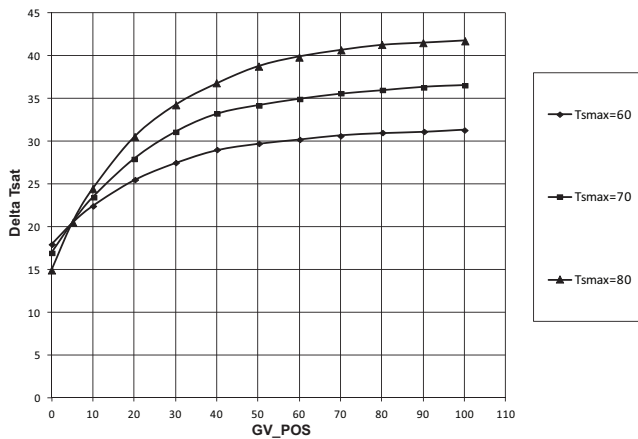


Fig. 33 — Effect of SURGE DELTA TSMAX on Surge Prevention

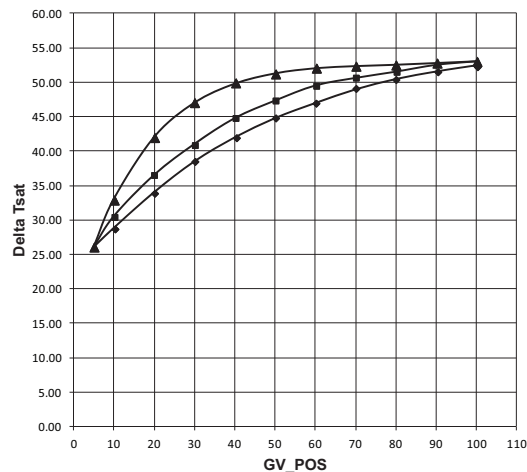


Fig. 34 — Effect of SURGE LINE SHAPE FACTOR on Surge Prevention

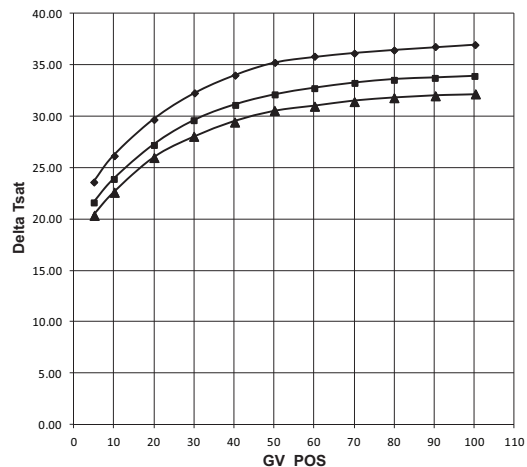


Fig. 35 — Effect of SURGE LINE SPEED FACTOR on Surge Prevention

If ACTUAL GUIDE VANE POSITION is less than 30%, go to Step 1. If ACTUAL GUIDE VANE POSITION is greater than 60%, then go to Step 3.

1. Do not change SURGE LINE SHAPE FACTOR from the value selected by Chiller Builder (ECAT). Decrease SURGE DELTA TSMIN in 1°F steps up to 5 times. Monitor chiller for surge.

2. If ACTUAL GUIDE VANE POSITION is still less than 30% and Step 1 failed, increase the value of SURGE LINE SHAPE FACTOR in steps of 0.01 up to 2 times. For example, if surge is encountered when shape factor is -0.06 , increase the SURGE LINE SHAPE FACTOR to -0.05 . If this does not solve the problem, go to Step 5, even if ACTUAL GUIDE VANE POSITION is less than 30%.
3. Do not change SURGE LINE SHAPE FACTOR from the value selected by Chiller Builder (ECAT). Decrease SURGE DELTA TSMAX by 1°F steps up to 5 times. Monitor chiller for surge.
4. If ACTUAL GUIDE VANE POSITION is greater than 60% and Step 3 failed to eliminate surge, then set SURGE DELTA TSMAX to 5°F below the value specified by Chiller Builder (ECAT). Increase the value of the SURGE LINE SHAPE FACTOR in steps of 0.01 up to 2 times. For example, if surge is encountered when the SURGE LINE SHAPE FACTOR is -0.06 , increase the SURGE LINE SHAPE FACTOR to -0.05 . If this does not solve the problem, go to Step 5, even if ACTUAL GUIDE VANE POSITION is greater than 60%.
5. If ACTUAL GUIDE VANE POSITION is greater than 30% but less than 60% or if Step 2 failed (with ACTUAL GUIDE VANE POSITION less than 30) or if Step 4 failed (with ACTUAL GUIDE VANE POSITION greater than 60), then perform this step. Do not change SURGE LINE SHAPE FACTOR from the value specified by Chiller Builder (ECAT). Reset SURGE DELTA TSMIN and SURGE DELTA TSMAX to the value specified by Chiller Builder (ECAT). Decrease SURGE DELTA TSMIN and SURGE DELTA TSMAX in steps of 1°F up to 5 times. Monitor chiller for surge.

If the drive does not slow down adequately at part load, then the machine may be operating at a point above the configured “software” surge line and the machine is in surge prevention mode. Check for a surge protection message on the HMI. If the unit is not in a surge protection state, then the ENVELOPE SPEED FACTOR may need to be increased (more aggressive surge line protection) in combination with a decrease in the SURGE LINE SHAPE FACTOR.

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 the 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 33.

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 normal bearing temperature should be about 95°F (35°C). Alert will initiate at 104°F (40°C) and Alarm will be initiated at 122°F (50°C).
2. The First Stage and Second Stage Bearing Temperatures can be accessed from the Temperatures menu. If the bearing temperature is high or in Alarm/Alert state with the refrigerant pump running, stop the chiller and determine the cause of the high temperature. *Do not restart* the chiller until corrected.
3. The liquid level sensor on the condenser float chamber should indicate Closed in the INPUT menu.
4. The bearing pressure drop should exceed 13 psid (90 kPa) when the compressor is ON, as seen on the HMI Transmission Status screen. If not an alert will be generated. Typically the reading will be slightly lower at initial start-up. There will be an alarm if compressor is ON and the bearing pressure drop is less than 10 psid for 10 seconds.
5. The moisture indicator sight glass on the refrigerant motor cooling line should indicate single phase refrigerant flow and a dry condition.
6. The condenser pressure and temperature varies with the chiller design conditions. Typically the pressure will range from -1.5 to 17.5 psig (-10.3 to 120.6 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.
7. Cooler pressure and temperature also will vary with the design conditions. Typical pressure range will be between -7.7 to -5.0 psig (-50.8 kPa to -35 kPa), with temperature ranging between 34 and 45°F (1.1 and 7.2°C).
8. The compressor may operate at full capacity for a short time after the pulldown ramping has ended, even though the building load is small. The active electrical demand setting can be overridden to limit the compressor kW, or the pulldown rate can be decreased to avoid a high demand charge for the short period of high demand operation. Pulldown rate can be based on load rate or temperature rate and is viewed at MAINTENANCE MENU → CAPACITY CONTROLS → RAMP_DEM (Ramping Demand Limit Value). Configuration done in General Config and rate done in Service Parameters.
9. High and low float chambers each provide two sight glasses for looking into the float chamber to confirm proper float operation.

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 — If freezing temperatures are likely to occur in the chiller area, drain the chilled water, condenser water, and the pumpout condenser water circuits to avoid freeze-up. Keep the waterbox drains open. Ensure that chiller is powered up so purge can automatically remove non-condensables from the low pressure chiller system during the shutdown. It is recommended not to store the refrigerant in the unit if below freezing temperatures are anticipated or if the extended shutdown extends past a normal seasonal shutdown. In that case both refrigerant and water side should be purged with positive pressure of dry nitrogen.

After Extended Shutdown — Ensure the water system drains are closed. It may be advisable to flush the 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.

Match the actual to the recorded nitrogen pressure prior to the extended shutdown to determine if a leak is present. Check the cooler pressure on the HMI panel and compare it to the original holding charge that was left in the chiller. If (after adjusting for ambient 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 38. 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 may be required. Economizer bypass option may be required for units operating at low lift.

IMPORTANT: A field-supplied water temperature control system for condenser water should be installed. The system should be able to maintain the leaving condenser water temperature at design conditions.

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.

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 19DV with PIC5 Controls Operation and Troubleshooting guide.

Refrigeration Log — A refrigeration log (as shown in Fig. 36), 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. 36. Automatic recording of data is possible by using CCN devices such as the Data Collection module and a Building Supervisor. Contact a Carrier representative for more information.

REFRIGERATION LOG CARRIER 19DV SEMI-HERMETIC CENTRIFUGAL REFRIGERATION MACHINE

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

DESCRIPTION			DATE				
COOLER	REFRIGERANT	PRESSURE SAT					
		LIQUID TEMP					
		LEVEL					
	WATER	FLOW					
		TEMP IN					
		TEMP OUT					
CONDENSER	REFRIGERANT	PRESSURE					
		TEMP SAT					
	WATER	FLOW					
		TEMP IN					
		TEMP OUT					
COMPRESSOR	CAPACITY	GV1 ACTUAL POS					
		GV2 ACTUAL POS					
	BEARINGS	1ST STAGE TEMP					
		2ND STAGE TEMP					
	REFRIGERANT LUBE	BEARING DELTA P					
		REF PUMP DELTA P					
DRIVE TRAIN	MOTOR	RUNNING AMPS					
		TEMPERATURE					
	VFD	ACTUAL SPEED					
PURGE	RUNTIME	AV DAILY PURGE IN 7 DAYS					

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

Fig. 36 — Refrigeration Log

PUMPOUT AND REFRIGERANT TRANSFER PROCEDURES

Preparation — For refrigerant side service work the refrigerant can be isolated in a storage tank. The following procedures and Fig. 37-38 describe how to transfer refrigerant from vessel to vessel and perform chiller evacuation.

⚠ CAUTION

If equipped, 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. Similarly a recovery unit suited for low pressure refrigerant should be used.

⚠ 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 -15 in. Hg (-51 kPa). Below this pressure, liquid refrigerant flashes into gas, resulting in extremely low temperatures in the cooler/condenser tubes and possibly causing tube freeze-up.

⚠ WARNING

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

⚠ CAUTION

Do not mix refrigerants from chillers that use different compressor oils and ensure that tanks previously used with a different refrigerant have been cleaned in order to avoid refrigerant contamination. Compressor and heat exchanger damage can result.

⚠ CAUTION

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

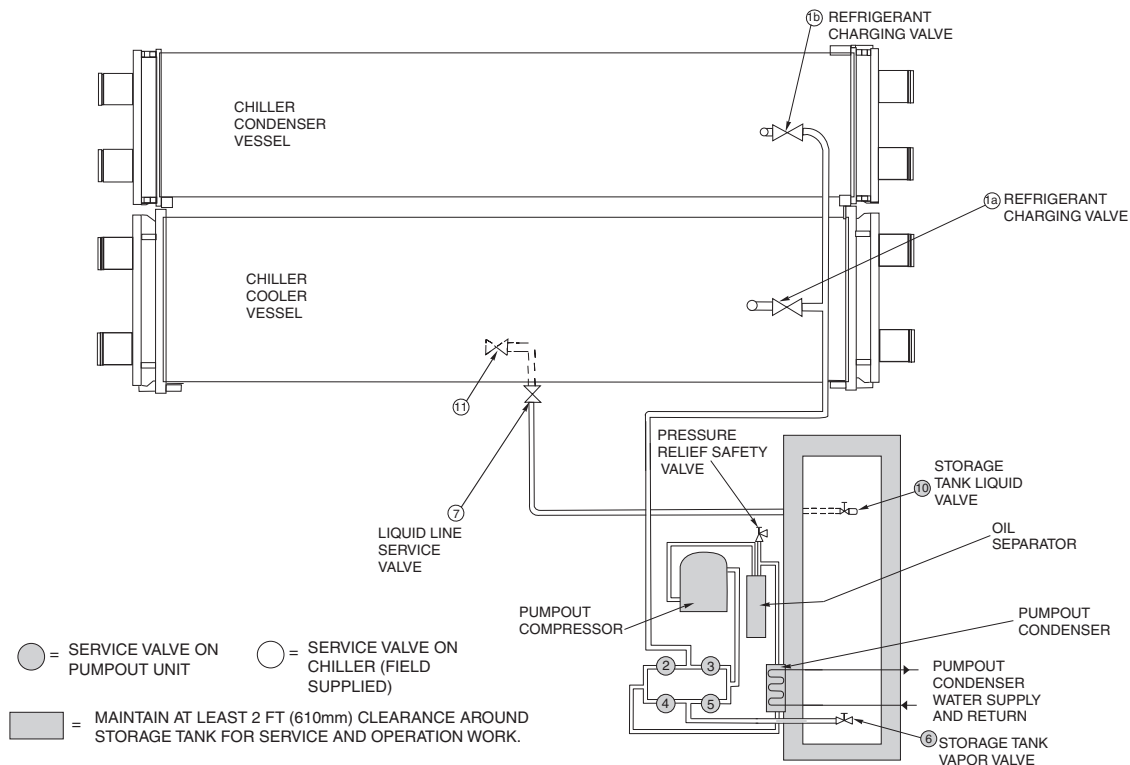


Fig. 37 — Typical Optional Pumpout System Piping Schematic with Storage Tank

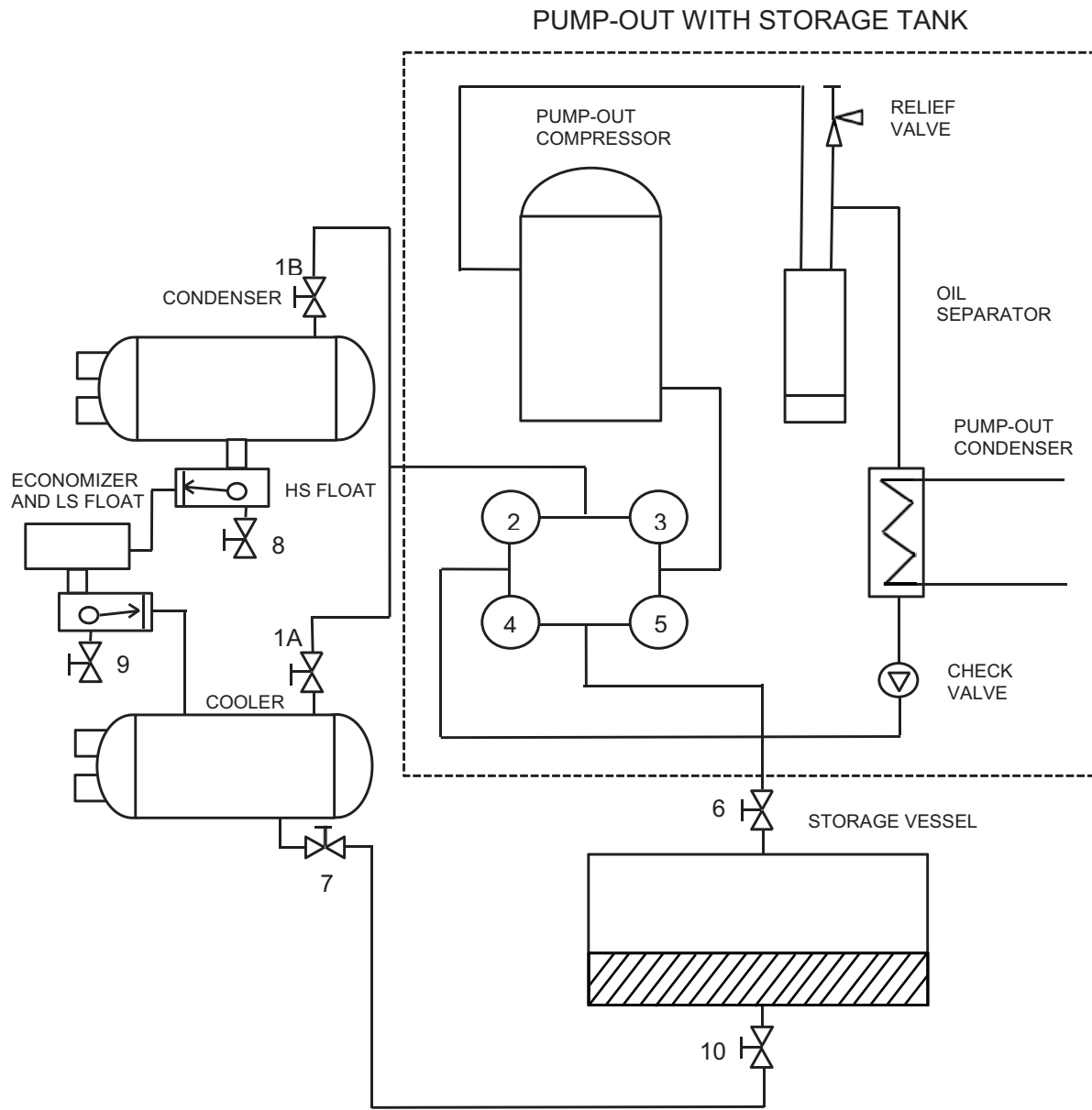


Fig. 38 — Refrigerant Transfer Schematic

The following procedures assume that system is piped in agreement with Fig. 38. Use the PIC5 Pumpdown/Lockout feature under the Maintenance menu.

NOTE: Instructions assume pumpout unit with four control valves oriented as shown. Actual equipment may have a different design, in which case the procedure changes.

Transfer Refrigerant from Storage Tank Vessel to Chiller

1. Equalize refrigerant pressure.
 - a. Turn on chiller water pumps, establishing water flow (assumes vacuum condition in chiller system)
 - b. Open (O) and close (C) pumpout and storage tank valves according to below table.

VALVE	1A	1B	2	3	4	5	6	7	8	9	10
CONDITION	O	O	C	O	C	C	O	C	C	C	C

- c. Gradually open valve 5 to allow vapor pressure to equalize between storage tank and chiller system.
- d. Open valve 5 fully after the chiller pressure exceeds -12.7 in. Hg (58.3 kPa abs) corresponding to a saturation temperature of 40°F (4.4°C). The chiller water pumps can be turned off (if desired).

When vacuum pressure is fully equalized, close valve 5.

VALVE	1A	1B	2	3	4	5	6	7	8	9	10
CONDITION	O	O	C	O	C	C	O	C	C	C	C

- e. Open valve 7 and 10 to prepare to let higher pressure in the recovery tank push liquid refrigerant into the chiller through the cooler charging/vacuum valve.

