United Technologies

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

Centrifugal Water-Cooled Liquid Chiller

19DV

greenspeed
AQUAEDGE
PUREtec

Original document

CONTENTS

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1 - SAFETY CONSIDERATIONS

19DV 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 machine instructions, as well as those listed in this guide.

To find out, if these products comply with European directives (machine safety, low voltage, electromagnetic compatibility, equipment under pressure, etc.) check the declarations of conformity for these products.

1.1 - Installation safety considerations

In certain cases the safety relief valves are installed on ball valves. These ball valves are factory-supplied lead-sealed in the open position. This system permits isolating and removing the safety relief valves for checking and replacing. The safety relief valves are designed and installed to ensure protection against fire risk. Removing the safety relief valves is only permitted if the fire risk is fully controlled and the responsibility of the user.

All factory-installed safety valves are lead-sealed to prevent any calibration change. If a safety stop is removed for checking or replacement please ensure that there is always an active safety stop on each of the reversing valves installed in the unit.

The safety valves must be connected to discharge pipes. These pipes must be installed in a way that ensures that people and property are not exposed to refrigerant leaks. These fluids may be diffused in the air, but far away from any building air intake, or they must be discharged in a quantity that is appropriate for a suitably absorbing environment.

The set pressure of a relief valve that has leaked is generally lower than its original setting. The new setting may affect the operating range. To avoid nuisance tripping or leaks, replace or re-set the valve.

DANGER: Do not vent refrigerant relief valves within a building. Outlet from relief valve must be vented outdoors. The accumulation of refrigerant in an enclosed space can displace oxygen and cause asphyxiation.

Provide adequate ventilation, especially for enclosed and low overhead spaces. Inhalation of high concentrations of vapour is harmful and may cause heart irregularities, unconsciousness, or death. Misuse can be fatal. Vapour is heavier than air and reduces the amount of oxygen available for breathing. Product causes eye and skin irritation. Decomposition products are hazardous.

Do not use oxygen to purge lines or to pressurize a machine for any purpose. Oxygen gas reacts violently with oil, grease, and other common substances. 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 before operating the machine.

1.2 - Maintenance safety considerations

Engineers working on the electric or refrigeration components must be authorized, trained and fully qualified to do so. All refrigerant circuit repairs must be carried out by a trained person, fully qualified to work on these units. He must have been trained and be familiar with the equipment and the installation. All welding operations must be carried out by qualified specialists.

During maintenance operations (such as a refrigerant charge transfer or pumpdown) or leak repairs, that can result in a significant pressure loss of saturated evaporation pressure, the qualified technician must ensure that the heat exchanger water pumps continue to operate to ensure a sufficient flow rate and prevent evaporator freeze-up. If there is a fault, the chiller control is wired to automatically control the water pumps and the cooling tower fans to guarantee independent machine frost protection. If for a specific installation water flow control and control of the cooling towers must be done by another means, a parallel Carrier control must be put in place.

Any manipulation (opening or closing) of a shut-off valve must be carried out by a qualified and authorized engineer. These procedures must be carried out with the unit shut-down.

During any handling, maintenance and service operations the engineers working on the unit must be equipped with safety gloves, glasses, shoes and protective clothing.

WARNING: Do not weld or flamecut any refrigerant line or vessel until all refrigerant (liquid and vapour) has been removed from chiller. Traces of vapour should be displaced with dry air nitrogen and the work area should be well ventilated. Refrigerant in contact with an open flame produces toxic gases.

Do not work on electrical components, including control panels, switches, relays etc, until you are sure all power is off; residual voltage can leak from capacitors or solid state components. Lock open and tag electrical circuits during servicing.

If work is interrupted, confirm that all circuits are deenergized before resuming work.

WARNING: machines can be equipped with two independent power supplies to power the following equipments:
- ***compressor power,***
- ***machine control, purge group and refrigerant pump, to be supplied by an uninterruptible power supply (UPS) resulting from the installation.***

Do not work on electrical components until you have disconnected each of the power supplies.

Each of the power supply is connected to the main power cabinet containing the power converter. The external operating handle on this cabinet is intended to shut off the compressor power supply, but does not shut down the UPS power supply: refer to the detailed wiring diagram supplied with the unit.

Beware of electrostatic discharges (static electricity) when handling or contacting circuit boards or module connections. Always touch a portion (grounded) of the chassis to dissipate the electrostatic charge from the body before working inside the control cabinet.

Use extreme care when handling tools near boards and when connecting or disconnecting terminal plugs. Circuit board can easily be damaged.

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.

RISK OF INJURY OR DEATH by electrocution. 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.

1.3 - Operating checks, relief valves

Operating checks :

Important information regarding the refrigerant used:

Refrigerant type: HFO-R1233zd(E)

Low pressure refrigerant and non-flammable.

Global Warming Potential (GWP): 1 (very low)

Periodic inspections for refrigerant leaks may be required depending on European or local legislation. Please contact your local dealer for more information. During the life-time of the system, inspection and tests must be carried out in accordance with national regulations.

The information on operating inspections given in annex C of standard EN378-2 can be used if no similar criteria exist in the national regulations.

Safety device checks (annex C6 – EN378-2): The safety devices must be checked on site once a year for safety devices (high-pressure switches), and every five years for external overpressure devices (safety valves).

See Periodic check of the safety loop section for this safety device check procedure.

For a detailed explanation of the high pressure switch test method contact Carrier Service.

Do not attempt to repair or recondition any safety devices when corrosion or build-up of foreign material (rust, dirt, scale, etc.) is found within the valve body or mechanism. If necessary, replace the device.

Do not install safety valves in series or backwards.

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

1.4 - Equipment and components under pressure

These products incorporate equipment or components under pressure, manufactured by Carrier or other manufacturers. We recommend that you consult your appropriate national trade association or the owner of the equipment or components under pressure (declaration, re-qualification, re-testing, etc.).

The characteristics of this equipment/these components are given on the nameplate or in the required documentation, supplied with the products.

1.5 - Repair safety considerations

All installation parts must be maintained by the personnel in charge, in order to avoid material deterioration and injuries to people. Faults and leaks must be repaired immediately. The authorized technician must have the responsibility to repair the fault immediately. Each time repairs have been carried out to the unit, the operation of the safety devices must be re-checked.

If a leak occurs or if the refrigerant becomes polluted remove the complete charge using a recovery unit and store the refrigerant in mobile containers. Repair the leak detected and recharge the circuit with the total refrigerant charge, as indicated on the unit name plate.

Do not siphon refrigerant.

Avoid spilling liquid refrigerant on skin or getting it into the eyes. Use safety goggles and safety gloves. Wash any spills from the skin with soap and water. If liquid refrigerant enters the eyes, immediately flush eyes with water and consult a doctor.

Never apply an open flame or live steam to a refrigerant cylinder. Dangerous overpressure can result. If it is necessary to heat refrigerant, use only warm water (43°C).

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:

a. Shut off electrical power to unit.

b. 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 18.5°C.

c. Traces of vapor should be displaced with nitrogen and the work area should be well ventilated. Refrigerant in contact with an open flame produces toxic gases.

d. Cut component connection tubing with tubing cutter and remove component from unit.

e. Carefully unsweat remaining tubing stubs when necessary.

DANGEROUS AND ILLEGAL: Do not reuse disposable (non-returnable) cylinders or attempt to refill them. When cylinders are emptied, evacuate remaining gas pressure, loosen the collar and unscrew and discard the valve stem.

Do not incinerate.

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

After refrigerant draining operations, check the refrigerant type before adding refrigerant to the machine. The introduction of the wrong refrigerant can cause damage or malfunction to this machine.

Any use of these chillers with a different refrigerant must be in accordance with applicable national standards.

Do not attempt to remove connections, components etc., while the machine is under pressure or operating. Make sure that the pressure is 0 kPa, before disconnecting the refrigerant connections.

ATTENTION: No part of the unit must be used as a walkway, rack or support.

Periodically monitor and repair or if necessary replace any component or piping that shows signs of damage.

Do not climb over a machine. Use platform, or staging.

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

Do not use eyelets to lift any part of the machine or the complete machine.

ATTENTION: Be aware that certain automatic start arrangements can engage cooling tower fan 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, without the permission of your process control group.

Do not loosen waterbox bolts until the waterbox has been completely drained.

Do not loosen a packing gland nut before checking that the nut has a positive thread engagement.

Periodically inspect all valves, fittings, and piping for corrosion, rust, leaks, or damage.

During refrigerant removal and storage operations follow applicable regulations. These regulations, permitting conditioning and recovery of HFO refrigerant under optimum quality conditions for the products and optimum safety conditions for people, property and the environment are described in standard NFE 29795.

R1233zD dissolves in some non-metallic materials, dries the skin, and in high concentrations can replace enough oxygen to cause asphyxiation.

When handling this refrigerant, protect hands and eyes and avoid inhaling vapors.

Any refrigerant transfer and recovery operations must be carried out using a transfer unit for HFO application. A connection under the evaporator is supplied with all units for connection to the transfer station. The units must never be modified to add refrigerant and oil charging, removal and purging devices. These devices are provided with the units. Please see to the certified dimensional drawings for the units.

2 - INTRODUCTION AND CHILLER FAMILIARISATION

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. This document is outlined so that you may become familiar with the control system before performing start-up procedures. Procedures in this manual are arranged in the sequence required for proper chiller start-up and operation.

Since 19DV is equipped with VFD (Variable Frequency Drive), special qualifications are required for personnel commissioning these machines or working on the variable-frequency drive.

2.1 - Operating conditions range

Transport and storage of 19DV units

The minimum and maximum allowable outside temperatures are:

Minimum temperature = -15°C

Maximum temperature = +60°C.

Operating limits

In operating the minimum and maximum allowable outside temperatures are:

Minimum temperature = +5°C

Maximum temperature = +40°C.

The operating and storage conditions are as those described for the standard machine. The machines must be installed inside the building. Electrical cabinets are protected IP23 in accordance with standard IEC60529-1.

The operating range of the selected unit must always be verified at full load and part load by the selection program for the chosen configuration.

The selection program values apply. If they are outside the operating limits below, the selection must be validated by the factory customer support team.

Indicative operating range of 19DV chiller

Evaporator (fresh water)		Minimum	Maximum
Evaporator entering water temperature	°C		28**
Evaporator leaving water temperature	°C	3	

Condenser (water-cooled)			
Condenser entering water temperature	°C	13*	
Condenser leaving water temperature	°C	18	45

* this minimum can be maintained with head pressure control system such as 2 or 3 way valve or any other applicable devices…

** In operation or before starting, the user must maintain a water inlet temperature at the evaporator of 28 ° C maximum to avoid, in the event of extreme failure of the control system and the pressure switches, any risk of overpressure causing relief valve exhaust.
When chiller is stopped, the maximum permissible circulation temperature in the exchangers is 65 ° C. Higher temperatures can result in a risk of valve tripping.

2.2 - Abbreviations and explanations

Frequently used abbreviations in this manual include:

CCN — Carrier Comfort Network
CCW — Counter Clock Wise
CW — Clock Wise
CHWR — Chilled Water Reclaim
CHWS — Chilled Water Supply
ECDW — Entering Condenser Water
ECW — Entering Chilled Water
EMS — Energy Management System
I/O — Input /Output
IOB — Input /Output Board
LCDW — Leaving Condenser Water
LCW — Leaving Chilled Water
LED — Light-Emitting Diode
OLTA — Overload Trip Amps
PIC 5+ — Product Integrated Controls version 5 and more
RLA — Rated Load Amps
SI — International System of Units
SIOB — Starfire 2 Input Output Board (for Purge system control)
VFD — Variable Frequency Drive

The PIC5+ software version number of your 19DV unit will be located on the HMI module.

Information on the unit control is not included in this manual. Refer to separate controls manual.

2.3 - Chiller technical documentation (wiring diagram, dimensional drawings, PID)

All figures, chiller view, and schematics of the IOM documents are not contractual not-certified drawings. Please refer to the certified drawings and electrical diagrams supplied with the unit or available on request, when designing and installation.

Weight and dimensions are not-certified and only indicative data. Please refer to certified drawings of the selected chiller.

2.4 - CE marking

19DV chillers with CE marking have been designed and manufactured according to the following European directives:

- Pressure Equipment Directive 2014/68 / EU, by application of harmonized standard 378-2 Refrigeration and heat pump systems Safety and environmental requirements
- Machinery Directive 2006/42 / EC, by application of Harmonized Standard 60204-1: Safety of machinery - Electrical equipment of machines - Part 1: General rules
- Electromagnetic compatibility (EMC) 2014/30 / EU by application of harmonized standard 61800-3 for variable speed drives.

The electromagnetic emission and immunity levels comply with the requirements for an industrial environment and are not designed for operation in a residential environment.

This equipment uses and can emit radio energy. In the event of installation or use not in accordance with the instruction manual, interference with radio communications may occur.

2.4.1 - CLASSIFICATION

In accordance with the requirements of the Pressure Equipment Directive and the national regulations, the safety accessories of the unit are classified as follows:

	Safety component (1)	Accessory for limiting damage in case of external fire (2)
Refrigerant circuit		
Safety contactor	X	
Relief valves (3)		X
Coolant circuit		
Relief valves	(4)	(4)

(1) Classification for protection in a normal service situation.
(2) Classification for protection in a abnormal service situation. These accessories are fire sized for a thermal flux of 10kW/m2. No combustible material should be within 6.5m of the unit.
(3) The momentary overpressure limited to 10% of the service pressure does not apply to this abnormal service situation.
The set pressure may be above the operating pressure. In this case, the failure to exceed the operating pressure under normal operating conditions is ensured either by the design temperature or by the high pressure switch.
(4) The classification of these valves must be done by the integrators who carry out the entire hydraulic installation.

The unit is equipped with a safety loop, also called measurement, control and regulation devices playing a role in safety (SRMCR for protection against overpressure that could be created by the compressor).

Made of :
- 2 active pressure switches (HPS) at compressor discharge
- Safety relay inside the control cabinet
- Power contactor inside the VFD
- VFD

This SRMCR is designed in accordance with EN ISO 13849-1: 2016 according to the following characteristics:
- PL d
- Category 3.
- Mission duration 20 years.

In case of chiller operating with VFD freestanding (not factory supplied), the VFD shall be equipped with Safe Torque Off (compliant with Pl d according EN ISO 13849-1: 2016 and/or SIL2 level according IEC 61508)

2.5 - Chiller familiarization 19DV

2.5.1 - Chiller information plate

The chiller information plate is located in front of the electrical control box.

2.5.2 - 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.

2.5.2.1 - Cooler

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.

2.5.2.2 - Condenser

The condenser operates at a higher temperature/pressure than the cooler 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.

2.5.2.3 - 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.

2.5.2.4 - 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.

2.5.2.5 - 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.

2.5.2.6 - Variable Frequency Drive (VFD)

A variable-frequency drive allows start-up and compressor motor power supply interruption. It also allows adjustment of the compressor speed based on the required capacity. It is either factory-installed in the unit in a cabinet that also includes the protection and power transmission elements, or not unit-mounted.

2.5.2.7 - Refrigerant lubrication system

This system provides lubrication to the compressor bearing by means of a refrigerant pump.

2.5.2.8 - Chiller control cabinet

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

2.5.2.9 - Purge control panel

The purge panel includes the input and output board, 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.