VALVE	1A	1B	2	3	4	5	6	7	8	9	10
CONDITION	O	O	C	O	C	C	O	O	C	C	O

2. Push liquid to chiller; then remove remaining vapor from storage tank;
 - a. Open valve 4.
 - b. Ensure pumpout condenser water is off; then turn on the pumpout compressor in manual mode to push liquid to chiller. Monitor the storage tank level until tank is empty of liquid refrigerant.
 - c. Close charging valves 7 and 10.

- d. Turn off the pumpout compressor.

VALVE	1A	1B	2	3	4	5	6	7	8	9	10
CONDITION	O	O	C	O	O	C	O	C	C	C	C

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

VALVE	1A	1B	2	3	4	5	6	7	8	9	10
CONDITION	O	O	O	C	C	O	O	C	C	C	C

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

VALVE	1A	1B	2	3	4	5	6	7	8	9	10
CONDITION	C	C	C	C	C	C	C	C	C	C	C

- h. Turn off pumpout condenser water.

Transfer Refrigerant from to Chiller from Storage Tank Vessel

- Equalize refrigerant pressure. Ensure to run pumps if saturated refrigerant temperature is near the freezing point to avoid potential tube freeze up.
 - Dehydrate the refrigerant storage vessel, and connected hoses/piping so there are no non-condensables mixed with the refrigerant.
 - Open (O) and close (C) pumpout and storage tank valves according to below table.

VALVE	1A	1B	2	3	4	5	6	7	8	9	10
CONDITION	O	O	C	O	C	C	O	C	C	C	C

- Gradually open valve 5 to allow vapor pressure to equalize between chiller system and storage tank, open valve 7 and 10 to allow liquid refrigerant to drain by gravity.

VALVE	1A	1B	2	3	4	5	6	7	8	9	10
CONDITION	O	O	C	O	C	C	O	O	C	C	O

- Push remaining liquid, followed by refrigerant vapor removal from chiller. Open valve 7 and 10 to prepare to let higher pressure in the recovery tank push liquid refrigerant into the chiller through the cooler charging/vacuum valve.
 - To prepare for liquid push, turn off the pumpout condenser water. Place valves in the following positions.

VALVE	1A	1B	2	3	4	5	6	7	8	9	10
CONDITION	O	O	O	C	C	O	O	O	C	C	O

- Run the pumpout compressor in manual until all liquid is pushed out of the chiller (approximately 45 minutes). To drain remaining liquid in HS and LS float chambers refrigerant hoses can be connected to valve 8 and 9 and this liquid can be drained (or pushed) to the storage tank prior to next step. Close valves 2, 5, 7 and 10, then stop compressor.

VALVE	1A	1B	2	3	4	5	6	7	8	9	10
CONDITION	O	O	C	C	C	C	O	C	C	C	C

- Turn on pumpout condenser water.

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

VALVE	1A	1B	2	3	4	5	6	7	8	9	10
CONDITION	O	O	C	O	O	C	O	C	C	C	C

- Run the pumpout compressor until the chiller pressure reaches -7.5 psig (49.5 kPa abs), followed by turning off the pumpout compressor. Note it is possible that the pressure switch is satisfied before this condition. Warm chiller condenser water will boil off any entrapped liquid refrigerant, and chiller pressure will rise.
- When chiller pressure increases to -5.5 psig (63 kPa abs) turn on the pumpout compressor until the pressure reaches 7.5 psig (49.5 kPa abs) again; then turn off the pumpout compressor. Repeat this process until the chiller pressure no longer rises.
- Start the chiller water pumps (condenser and cooler), establish water flow. At this point turn on the pumpout compressor in auto until the vacuum switch is satisfied. This occurs at approximately 15 in. Hg vacuum (48 kPa abs, 7 psia).
- Close all valves.

VALVE	1A	1B	2	3	4	5	6	7	8	9	10
CONDITION	C	C	C	C	C	C	C	C	C	C	C

- Turn off the pumpout condenser water.

DISTILLING THE REFRIGERANT

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

VALVE	1A	1B	2	3	4	5	6	7	8	9	10
CONDITION	O	O	C	O	C	C	O	C	C	C	C

- Gradually crack open valve 5 to increase chiller pressure to -7.5 psig (49.5 kPa abs). Slowly feed refrigerant to prevent freeze-up.
- Open valve 5 fully after the chiller pressure rises above the freezing point. Let the storage tank and chiller pressure equalize.
- Transfer remaining refrigerant.
 - Set valves as per below table and turn on the pumpout condenser water.

VALVE	1A	1B	2	3	4	5	6	7	8	9	10
CONDITION	O	O	O	C	C	O	O	C	C	C	C

- Run the pumpout compressor until all refrigerant is removed from the storage tank (remaining content in tank is non-condensables).
- Turn off the pumpout compressor, close all valves and turn off the pumpout condenser water.

VALVE	1A	1B	2	3	4	5	6	7	8	9	10
CONDITION	C	C	C	C	C	C	C	C	C	C	C

- Drain the contaminants from the bottom of the storage tank into a container and dispose of it safely.

GENERAL MAINTENANCE

Refrigerant Properties — The standard refrigerant for the 19DV chiller is HFO R-1233zd(E). At normal atmospheric pressure, HFO R-1233zd(E) will boil at 65°F (18°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

HFO R-1233zd(E) 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 Trim Refrigerant Charge section, page 43.

CAUTION

Always use the compressor pumpdown function in the PUMPDOWN/LOCKOUT feature to turn on the cooler pump and lock out the compressor when transferring refrigerant. Liquid refrigerant may flash into a gas and cause possible freeze-up when the chiller pressure is below -15 in. Hg (-53 kPa) for HFO R-1233zd(E).

Adjusting the Refrigerant Charge — If the addition or removal of refrigerant is required to improve chiller performance, follow the procedures given under the Trim Refrigerant Charge section, page 43.

Refrigerant Leak Testing — Since parts of the refrigerant system operates in vacuum non-condensables will enter the cooling systems. The PIC5 HMI will issue an alert indicating excessive purge operation. Leaks, which cause frequent purge cycles, should be repaired without delay. Non-condensable gas in the machine causes higher than normal condenser pressure, compressor surge at start-up and frequent purge cycles, so locate and repair any leaks as soon as possible. Before making any necessary repairs to a leak, transfer all refrigerant from the 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

HFO R-1233zd(E) should not be mixed with air or oxygen and pressurized for leak testing. In general, this refrigerant should not be present with high concentrations of air or oxygen above atmospheric pressures, because the mixture can undergo combustion.

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

TESTING WITHOUT REFRIGERANT TRACER — Another method of leak testing is to pressurize with nitrogen only and to use a soap bubble solution or an ultrasonic leak detector to determine if leaks are present.

TO PRESSURIZE WITH DRY NITROGEN

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

1. Connect a copper tube from the pressure regulator on the cylinder to the refrigerant charging valve. Never apply full cylinder pressure to the pressurizing line. Follow the listed sequence.
2. Open the charging valve fully.
3. Slowly open the cylinder regulating valve.
4. Observe the pressure gage on the chiller and close the regulating valve when the pressure reaches test level. *Do not exceed* maximum allowable test pressure 45 psig (310 kPa) for units marked 57 MAWP to allow for plenty of margin to avoid from bursting the rupture discs.
5. Close the charging valve on the chiller. Remove the copper tube if it is no longer required.

Repair the Leak, Retest, and Apply Standing Vacuum Test — After pressurizing the chiller, test for leaks with an electronic halide leak detector, soap bubble solution, or an ultrasonic leak detector. Bring the chiller back to atmospheric pressure, repair any leaks found, and retest.

After retesting and finding no leaks, apply a standing vacuum test. Then dehydrate the chiller. Refer to the Standing Vacuum Test and Chiller Dehydration sections (pages 18 and 20) 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. 39-40):

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.

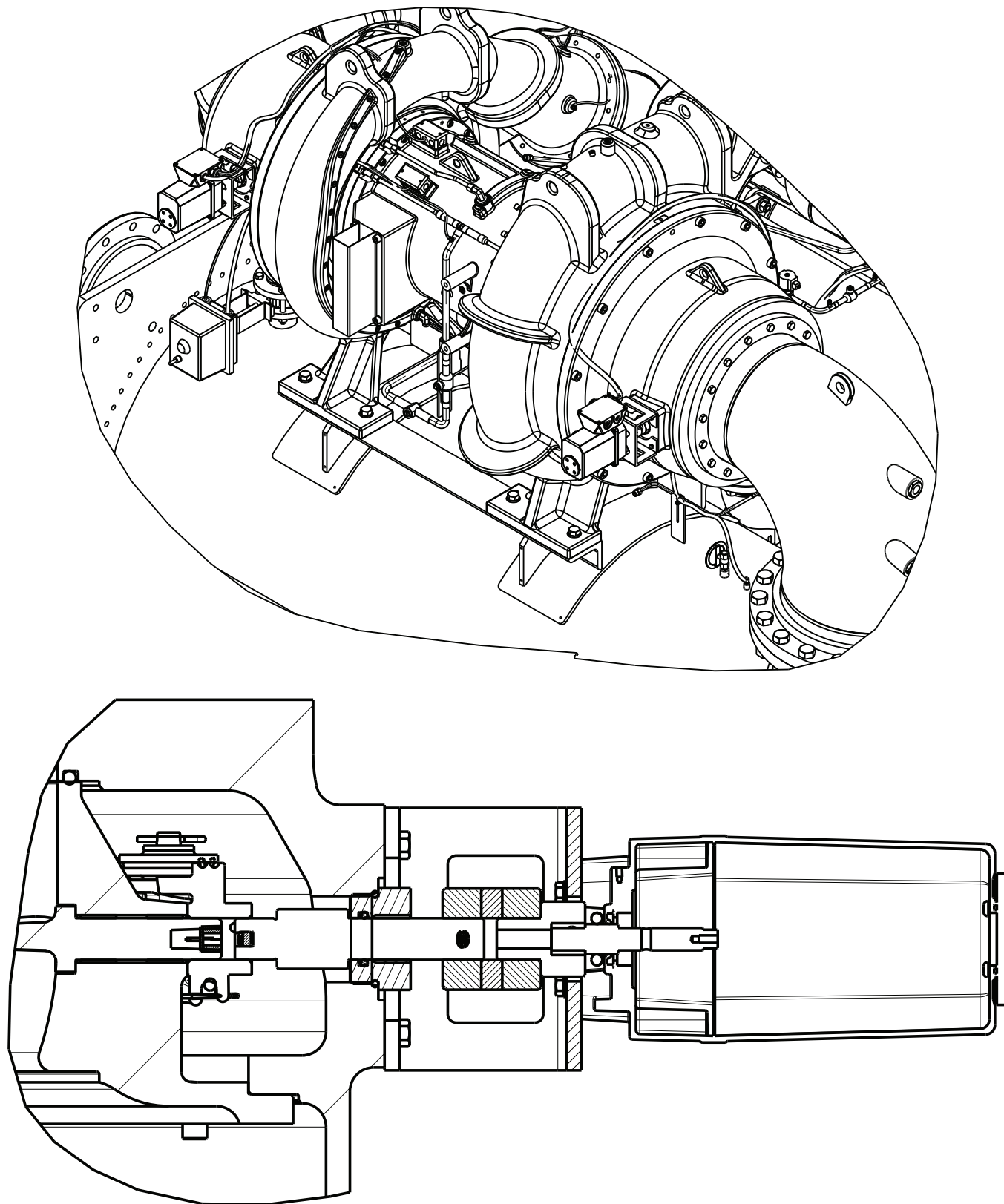


Fig. 39 — Guide Vane Actuator

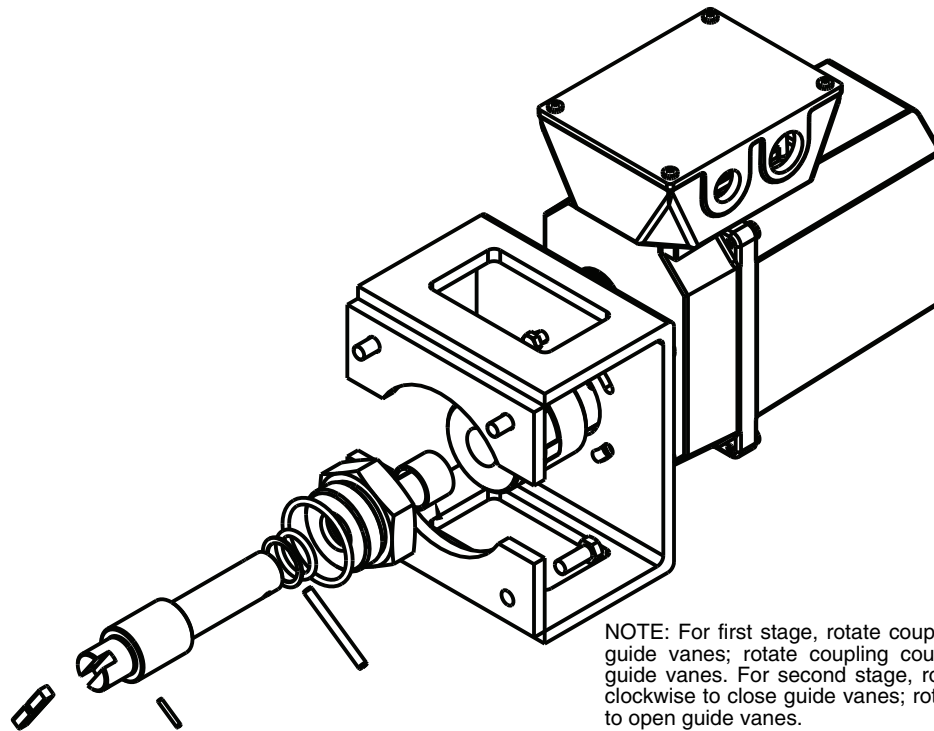


Fig. 40 — Guide Vane Actuator Detail

4. If required, rotate the guide vane sprocket 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.)

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 cooler refrigerant temperature reaches design conditions or becomes a minimum. *Do not overcharge*. Use cooler sight glasses to visually determine optimum charge. At steady state full load operation the cooler tubes should be covered with liquid refrigerant — if tubes are covered maximum efficiency is achieved and there is no benefit of additional refrigerant.

Refrigerant may be added either through the storage tank or directly into the chiller as described in the Charge Unit with Refrigerant section.

To remove any excess refrigerant, follow the procedure in Transfer Refrigerant from Chiller to Pumpout Storage Tank section.

WEEKLY MAINTENANCE

Check the Refrigerant Lubrication System

1. Enter INPUT menu and verify that Liquid Level Switch is closed (if compressor is on).
2. Check moisture indicating sight glass on bearing supply line (Fig. 41) as well as on the motor/VFD liquid cooling line (located between vessels feeding of the high side float chamber; sight glass is located downstream of filter drier).

3. Check that pressure Ref Pump Delta P (PRESSURE Menu is above 13 psig [89.6 kPa]).

Check for Leaks — Frequent purge pumpout operation is an indication of a leak. When the daily pumpout limit is exceeded, the controls will show process Alert 148 — Purge Daily Pumpout Limit Exceeded. If no alert, the purge run-time for the past 24 hours as well as the past 7 days can be obtained from RUNTIME menu.

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.*

Service Ontime — The HMI will display a resettable “After Service Hrs”, “Total Pumpout Numbers”, and “Total Pumpout Time” value on the MAIN MENU → RUN TIMES screen. These values 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 Control 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 46 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.

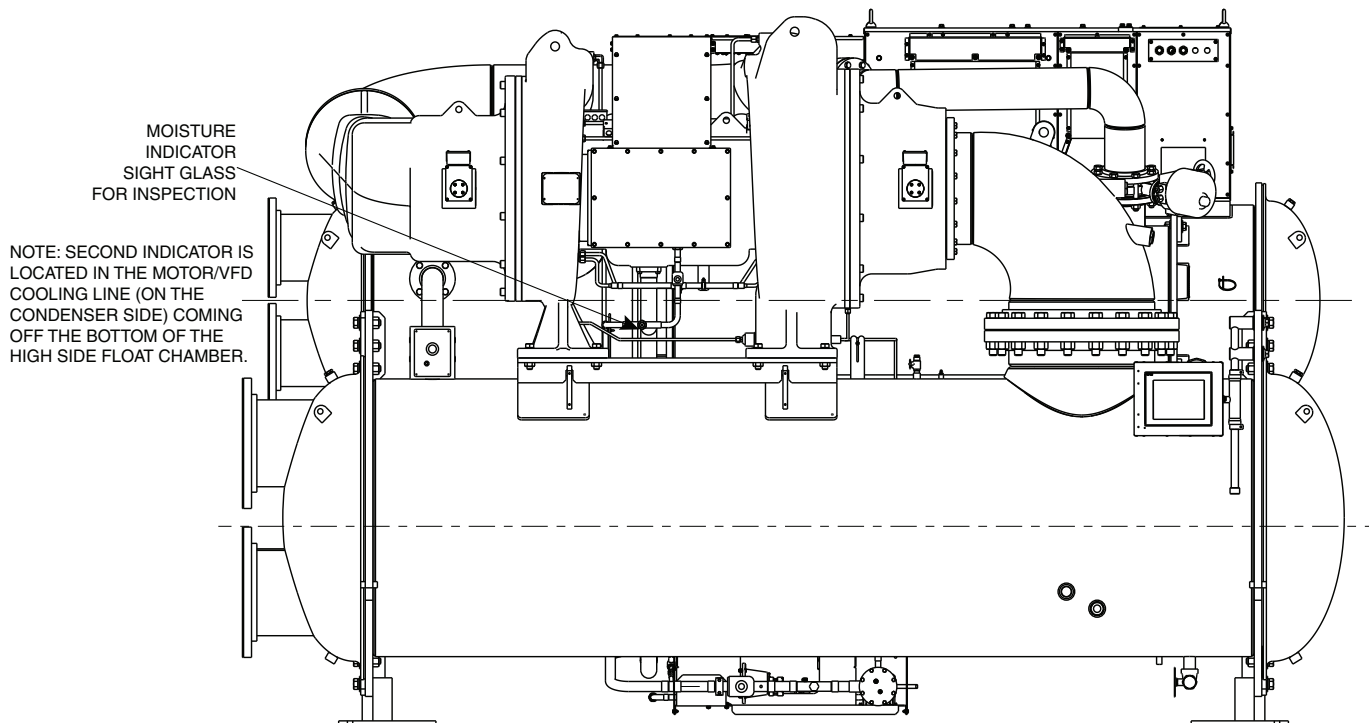


Fig. 41 — Moisture Indicator Sight Glass for inspection

Inspect the Purge — With unit off drain, purge tank by entering QUICK TEST menu, opening Drainage Solenoid Valve, and Purge Condenser Solenoid Valve, and turning the Refrigerant pump on to drain the refrigerant liquid. Let it run for about 15 minutes. Turn on Purge Compressor and verify that it runs. Close all valves using the Quick Test Menu. Clean the condenser coil as required and replace the strainer as needed.

Changing Refrigerant Lubrication Filters — Change the refrigerant lubrication filter, motor cooling filter, and bearing filter 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. Strainers such as 2x refrigerant pump suction strainers, inhibitor reclaim, and inductor are to be replaced every 5 years or as required when the machine is open for service. These filters do not contain desiccant for moisture removal so changing the filter will not change the moisture indicator status.

Change strainers/filters by closing isolation valves and slowly opening the flare fitting with a wrench and back-up wrench to relieve pressure.

Inspect Refrigerant Float System — Perform this inspection only if the following symptoms are seen.

- There is a simultaneous drop in cooler pressure and increase in condenser pressure. This will be accompanied by an increase in kW/Ton.
 - The liquid line downstream of the float valve feels warm and float valve seems stuck based on a visual inspection through the end cover sight glass. This indicates condenser gas flowing past the float.
1. Transfer the refrigerant into a pumpout storage tank.
 2. Remove the float access cover.
 3. Clean the chamber and valve assembly thoroughly. Be sure the valve moves freely. Ensure that all openings are free of obstructions.
 4. Examine the cover gasket and replace if necessary.

This applies for both the high side float (first float downstream of condenser) and the low side float (second

float downstream of condenser). The float refrigerant level can be observed through the two sight glasses located on the float cover under the condenser. See Fig. 42 for float detail. Inspect the float every five years. Clean the chamber and the float valve assembly. Be sure that the float moves freely and the ball bearings that the float moves on are clean.

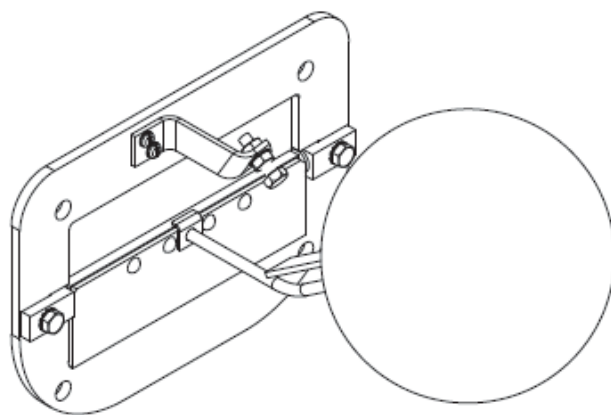


Fig. 42 — Float System

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 rupture disk for any evidence of internal corrosion or rust, dirt, scale, leakage, etc. Verify that vent piping has a section leaning away from valve 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 key to good bearing maintenance is proper lubrication. Inspect the lubrication system regularly and thoroughly. Annual vibration measurements are recommended to monitor overall compressor status. Annual refrigerant analysis is recommended to monitor refrigerant acid and moisture levels over time.

Excessive bearing wear can sometimes be detected through increased vibration or increased bearing temperature. To inspect the bearings, a complete compressor teardown is required. Only a trained service technician should perform a compressor disassembly. Bearings cannot be field inspected; excessive vibration is the primary sign of wear or damage. If either symptom appears, contact an experienced and responsible service organization for assistance. Annual compressor vibration analysis and trending is recommended for compressor preventative monitoring and maintenance.

⚠ CAUTION

If compressor requires disassembly, cleanliness is of critical importance to avoid contamination. Small amounts of contamination can result in damage to ceramic bearings.

Inspect the Heat Exchanger Tubes and Flow Devices

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

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

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

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

Water Leaks — The refrigerant moisture indicator on the refrigerant motor cooling line along with the moisture

indicator located in the liquid refrigerant feeding the compressor bearings (Fig. 2) indicates whether there is water or air leakage during chiller operation. Water leaks should be repaired immediately.

⚠ CAUTION

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

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

⚠ CAUTION

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

Inspect the VFD — Before working on any starter, shut off the chiller, 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.

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 month of operation. Turn power off and retighten. Recheck annually thereafter.

⚠ CAUTION

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

Recalibrate Pressure Transducers — Once a year, the pressure transducers should be checked against a pressure gage reading. Check all 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. 30.

Recalibrate Temperature Thermistors — 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.

Carrier Inhibitor — Add Carrier Inhibitor to evaporator after every 5 years of service. Carrier Inhibitor (Carrier Material Spec RW01-26) should be added to 500 ppm concentration when compared to nameplate total refrigerant charge.

TROUBLESHOOTING GUIDE

Overview — The PIC5 control system has many features to help the operator and technician troubleshoot a 19DV 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 19 Series Controls Operation and Troubleshooting Manual for PIC5.
- The Configuration menu screens display information that helps to diagnose problems with chilled water temperature control, chilled water temperature control overrides, hot gas bypass, surge algorithm status, and time schedule operation.

- The quick test and quick calibration feature facilitates the proper operation and test of temperature sensors, pressure transducers, the guide vane actuator, refrigerant pump, 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 19 Series Controls Operation and Troubleshooting Manual for PIC5. 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 19DV 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 19 Series Controls Operation and Troubleshooting Manual for PIC5.

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 16 and 17.

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 16 and 17. 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 16 and 17 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.

Table 16 — Thermistor Temperature (F) vs. Resistance/Voltage Drop

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

Table 17 — 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

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 PIC5 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 $\pm 2^\circ\text{F}$ (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 cooler barrel, is displayed as Evap Refrig Liquid Temp on the TEMPERATURES display screen. This thermistor provides additional protection against a loss of water flow.

DUAL TEMPERATURE SENSORS — For servicing convenience, there are 2 redundant sensors each on the bearing and motor temperature sensors. If one of the sensors is damaged, the other can be used by simply moving a wire. The number 2 terminal in the sensor terminal box is the common line. To use the second sensor, move the wire from the number 1 position to the number 3 position. See Fig. 43 or Fig. 44.

Checking Pressure Transducers — There are 6 factory-installed pressure transducers measuring refrigerant pressure: condenser pressure, evaporator pressure, refrigerant pump suction, discharge pressure, bearing inlet pressure, and bearing outlet pressure.

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 TRANSDUCER VOLTAGE REF supply voltage. It should be 5 vdc ± 0.5 v as displayed in MAINTENANCE MENU $\rightarrow$ MAINTENANCE OTHERS, where all the transducer voltages are shown. If the TRANSDUCER VOLTAGE REF supply voltage is correct, the transducer should be recalibrated or replaced.

Also check that any external inputs have not been grounded and are not receiving anything other than a 4 to 20 mA signal.

TRANSDUCER REPLACEMENT — Since the transducers are mounted on Schrader-type fittings, there is no need to remove refrigerant from the vessel when replacing the transducers. Disconnect the transducer wiring. *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.

COOLER, CONDENSER, REFRIGERANT PUMP SUCTION AND DISCHARGE, BEARING INLET AND OUTLET 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 10 and 30 psig (69 and 207 kPa). Connect pressure transducer to Schrader connection. To calibrate these transducers:

1. Shut down the compressor, cooler, and condenser pumps.
NOTE: There should be no flow through the heat exchangers.
2. Disconnect the transducer in question from its Schrader fitting for cooler or condenser transducer calibration. For other pressure or flow device calibration, leave the transducer in place.

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

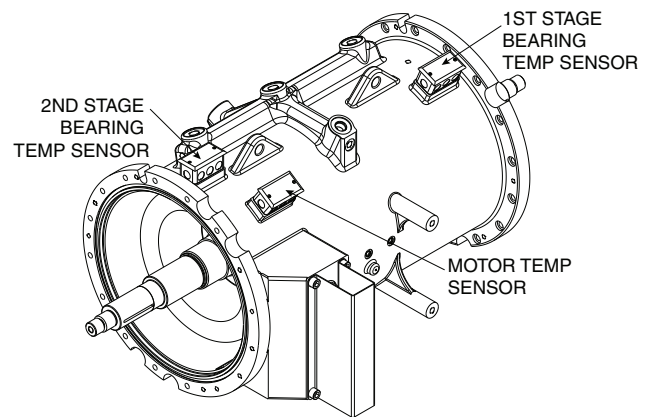


Fig. 43 — Motor Housing Temperature Sensors

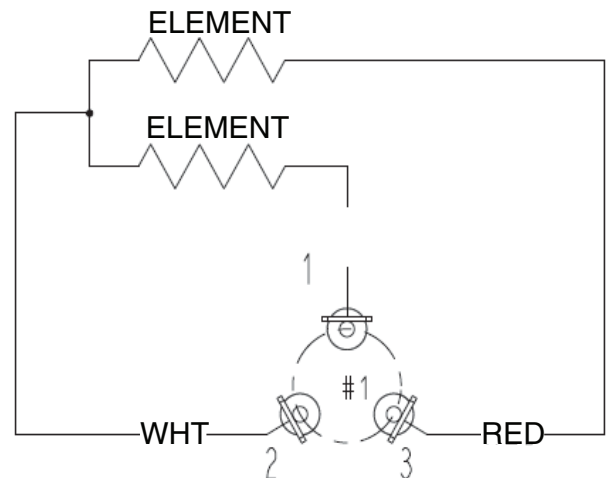


Fig. 44 — First and Second Stage Bearing Temperature Wiring and Motor Thermistor Wiring

3. Access the PRESSURE or (if water side pressure) HYDRAULIC STATUS screen and view the particular transducer reading. To calibrate pressure or water-side 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.

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.

4. Installation of pressure transducers into water nozzles using flushable dirt leg trap is suggested; see Fig. 45. 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.

The PIC5 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.

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 — 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 control inlet guide vane, EC 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. During pumpdown operations, the pumps are energized to prevent freeze-up and the vessel pressures and temperatures are displayed.

Quick Calibration — Use this menu to calibrate IGVs and the EC valve if it has feedback.

Pumpdown/Lockout — The Pumpdown/Lockout feature, available from the Maintenance Menu, prevents compressor start-up when there is no refrigerant in the chiller or if the vessels are isolated. The Terminate Lockout feature ends the Pumpdown/Lockout after the pumpdown procedure is reversed and refrigerant is added.

Physical Data — Tables 18-26 and Fig. 46-58 provide additional information on component weights, compressor fits and clearances, physical and electrical data, and wiring schematics for the operator's convenience during troubleshooting.

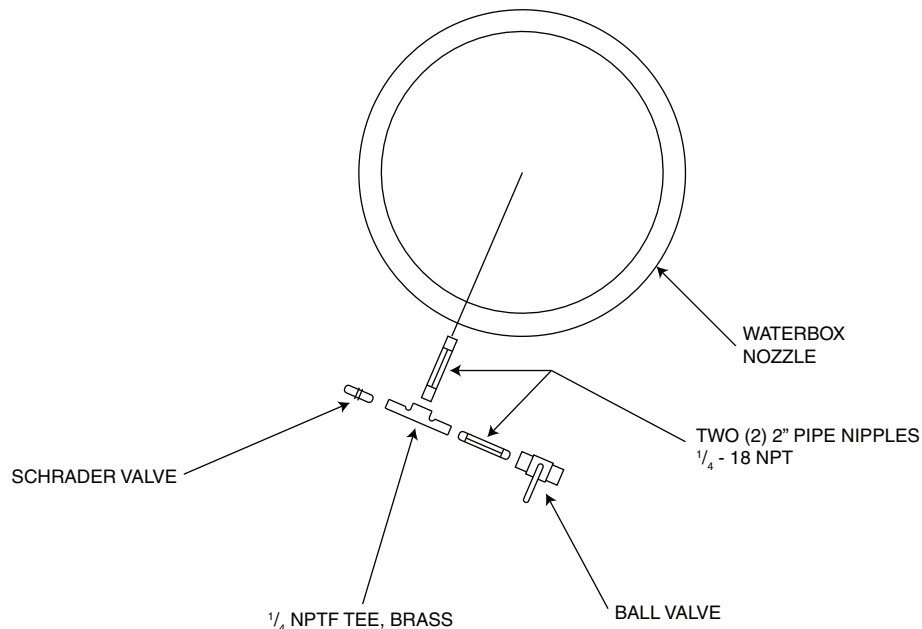


Fig. 45 — Suggested Installation of Pressure Transducers into Water Nozzles Using Flushable Dirt Leg Trap

Table 18 — Component Weights

COMPONENT	DV4 COMPRESSOR	
	lb	kg
SUCTION PIPE ASSEMBLY (INCLUDES FLANGES)	569	258
INTERSTAGE PIPING	346	156
DISCHARGE PIPING	5	3
HMI PANEL	24	11
CONTROL PANEL	190	86
HIGH SIDE FLOAT CHAMBER COVER	50	23
LOW SIDE FLOAT CHAMBER COVER	50	23
PURGE ASSEMBLY	263	119
ENVELOP CONTROL VALVE / HGBP (OPTION)	97	44
ECONOMIZER BYPASS VALVE (OPTION)	121	55
FREE COOLING VALVE (OPTION)	200	91
LIQUID BYPASS AND ISOLATION VALVE (OPTION)	300	136
VFD 32VSS0850	1450	658
VFD HARMONIC FILTER	800	363
VFD CABLE	200	91
VFD TRAY	124	57

Table 19 — 19DV Compressor and Motor Weights* — DV4 High-Efficiency Motors

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)
Voltage: 380/460						
B	6195	1090	330	2810	494	150
D	6195	1150	340	2810	522	154
F	6195	1230	350	2810	558	359
H	6195	1316	364	2810	597	165

* 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 20 — 19DV Two-Stage Compressor Frame Size DV4
Heat Exchanger Weights (English)**

CODE†	DRY RIGGING WEIGHT (lb)*		REFRIGERANT WEIGHT (lb)		WATER WEIGHT (lb)	
	EVAPORATOR ONLY	CONDENSER ONLY	EVAPORATOR ONLY	CONDENSER ONLY	EVAPORATOR ONLY	CONDENSER ONLY
G20	8547	—	700	—	1764	—
G21	8702	—	700	—	1841	—
G22	8864	6633	700	413	1921	1347
G23	9027	6869	700	405	2001	1444
G24	9238	7128	700	402	2105	1549
G25	8547	—	700	—	1764	—
G26	8666	—	700	—	1823	—
G27	8828	6559	700	413	1903	1317
G28	8998	6769	700	405	1987	1403
G29	9182	7017	700	402	2077	1504
G40	9227	—	840	—	1867	—
G41	9410	—	840	—	1956	—
G42	9602	7247	840	468	2049	1490
G43	9794	7525	840	458	2142	1602
G44	10044	7830	840	455	2264	1724
G45	9227	—	840	—	1867	—
G46	9368	—	840	—	1936	—
G47	9560	7160	840	468	2029	1455
G48	9760	7407	840	458	2126	1554
G49	9978	7699	840	455	2231	1672
G2A	8210	—	700	—	1775	—
G2B	8307	—	700	—	1842	—
G2C	8412	6128	700	413	1915	1437
G2D	8514	6327	700	405	1985	1554
G2E	8668	6505	700	397	2092	1660
G2F	8157	—	700	—	1738	—
G2G	8248	—	700	—	1802	—
G2H	8364	6083	700	413	1882	1410
G2J	8490	6256	700	405	1969	1512
G2K	8616	6398	700	397	2055	1596
G4A	8834	—	840	—	1879	—
G4B	8949	—	840	—	1957	—
G4C	9074	6657	840	468	2043	1594
G4D	9194	6892	840	458	2124	1731
G4E	9377	7102	840	448	2249	1854
G4F	8771	—	840	—	1836	—
G4G	8879	—	840	—	1910	—
G4H	9017	6603	840	468	2004	1562
G4J	9166	6808	840	458	2105	1682
G4K	9315	6976	840	448	2206	1780

* Rigging weights are for standard Super B5LSL and Super C5 tubes of standard wall thickness (0.025-in. [0.635 mm] wall) and do not include refrigerant weight.

† See Model Number Nomenclature on page 5.

NOTES:

1. Evaporator weight includes two-pass Victaulic dished heads.
2. Condenser weight includes the high side float chamber, discharge pipe, and two-pass Victaulic dished heads; does not include economizer weight.

**Table 21 — 19DV Two-Stage Compressor Frame Size DV4
Heat Exchanger Weights (SI)**

CODE†	DRY RIGGING WEIGHT (kg)*		REFRIGERANT WEIGHT (kg)		WATER WEIGHT (kg)	
	EVAPORATOR ONLY	CONDENSER ONLY	EVAPORATOR ONLY	CONDENSER ONLY	EVAPORATOR ONLY	CONDENSER ONLY
G20	3877	—	318	—	800	—
G21	3947	—	318	—	835	—
G22	4021	3009	318	187	871	611
G23	4094	3116	318	184	907	655
G24	4190	3233	318	182	955	702
G25	3877	—	318	—	800	—
G26	3931	—	318	—	827	—
G27	4004	2975	318	187	863	598
G28	4081	3070	318	184	901	636
G29	4165	3183	318	182	942	682
G40	4185	—	381	—	847	—
G41	4268	—	381	—	887	—
G42	4355	3287	381	212	929	676
G43	4443	3413	381	208	972	727
G44	4556	3552	381	206	1027	782
G45	4185	—	381	—	847	—
G46	4249	—	381	—	878	—
G47	4336	3248	381	212	920	660
G48	4427	3360	381	208	964	705
G49	4526	3492	381	206	1012	758
G2A	3724	—	318	—	805	—
G2B	3768	—	318	—	835	—
G2C	3816	2780	318	187	869	652
G2D	3862	2870	318	184	901	705
G2E	3932	2951	318	180	949	753
G2F	3700	—	318	—	789	—
G2G	3741	—	318	—	817	—
G2H	3794	2759	318	187	854	639
G2J	3851	2838	318	184	893	686
G2K	3908	2902	318	180	932	724
G4A	4007	—	381	—	852	—
G4B	4059	—	381	—	888	—
G4C	4116	3020	381	212	927	723
G4D	4170	3126	381	208	964	785
G4E	4254	3222	381	203	1020	841
G4F	3978	—	381	—	833	—
G4G	4028	—	381	—	866	—
G4H	4090	2995	381	212	909	709
G4J	4158	3088	381	208	955	763
G4K	4225	3164	381	203	1001	807

* Rigging weights are for standard Super B5LSL and Super C5 tubes of standard wall thickness (0.025-in. [0.635 mm] wall) and do not include refrigerant weight.