2.5.2.10 - PIC 5+ 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

2.5.3 - Product identification

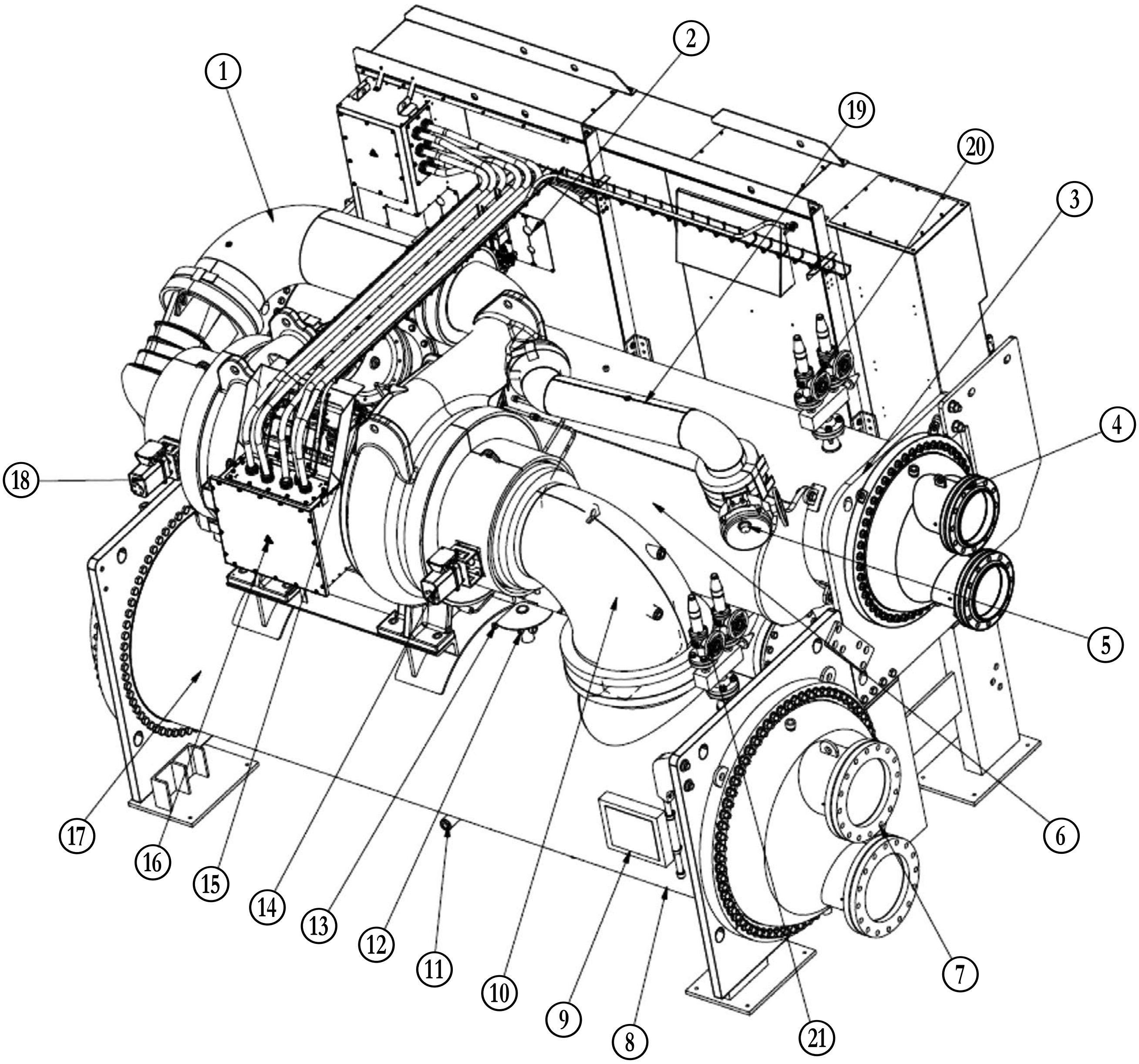
Model number	19	DV	G44	G44	4	4	4	A	H	9
(example)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)

1 : High Efficiency Semi-Hermetic Centrifugal Chiller
2 : D : low pressure V : Variable Speed Drive
3 : Evaporator frame size (Length, Pass arrangement, tube count)
4 : Condenser frame size (Length, Pass arrangement, tube count)
5 : Compressor frame size / 4 : 1758 – 2813 kW
6 : Compressor shroud code (3-4-5-6)
7 : Compressor Impeller Diameter Code (2 – 4)
8 : VFD code * (A : high tier LF2 Rockwell / 5 : low tier VFD / 0 : Freestanding)
9 : Motor code * (B/D/F/H)
10 : Motor voltage code 3: 380/3/60 4 : 416/3/60 5 : 460/3/60 9 : 400/3/50

Service number	19DV	G44	G44	444	001	E	-
(example)	(1)	(2)	(3)	(4)	(5)	(6)	

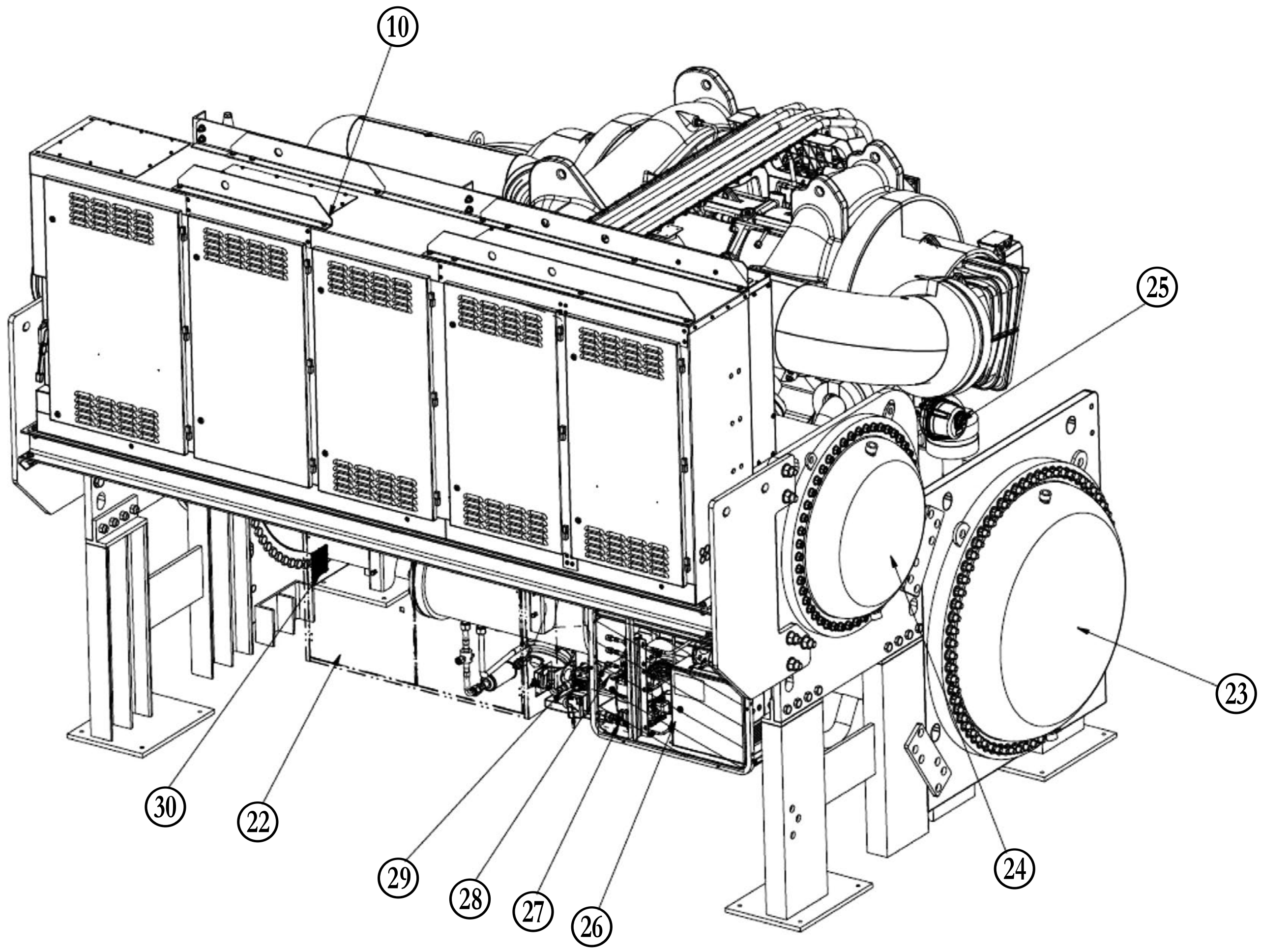
1 : Chiller designation
2 : Evaporator designation
3 : Condenser designation
4 : Compressor designation
5 : Unit manufacturing incrementing number
6 : E : Unit manufactured at MTL factory

Figure 1 - Chiller model identification



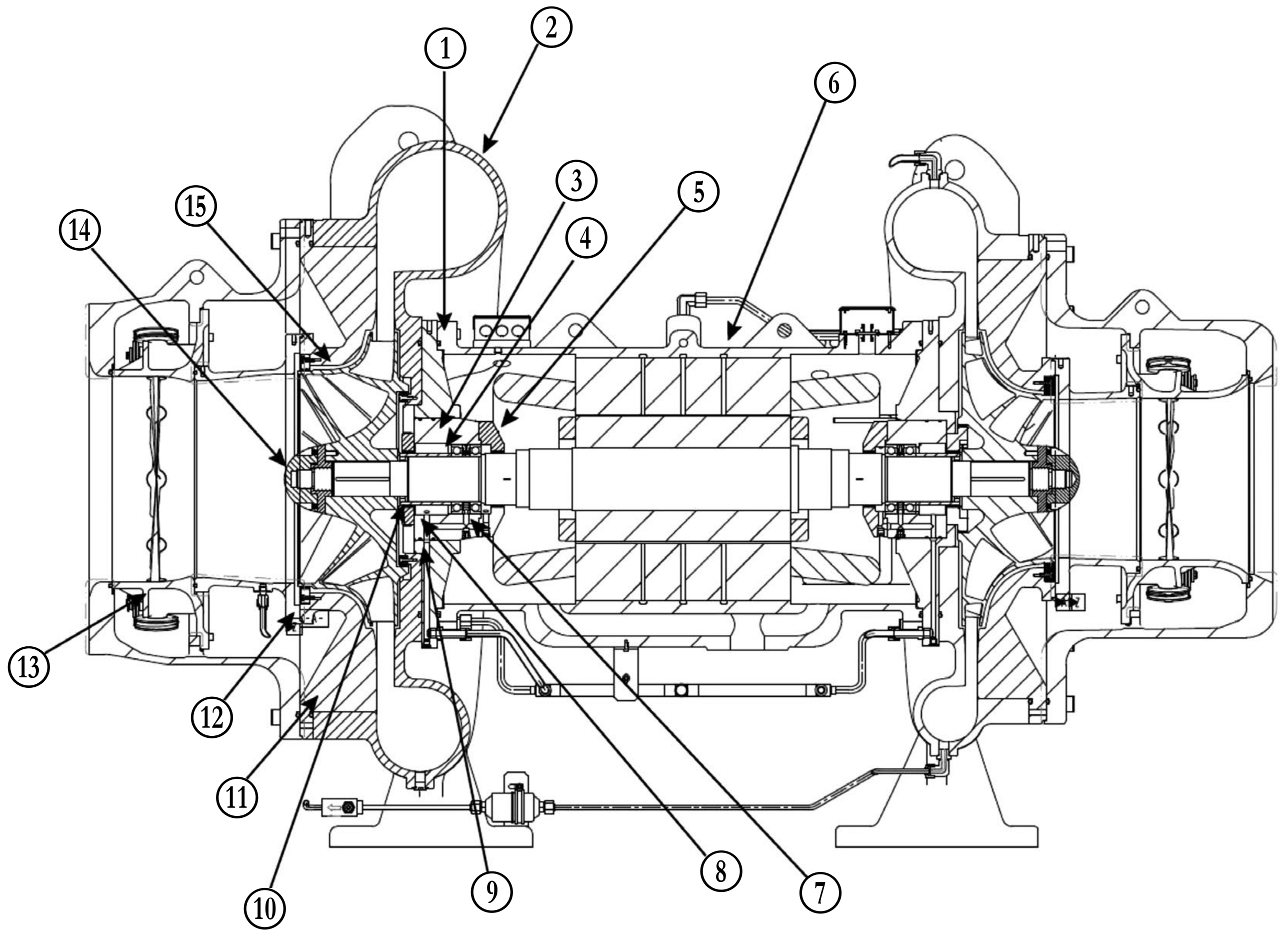
1. Interconnecting Compressor Piping (ICP) from 1st stage to 2nd stage
2. VFD cooling piping
3. Condenser
4. Condenser waterbox nozzles
5. Economizer isolation valve (option)
6. Economizer
7. Evaporator waterbox nozzles
8. Evaporator
9. PIC5+ HMI touchscreen panel
10. Suction elbow
11. Evaporator sightglass
12. Evaporator charging valve
13. Evaporator pressure transducer
14. 1st stage Inlet Guide Vane (IGV) actuator
15. Compressor
16. Motor terminal box
17. Power cables from VFD to compressor motor
18. 2nd stage Inlet Guide Vane (IGV) actuator
19. Economizer pipe
20. Condenser relief valve assy
21. Evaporator relief valve assy

Figure 2 - Typical 19DV chiller components (Chiller shown with LF2 2CC VFD model)



22. Control cabinet
23. Evaporator return end waterbox
24. Condenser return end waterbox
25. Envelop stability control valve (ECV) (option)
26. Purge system assy
27. Lubrication assy
28. VFD
29. Chiller serial plate label
30. Pressure switches assy

Figure 3 - Typical 02DV compressor internal view



1. Bearing support housing
2. Volute
3. Bearing housing
4. Spacer / sizer
5. Motor shaft laby
6. Motor housing
7. Roller element bearing assembly
8. Impeller labyrinth
9. Bearing flange
10. Impeller shim
11. Shroud
12. Eye laby
13. IGV
14. Nose piece
15. Impeller

2.5.4 - 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 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.

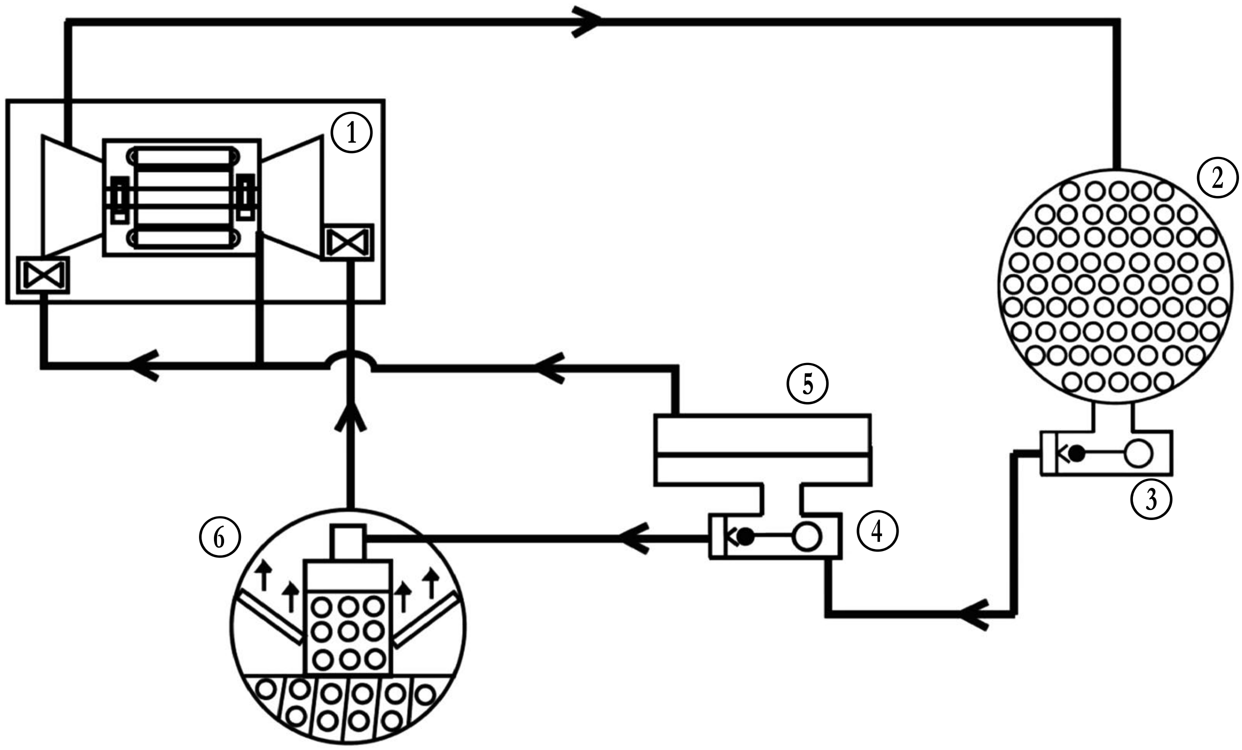
After taking heat from the water, the refrigerant vapor is compressed by a back-to-back compression connected by means of interstage piping. Compression adds heat energy and the refrigerant is quite warm (typically 37 to 40°C) when it is discharged from the compressor into the condenser. Relatively cool (typically18 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 high side 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. 4** summarizes the refrigeration cycle.