† See Model Number Nomenclature on page 5.

NOTES:

1. Evaporator weight includes two-pass Victaulic dished heads.
2. Condenser weight includes the high side float chamber, discharge pipe, and two-pass Victaulic dished heads; does not include economizer weight.

**Table 22 — 19DV Two-Stage Compressor Frame Size DV4
Economizer Weight**

ECONOMIZER SIZE	DRY WEIGHT (lb)*	REFRIGERANT WEIGHT (lb)	OPERATION WEIGHT (lb)	DRY WEIGHT (kg)*	REFRIGERANT WEIGHT (kg)	OPERATION WEIGHT (kg)
12 in.	1961	342	2303	889	155	1044
14 in.	2330	342	2672	1057	155	1212

*Includes standard economizer weight and all connecting piping to compressor.

**Table 23 — Additional Weights for 19DV 150 psig (1034 kPa) Marine Waterboxes*
19DV4† — English (lb)**

FRAME	NUMBER OF PASSES	EVAPORATOR			CONDENSER		
		Rigging Wgt		Water Wgt	Rigging Wgt		Water Wgt
		Victaulic	Flange		Victaulic	Flange	
G	2	504	499	1135	390	387	606

*Add to cooler and condenser weights for total weights. Cooler and condenser weights may be found in Tables 20-21. The first digit of the heat exchanger code (first column) is the heat exchanger frame size.

†Values are for Victaulic nozzles, two-pass dished head design.

**Table 24 — Additional Weights for 19DV 150 psig (1034 kPa) Marine Waterboxes*
19DV4† — SI (kg)**

FRAME	NUMBER OF PASSES	EVAPORATOR			CONDENSER		
		Rigging Wgt		Water Wgt	Rigging Wgt		Water Wgt
		Victaulic	Flange		Victaulic	Flange	
G	2	229	226	515	177	176	275

*Add to cooler and condenser weights for total weights. Condenser weights may be found in Tables 20-21. The first digit of the heat exchanger code (first column) is the heat exchanger frame size.

†Values are for Victaulic nozzles, two-pass dished head design.

Table 25 — 19DV Waterbox Cover Weights, DV4 — English (lb)

WATERBOX DESCRIPTION	PASSES	EVAPORATOR		CONDENSER	
		FRAME G		FRAME G	
		STANDARD NOZZLES	FLANGED	STANDARD NOZZLES	FLANGED
Dished Head, 150 psig	2	528	681	235	308
Dished Head (Return Cover), 150 psig	2	404	404	235	235
MWB End Cover, 150 psig	2	404	404	235	235
MWB End Cover (Return Cover), 150 psig	2	404	404	235	235
MWB End Cover (ASME), 300 psig	2	2460	2460	2117	2117
MWB End Cover (ASME) (Return Cover), 300 psig	2	2460	2460	2117	2117

LEGEND

ASME — American Society of Mechanical Engineers
MWB — Marine Waterbox

NOTE: Weights for dished head cover and MWB end cover 150 psig are included in the heat exchanger weights shown in Table 20.

Table 26 — 19DV Waterbox Cover Weights, DV4 — SI (kg)

WATERBOX DESCRIPTION	PASSES	EVAPORATOR		CONDENSER	
		FRAME G		FRAME G	
		STANDARD NOZZLES	FLANGED	STANDARD NOZZLES	FLANGED
Dished Head, 150 psig	2	239	309	107	140
Dished Head (Return Cover), 150 psig	2	183	183	107	107
MWB End Cover, 150 psig	2	183	183	107	107
MWB End Cover (Return Cover), 150 psig	2	183	183	107	107
MWB End Cover (ASME), 300 psig	2	1116	1116	1440	1440
MWB End Cover (ASME) (Return Cover), 300 psig	2	1116	1116	1245	1245

LEGEND

ASME — American Society of Mechanical Engineers
MWB — Marine Waterbox

NOTE: Weights for dished head cover and MWB end cover 1034 kPa are included in the heat exchanger weights shown in Table 21.