The 19DV unit utilizes R-1233zd(E) refrigerant. At atmospheric pressure its boiling point is 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.

Figure 4 - Refrigeration cycle – 19DV Two Stage Compressor



1. Compressor
2. Condenser
3. High side float chamber
4. Low side float chamber
5. Cooler
6. Economizer

CAUTION: To avoid adverse effects on chiller operation, considerations must be made to condenser water temperature control. For steady state operation, the minimum operating refrigerant pressure differential between cooler and condenser is approximately 7 psid (48 kPa) with a maximum evaporator refrigerant temperature of 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).

2.5.5 - Refrigerant lubrication cycle

2.5.5.1 - 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.

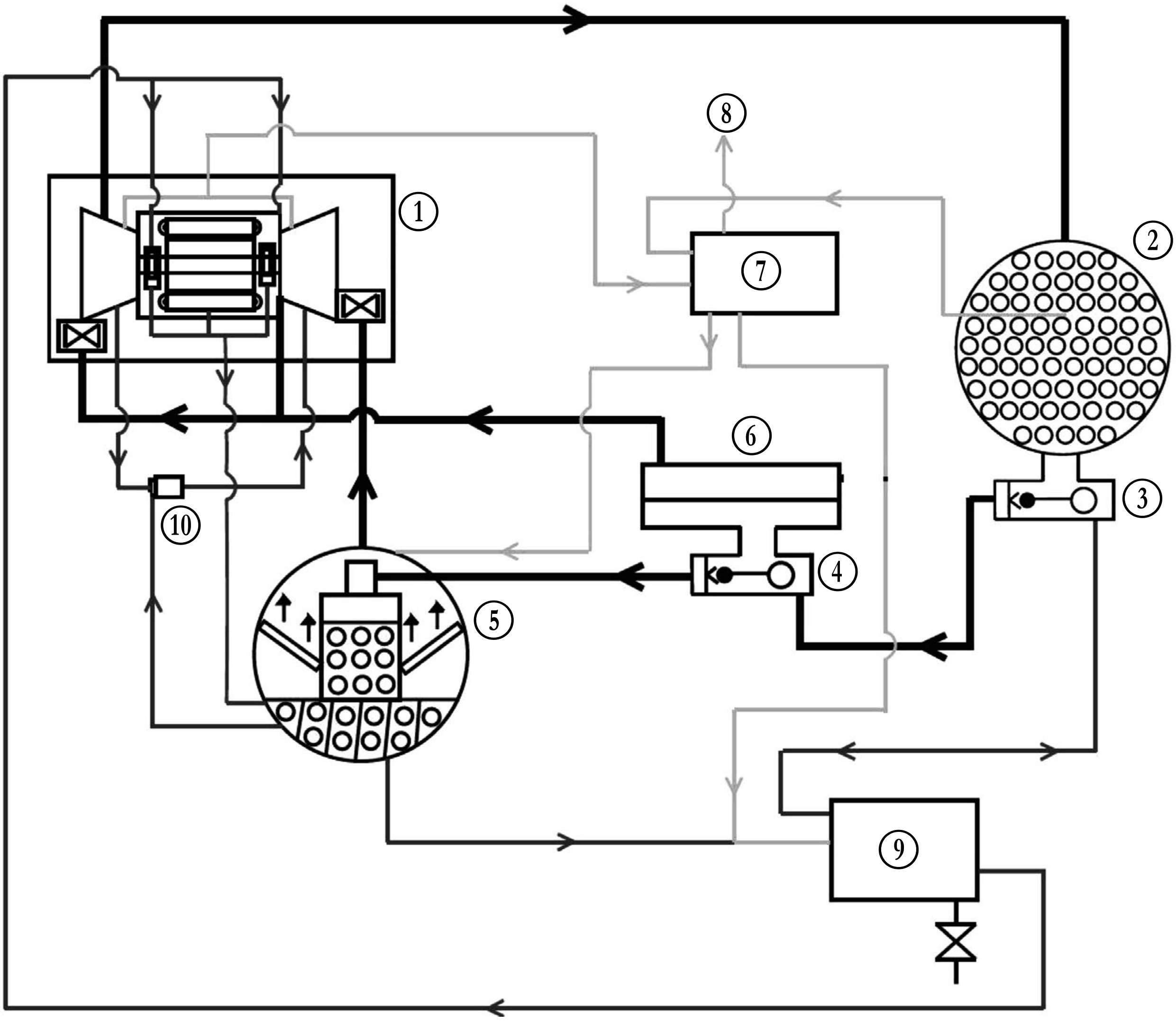
If liquid high side float level is not satisfied the pump will move refrigerant from the evaporator to the condenser.

Figures 5 and 6 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 82.7 kPa is required for the refrigerant pump delta difference. An alert will trigger if this value is less than 89.6 kPa while the machine is in normal operating mode. Consult the Controls Operation and Troubleshooting Manual for details.

Figure 5 - Refrigerant lubrication Cycle



1. Compressor
2. Condenser
3. High side float chamber
4. Low side float chamber
5. Cooler
6. Economizer
7. Purge system
8. Vent line
9. Refrigerant lubrication system
10. Eductor

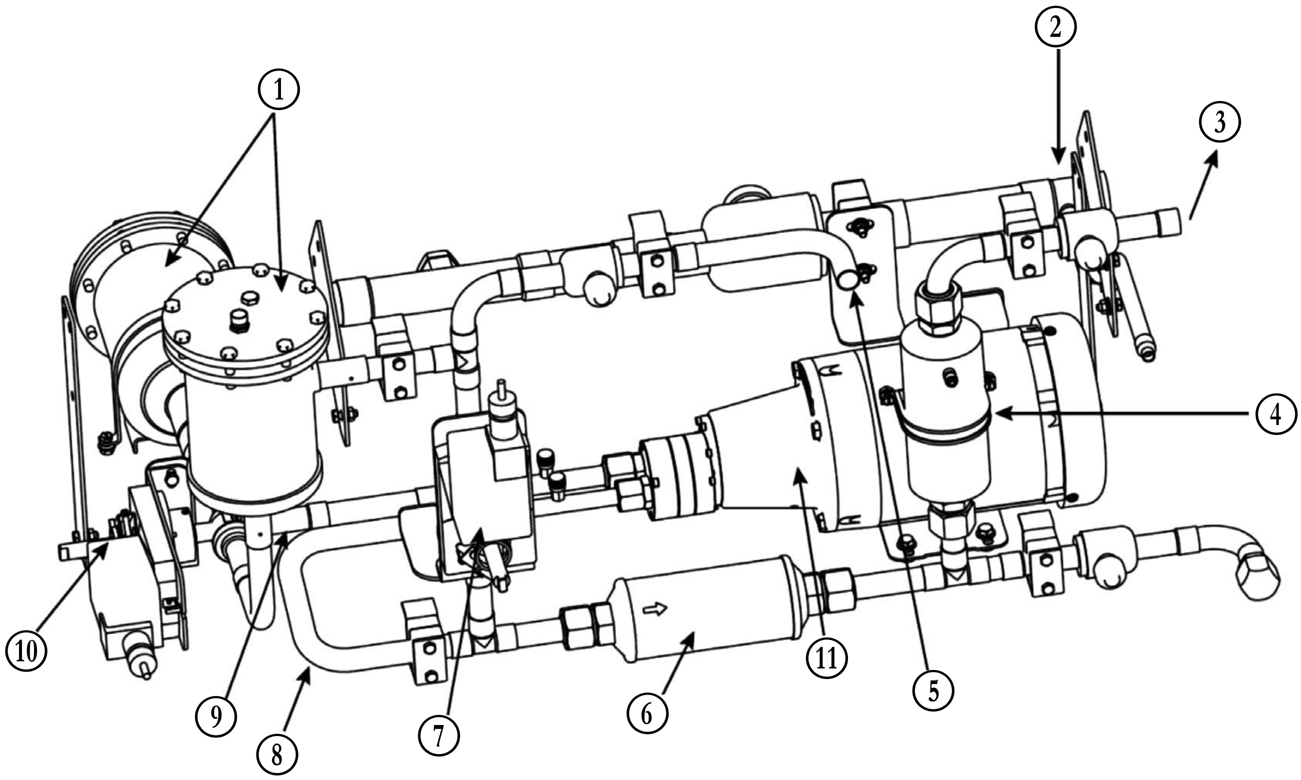
: Purge
: Lube system
: Main refrigerant system

2.5.5.2 - 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.

Figure 6 - Refrigerant lubrication Assembly

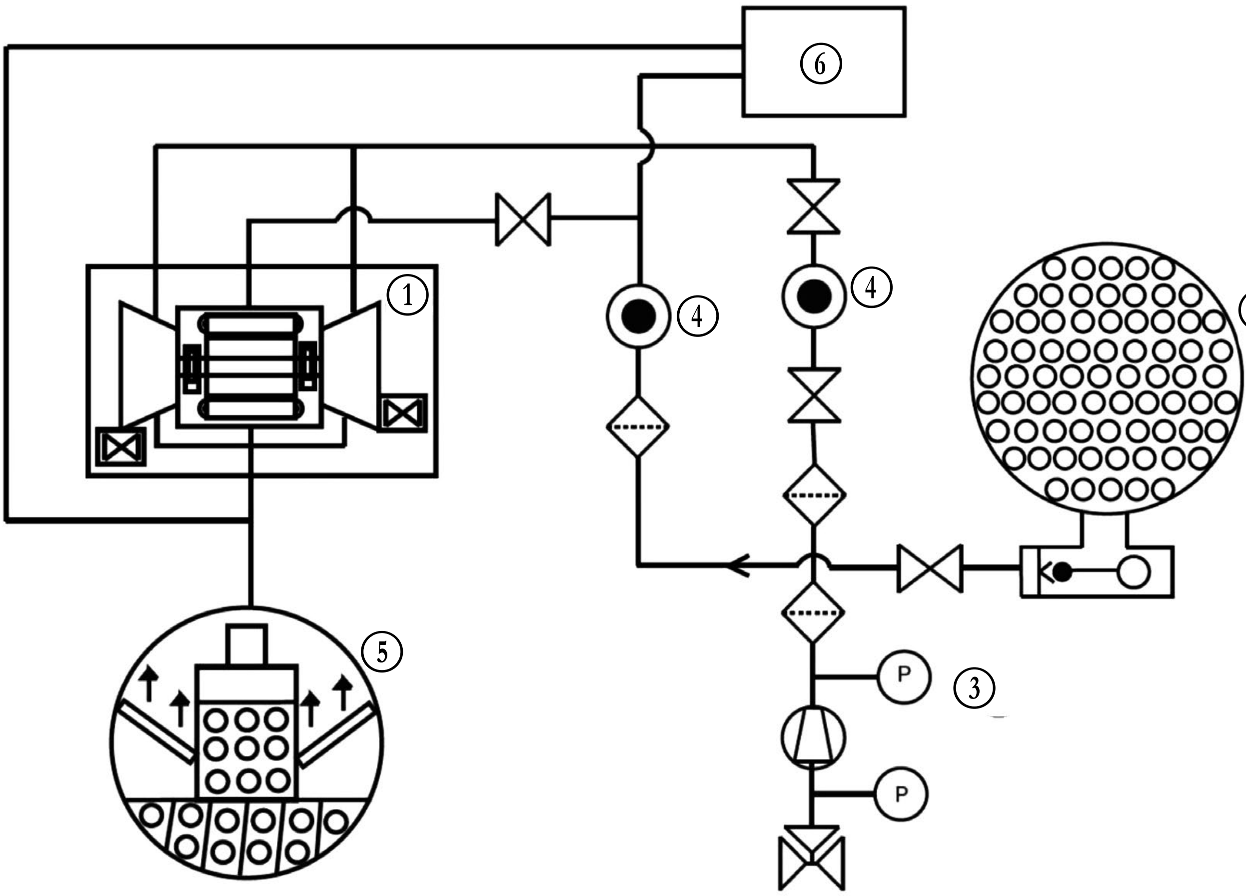


1. Strainer
2. From evaporator
3. To compressor motor bearings
4. Filter
5. From high side float chamber
6. Filter
7. Actuator, condenser valve
8. Pump discharge
9. Pump suction
10. Actuator and 3 way valve, cooler valve
11. Pump

2.5.5.3 - 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 5.5°C above this set point, the controls close the inlet guide vanes. If the temperature rises above 50°C, the compressor shuts down. **See Fig. 7**.

Figure 7 - Motor/VFD cooling system



1. Compressor
2. Condenser
3. Motor cooling system
4. Moisture indicator
5. Cooler

2.5.5.4 - FD cooling

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. The power module of the variable-frequency drive is equipped with a heat exchanger to provide cooling, using the refrigerant in the machine. If equipped with a unit-mounted VFD, the refrigerant line that feeds the motor cooling also feeds the heat exchanger on the unit-mounted VFD.

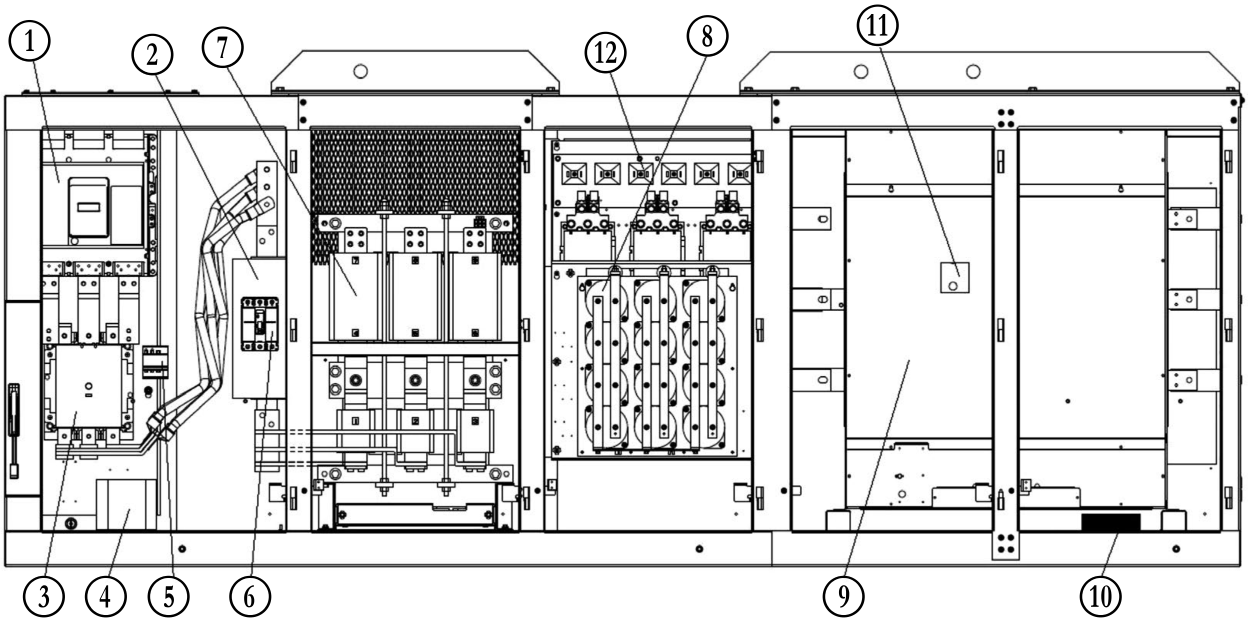
2.5.5.5 - VFD

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 most of time mounted on the chiller. See Manufacturer VFD specific information and VFD schematics.