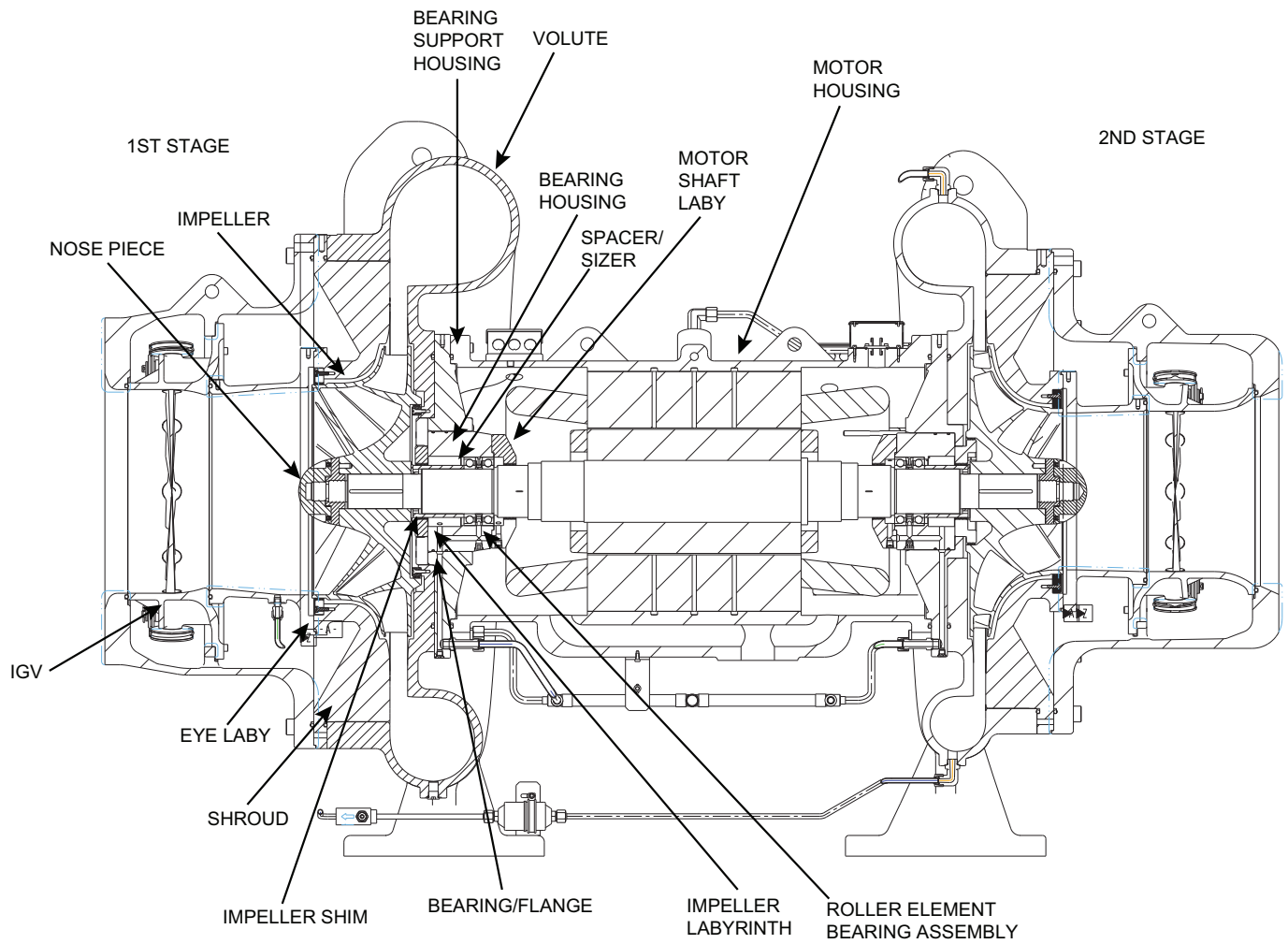


Fig. 46 — 19DV Compressor

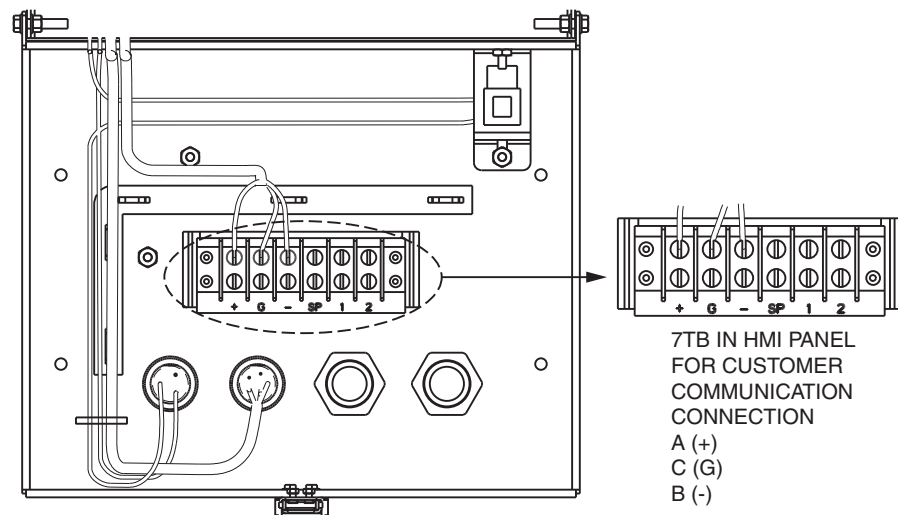


Fig. 47 — HMI Panel

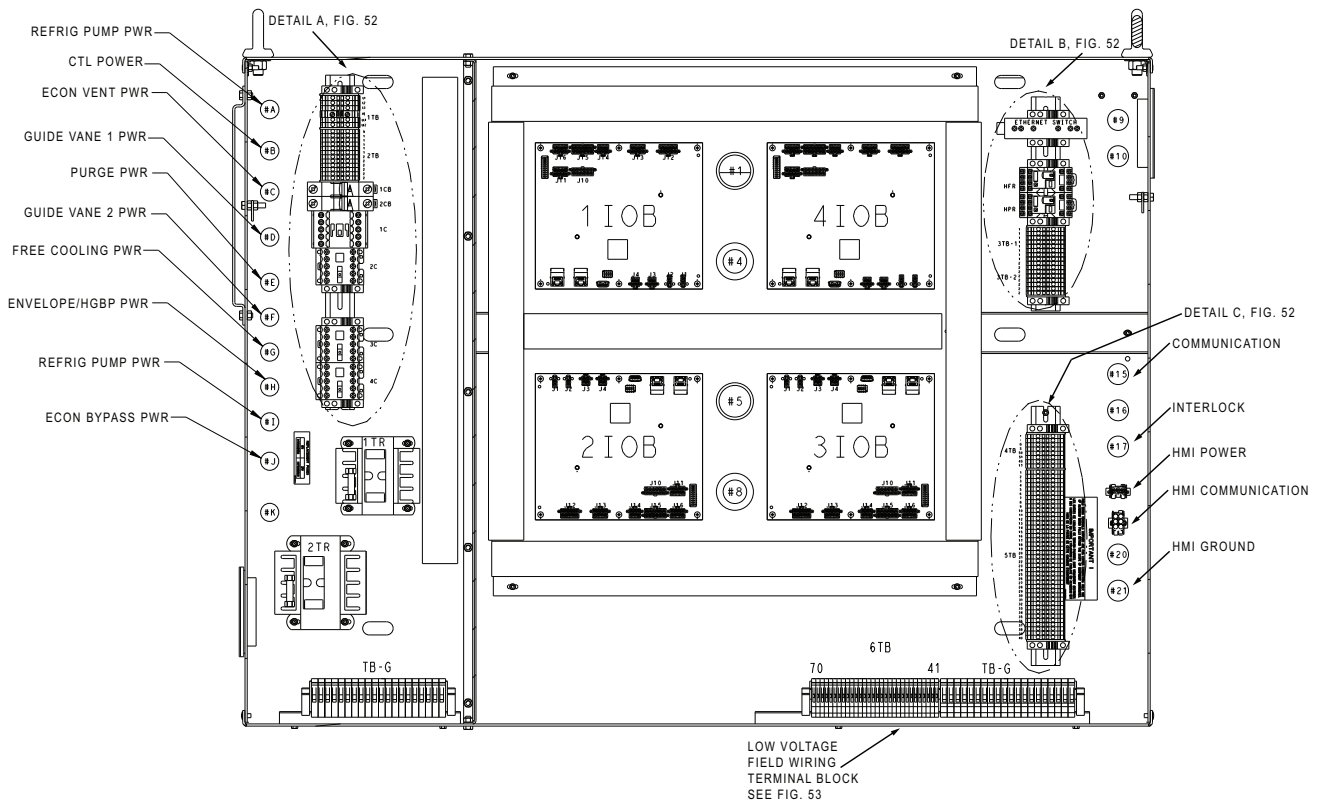


Fig. 48 — Control Panel

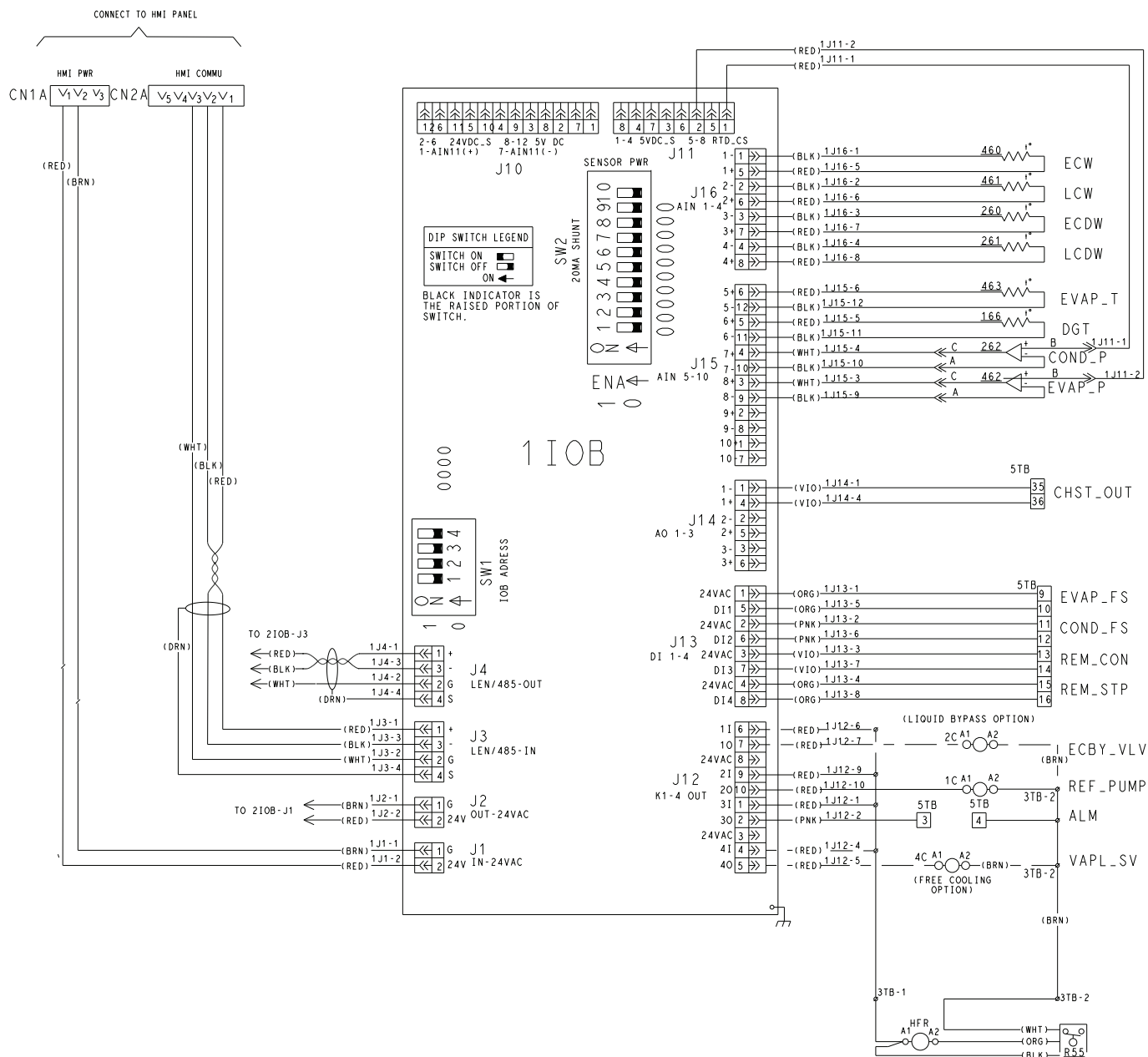


Fig. 50 — 19DV Input Output Board (IOB) Schematic

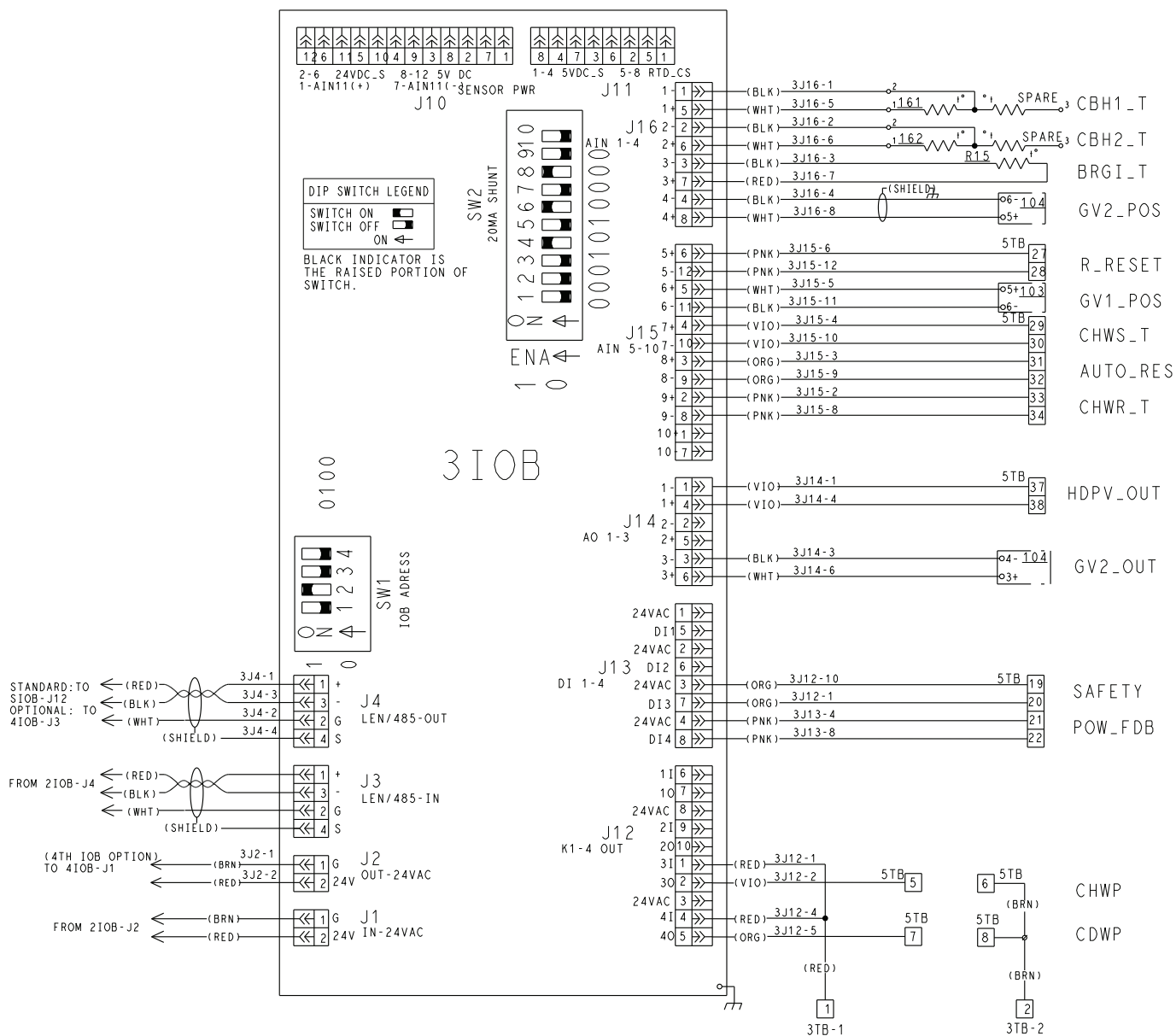
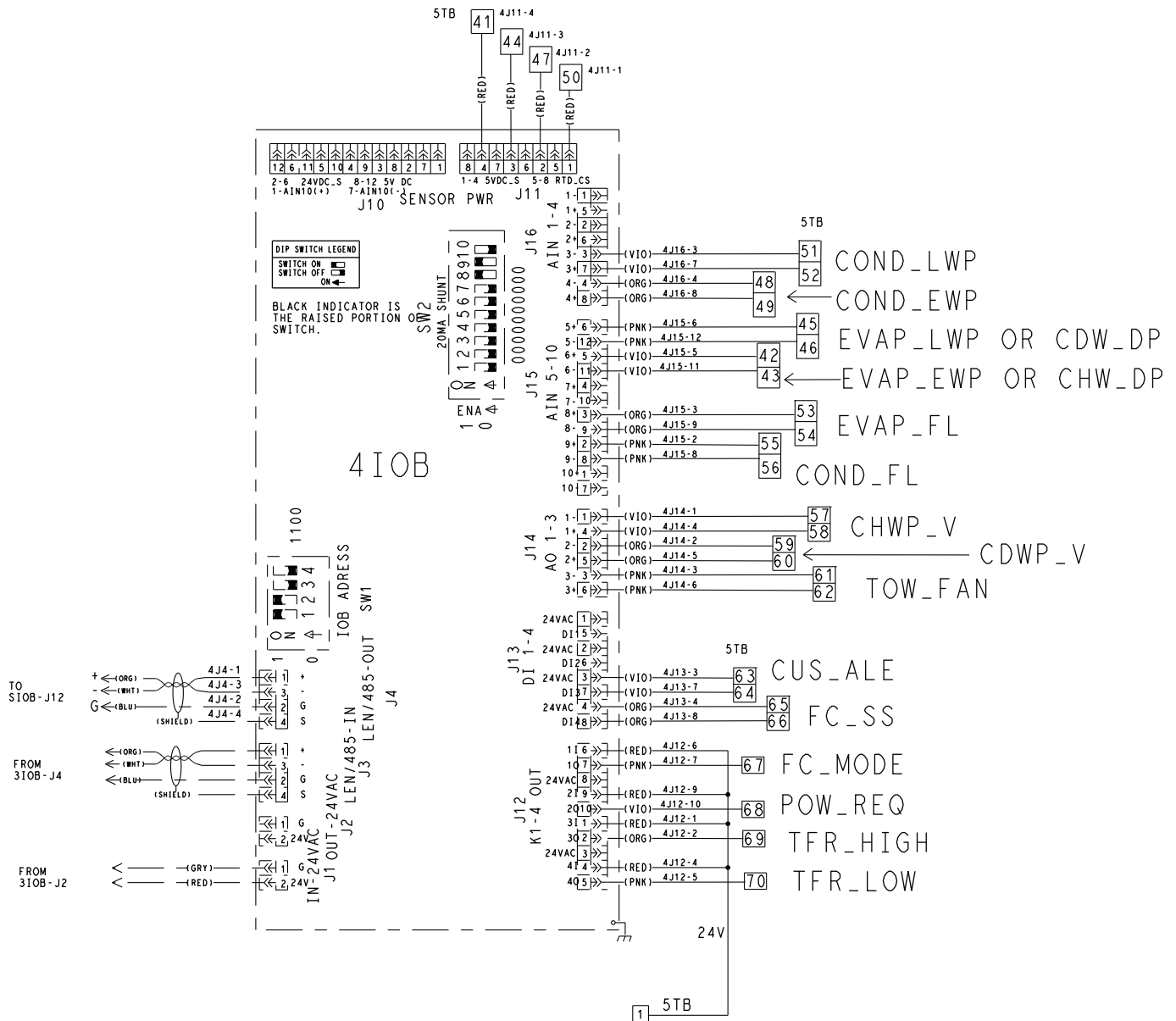


Fig. 50 — 19DV Input Output Board (IOB) Schematic (cont)



THIS TYPICAL DRAWING SHOWS THE CARRIER STANDARD PRESSURE TRANSDUCER WHICH IS 5VDC POWER SUPPLY.

Fig. 50 — 19DV Input Output Board (IOB) Schematic (cont)

LEGEND		ECBY_VLV	ECONOMIZER BYPASS VALVE		
	DENOTES INTERNAL COMPONENT TERMINAL	ECW	ENTERING CONDENSER WATER TEMPERATURE	461	LEAVING CHILLED WATER TEMPERATURE THERMISTOR
	DENOTES CONDUCTOR MALE/FEMALE CONNECTOR	ECON_IV	ECONOMIZER VENT VALVE ACTUATOR	462	EVAPORATOR PRESSURE TRANSDUCER
	FIELD WIRING	ECW	ENTERING CHILLED WATER TEMPERATURE	463	EVAPORATOR REFRIGERANT LIQUID TEMPERATURE THERMISTOR
	OPTIONAL WIRING	EVAP_CV	EVAPORATOR CONTROL VALVE	M60	MOTOR WINDING TEMPERATURE 1(THERMISTOR/PT100)
	COMPONENT/PANEL ENCLOSURE			P00	PURGE DEVICE
	SHIELD WIRE	EVAP_EWP	ENTERING EVAPORATOR WATER PRESSURE	R04-1	CONDENSER CONTROL VALVE
	TWISTED WIRE	EVAP_FL	EVAPORATOR WATER FLOW MEASUREMENT	R04-2	EVAPORATOR CONTROL VALVE
	TERMINAL BLOCK FOR FIELD WIRING	EVAP_FS	EVAPORATOR WATER FLOW SWITCH	R10-1	REFRIGERANT PUMP OUTLET PRESSURE TRANSDUCER
	WIRE SPLICE	EVAP_LWP	LEAVING EVAP WATER PRESSURE	R10-2	BEARING OUTLET PRESSURE TRANSDUCER
	INTERNAL TERMINAL BLOCK/TERMINAL	EVAP_P	EVAPORATOR PRESSURE	R10-3	BEARING INLET PRESSURE TRANSDUCER
		EVAP_T	EVAPORATOR REFRIGERANT TEMPERATURE	R10-4	REFRIGERANT PUMP INLET PRESSURE TRANSDUCER
		FC_MODE	FREE COOLING MODE	R15	BEARING REF SUPPLY TEMP THERMISTOR
BLK	BLACK	FC_SS	FREE COOLING START SWITCH	R45	REFRIGERANT PUMP
BLU	BLUE	FIRE_LOCK	FIRE ALARM INTERLOCK	R55	HIGH FLOAT LIQUID LEVEL SWITCH
BRN	BROWN	GV1/2_POS	IGV1/2 ACTUAL POS	S01-2	HIGH FLOAT LIQUID LEVEL SWITCH
GRN	GREEN	GV1/2_OUT	IGV1/2 OUTPUT	S02-1	ECONOMIZER VENT VALVE ACTUATOR
GRY	GREY	HDPV_OUT	HEAD PRESSURE OUTPUT	S02-2	MODULATING HOT GAS CONTROL VALVE ACTUATOR
RED	RED	HGBP_MA	MODULATING HOT GAS VALVE FEEDBACK	S02-3	FREE COOLING VENT VALVE ACTUATOR
ORG	ORANGE	HGBP_OUT	MODULATING HOT GAS VALVE OUTPUT MA		INSTRUMENT CODE(WITHIN THE CONTROL PANEL)
WHT	WHITE	HF_LS	HIGH FLOAT LIQUID LEVEL SWITCH	1C	REFRIGERANT PUMP CONTACTOR
YEL	YELLOW	HP_SW	HIGH PRESSURE SWITCH	2C	LIQUID BYPASS VALVE RELAY
G/Y	GREEN/YELLOW	ICE_CON	ICE BUILD CONTACT	3C	ECONOMIZER VENT VALVE RELAY
CONTROL ABBREVIATION LIST		LCW	LEAVING CONDENSER WATER TEMPERATURE	4C	FREE COOLING VENT VALVE RELAY
ALM	CHILLER ALARM	LCW	LEAVING CHILLED WATER TEMPERATURE	1-3CB	MICRO CIRCUIT BREAKER
AUTO_DEM	DEMAND LIMIT INPUT	MTRW1	MOTOR WINDING TEMPERATURE 1	1FU	FUSE, 5A, TIME-DELAY, 13/32" X 1-1/2"
AUTO_RES	AUTO WATER TEMP RESET	PUMPI_P	PUMP INLET PRESSURE	2FU	FUSE, 5A, TIME-DELAY, 13/32" X 1-1/2"
BRGI_P	BEARING INLET PRESSURE	PUMPO_P	PUMP OUTLET PRESSURE	1-4 IOB	1-4 INPUT OUTPUT BOARD 1-4
BRGI_T	BEARING REF SUPPLY TEMP	REF_LEAK	REFRIGERANT LEAK DETECTOR	1TB	TERMINAL BLOCK FOR POWER CONNECTION
BRGO_P	BEARING OUTLET PRESSURE	REF_PUMP	REFRIGERANT PUMP	2TB	INTERNAL 115/120 V TERMINAL BLOCK
CBH1_T	1ST STAGE BEARING TEMP	REM_CON	REMOTE CONTACT INPUT	3TB	INTERNAL 24V TERMINAL BLOCK
CBH2_T	2ND STAGE BEARING TEMP	TFR_HIGH	TOWER FAN HIGH	4TB	TERMINAL BLOCK FOR VFD CONNECTION
CDWP	CONDENSER WATER PUMP	TFR_LOW	TOWER FAN LOW	5TB	TERMINAL BLOCK FOR CUSTOMER OPTIONAL CONNECTION
CDWP_V	CONDENSER WATER PUMP(VARIABLE SPEED OUTPUT)	TOW_FAN	TOWER FAN(VARIABLE)		
CHWP	CHILLED WATER PUMP	VAPL_SV	VAPOR VENTING LINE SV	7TB	230V/115V TERMINAL BLOCK (PURGE PANEL)
CHWP_V	CHILLED WATER PUMP(VARIABLE SPEED OUTPUT)	INSTRUMENT CODE (OUTSIDE CONTROL PANEL REFER PID DRAWING)		1TR	TRANSFORMER 1 230V-115V/24V 100VA
CHST_OUT	CHILLER RUNNING(ON/OFF/READY)	103	1ST STAGE IGV	2TR	TRANSFORMER 2 230V-115V/24V 100VA
COND_CV	CONDENSER CONTROL VALVE	104	2ND STAGE IGV	CN1A/B	CONNECTOR FOR HMI POWER
COND_DCV	CONDENSER DRAIN VALVE	161	1ST BEARING TEMP THERMISTOR	CN2A/B	CONNECTOR FOR HMI COMMUNICATION
COND_EWP	ENTERING CONDENSER WATER PRESSURE	162	2ND BEARING TEMP THERMISTOR	HFR	HIGH FLOAT LEVEL SWITCH
COND_FL	CONDENSER WATER FLOW MEASUREMENT	166	2ND STAGE COMPRESSOR DISCHARGE TEMPERATURE THERMISTOR	HPR	HIGH PRESSURE SWITCH RELAY
COND_FS	CONDENSER WATERFLOW SWITCH	168	HIGH PRESSURE SWITCH	HMI	HMI TOUCH SCREEN AND MAIN BOARD SAIA
COND_LWP	LEAVING COND WATER PRESSURE	260	ENTERING CONDENSER WATER TEMPERATURE THERMISTOR	SIOB	STANDARD INPUT OUTPUT BOARD (PURGE PANEL)
COND_P	CONDENSER PRESSURE	261	LEAVING CONDENSER WATER TEMPERATURE THERMISTOR	TB-G	COPPER TERMINAL BLOCK FOR GROUND
CUS_ALE	CUSTOMER ALERT	262	CONDENSER PRESSURE TRANSDUCER		
DGT	COMPRESSOR DISCHARGE TEMPERATURE	460	ENTERING CHILLED WATER TEMPERATURE THERMISTOR		

Fig. 51 — 19DV Input Output Board (IOB) Schematic Abbreviations

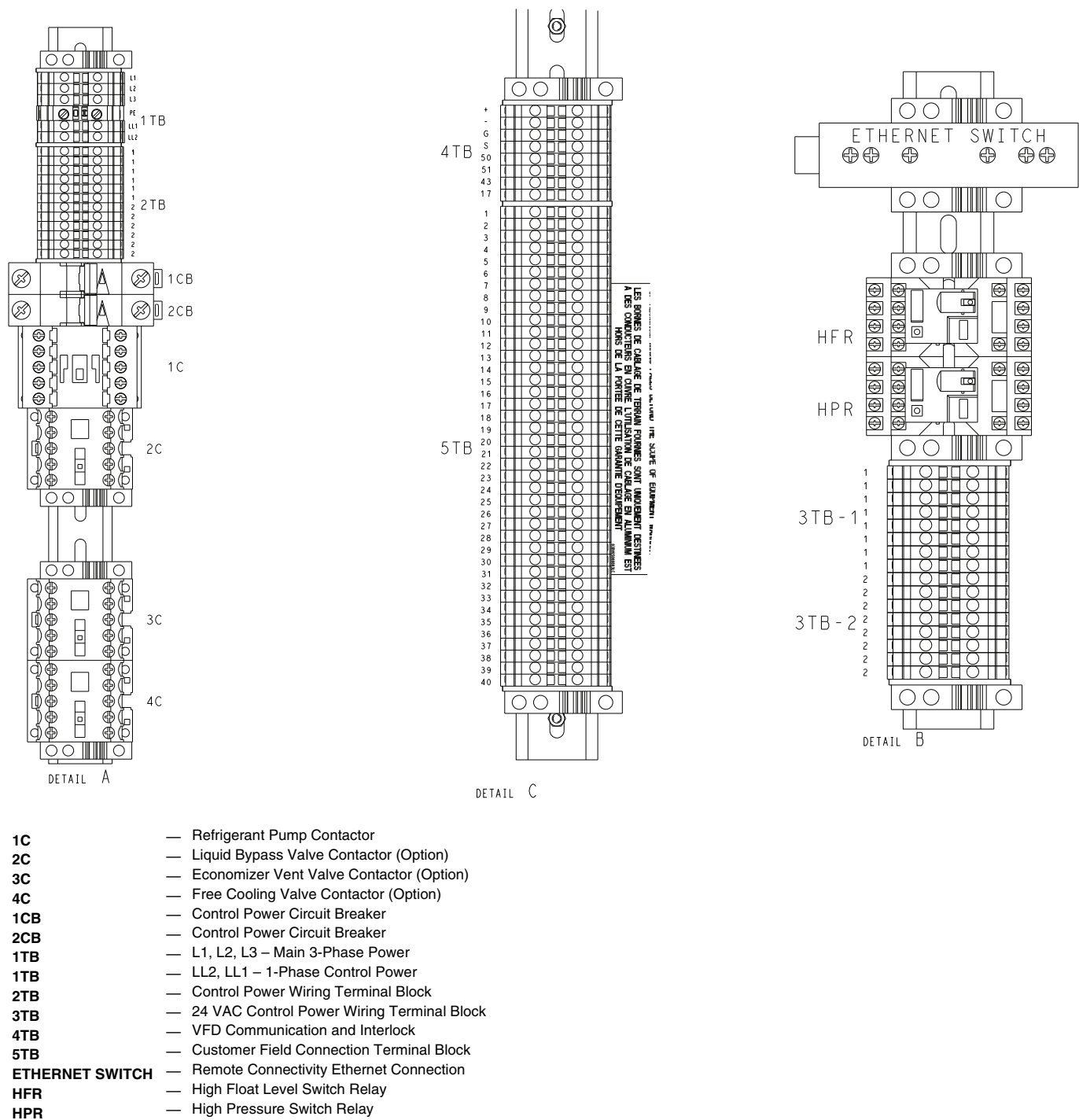
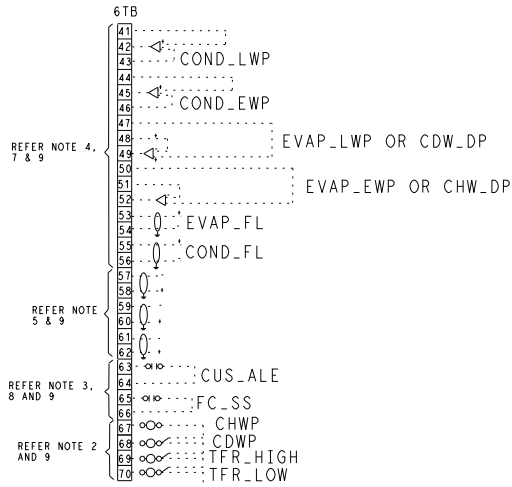
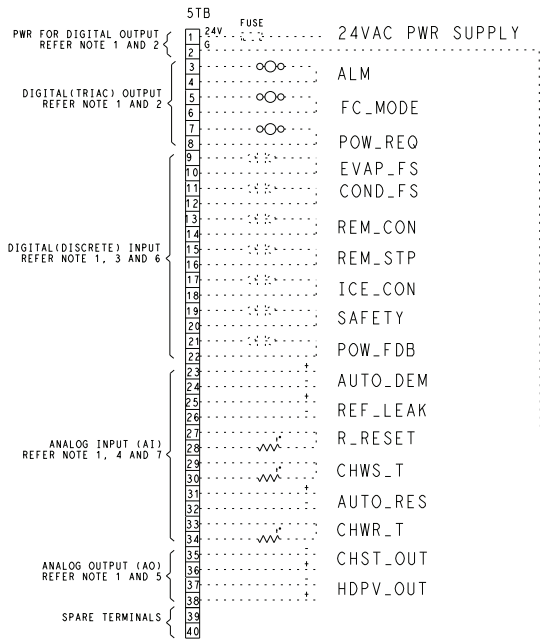