This VFD is used with low voltage motors between 380 and 460 vac. It reduces the starting current inrush by controlling the voltage and frequency to the compressor motor. Operational parameters and fault codes are displayed relative to the drive. Refer to specific drive literature along with troubleshooting sections. The display is also the interface for entering specific chiller operational parameters. These parameters have been preprogrammed at the factory. VFD is designed to operate in an ambient range of up 40°C.

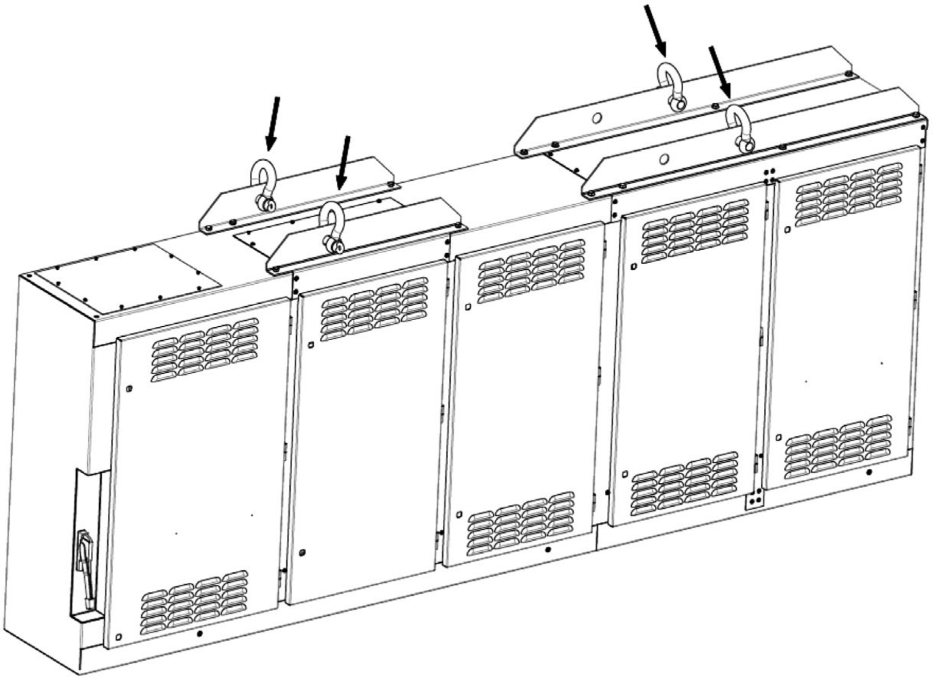
The compressor power variable-frequency drive cabinet includes the following functional components (identified in accordance with the references on the wiring diagram):

Fig 8 - VFD cabinet view (example of LF2 4AA)



1. Circuit breaker/main disconnect switch (QF101) for the following functions:
   - Short-circuit protection of the main circuit
   - Single connection point of the installation power cables
   - Isolation and shut-down of the machine, using the handle accessible on the outside of the control box
   - Emergency stop, initiated by the PIC control
2. Filter CEM RFI (ZGS) to limit high-frequency conductor interferences (>150 kHz).
3. Power safety contactor (K101)
4. Power transformer (T1) and fuse (FU10) for the internal control circuit of the variable-frequency drive.
5. Surge limiter (F).
6. Power supply circuit protection disconnect switch for the PIC control box (QF).
7. Load resistor shunt capacitors (K1-). They short-circuit the load resistors when the capacitors are loaded.
8. Capacitor resistors (R1-3C) and coils for inlet filtering of the main circuit
9. Power module and associated control interface board (GS) for the following functions:
   - Compressor start-up and shutdown by voltage/frequency ramping to permit limiting of the couple and inrush current at start-up
   - Control of the voltage/frequency applied to the compressor
   - All electrical compressor protection devices
   - All devices to protect against internal faults of the variable-frequency drive as well as pressure safety switch cut-out and re-starting the oil pump
   - Report of variable-frequency drive status parameters and internal faults to the PIC control.
10. Terminal connections (XP), I/O with chiller (Gatekill chain from pressure switches terminals, run feedback, com…)
11. Communication gateway board. Provides the communication interface between the variable-frequency drive and the PIC control.
12. Load resistors of the main power circuit (R4-6C) and protection fuses of the load circuit (FU**). To limit the inrush current while power is supplied to the variable-frequency drive.

Fig 9 - VFD cabinet lifting lugs



2.5.5.6 - Purge system

The purge system is located under the condenser. **See Fig. 10**. 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-condensable 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. 11.

Non-condensable 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-condensable 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 default 18.3°C. If chiller compressor is running, condenser solenoid valve should be opened to purge refrigerant from condenser.

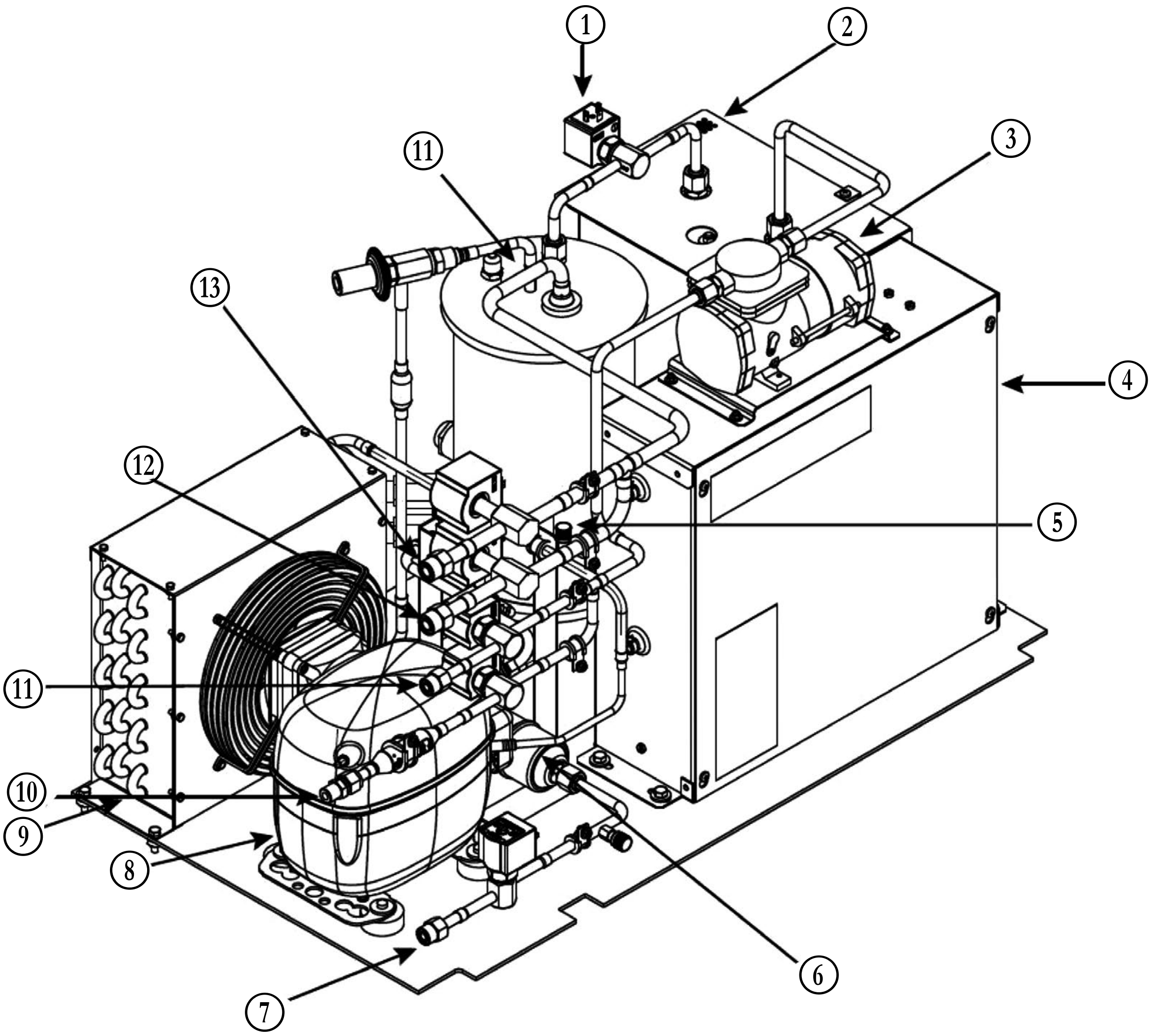
If chiller compressor is not running, open the compressor solenoid valve to purge refrigerant from compressor. If Purge Comp Suction Temp is less than purge compressor off temp (default to -15.5°C) and the refrigerant level flag is ON, close compressor solenoid valve, condenser solenoid valve, and open 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 -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 -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.

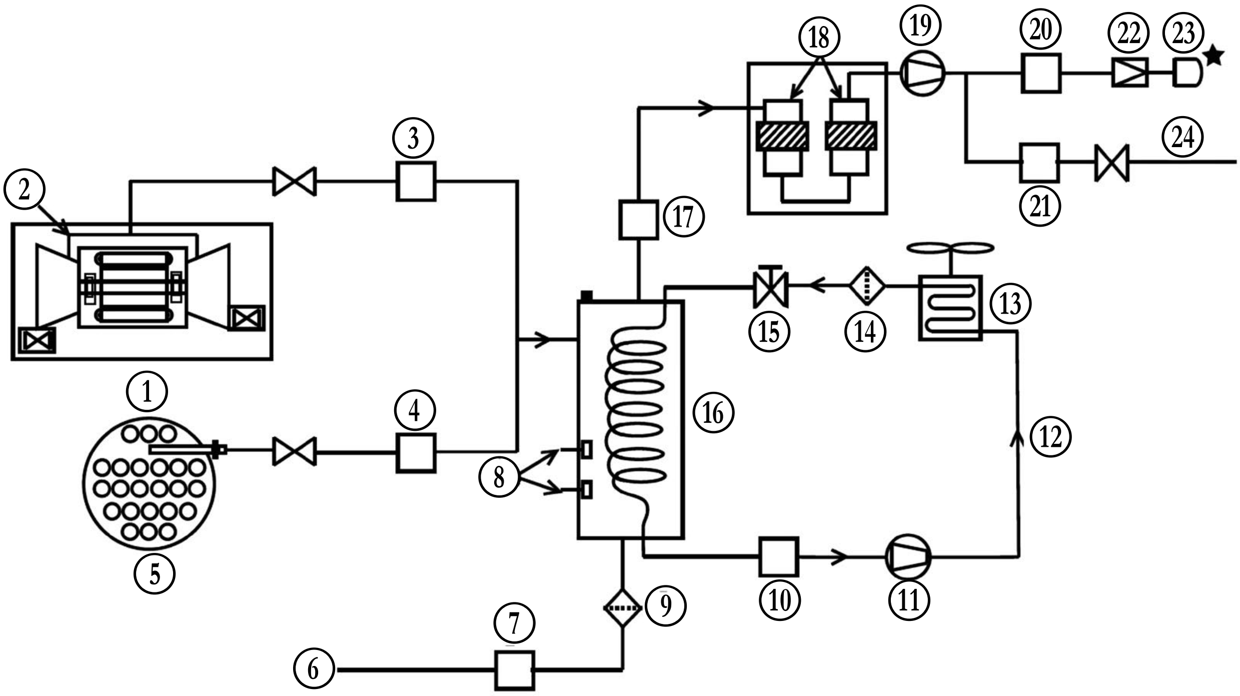
If pump out solenoid valve is accumulated ON for 100 minutes, purge system should do regeneration process for reg_tim minutes (default = 120 minutes - 19DV Configuration Menu), regardless whether purge is active. When regeneration process active, the Purge Regeneration Valve and Purge Heater should be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

Fig 10 - purge system



1. Purge pumpout (SV01)
2. Extra filters with strap heaters (not shown)
3. Vacuum pump
4. Control panel
5. Compressor suction
6. Strainer
7. Purge drain (SV04) – connected to refrigerant pump inlet piping
8. Compressor
9. Condenser assembly
10. Venting (SV06), non-condensable exhaust
11. Connected to motor drain (SV05)
12. Connected to chiller condenser (SV01)
13. Connected to compressor volute (SV02)
14. Purge tank

Fig 11 - purge system diagram

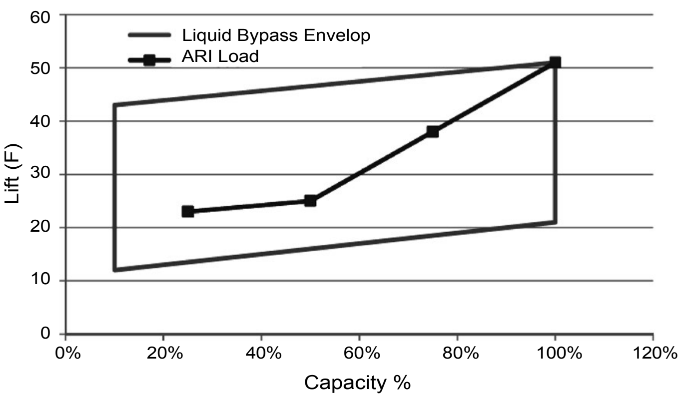


1. Compressor
2. Check valve (hidden)
3. Compressor valve (SV02)
4. Condenser valve (SV01)
5. Condenser
6. Purge drain (to lube assy)
7. Drain valve (SV04)
8. Level switches
9. Strainer
10. Suction temperature
11. Purge compressor
12. R134a circuit
13. Purge condenser assy
14. Strainer
15. Throttle service
16. Sight glass
17. Pumpout valve (SV03)
18. Carbon filters
19. Vacuum pump
20. Vent valve (SV06)
21. Regeneration valve (SV05)
22. Check valve
23. Vent line (field connection / purge vent 3/8 NPT)
24. Regenerated refrigerant (to motor drain)

2.5.5.7 - Liquid bypass

The liquid bypass (LBP) system will be an option for customer when the chiller operation envelope has low-er profile like below:

Fig 12 - liquid bypass envelop



Lift = Lvg Cnd Water Temp - Lvg Clr Water Temp

At very low Entering Condenser Water Temp, the pressure difference between condenser and evapo¬rator is reduced. At bigger system flow rate, the pip¬ing resistance may get higher than system pressure difference. In this case, the liquid may stack in the condenser or the economizer, and cause evaporator lack of refrigerant. Therefore, the chiller will easily get tripped out due to low evaporating temperature alarm.

The LBP system is designed to avoid above opera¬tion failure. It includes an Economizer Bypass Valve installed between condenser float chamber and evap¬orator inlet piping, an Economizer Isolation Valve in-stalled on the vapor piping between economizer and compressor interstage.

When the LBP is activated, the chiller will operate as a single stage system. The condenser float valve will still control the system flow rate according to the chamber liquid level.

When system lift decrease, and evaporating saturat¬ed temperature goes to below evaporator freezing point (default 0.56°C) for a period of time, or when the Leaving Condenser Water Temperature minus Leav¬ing Evap Water Temperature is less than 11.8°C and Cooler LTD is larger than 2.78°C for a period of time, the valve installed on bypass piping will be actuated to fully open, and the valve installed on the economizer vapor piping needs to be closed completely.

When the system lift increase, the bypassed line will pass more refrigerant than the system requires. So the evaporator will have too much refrigerant, and its liq¬uid level will increase to cause liquid carryover to the compressor. The system discharge temperature dif¬ference (DTD) will drop down.

When the DTD is less than the required, close the bypass valve and open the economizer vapor line valve, then the system will switch back to a two stage economized cycle.

2.6 - CONTROLS

2.6.1 - 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.)

2.6.2 - 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 shutdowns, if required. The variable frequency drive (VFD) allows compressor start-up and capacity control by modulating the motor frequency based on the operation condition.