Fig. 52 — Chiller Control Schematic

FIELD OPTION WIRING INSTRUCTION OF CONTROL PANEL



NOTES:

1. FIELD-SUPPLIED CONTROL CONDUCTORS TO BE AT LEAST 18AWG (AMERICAN WIRE GAGE) OR LARGER. THE CONTROL CABINET SHOULD ONLY BE USED FOR LOW VOLTAGE FIELD WIRING (50-V MAXIMUM.)
2. EACH DIGITAL OUTPUT LOOP SHALL BE LIMITED TO A MAXIMUM OF 1A AC RMS STEADY-STATE 24VAC. LIGHT LOAD RELAY IS RECOMMENDED AND THE COIL VOLTAGE OF RELAY IS 24VAC. CONNECT 5TB-1 TO 3TB-1 AND 5TB-2 TO 3TB-2 FOR 24VAC POWER SUPPLY IF TOTAL POWER CONSUMES LESS THAN 40VA@24VAC. OTHERS, POWER SUPPLY SHALL BE PROVIDED BY CUSTOMER FUSED TRANSFORMER.
3. EACH DISCRETE INPUT LOOP IS POWERED BY INTERNAL 24VAC POWER SUPPLY. FIELD OPTIONAL CONTACTS OR SWITCH MUST HAVE 24VAC RATING, MAX CURRENT IS 60MA. NOMINAL CURRENT IS 10MA. SWITCHES WITH GOLD PLATED BIFURCATED CONTACTS ARE RECOMMENDED.
4. THE ANALOG INPUT SUPPORT 5K/10K NTC THERMISTOR, 0/4-20MA SENSOR AND 5VDC SENSOR.
5. EACH ANALOG OUTPUT LOOP SUPPORT 0/4-20MA OR 0/2-10VDC VOLTAGE OUTPUT. THE ANALOG OUTPUT LOOP IS POWERED BY BOARD. DO NOT SUPPLY EXTERNAL POWER.
6. FOR STANDARD DISCRETE INPUT (ON 1/2/3/10B), ONLY WHEN THE CONTACT OR SWITCH IS CLOSED, AN ALARM WILL BE GENERATED. 7. SW2 CONFIGURED BY FIELD, IF 4-20MA SIGNAL SENSOR, SHALL TURN THE SWITCH TO "ON" POSITION.
8. FOR 4TH IOB DISCRETE INPUT, ONLY WHEN THE CONTACT OR SWITCH IS OPENED, AN ALARM WILL BE GENERATED.
9. ALL CONNECTORS OF IOB, EXCEPT ETHERNET, SHALL SUPPORT 18AWG WIRE.

Fig. 53 — Control Panel Schematic

NOTES FOR FIG. 50-53 19DV with 32VS VFD

I. General

- 1.0 Variable Frequency Drive (VFD) shall be designed and manufactured in accordance with Carrier engineering requirement.
- 1.1 All field-supplied conductors and devices must be compliant, and be installed in compliance with all applicable codes and job specifications.
- 1.2 The routing of field-installed conduit and conductors and the location of field-installed devices must not interfere with equipment access or the reading, adjusting or servicing of any component.
- 1.3 Equipment installation and all starting and control devices must comply with details in equipment submittal drawings and literature.
- 1.4 Contacts and switches are shown in the position they would assume with the circuit deenergized and the chiller shutdown.
- 1.5 Warning — Do not use aluminum conductors.
- 1.6 Warning — Remove panel above VFD bus bar before drilling. Do not drill into any other VFD cabinet panels.

II. Power Wiring To VFD

- 2.0 Provide a means of disconnecting branch feeder power to VFD. Provide short circuit protection and interrupt capacity for branch feeder in compliance with all applicable codes.
- 2.1 Metal conduit must be used for the power wires, from VFD to branch feeder.
- 2.2 Line side power conductor rating must meet VFD nameplate voltage and chiller full load amps (minimum circuit ampacity).
- 2.3 Lug adapters may be required if installation conditions dictate that conductors be sized beyond the minimum ampacity required. Lugs will accommodate the quantity (#) and size cables (per phase) as follows. If larger lugs are required, they may be purchased from the manufacturer of the circuit breaker.

VFD MAX INPUT AMPS	100KAIC LUG CAPACITY (PER PHASE)		
	NO. OF CONDUCTORS	CONDUCTOR RANGE	GROUND CONNECTOR
32VSS0850	4	4/0 - 500 kcmil	2/0

- 2.4 Compressor motor and controls must be grounded by using equipment grounding lug provided inside unit-mounted VFD enclosure.

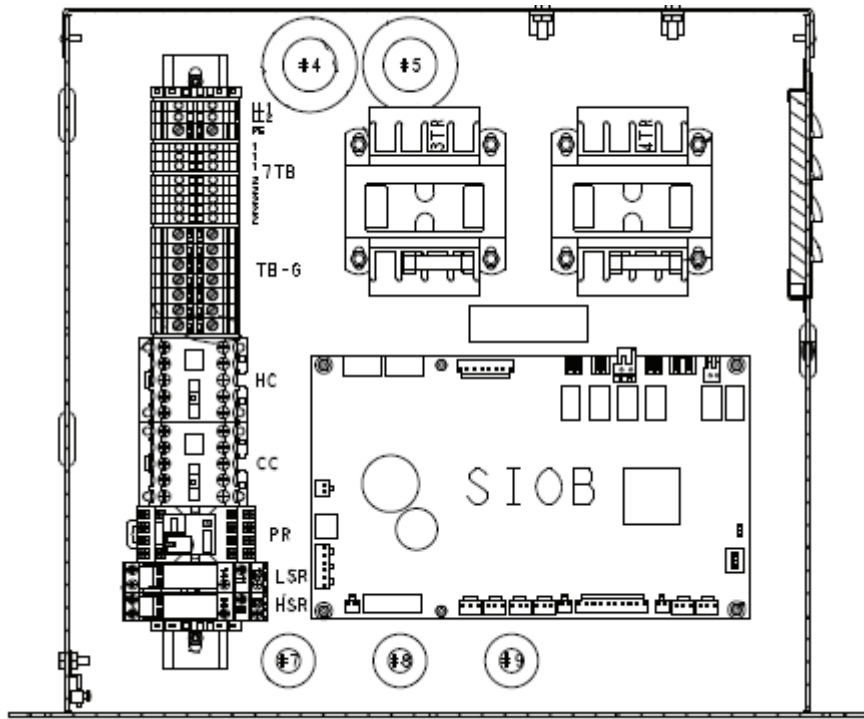
III. Control Wiring

- 3.0 Field-supplied control conductors to be at least 18 AWG (American Wire Gage) or larger.
- 3.1 Ice build start/terminate device contacts, remote start/stop device contacts and spare safety device contacts (devices not supplied by Carrier) must have 24 vac rating. Max current is 60 mA, nominal current is 10 mA. Switches with gold-plated bifurcated contacts are recommended.
- 3.2 Each integrated contact output can control loads (VA) for evaporator pump, condenser pump, tower fan low, tower fan high and alarm annunciator devices rated 5 amps at 115 vac and up to 3 amps at 250 vac.

WARNING

Control wiring required for Carrier to start pumps and tower fan motors, and established flows must be provided to assure machine protection. If primary pump, tower fan and flow control is by other means, also provide a parallel means for control by Carrier. Failure to do so could result in machine freeze-up or overpressure.

- 3.3 Do not use control transformers in the VFD enclosure or control panel as the power source for external or field-supplied contactor coils, actuator motors or any other loads.
- 3.4 Do not route control wiring carrying 30 v or less within a conduit which has wires carrying 50 v or higher or along side wires carrying 50 v or higher.
- 3.5 Spare 4 to 20 mA output signal is designed for controllers with a non-grounded 4 to 20 mA input signal and a maximum input impedance of 500 ohms.



3TR
 4TR
 7TB 1,2
 7TB LL1, LL2
 7TB PE
 CC
 HC
 HSR
 LSR
 PR
 SIOB

- Transformer
- Transformer
- 24VAC Low Voltage Wiring Terminal Block
- Main One Phase Power
- Ground
- Purge Compressor/Fan Contactor
- Purge Heater Contactor
- High Level Switch Relay
- Low Level Switch Relay
- Purge Vacuum Pump Relay
- Purge Input/Output Board

Fig. 54 — 19DV Purge Panel Layout

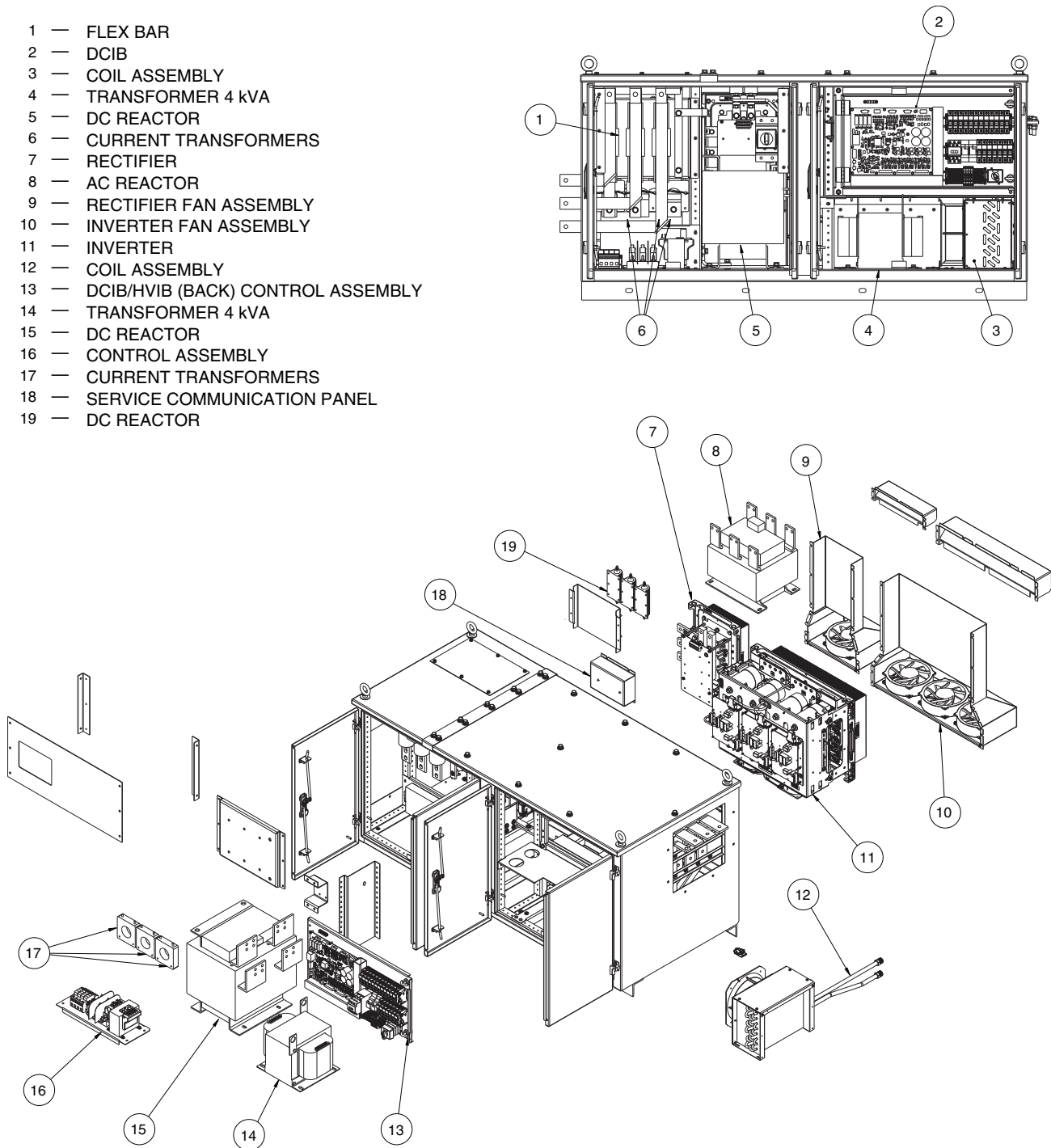


Fig. 56 — Exploded View of 32VS VFD

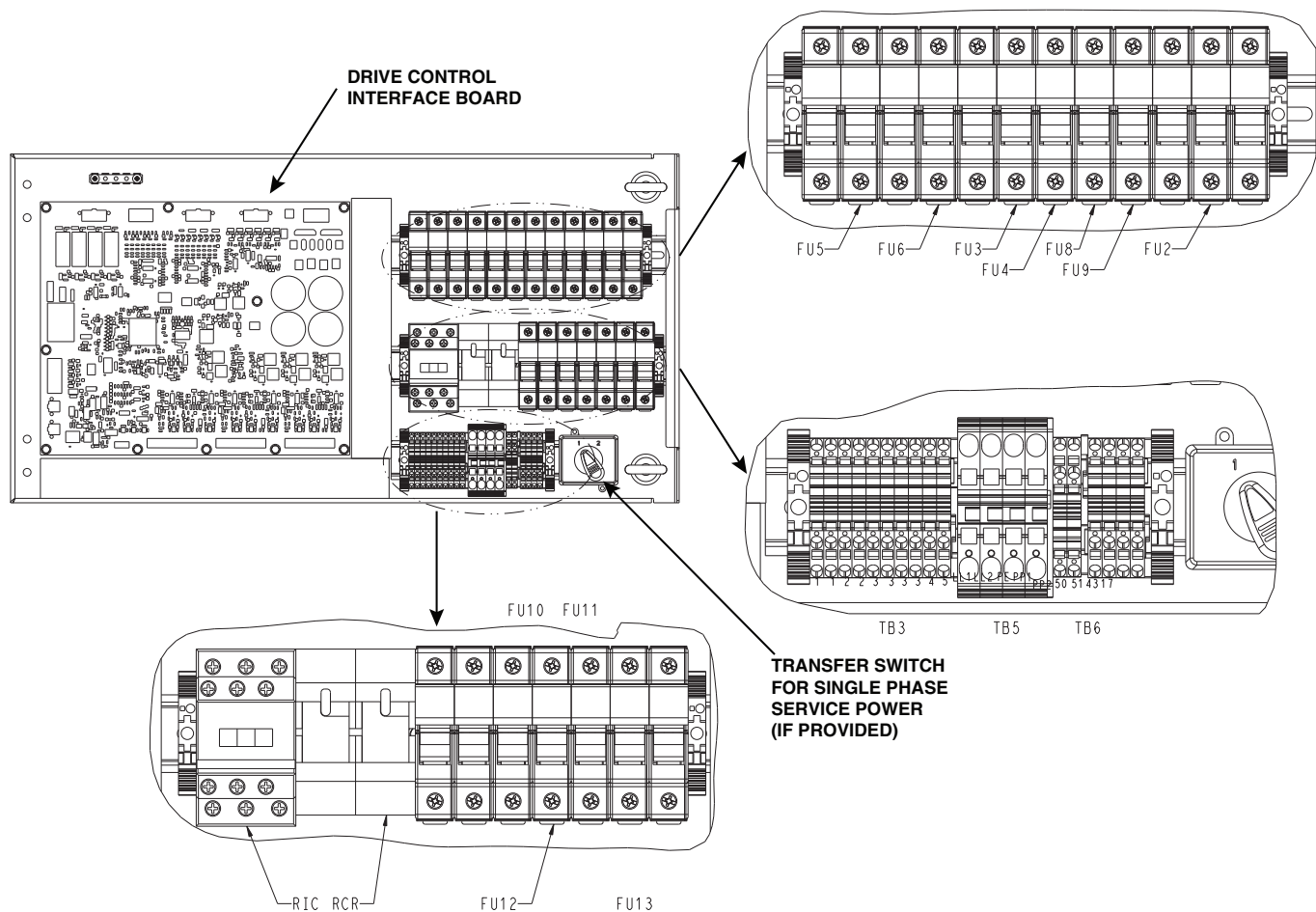
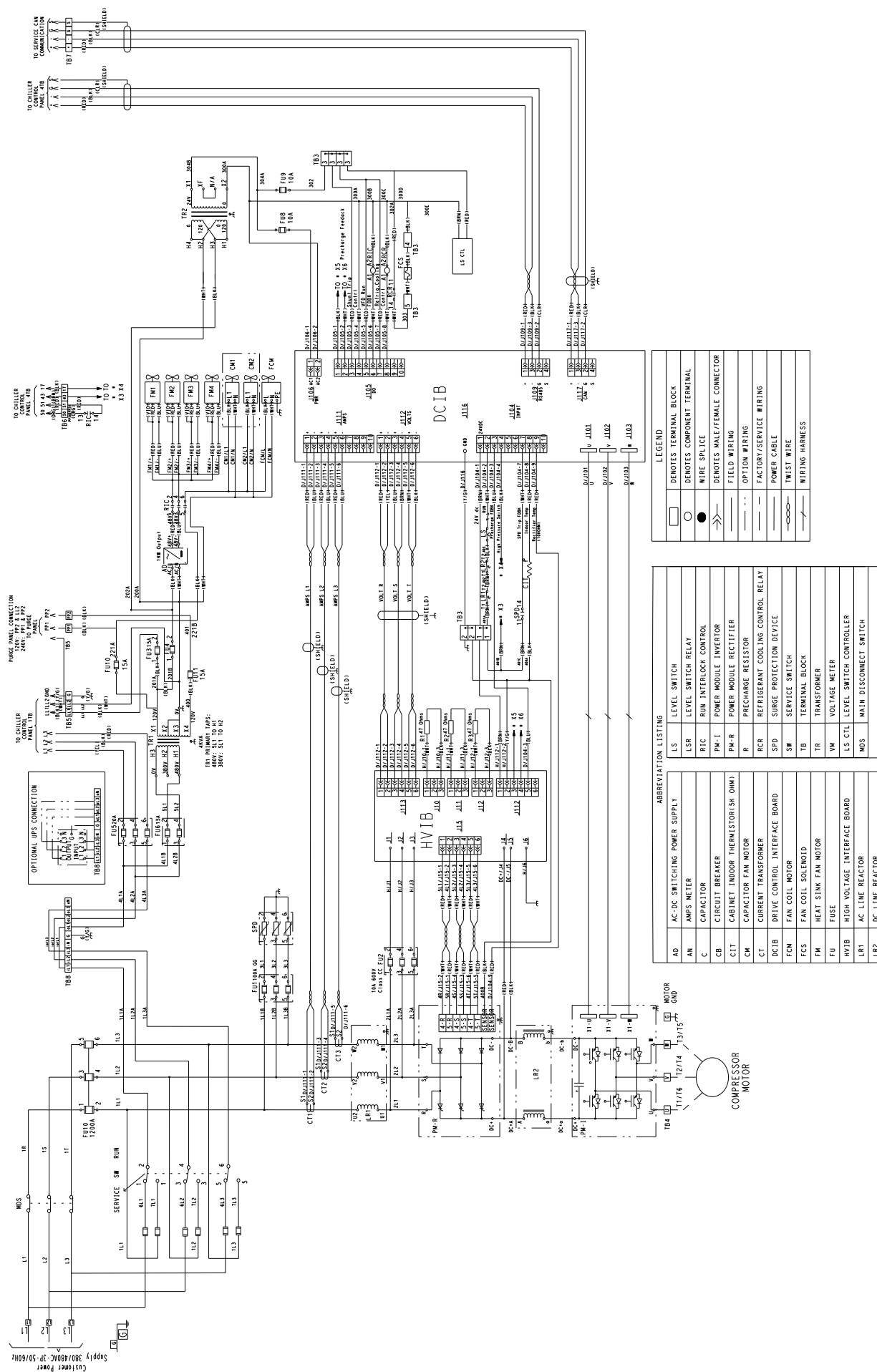


Fig. 57 — VFD Power Panel Assembly



APPENDIX A — PIC5 SCREEN AND MENU STRUCTURE

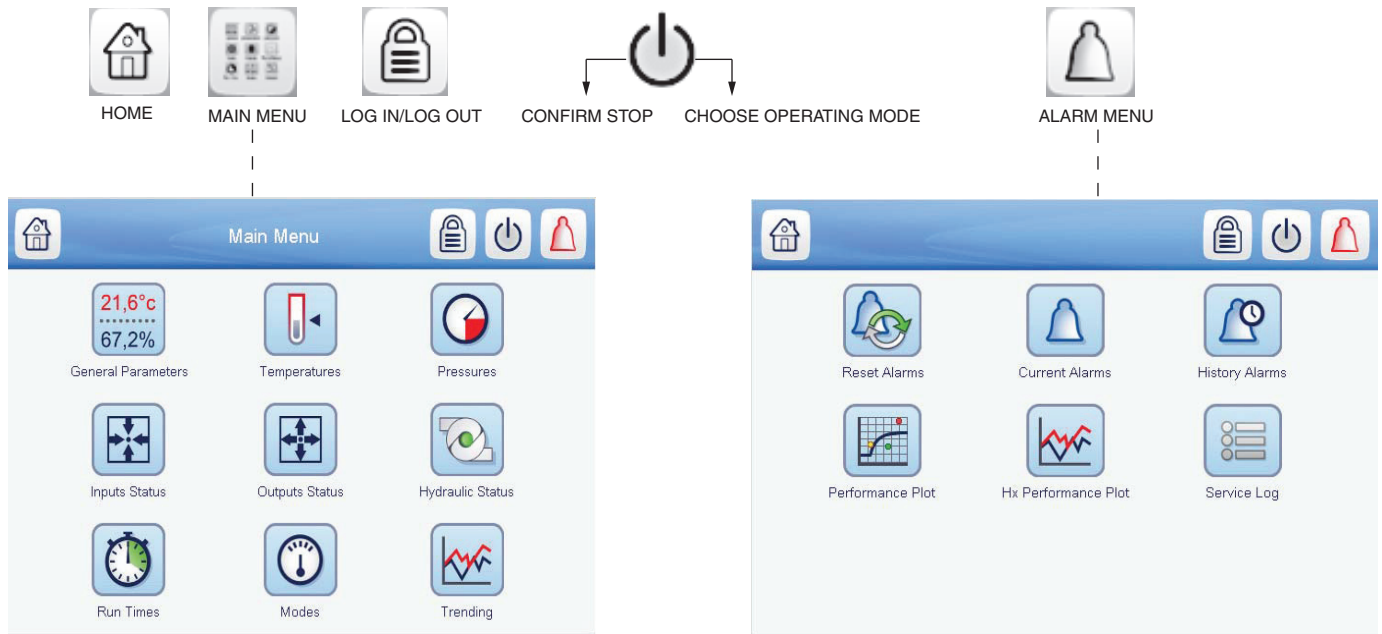


Fig. A — Screen Structure, Basic Level (All) Access (No Password Required)

APPENDIX A — PIC5 SCREEN AND MENU STRUCTURE (cont)



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

APPENDIX A — PIC5 SCREEN AND MENU STRUCTURE (cont)

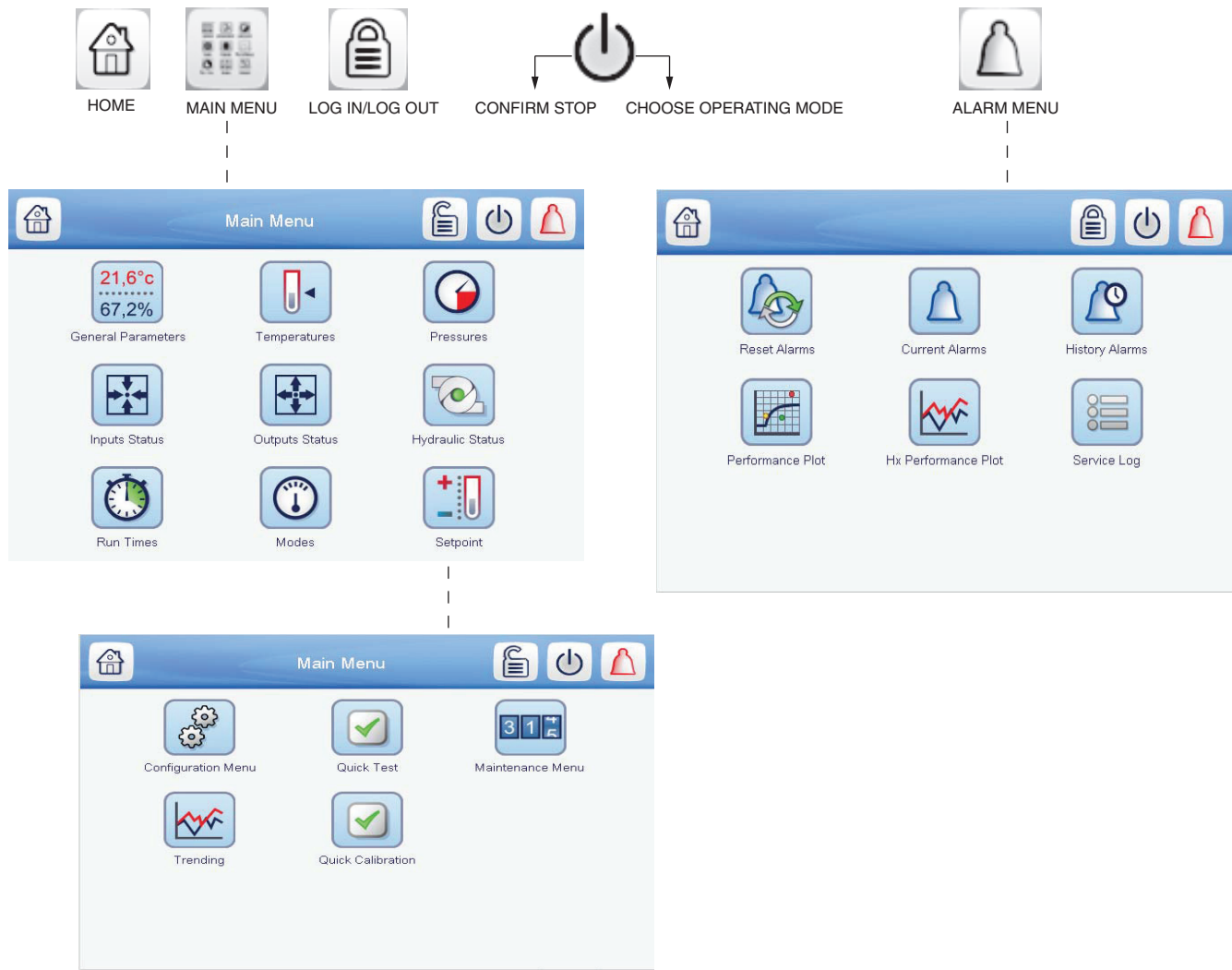


Fig. C — Screen Structure, Service (Advanced User) / Factory Level Access Password Required

APPENDIX A — PIC5 SCREEN AND MENU STRUCTURE (cont)

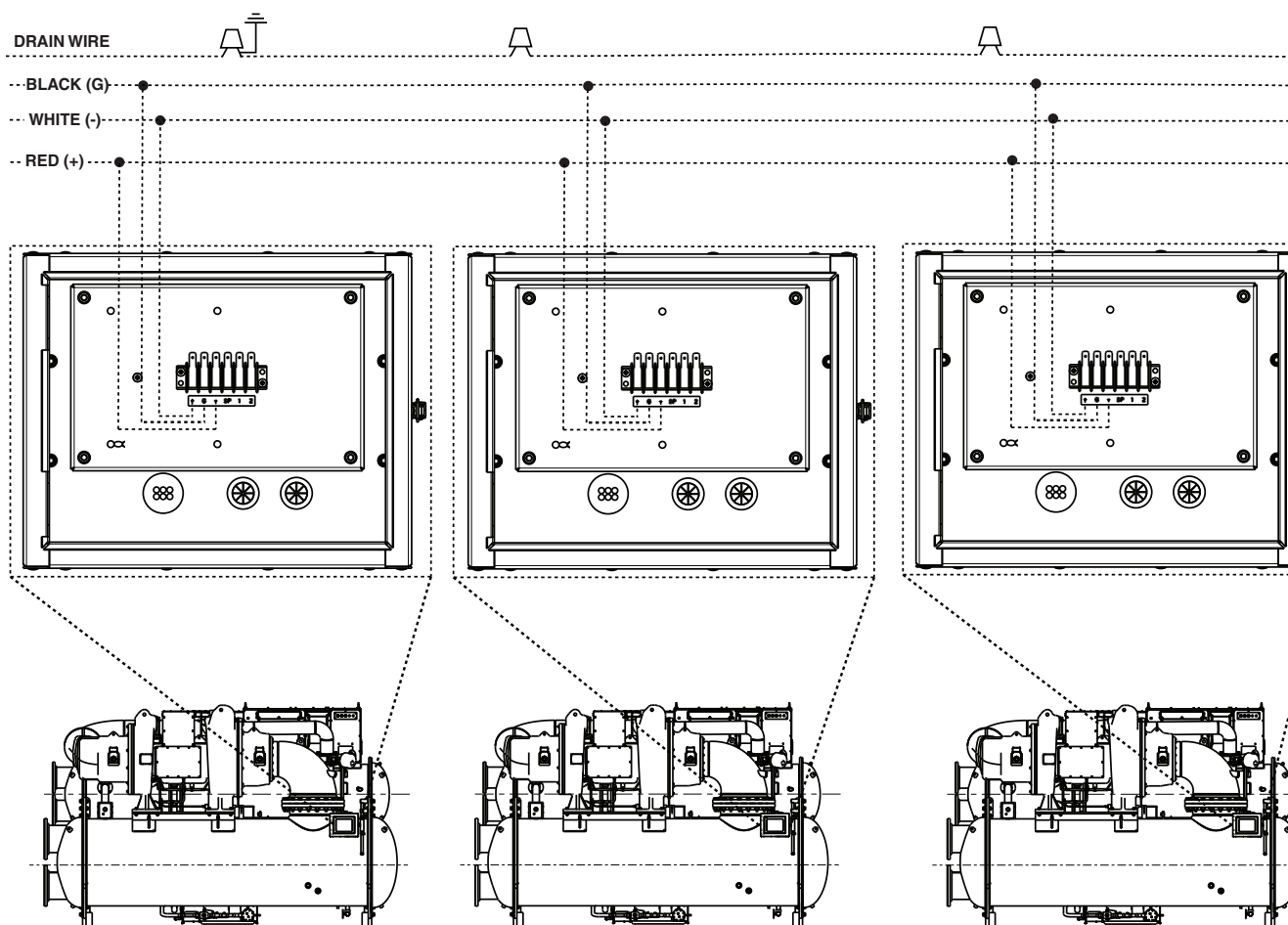
Main Menu Description

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, Factory	CONFIG
	Quick Test	Factory	QCK_TEST
	Maintenance Menu	Factory	MAINTAIN
	Trending	Basic, User, Factory	TRENDING
	Quick Calibration	Factory	QCK_CALI

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

†See the 19DV 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

19DV Maintenance Interval Requirements

WEEKLY			
COMPRESSOR	None	CONTROLS	Review PIC5 Alarm/Alert History.
COOLER	None.	VFD	None.
CONDENSER	None.	OIL RECLAIM	None.
MONTHLY			
COMPRESSOR	None.	CONTROLS	Review and record purge operating time.
ANNUALLY			
COMPRESSOR	Change lubrication assembly refrigerant and bearing filters. Leak test. Vibration trending.	CONTROLS	Perform general cleaning. Tighten connections. Check pressure transducers. Confirm accuracy of thermistors.
COOLER	Inspect and clean cooler 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 (closes to cooler inlet).	VFD	Perform general cleaning. Tighten connections. Change refrigerant/motor filter feeding VFD devices. Perform visual inspection of the capacitors located on the DC bus and inductors. Check cooling fan operation. Check condensate drain for the VFD enclosure. Change VFD strainer.
CONDENSER	Inspect and clean condenser tubes. Leak test. Verify water pressure differential. Inspect water pumps and cooling tower.	PURGE	Record total purge Pumpout Numbers and Pumpout Time. If excessive then leak test and correct. Inspect moisture sight glasses in line to bearings and VFD. Replace purge strainer in drain line.
LUBRICATION ASSEMBLY	Replace both refrigerant filter and bearing filter.		
EVERY 3-5 YEARS			
COMPRESSOR	None.	CONTROLS	None.
COOLER	Perform eddy current test.	VFD	None.
CONDENSER	Inspect float valves and strainers. Perform eddy current test.	PURGE	None.
EVERY 5 YEARS			
COMPRESSOR	Add dose of Carrier Inhibitor (500 ppm). Replace gas strainer prior to eductor (or when refrigerant is removed).	CONTROLS	None.
COOLER	None.	VFD	None.
CONDENSER	None.	PURGE	
LUBRICATION ASSEMBLY	Replace lubrication assembly suction strainers (or when refrigerant is removed).		
SEASONAL SHUTDOWN			
COMPRESSOR	None.	CONTROLS	Do not disconnect control power.
COOLER	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.	PURGE	Purge operation is required to remove non-condensables.

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

APPENDIX D — REMOTE CONNECTIVITY COMMISSIONING

Introduction

Cellular Remote Connectivity is a system developed by Carrier to remotely monitor a chiller. It consists of a PIC5 controller, IP Switch, cellular modem and an antenna.

This appendix describes typical commissioning steps required for a chiller supplied with the Remote Connectivity option.

First locate the cellular antenna which is located in the chiller control panel. See Fig. D. 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.

Installation during commissioning

1. Disconnect unit power. Use proper lockout-tagout procedures to ensure safety while installing this equipment since the control panel door will need to be open during installation. See Fig. E for 19DV modem and router installation locations.
2. In Table A, record serial number of Cellular Modem which is printed on two labels on either side of the modem. It begins with the manufacture year, such as “2017”. This will be required later during commissioning.