2.6.3 - PIC 5+ system components

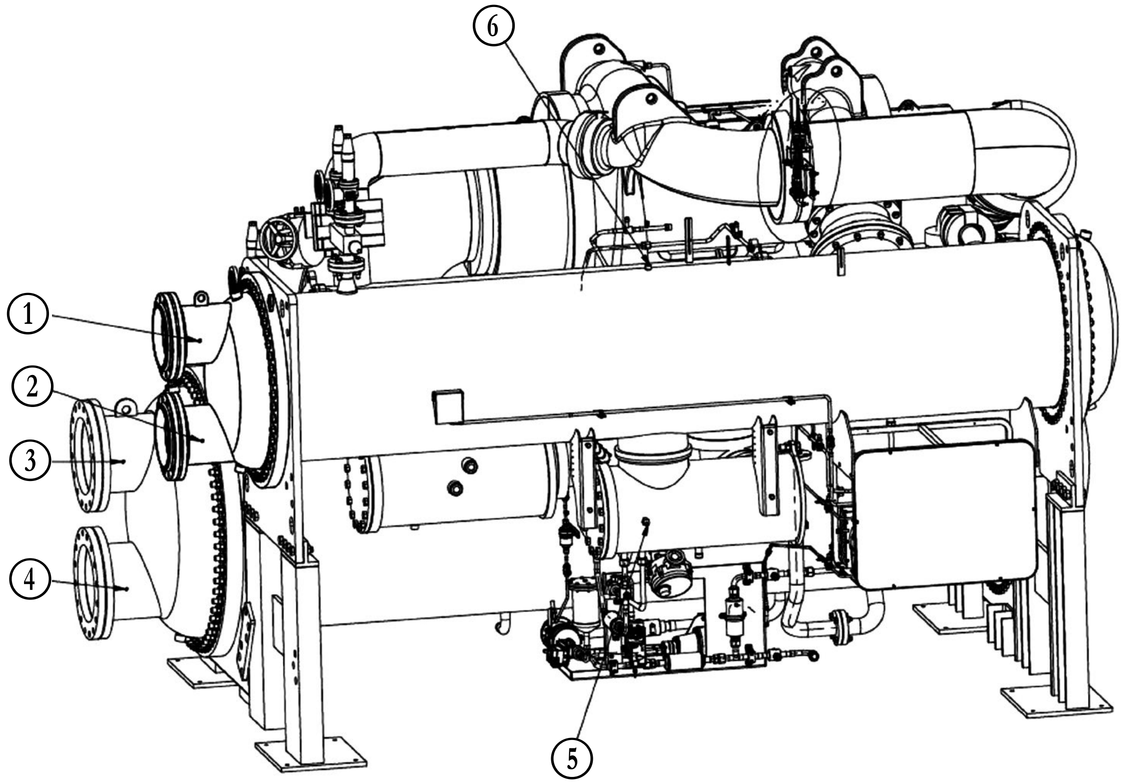
The chiller control system is called the PIC5+ (Product Integrated Control 5).

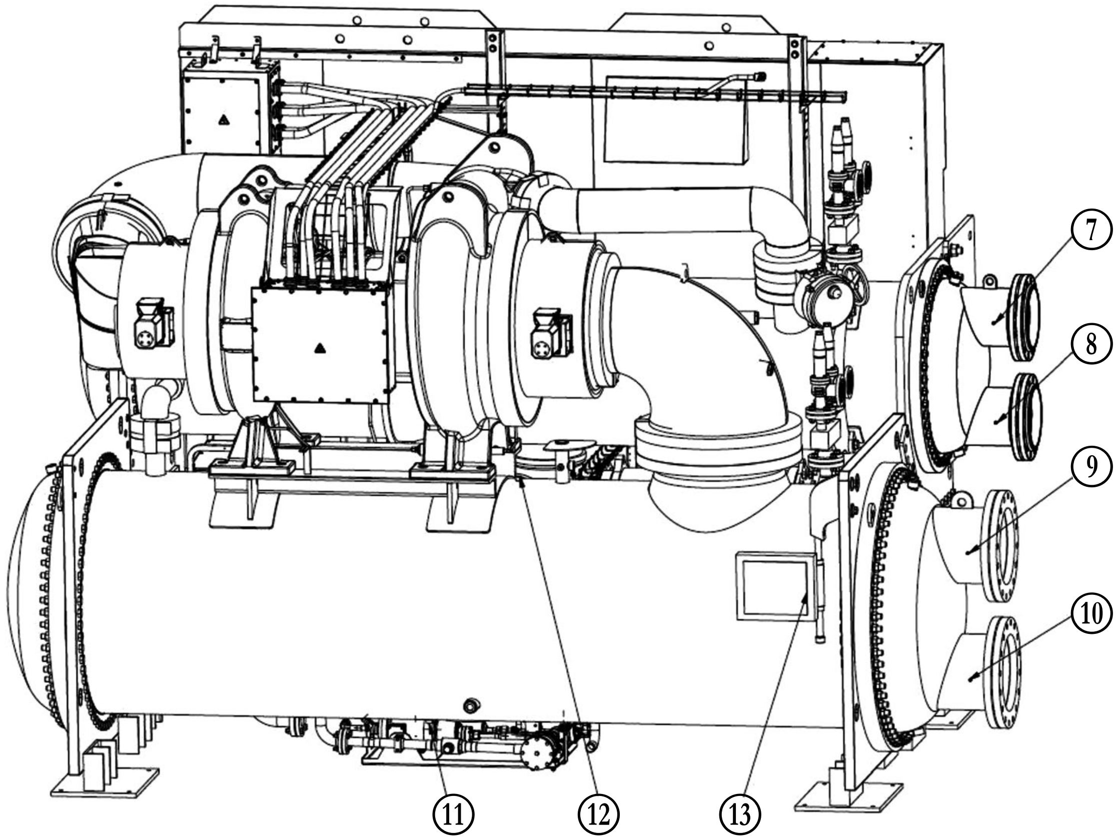
As with previous PIC versions, the PIC5+ system controls the operation of the chiller by monitoring all operating conditions. The PIC5+ control system can diagnose a problem and let the operator know what the problem is and what to check. It positions the guide vanes and VFD speed to maintain leaving 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.

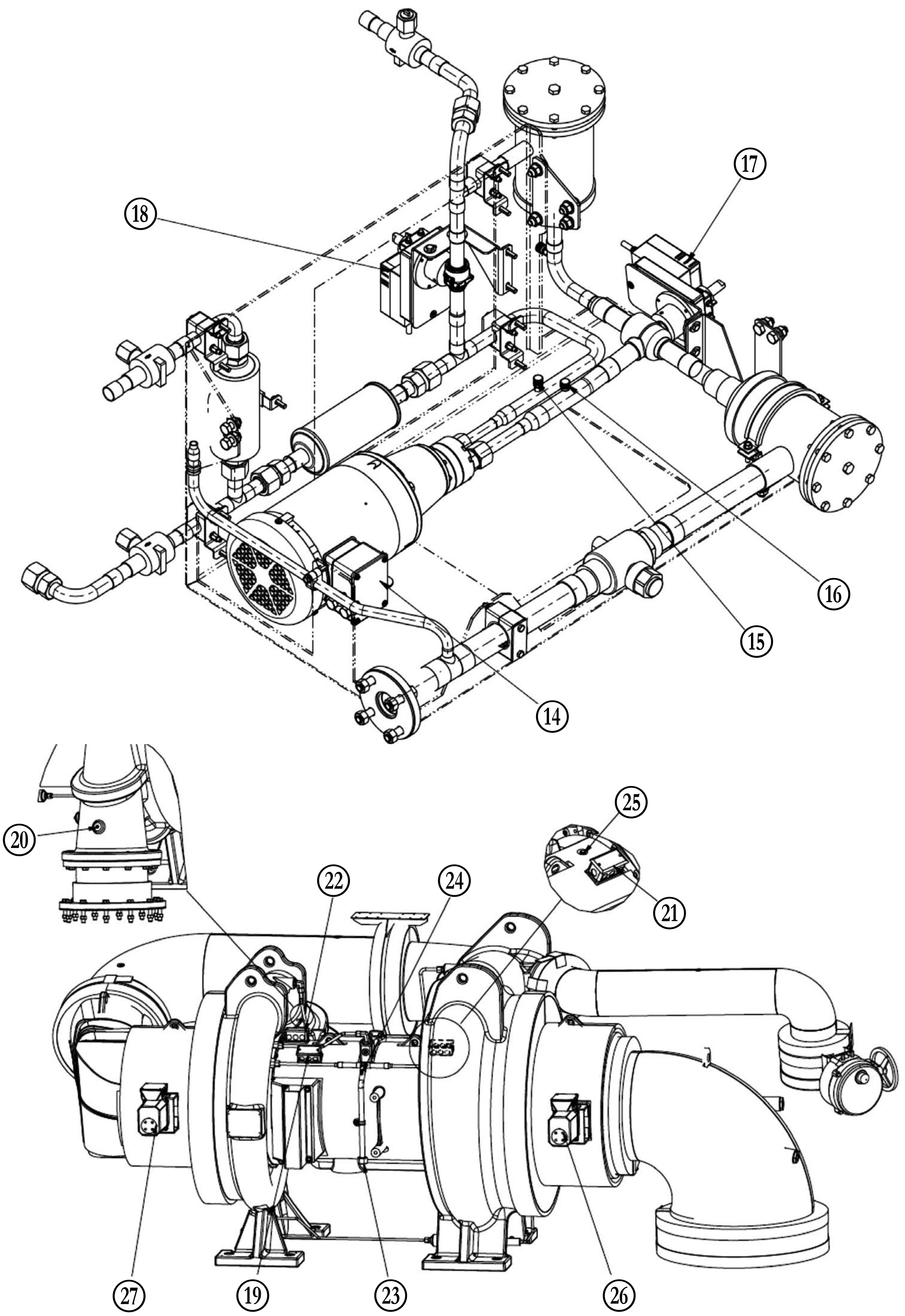
Fig 13 - Sensors, actuators location





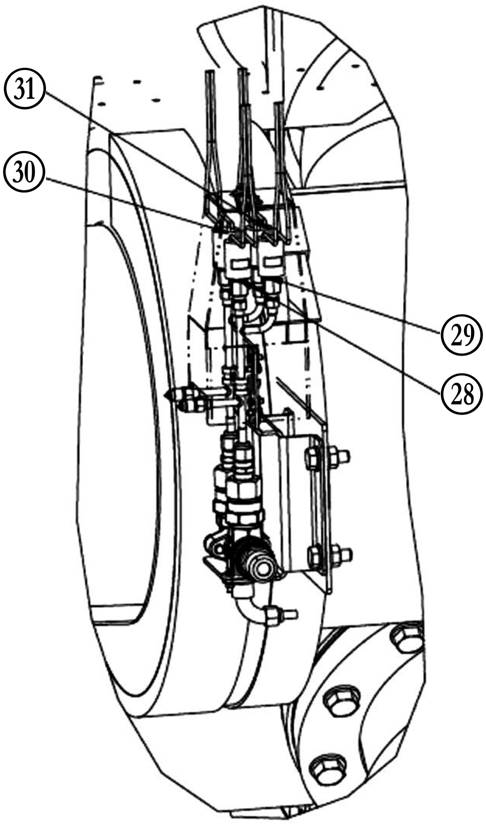
1. Condenser water outlet temperature sensor (RT8)
2. Condenser water inlet temperature sensor (RT7)
3. Evaporator water outlet pressure transducer (BP12)
4. Evaporator water inlet pressure transducer (BP13)
5. High side level switch (HF_LS)
6. Condenser refrigerant pressure transducer (BP1)
7. Condenser water outlet pressure transducer (BP14)
8. Condenser water inlet pressure transducer (BP15)
9. Evaporator water outlet temperature sensor (RT2)
10. Evaporator water inlet temperature sensor (RT1)
11. Evaporator refrigerant liquid temperature sensor (RT15)
12. Evaporator refrigerant pressure transducer (BP3)
13. PIC5+ HMI touchscreen panel

Fig 13 - Sensors, actuators location (cont.)



14. Refrigerant pump motor terminal
15. Refrigerant pump outlet pressure transducer (BP81)
16. Refrigerant pump inlet pressure transducer (BP80)
17. Evaporator control valve (ECV1)
18. Condenser control valve (CCV1)
19. Motor winding temperature sensor (RT31C)
20. Compressor discharge temperature sensor (RT21)
21. 1st stage bearing temperature sensor (RT39C)
22. 2nd stage bearing temperature sensor (RT40C)
23. Bearing refrigerant supply temperature sensor (RT41)
24. Bearing inlet pressure transducer (BP70)
25. Bearing outlet pressure transducer (BP71)
26. 1st Inlet Guide Vane actuator (M67)
27. 2nd Inlet Guilde Vane actuator (M69)

Fig 13 - Sensors, actuators location (end)



28. Pressure switch, safety device, (SP1FB)
29. Pressure switch, safety device, (SP1FA)
30. Pressure switch, safety device, spare (SP2FB)
31. Pressure switch, safety device, spare (SP2FA)

2.6.4 - Temperature sensors:

The system uses temperature sensors to measure and control the temperatures in the unit. There are three types of temperature sensors, 5K thermistor (standard), 10K thermistor and RTD (three wires) based on the IOB channel configurations.

Table 1a - Temperature sensors

Temperature sensor	Point Name	Wiring information (see chiller wiring diagram)				
		Designation	#IOB	# Channel	# Block	# Terminal
Entering chilled water temperature	ECW	RT1	IOB 1	AI1	J16	1-5
Leaving chilled water temperature	LCW	RT2	IOB 1	AI2	J16	2-6
Entering condenser water temperature	ECDW	RT7	IOB 1	AI3	J16	3-7
Leaving condenser water temperature	LCDW	RT8	IOB 1	AI4	J16	4-8
Evap. refrigerant liquid temperature	EVAP_T	RT15	IOB 1	AI5	J15	6-12
Compressor Discharge temperature	DGT	RT21	IOB 1	AI6	J15	5-11
Motor winding temperature 1	MTRW1	RT31C	IOB 2	AI1	J16	1-5
1st stage Bearing Temp	CBH1_T	RT39C	IOB 3	AI1	J16	1-5
2nd stage Bearing temp	CBH2_T	RT40C	IOB 3	AI2	J16	2-6
Bearing Ref Supply Temp	BRGI_T	RT41	IOB 3	AI3	J16	3-7

The temperature sensor range is -40 ~ +118°C.

2.6.5 - Pressure transducers

Pressure transducers are used to measure and control the pressures in the unit. These electronic sensors deliver 0 to 5 VDC. The transducers can be calibrated through the controller. The pressure transducers are connected to the IOBs.

Table 1b - Pressure sensors

Temperature sensor	Point Name	Wiring information (see chiller wiring diagram)					Pressure transducer type
		Designation	#IOB	# Channel	# Block	# Terminal	
Condenser pressure	COND_P	BP1	IOB 1	AI7	J15	4-10	5VDC – low refr. Pressure range
Evaporator pressure	EVAP_P	BP3	IOB 1	AI8	J15	3-9	5VDC – low refr. Pressure range
Pump Outlet Pressure	PUMPO_P	BP81	IOB 2	AI5	J15	6-12	5VDC – low refr. Pressure range
Bearing Outlet pressure	BRGO_P	BP71	IOB 2	AI6	J15	5-11	5VDC – low refr. Pressure range
Bearing inlet pressure	BRGI_P	BP70	IOB 2	AI7	J15	4-10	5VDC – low refr. Pressure range
Pump inlet Pressure	PUMPI_P	BP80	IOB 2	AI10	J15	1-7	5VDC – low refr. Pressure range
Entering Evap water pressure	EVAP_EWP	BP13	IOB 4	AI3	J16	3-7	5VDC – water side pressure range
Leaving Evap water pressure	EVAP_LWP	BP12	IOB 4	AI4	J16	4-8	5VDC – water side pressure range
Entering Cond water pressure	COND_EWP	BP15	IOB 4	AI5	J15	6-12	5VDC – water side pressure range
Leaving Cond water pressure	COND_LWP	BP14	IOB 4	AI6	J15	5-11	5VDC – water side pressure range

3.1 - Introduction

The 19DV machines are factory assembled, wired, leak tested and electrically tested. Installation (not by Carrier) consists primarily of establishing water and electrical services to the machine. The rigging, installation, field wiring, field piping, and insulation of waterbox covers are the responsibility of the contractor and/or customer.

3.2 - Step 1 – Receive the machine

3.2.1 - Inspect the product delivered

CAUTION: Do not open any valves or loosen any connections. The standard 19DV machine is shipped with a full refrigerant charge. Some machines may be shipped with a nitrogen holding charge as an option. Damage to machine may result.

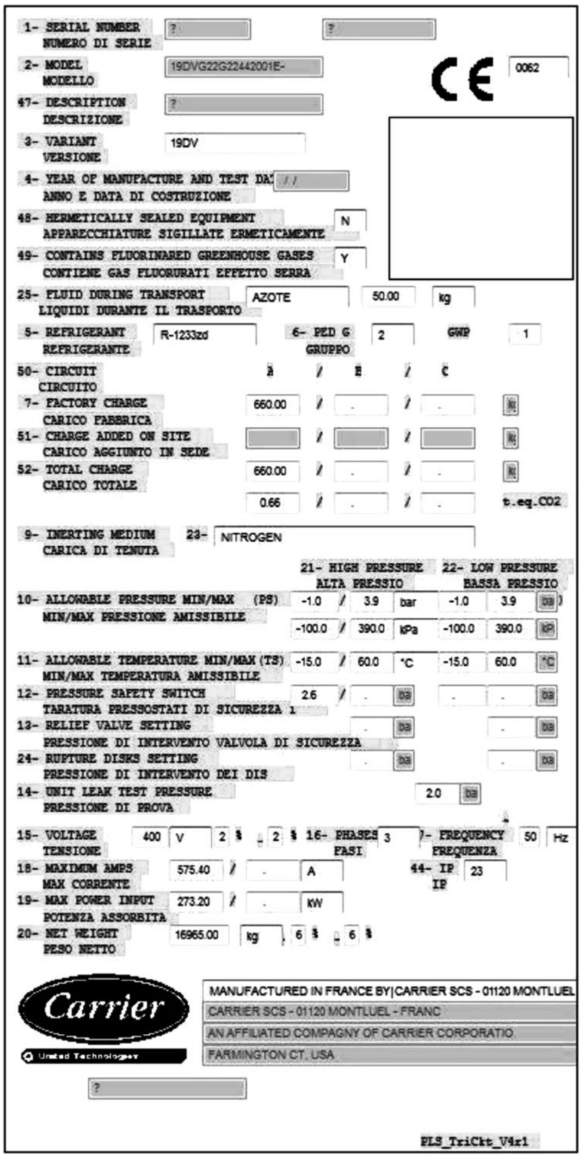
1. ***Inspect for shipping damage while machine is still on shipping conveyance. If machine appears to be damaged or has been torn loose from its anchorage, have it examined by transportation inspectors before removal. Forward claim papers directly to transportation company. Manufacturer is not responsible for any damage incurred in transit.***
2. ***Check all items against shipping list. Immediately notify the nearest Carrier representative if any item is missing.***
3. ***To prevent loss or damage (standard EN 378-2 11.22 k, annex A and B), leave all parts in original packages until beginning installation. All openings are closed with covers or plugs to prevent dirt and debris from entering machine components during shipping. A full operating inhibitor charge is placed in the lubrication assembly before shipment. from the factory. Do not open lube assembly valves until unit is fully charged with refrigerant.***

3.2.2 - Identify machine

Confirm that the unit received is the one ordered. Compare the name plate data with the order. The unit name plate must include the following information:

- Service number
- Serial number
- Model number
- Variant
- Year of manufacture and test date
- CE marking
- Medium used during the transport and quantity (kg)
- Medium used and group
- Medium charge
- Containment medium to be used
- PS: Min./max. allowable pressure (high and low pressure side)
- TS: Min./max. allowable temperature (high and low pressure side)
- Pressure switch setting
- Safety relief valve setting
- Unit leak test pressure
- Operating voltage
- Number of phases
- Maximum current drawn
- Maximum power input
- Unit net weight
- Cutout pressure setting of rupture disks if unit is equipped.

Fig 14 - Example of chiller serial plate


1- SERIAL NUMBER / NUMERO DI SERIE: ? ?
2- MODEL / MODELLO: 19DVG22G22442001E-
CE 0062
47- DESCRIPTION / DESCRIZIONE: ?
3- VARIANT / VERSIONE: 19DV
4- YEAR OF MANUFACTURE AND TEST DA / ANNO E DATA DI COSTRUZIONE: / /
48- HERMETICALLY SEALED EQUIPMENT / APPARECCHIATURE SIGILLATE ERMETICAMENTE: N
49- CONTAINS FLUORINARED GREENHOUSE GASES / CONTIENE GAS FLUORURATI EFFETTO SERRA: Y
25- FLUID DURING TRANSPORT / LIQUIDI DURANTE IL TRASPORTO: AZOTE 50.00 kg
5- REFRIGERANT / REFRIGERANTE: R-1233zd; 6- PED G / GRUPPO: 2; GWP: 1
50- CIRCUIT / CIRCUITO: A / B / C
7- FACTORY CHARGE / CARICO FABBRICA: 660.00 / . / . kg
51- CHARGE ADDED ON SITE / CARICO AGGIUNTO IN SEDE: / / kg
52- TOTAL CHARGE / CARICO TOTALE: 660.00 / . / . kg; 0.66 / . / . t.eq.CO2
9- INERTING MEDIUM / CARICA DI TENUTA; 23- NITROGEN
21- HIGH PRESSURE / ALTA PRESSIO; 22- LOW PRESSURE / BASSA PRESSIO
10- ALLOWABLE PRESSURE MIN/MAX (PS) / MIN/MAX PRESSIONE AMISSIBILE: -1.0 / 3.9 bar, -1.0 3.9 bar; -100.0 / 390.0 kPa, -100.0 390.0 kPa
11- ALLOWABLE TEMPERATURE MIN/MAX (TS) / MIN/MAX TEMPERATURA AMISSIBILE: -15.0 / 60.0 °C, -15.0 60.0 °C
12- PRESSURE SAFETY SWITCH / TARATURA PRESSOSTATI DI SICUREZZA 1: 2.6 / . bar, . . bar
13- RELIEF VALVE SETTING / PRESSIONE DI INTERVENTO VALVOLA DI SICUREZZA: . bar, . bar
24- RUPTURE DISKS SETTING / PRESSIONE DI INTERVENTO DEI DIS: . bar, . bar
14- UNIT LEAK TEST PRESSURE / PRESSIONE DI PROVA: 2.0 bar
15- VOLTAGE / TENSIONE: 400 V 2 % _ 2 %; 16- PHASES / FASI: 3; 7- FREQUENCY / FREQUENZA: 50 Hz
18- MAXIMUM AMPS / MAX CORRENTE: 575.40 / . A; 44- IP / IP: 23
19- MAX POWER INPUT / POTENZA ASSORBITA: 273.20 / . kW
20- NET WEIGHT / PESO NETTO: 16965.00 kg , 6 % _ 6 %
Carrier
United Technologies
MANUFACTURED IN FRANCE BY|CARRIER SCS - 01120 MONTLUEL
CARRIER SCS - 01120 MONTLUEL - FRANC
AN AFFILIATED COMPAGNY OF CARRIER CORPORATIO
FARMINGTON CT, USA
?
PLS_TriCkt_V4r1

		High pressure side		Low pressure side	
		Min	**Max.**	**Min**	**Max.**
PS (see in the list above)	kPa	-100	390	-100	390
TS (see in the list above)	°C	-15	60	-15	60
Pressure switch cut-out pressure	kPa	262			
Relief valve cut-out pressure	kPa	500		500	
Test pressure, unit leak test	kPa		200		200

Check all items against shipping list. Immediately notify the nearest Carrier representative if any item is missing.

3.2.3 - Installation requirements

Prior to starting the chiller's electrical installation, certain requirements should be checked. Input power wire sizes, branch circuit protection, and control wiring are all areas that need to be evaluated.

Conduit Entry Size — It is important to determine the size of the conduit openings in the enclosure power entry plate so that the wire planned for a specific entry point will fit through the opening. Do NOT punch holes or drill into the top surface of any panels. Knockouts are provided on the enclosure. The VFD entry plate is designed to be removed before any holes are made to prevent particulate from entering the cabinet.

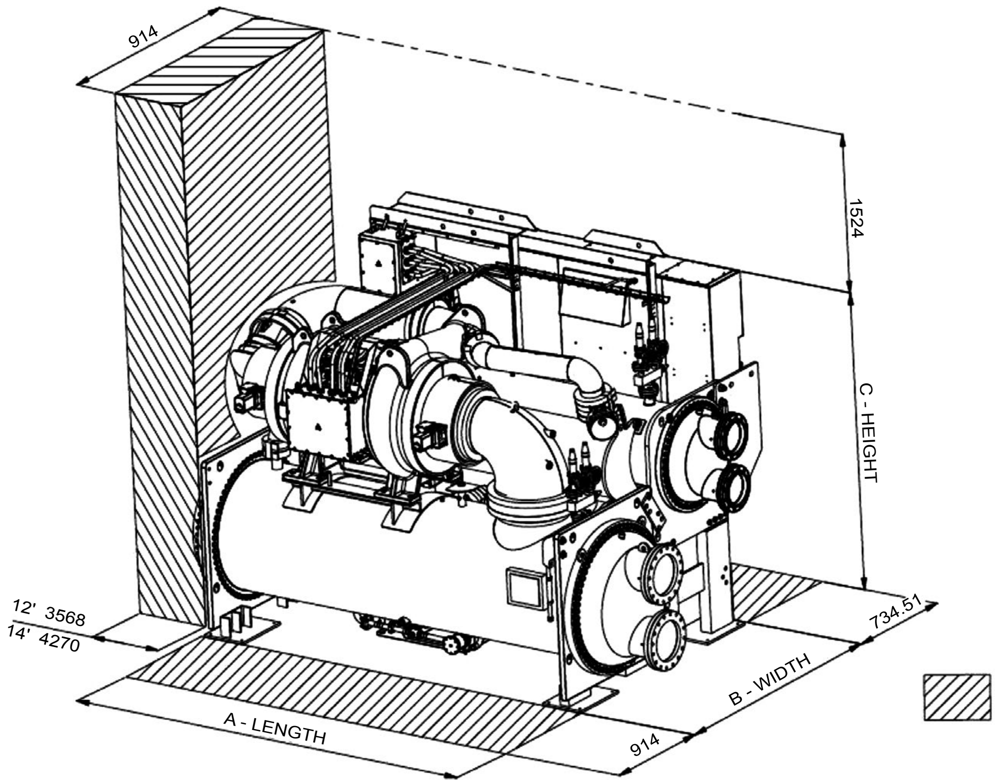
Recommended Control and Signal Wire Sizes — The recommended minimum size wire to connect I/0 signals to the control terminal blocks is 0.75 mm^2.

Recommended Airflow Clearances — Be sure there is adequate clearance for air circulation around the enclosure. 152.4 mm minimum clearance is required wherever vents are located in an enclosure.

Service Clearances — Verify that there are adequate service clearances as identified in **Fig. 15**.

Match Power Module Input and Supply Power Ratings — It is important to verify that building power will meet the input power requirements of the Machine Electrical Data nameplate input power rating. Be sure the input power to the chiller corresponds to the chiller's nameplate voltage, current, and frequency and to the design data sheet provided by the equipment salesman. Verify all electrical inputs against design data sheets.

Fig 15 - 19DV overhead service clearance



3.2.4 - Provide machine protection

Protect machine from construction dirt and moisture. Keep protective shipping covers in place until machine is ready for installation. Do not keep the 19DV units outside where they are exposed to the weather.

If machine is exposed to freezing temperatures after water circuits have been installed, open waterbox drains and remove all water from cooler and condenser. Leave drains open until system is filled.

It is important to properly plan before installing a 19DV unit to ensure that the environmental and operating conditions are satisfactory and the machine is protected. The installation must comply with all requirements in this document and in the certified prints.

3.2.5 - Operating Environment

Chiller should be installed in an indoor environment where the ambient temperature is between 5 and 40°C with a relative humidity of 95% or less, non-condensing. To ensure that electrical components operate properly, do not locate the chiller in an area exposed to dust, dirt, corrosive fumes, or excessive heat and humidity.

3.3 - Step 2 – Rig the machine

The 19DV machine can be rigged as an entire assembly. It also has connections that allow the compressor, evaporator, condenser, VFD, an major accessories be separated for plant introduction under the supervision of Carrier. Contact local Carrier office for details if separation is required.

3.3.1 - Rigging the complete machine

See rigging instructions on label attached to machine. Lift machine only from the points indicated in the instructions supplied and in the machine rigging drawings. Each lifting cable or chain must be capable of supporting the entire weight of the machine.

WARNING: Lifting machine from points other than those specified may result in serious damage to the unit and personal injury. Rigging equipment and procedures must be adequate for machine weight. See table 2 for the machine weights.

If the unit is disassembled for slinging, the weight of each element of the machine must be known: motor, compressor, heat exchangers with and without refrigerant charge, electrical equipment, special water boxes, etc. This information is available on the dimensional drawing supplied with the machine.

IMPORTANT: Only a qualified service technician should perform this operation.

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

CAUTION: Before rigging the compressor, disconnect all wires entering the control box.

IMPORTANT: Verify with company performing the rigging that they have access to required spreader beam for 4 point lift. Carrier is not responsible for rigging damage.

CAUTION: Factory-supplied insulation is not flammable but can be damaged by welding sparks and open flame. Protect insulation with a wet canvas cover.

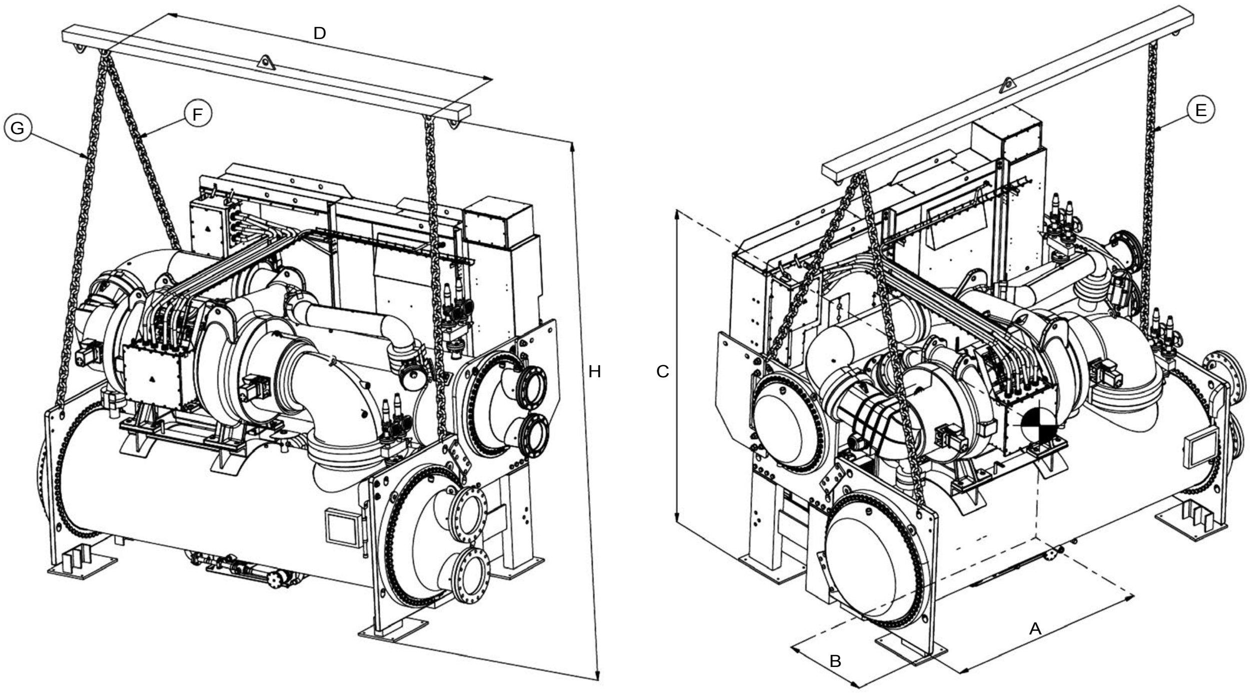
Each lifting cable or chain must be capable of supporting the entire weight of the machine.