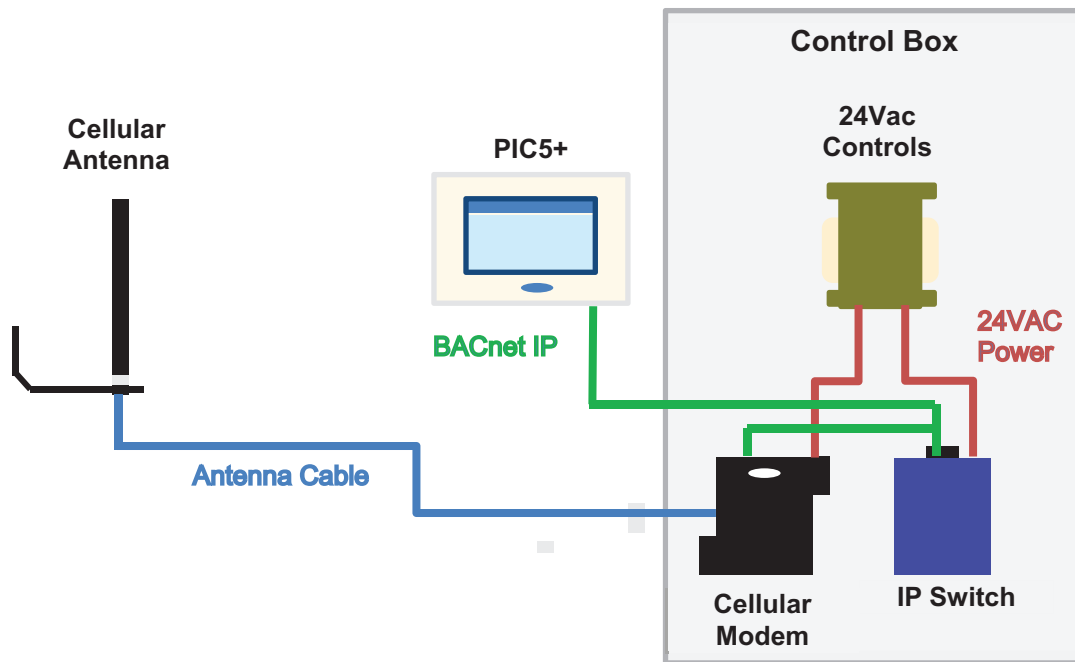


Fig. D — Remote Connectivity Option

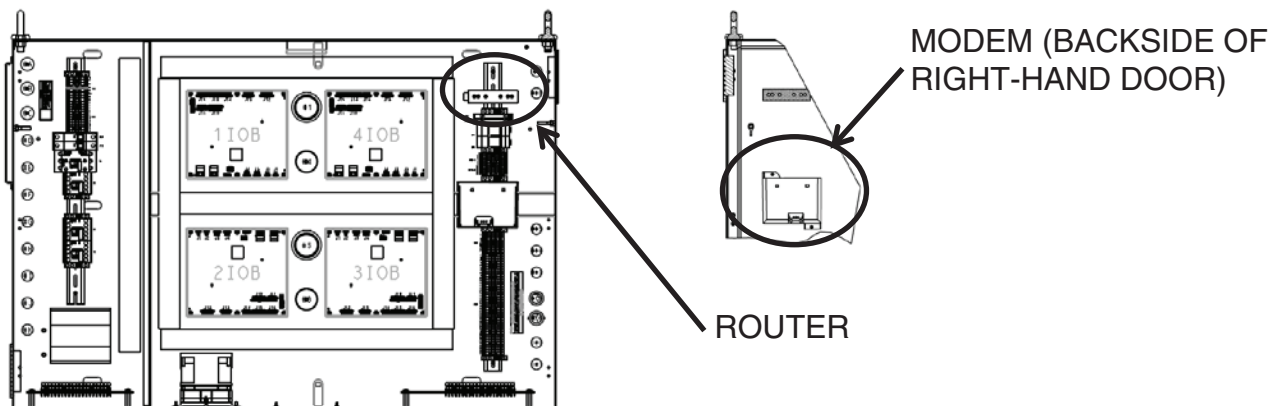


Fig. E — Modem and Router Installation Locations (19DV)

APPENDIX D — REMOVE CONNECTIVITY COMMISSIONING (cont)

Table A — Customer Gateway Data Submittal Information

Submittal Data: Fill out all white fields. Scan or photograph and submit per Customer Gateway instructions.

CHILLER INFORMATION			
#	Parameter	Write Values Below	Description
1.1	PIC5 Software Part Number	_____	Shown at bottom of start-up screen, or in the menu under Configuration > Control Identification. E.g. SCG-SR-20M200400
1.2	Chiller Model Number	_____	E.g. 19DV-G4CG4C4425H4-
1.3	Chiller Serial Number	_____	E.g. 5217Q28248
GATEWAY INFORMATION			
#	Parameter	Write Values Below	
2.1	Modem information	Modem serial number e.g. "2017N089911": Modem S/N: _____	
2.2	STATUS LED	SIGNAL LED Color (per Table B) – (circle one): STATE (circle one):	RED / YELLOW / GREEN SOLID / FLASHING
CHILLER CONTROLLER INFORMATION			
	Parameter	Value	Description
3.1	BACnet Identifier	_____	Seven digits e.g. 1600001 (from Customer Gateway).
3.2	IP Address	_____._____._____._____	This is the IP address with which the PIC5 is configured (from Customer Gateway).
SITE INFORMATION			
#	Parameter	Value	Description
4.1	Jobsite Name	_____	This is the name by which the jobsite is usually recognized. It will be used to distinguish the site in the monitoring system.
4.2	Jobsite Address	_____ _____	Full address of jobsite. Used to uniquely identify jobsites in case Jobsite Name is duplicated.
4.3	Service Office	_____	Name of service office that services this site.
4.4	Service Office Contact	_____ _____ _____	Name and Telephone Number (or e-mail address).

- Verify that both power wiring and connection to router is intact. Verify that a SIM card is installed in the modem. See Fig. F for connections.



Fig. F — Modem Connections

- Install the provided antenna and route through knockout in back of control panel. Be sure to observe the warning in Fig. G.

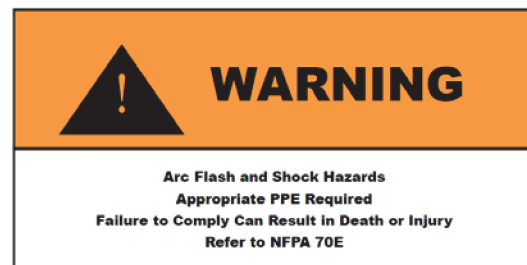


Fig. G — Arc Flash Warning

- Apply appropriate protective personal equipment (PPE) and apply power to unit and verify that modem and router are powered by confirming power LEDs are on.
- Wait approximately 5 minutes before proceeding to next step to allow communication to be fully initiated.

APPENDIX D — REMOVE CONNECTIVITY COMMISSIONING (cont)

Signal Evaluation

Test the antenna at various positions where it can possibly be wall mounted. See Fig. H.

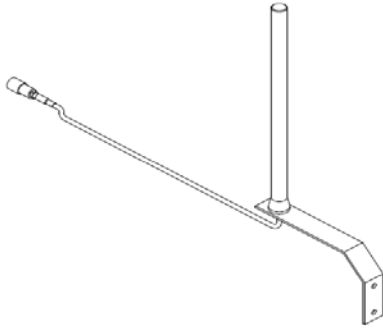


Fig. H — Antenna Mounting

At each position, wait at least 5 seconds, and then read the state of the SIGNAL LED on the modem. The states and conclusions are given in Table B. Signal strength is measured in DBm (decibel-milliwatts), and is always a negative number.

Table B — Signal Evaluation

COLOR	STATE	GSM SIGNAL	ACTION
RED	Flashing	<-85	This location will not work
RED	Solid	-80 through -85	This location may work with a high-gain antenna, but other options should be explored first
YELLOW	Flashing	-75 through -80	This location may work, but there may be occasional delays in sending data, and it may not be robust over time
YELLOW	Solid	-70 through -75	This location should work
GREEN	Flashing	-65 through -70	This location should work well
GREEN	Solid	>-65	This location is highly likely to work well

Even if a position is found with signal better than -75, several positions should be tested to find the best signal case. Also consideration should be given to the accessibility of each position for mounting. Consideration should also be given to the routed length of the antenna cable — total length 196 in. (5 m). For final mounting of the antenna secure the bracket to fixed object and ensure that the antenna body itself does not make contact with any objects.

Signal strength can also be evaluated with a smart phone if operating on AT&T network. Path to see the phone's current dBm signal varies by phone make and model.

Note that the network signal strength is outside of Carrier's control. If no suitable positions are identified with the standard antenna cable, there are some alternate approaches that can be considered such as trying a high gain antenna (expect +3-5dBm but this option also has a longer cable), using an AT&T signal boost device, or installing a Remote Connectivity Accessory box (a separately powered box that can be installed up to 100m [330 ft] from chiller).

The standard offering during the start-up of the chiller is with the 5 meter cable equipment supplied with the chiller. Any additional requirements to get the remote connectivity fully functional will be part of the chiller installation cost, is not part of the standard chiller start-up, and is not covered under warranty.

Commissioning the Modem

As the Remote Connectivity feature involves communication over the cellular network into a server, commissioning requires support from support personnel at the Customer Gateway.

Fill out Table A, section 1, 2, and 4, and then call the Customer Gateway at 877-963-1995 and advise that you are commissioning Cellular Remote Connectivity. They will assign a case number and inform the support personnel. The assigned support engineer will call back within a short time.

Receive Data for Configuring the PIC5 and enter in PIC5 HMI

Required Data

There are two pieces of data that have to be provided by the Customer Gateway support engineer and configured into the PIC5 by the commissioning engineer.

BACnet Identifier

IP Address

These parameters should be recorded and kept for future use.

PIC5 Configuration

Hold fingers on the left side of the Home Screen. The Setup menu will appear after about 10 seconds; see Fig. I.

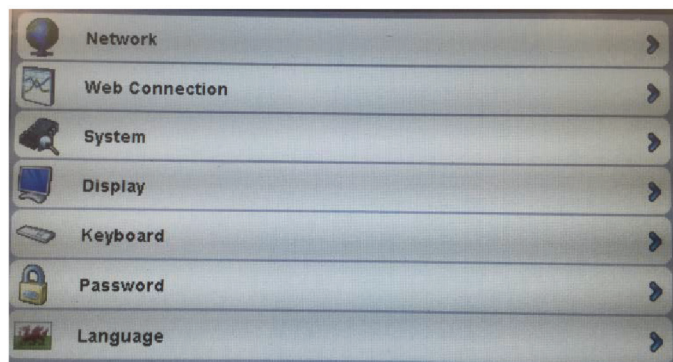
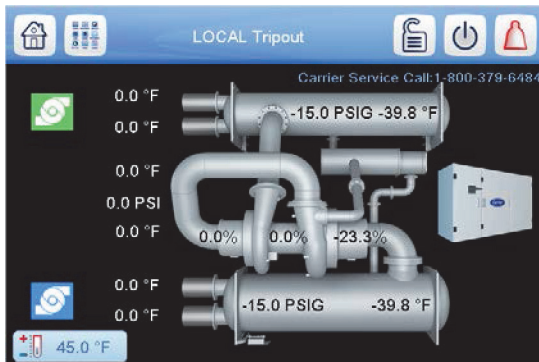


Fig. I — PIC5 Home Screen and Setup Menu

APPENDIX D — REMOVE CONNECTIVITY COMMISSIONING (cont)

From the Setup Menu, select “Network”. The PIC5 Network Setup menu will display; see Fig. J.

Fig. J — PIC5 Network Setup

Verify that “Enable DHCP” is unchecked and Subnet mask is set to 255.255.255.0.

Enter the supplied IP Address.

Save the changes.

Enter current Factory Password into PIC5, then go to Configuration > Network Configuration and navigate to page 3 (see Fig. K) using the bottom right hand arrow.

Fig. K — PIC5 Network Configuration Menu (page 3 of 5)

In Network Configuration do the following:

- “Enable” BACnet/IP
- Verify that BACnet Metric Units is set to the default “No”
- Type in the provided BACnet Identifier from the Customer Gateway

After making these changes, save the changes and the PIC5 panel will cycle power automatically.

INADEQUATE SIGNAL STRENGTH

Sites with inadequate signal strength should work with Carrier Service for the best on-site solution to activate the remote connectivity. Current alternatives to the standard antenna are a higher gain antenna, AT&T signal boost device or installing a Remote Connectivity Accessory box which is a separately powered box that can be installed up to 100 m (330 ft) from chiller.

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INITIAL START-UP CHECKLIST
FOR 19DV 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
COOLER									*****
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.		
Add dose of Carrier Inhibitor (500 ppm) during initial commissioning.	Yes ☐	No ☐

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 Cooler _____ 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 _____ Refrigerant (1TB L1/L2/L3) Pump _____ Controls (1TB LL1/LL2) _____

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 the top of the starter cabinet 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 refrigerant pump rotation-pressure: _____

Check compressor motor rotation (first stage suction housing sight glass) and record: 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.

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

SIGNATURES:

CARRIER
TECHNICIAN _____

CUSTOMER
REPRESENTATIVE _____

DATE _____

DATE _____

19DV PIC5 SET POINT TABLE CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Cooling ECW Set point	-9.4 to 48.9	°C	15.6	
EWT Control Option	DISABLE/ENABLE	—	DSABLE	
Ice Build Set point	-9.4 to 15.6	°C	4.4	
Cooling LCW Set point	-12.2 to 48.9	°C	7.2	
Base Demand Limit	10.0 to 100.0	%	100.0	

PIC5 TOUCH SCREEN Software Version Number: _____

PIC5 TOUCH SCREEN Controller Identification: BUS: _____ ADDRESS: _____

19DV PIC5 TIME SCHEDULE CONFIGURATION SHEET PERIOD 1

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

19DV PIC5 TIME SCHEDULE CONFIGURATION SHEET PERIOD 2

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

19DV PIC5 TIME SCHEDULE CONFIGURATION SHEET PERIOD 3

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

19DV PIC5 FACTORY TABLE CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Chiller Type 19XR6/7=0,19XR2-E/D/V=1, 19DV=2	0 to 2		0	
Unit Type Cool Only=0,Heat Mach=1	0 to 1		0	
Comp(Single=0,Dual=1)	0 to 1		0	
Chilled Medium Type Water =0, Brine =1	0 to 1		0	
19DV Comp Design Press 44PSI=0 72PSI=1	0 to 1		0	
Free Cooling Option	0 to 1		0	
VFD Option No=0,FS VFD=1,Carrier=2 Rockwell LF2=3, Eaton=4 Rockwell STD=5	0 to 5		0	
IOB4 Option	0 to 1		0	
Guide Vane1 Type Digital=0 Analog=1	0 to 1		0	
Marine Option	0 to 1		0	
Power Request Option	0 to 1		0	
Cont. Power Request	0 to 1		0	
Purge System Option	0 to 1		0	
Liquid Bypass Option	0 to 1		0	

19DV PIC5 CFG_19DV CONFIGURATION TABLE CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Motor Pole Pair Single=1 Double=2	1 to 2		1	
IGV2 Travel Limit	30 to 100	%	96.0	
IGV2 Minimum Degree	0 to 20	Deg.	2.0	
IGV2 Fully Open Degree	10 to 100	Deg.	90.0	
IGV2 Actuator Max	90 to 120	Deg.	94.0	
IGV2 Position @IGV1 20°	10 to 30	Deg.	28.1	
IGV2 Position @IGV1 30°	10 to 50	Deg.	37.2	
IGV2 Position @IGV1 50°	10 to 80	Deg.	71.6	
VFD Rate Speed Hz	10 to 200	Hz	80.5	
Purge Regen Lasting Time	0 to 65535	min	120	
Daily PG Pumpout Limit	20 to 200	min	50	

19DV PIC5 CFGSURGE_SURGE CORRECTION CONFIG TABLE CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Surge Line Configuration PR = 0, Delta T = 1	0 to 1		0	
IGV1 POS Configuration Degree =0, Percentage =1	0 to 1		0	
Surge Delta Tmax	0 to 150	°F	70	
Surge Delta Tmin	0 to 150	°F	45	
IGV1 Full Load Open Deg.	80.0 to 120.0	Deg.	88.0	
IGV1 Minimum Open Deg.	0.0 to 10.0	Deg.	2.0	
IGV1 Actuator Max Deg.	90.0 to 120.0	Deg.	109.0	
IGV1 Minimum Position	0.0 to 100.0	%	5.0	
IGV1 Full Load Position	0.0 to 100.0	%	100.0	
Envelope Line Offset	0.1 to 3.0	°F	2.0	
Envelope Speed Factor	0.00 to 3.00		2.0	
Surge Line Shape Factor	-1.000 to 0.000		-0.01	

19DV PIC5 CFGGEVFD_GENERAL VFD CONFIG TABLE CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
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	

19DV PIC5 CFGUMVFDUM VFD CONFIGURATION TABLE CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Compressor Speed 100%	47 to 200	Hz	50	
Motor 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 Voltage	200 to 13800	Volts	460	
Motor Nameplate RPM	1500 to 5000	rpm	3000	
Motor Nameplate KW	0 to 5600	KW	1500	
Skip Frequency 1	0.0 to 102	Hz	30	
Skip Frequency 2	0.0 to 102	Hz	30	
Skip Frequency 3	0.0 to 102	Hz	30	

19DV PIC5 SERVICE PARAMETERS TABLE CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Atmospheric Pressure	8.000 to 15.000	PSI	14.5	
GV1 Travel Limit	30 to 100	%	80.7	
GV1 Closure at Startup	0 to 40	%	4	
Controlled Fluid DB	0.5 to 2	^F	1	
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	
Soft Stop Amps Threshold	40 to 100	%	70	
Water Flow Verify Time	0.5 to 5	min	5	
Power Calibration Factor	0.5 to 2	-	1	
Enable Excessive Starts	0 to 1	-	0	
Purge Active Temp SP	30 to 90	-	65	

19DV PIC5 OPTION CONFIGURATION TABLE (CONF_OPT) CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Auto Restart Option	0 to 1		0	
Common Sensor Option	0 to 1		0	
EC Valve Option No=0, Cont.=1 ON/OFF=2, mA=3	0 to 3		0	
EC Selection Disable=0, Surge=1 Low Load=2, Comb=3	0 to 3		0	
Ice Build Option	0 to 1		0	
Water Flow Determination	0 to 1		0	
Liquid Bypass Selection	0 to 1		0	
Purge On Idle Option	0 to 1		0	

19DV PIC5 GENERAL PARAMETERS TABLE (GENUNIT) CONFIGURATION SHEET

DESCRIPTION	RANGE	UNITS	DEFAULT	VALUE
Cooling/Heating Select	0 to 1			

19DV PIC5 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	
ICE Build Setpoint	-9.4 to 15.6	°F	104	
Heating ECDW Setpoint	17.2 to 65.6	°F	113	
Heating LCDW Setpoint	20 to 65.6	°F	40	
Base Demand Limit	10.0 to 100.0	%	100.0	

ALARM SHUTDOWN STATE RECORD SHEET

PRIMARY MESSAGE	DATE	TIME	CHW IN	CHW OUT	EVAP REF	CDW IN	CDW OUT	COND REF	AMPS%

CUT ALONG DOTTED LINE

CUT ALONG DOTTED LINE