Contractors are not authorized to disassemble any part of the chiller without Carrier's supervision. Any request otherwise must be approved in writing by the Carrier Technical Service Manager. Non-conformance to this requirement may result in loss of product warranty.

NOTE: Carrier suggests that a structural engineer be consulted if transmission of vibrations from mechanical equipment is of concern and is not the responsibility of the manufacturer.

Lifting chiller or components from points other than those specified may result in serious damage to the machine or personal injury. Rigging equipment and procedures must be adequate for maximum chiller weight.

Fig 16 - Machine Rigging Guide (comp frame size DV4)



Notes :

1. Each chain must be capable of supporting the entire weight of the machine. See chart for maximum weight. (The maximum weights shown cover weights from steel and copper tubing, insulation, and refrigerant charge, excluding water weight.)
2. Chain lengths shown are typical for 4.5 m lifting height. Some minor adjustments may be required.

   Dimensions A and B define distance from machine center of gravity to tubesheet outermost surfaces. Dim "C" defines distance from machine c.o.g. to floor. Dim "D" defines distance measured between the chain and lifting hooks.
3. Rigging can be different and specific if unit is equipped of special components or devices which could have interference with chain way. Please refer always to the official dimensional drawings of the ordered job and contact customer service to get more information for rigging.

IMPORTANT : Make sure that rigging cable is over the rigging bar before lifting.

Table 2 - 19DV dimensions / rigging information

Unit model	heat exch. frame	Compr frame	Motor frame	Power VFD configuration	Overall max dimensions (mm)			Weight max (kg)	
					Length	Height	Width	Rigging	Operating
19DV	G2*G2* (12 feets)	02DV4	B, D,F, or H	VFD LF2 2CC (608 A)	4760	3190	3055	16500	18800
19DV	G2*G2* (12 feets)	02DV4	B, D,F, or H	VFD LF2 4AA (900 A)	4760	3190	3055	17390	19690
19DV	G2*G2* (12 feets)	02DV4	B, D,F, or H	VFD Danfoss E	*	*	*	16700	19000
19DV	G2*G2* (12 feets)	02DV4	B, D,F, or H	Control cabinet only (Freestanding VFD)	4760	2900	2585	15070	17370
19DV	G4*G4* (14 feets)	02DV4	B, D,F, or H	VFD LF2 2CC (608 A)	5275	3190	3055	17900	21350
19DV	G4*G4* (14 feets)	02DV4	B, D,F, or H	VFD LF2 4AA (900 A)	5275	3190	3055	18300	21750
19DV	G4*G4* (14 feets)	02DV4	B, D,F, or H	VFD Danfoss E	*	*	*	18100	21550
19DV	G4*G4* (14 feets)	02DV4	B, D,F, or H	Control cabinet only (Freestanding VFD)	5275	2900	2585	15970	19420
19DV	H2*H2* (12 feets)	02DV4	B, D,F, or H	VFD LF2 2CC (608 A)	4760	3330	3260	18290	20350
19DV	H2*H2* (12 feets)	02DV4	B, D,F, or H	VFD LF2 4AA (900 A)	4760	3330	3260	18660	20710
19DV	H2*H2* (12 feets)	02DV4	B, D,F, or H	VFD Danfoss E	*	*	*	18470	20530
19DV	H2*H2* (12 feets)	02DV4	B, D,F, or H	Control cabinet only (Freestanding VFD)	4760	3075	2790	16480	18610
19DV	H4*H4* (14 feets)	02DV4	B, D,F, or H	VFD LF2 4AA (900 A)	5195	3330	3260	19960	22980
19DV	H4*H4* (14 feets)	02DV4	B, D,F, or H	VFD Danfoss E	*	*	*	19760	22780
19DV	H4*H4* (14 feets)	02DV4	B, D,F, or H	Control cabinet only (Freestanding VFD)	5195	3075	2790	17630	20650

Unit model	heat exch. frame	Compr frame	Motor frame	Power VFD configuration	COG position (mm)			Rigging chain lengths (mm)		
					A	B	C	D	E	F
19DV	G2*G2* (12 feets)	02DV4	B, D,F, or H	VFD LF2 2CC (608 A)	1810	1135	1490	2500	2215	2670
19DV	G2*G2* (12 feets)	02DV4	B, D,F, or H	VFD LF2 4AA (900 A)	1800	1270	1470	2500	2150	2720
19DV	G2*G2* (12 feets)	02DV4	B, D,F, or H	VFD Danfoss E	*	*	*	2500	2210	2670
19DV	G2*G2* (12 feets)	02DV4	B, D,F, or H	Control cabinet only (Freestanding VFD)	1750	1240	1430	2500	2150	2720
19DV	G4*G4* (14 feets)	02DV4	B, D,F, or H	VFD LF2 2CC (608 A)	2020	1140	1470	2500	2215	2670
19DV	G4*G4* (14 feets)	02DV4	B, D,F, or H	VFD LF2 4AA (900 A)	2000	1270	1475	2500	2150	2720
19DV	G4*G4* (14 feets)	02DV4	B, D,F, or H	VFD Danfoss E	*	*	*	2500	2215	2670
19DV	G4*G4* (14 feets)	02DV4	B, D,F, or H	Control cabinet only (Freestanding VFD)	1965	1235	1435	2500	2150	2720
19DV	H2*H2* (12 feets)	02DV4	B, D,F, or H	VFD LF2 2CC (608 A)	1840	1060	1670	2380	2200	2570
19DV	H2*H2* (12 feets)	02DV4	B, D,F, or H	VFD LF2 4AA (900 A)	1820	1210	1690	2390	2110	2630
19DV	H2*H2* (12 feets)	02DV4	B, D,F, or H	VFD Danfoss E	*	*	*	2380	2200	2570
19DV	H2*H2* (12 feets)	02DV4	B, D,F, or H	Control cabinet only (Freestanding VFD)	1790	1005	1615	2390	2230	2550
19DV	H4*H4* (14 feets)	02DV4	B, D,F, or H	VFD LF2 4AA (900 A)	1990	1210	1660	2390	2110	2630
19DV	H4*H4* (14 feets)	02DV4	B, D,F, or H	VFD Danfoss E	*	*	*	2380	2200	2570
19DV	H4*H4* (14 feets)	02DV4	B, D,F, or H	Control cabinet only (Freestanding VFD)	1980	1015	1590	2380	2230	2550

* not available, see official dim drawing

Table 3 - 19DV Compressor weights

Compressor components	Weight (kg)
Power Train Assembly(Include Motor Stator, Rotor Assembly and 2nd Stage Lube Support)	1000
2nd Stage lube support	75
Rotor Assembly (Include Motor Rotor, 1st Stage Lube Support)	310
1st Stage Lube Support	70
1st Stage Suction Assembly(Include 1st Stage Blade Ring, 1st Stage Suction Housing)	379
1st Stage Blade Ring Assembly	79
1st Stage Suction Housing	281
2nd Stage Suction Assembly(Include 2nd Stage Blade Ring, 2nd Stage Suction Housing)	351
2nd Stage Blade Ring Assembly	60
2nd Stage Suction Housing	274
1st Stage Volute	613
2nd Stage Volute	478
1st Stage Shroud	225
2st Stage Shroud	200
1st Stage IGV Shroud	54
2st Stage IGV Shroud	44
1st Stage Impeller	29
2st Stage Impeller	27
Miscellaneous	172
Total Weight (Excludes Motor Stator and Motor Rotor)	**2810**

Table 4 - 19DV motor weigths

COMPRESSOR FRAME	MOTOR CODE	STATOR & HOUSING WEIGHT (kg)	ROTOR & SHAFT WEIGHT (kg)
DV4	NB	494	150
DV4	ND	522	154
DV4	NF	558	159
DV4	NH	597	165

Table 5 - 19DV VFD weights

VFD type	Frame	Weight (kg)
LF2 Rockwell 608 Amps	2CC	1180
LF2 Rockwell 900 Amps	4AA	1590
Danfoss	E	300

Table 6 - 19DV Cooler weights

Frame size	Dry weight (kg)	Water weight (kg)
G20	4858	890
G21	4936	925
G22	5013	960
G23	5091	995
G24	5194	1042
G25	4858	890
G26	4914	916
G27	4992	951
G28	5075	989
G29	5165	1030
G40	5174	928
G41	5264	968
G42	5354	1008
G43	5444	1048
G44	5563	1101
G45	5174	928
G46	5240	958
G47	5329	998
G48	5426	1041
G49	5530	1089
H20	6316	962
H21	6402	1001
H22	6486	1039
H23	6599	1090
H24	6712	1142
H25	6287	950
H26	6371	988
H27	6471	1033
H28	6566	1077
H29	6679	1129
H40	6812	1011
H41	6912	1055
H42	7009	1099
H43	7140	1158
H44	7271	1216
H45	6779	997
H46	6876	1041
H47	6991	1092
H48	7102	1143
H49	7233	1201

Frame size	Dry weight (kg)	Water weight (kg)
G2A	4672	896
G2B	4718	926
G2C	4769	960
G2D	4818	992
G2E	4892	1040
G2F	4642	880
G2G	4685	908
G2H	4742	944
G2J	4804	984
G2K	4862	1023
G4A	4961	935
G4B	5014	970
G4C	5074	1008
G4D	5130	1044
G4E	5216	1099
G4F	4927	917
G4G	4977	949
G4H	5043	991
G4J	5115	1035
G4K	5182	1080
H2A	6060	953
H2B	6117	991
H2C	6184	1035
H2D	6257	1083
H2E	6335	1135
H2F	6041	943
H2G	6098	981
H2H	6162	1023
H2J	6227	1067
H2K	6305	1118
H4A	6518	1002
H4B	6584	1045
H4C	6662	1095
H4D	6747	1149
H4E	6838	1208
H4F	6496	989
H4G	6563	1032
H4H	6638	1080
H4J	6714	1130
H4K	6804	1189

Table 7 - 19DV Condenser weights

Frame size	Dry weight (kg)	Water weight (kg)
G22	2845	611
G23	2951	656
G24	3068	705
G27	2808	597
G28	2902	637
G29	3013	684
G42	3065	667
G43	3188	718
G44	3322	773
G47	3023	651
G48	3131	696
G49	3260	750
H22	3446	760
H23	3589	818
H24	3743	882
H27	3390	738
H28	3526	795
H29	3671	855
H42	3759	831
H43	3923	897
H44	4100	970
H47	3694	806
H48	3852	870
H49	4018	939

Frame size	Dry weight (kg)	Water weight (kg)
G2C	2620	652
G2D	2708	707
G2E	2788	756
G2H	2594	638
G2J	2670	686
G2K	2752	736
G4C	2807	713
G4D	2909	775
G4E	3002	831
G4H	2777	697
G4J	2865	751
G4K	2961	808
H2C	3158	820
H2D	3262	883
H2E	3376	951
H2H	3109	793
H2J	3203	851
H2K	3311	916
H4C	3430	899
H4D	3550	971
H4E	3681	1049
H4H	3374	869
H4J	3483	934
H4K	3608	1009

Table 8 - 19DV Economizer weight

Frame size	Steel weight (kg)
DV4	1204

Table 9 - 19DV Std type Dish head water box weights

Frame size	Cooler		Condenser	
	Steel weight (kg)	Water weight (kg)	Steel weight (kg)	Water weight (kg)
G	845	614	407	215
H	783	607	315	249

Table 10 - 19DV Piping and others weights

Item	Weight (kg)
Suction piping	225
ICP (interstage connecting piping)	460
Discharge piping	70
Purge assy	60
Copper pipings	250
Control pannel	90
PIC5+ touch screen	10
Cable and cable tray	120

Table 11 - 19DV accessories weight (kg)

Condenser frame	Envelop control & piping (kg)	Liquid bypass & isolation valve (kg)
G	180	227
H	-	-

3.3.2 - Rigging the machine components

Refer to instructions **Fig. 16** and **Table 2** , and Carrier Certified Prints for machine component disassembly.

IMPORTANT: Only a qualified service technician should perform this operation.

WARNING: Do not attempt to disconnect flanges while the ma¬chine is under pressure. Failure to relieve pressure can result in personal injury or damage to the unit.

NOTE: If the cooler, economizer, and condenser vessels must be separated, the heat exchangers should be kept level by placing a support plate under the tube sheets. The support plate will also help to keep the vessels level and aligned when the vessels are bolted back together.

NOTE: Wiring must also be disconnected. Label each wire before removal (see Carrier Certified Prints). In order to disconnect the VFD from the machine, remove wiring between the VFD from the machine, remove wiring between VFD and control panel, purge system and the main motor leads at the starter lugs. Remove all transducer and sensor wires at the sensor. Clip all wire ties necessary to pull heat exchangers apart.

To Separate Evaporator and Condenser:

1. Place a support plate under each tube sheet leg to keep each vessel level.
2. Cut tubing between high side float chamber and motor/ VFD cooling.
3. Cut tubing between high side float chamber and lube assembly.
4. Disconnect the compressor discharge pipe.
5. Disconnect bolted connection between the low side float chamber and the evaporator.
6. Disconnect bolted economizer pipe between economizer and second stage compressor inlet.
7. Cut tubing between purge and compressor volute.
8. Cut tubing between purge regeneration line and motor drain.
9. Cover all openings.
10. Disconnect all wires and cables that cross from cooler side of the machine to the condenser side.
11. Disconnect the marriage brackets connecting the evaporator and condenser tubesheets (both ends).

To Separate the Compressor from the Evaporator:

1. Unbolt motor drain flange.
2. Unbolt suction pipe flange.
3. Unbolt discharge pipe flange.
4. Cut tubing from purge to compressor volute.
5. Disconnect O-ring face seal from bearing drain (near motor drain).
6. Cut bearing supply tubing from lube assembly.
7. Cut motor cooling supply line tubing from high side float chamber.
8. Disconnect inhibitor reclaim line running from compressor to near bottom of evaporator.
9. Disconnect all power and control wires connected to the compressor.
10. Cover all openings
11. Disconnect compressor motor power cables from VFD to motor.
12. Unbolt compressor mounting from the evaporator.

Additional Notes

1. Use silicone grease on new O-rings when refitting.
2. Use gasket sealant on new gaskets when refitting.

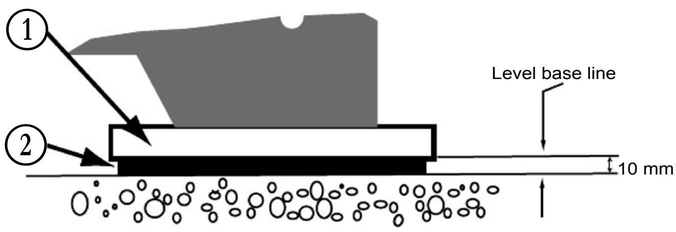
3.4 - Step 3 – Install Machine Supports

Typical applications of these units are in refrigeration systems, and they do not require earthquake resistance. Earthquake resistance has not been verified.

3.4.1 - Install standard isolation

Figure X shows the position of support plates and shear flex pads, which together form the standard machine support system.

Fig 17 - Standard isolation



Note: the isolation package includes four shear flex pads.

1. Support plate
2. Shear flex pad

Machine foot

Important: Chiller housekeeping pad, anchor bolts, and attachment points that are designed by others must be in accordance with all applicable national and local codes.

3.4.2 - Installation of levelling accessory (if necessary)

Uneven floors or other considerations may dictate the use of accessory soleplates (supplied by Carrier for field installation) and leveling pads. **Refer to Fig 18.**

Chiller support plates must be level within 1/4-in. (6 mm) from one end to the other.

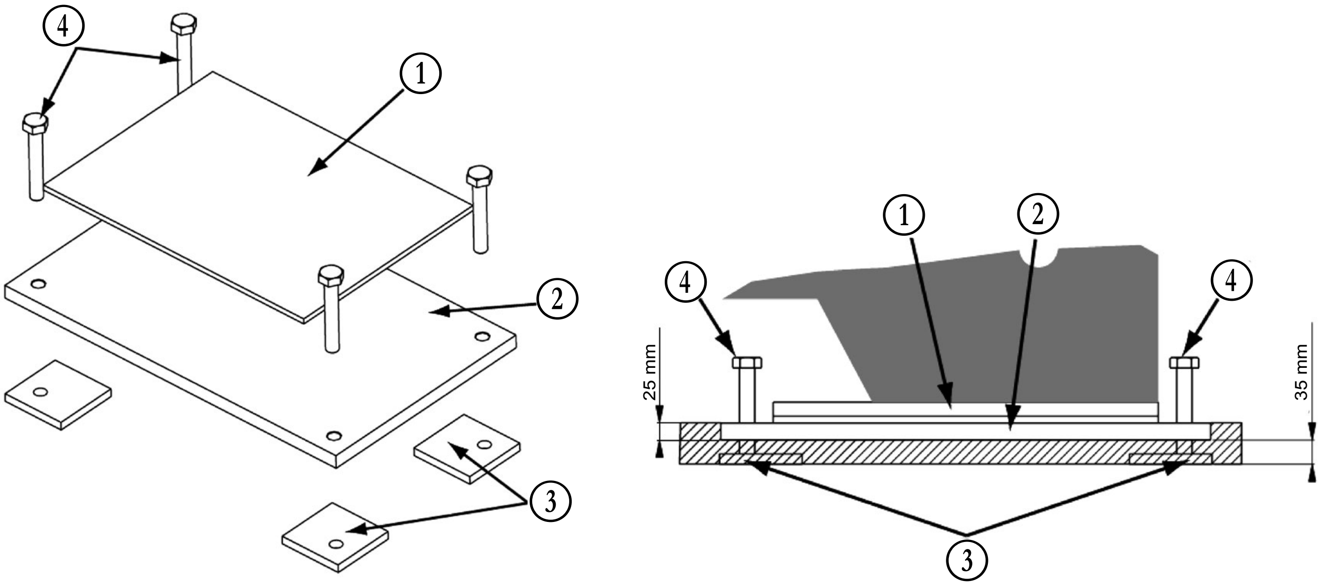
Level machine by using jacking screws in isolation soleplates. Use a level at least 24-in. (600 mm) long.

For adequate and long lasting machine support, proper grout selection and placement is essential. Carrier recommends that only pre-mixed, epoxy type, non-shrinking grout be used for machine installation.

Follow manufacturer's instructions in applying grout.

1. Check machine location prints for required grout thickness.
2. Carefully wax jacking screws for easy removal from grout.
3. Grout must extend above the base of the soleplate and there must be no voids in grout beneath the plates.
4. Allow grout to set and harden, per manufacturer's instructions, before starting machine.
5. Remove jacking screws from leveling pads after grout has hardened.

Fig 18 - Levelling accessory for 19DV units



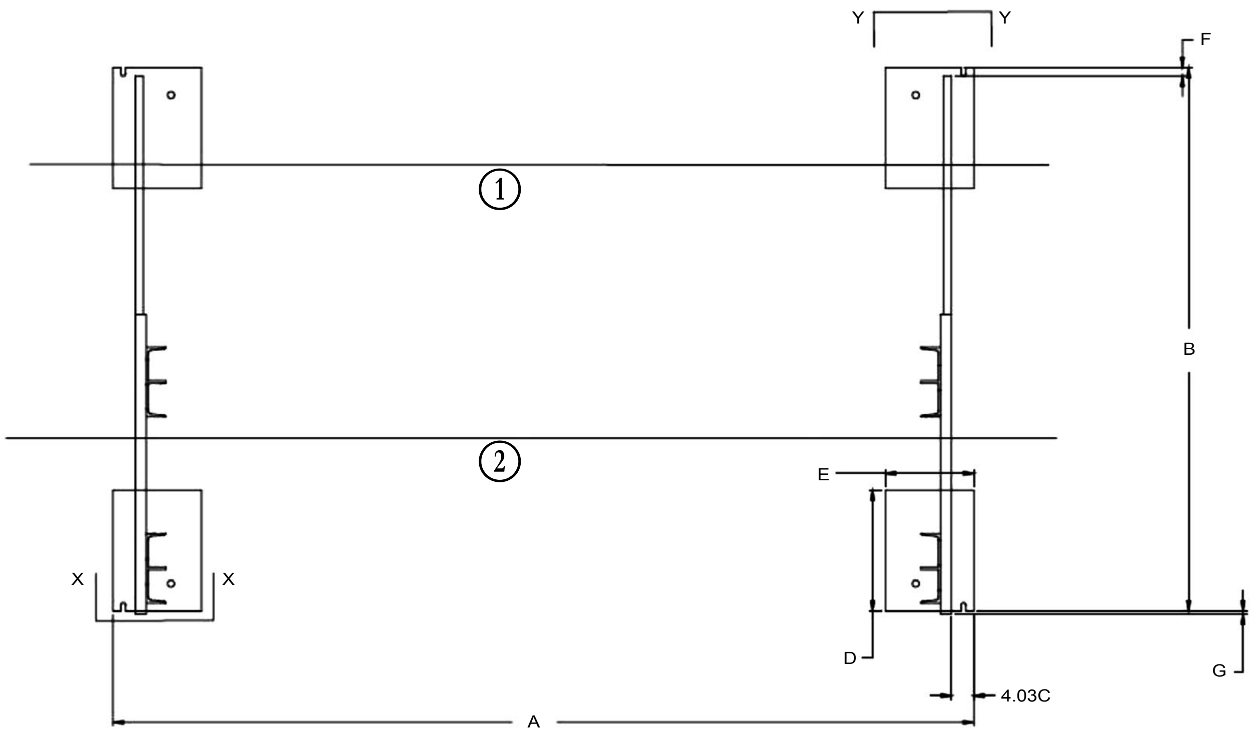
1. Accessory spring isolator
2. Soleplate (accessory) attaches securely to isolator
3. Level foundation
4. Adjusting screws

Note : Accessory (Carrier supplied, field-installed) soleplate package includes 4. Thickness of grout will vary depending on the amount necessary to level chiller. Use only pre-mixed non-shrinkink grout. Masterflow 648CP-Plus or Chemrex Embeco 636 Plus Grout 38 to 57 mm thick.

Machine foot (side view)

System base (concrete)

Fig 19 - 19DV footprint



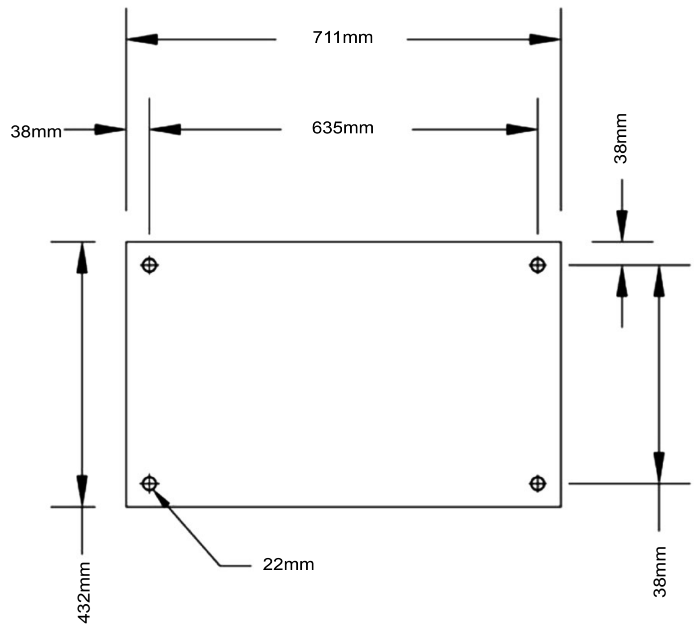
1. Condenser
2. Cooler

19DV heat exchanger size		Dimensions (mm)						
COOLER	CONDENSER	A	B	C	D	E	F	G
G2	G2	3951	2508	102	559	406	38	13
G4	G4	4472	2508	102	559	406	38	13
H2	H2	3951	2612	102	559	406	38	13
H4	H4	4472	2612	102	559	406	38	13

Note: X-X dimension refers to accessory soleplate. **See fig 20.**

Those dimensions are standard. Please always refer to the certified dimensional drawings supplied with the unit.

Fig 20 - Soleplate dimensions



3.4.3 - Installation of spring isolation system

Spring isolation may be purchased as an accessory from Carrier for field installation. It may also be field supplied and installed. Spring isolators may be placed directly under machine support plates or located under machine soleplates. See **Fig. 21**. Low profile spring isolation assemblies can be field supplied to keep the machine at a convenient working height.

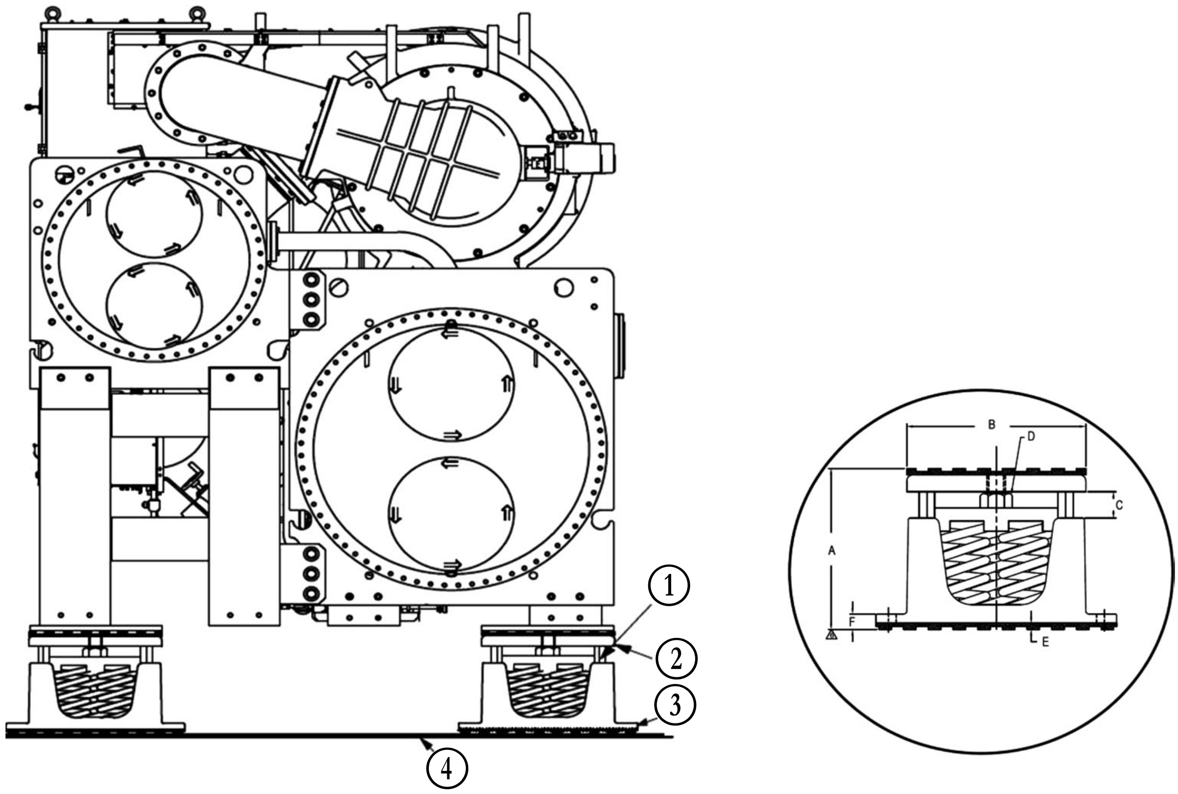
Obtain specific details on spring mounting and machine weight distribution from job data. Also, check job data for methods to support and isolate pipes that are attached to spring isolated machines.

NOTE: The springs are designed to support the weight of the chiller only. Connected piping must be supported independently of the chiller.

NOTE: It is recommended that any installation other than the ground floor should have spring isolation for the chiller and piping.

NOTE: These isolators are not intended for seismic duty, but are intended to reduce the vibration and noise levels transmitted from the chiller to the surrounding environment. For installations adjacent to areas that are sensitive to noise and/or vibration, use the services of a qualified consulting engineer or acoustics expert to determine whether these springs will provide adequate noise/vibration suppression.

Fig 21 - Spring isolation installation



1. Accessory spring isolator
2, 3. Resilient sheer flex pad, bonded to top and bottom of spring amount
4. Level foundation

A. 168 mm free height
B. 184 mm
C. 6 to 13 mm gap
D. Adjusting bolt
E. 6 mm elastomeric pad top & bottom
F. 16 mm

NOTES:
1. For spring installation follow manufacturer's instructions.
   Set chiller on all springs in one rig; jacking one end out of level will result in excess loading on springs and may cause damage.
2. The accessory spring isolators are supplied by Carrier for installation in the field if the accessory is purchased.

3.5 - Step 4 – Connection of water, vent and purge piping

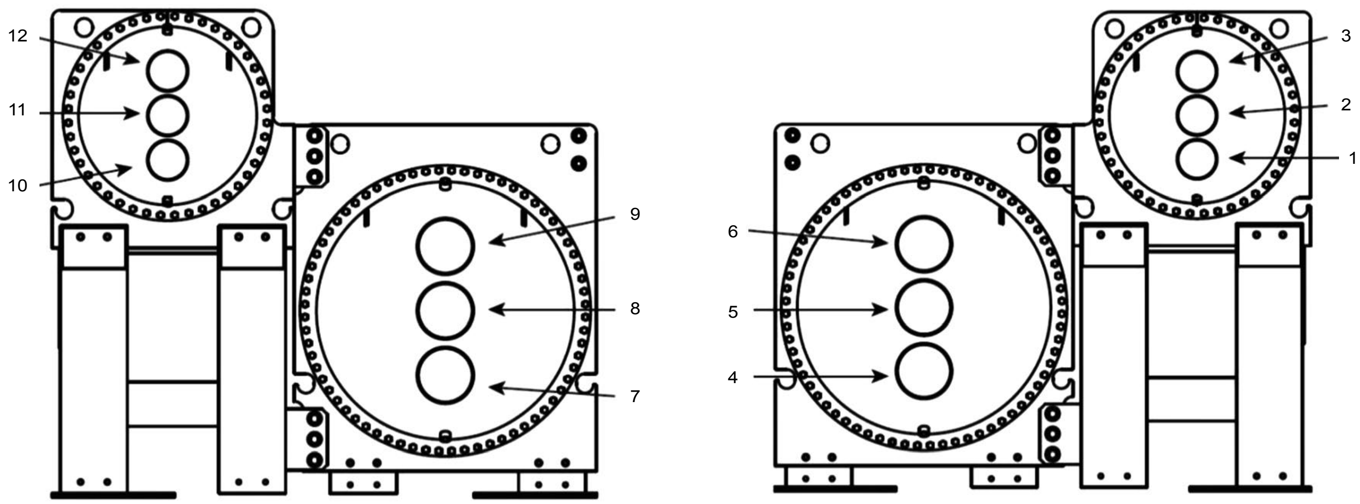
For size and position of the heat exchanger water inlet and outlet connections refer to the certified dimensional drawings supplied with the unit. See. Fig. 22 - "Standard waterboxes and nozzle arrangements" The water pipes must not transmit any radial or axial force nor any vibration to the heat exchangers.

The water supply must be analyzed and appropriate filtering, treatment, control devices, isolation and bleed valves and circuits built in, to prevent corrosion, fouling and deterioration of the pump fittings. Consult either a water treatment specialist or appropriate literature on the subject.

Table 12 - 19DV nozzle size

Heat exchanger frame size		Nozzle size (mm) (Nominal size)					
		Cooler			Condenser		
		1 pass	2 pass	3 pass	1 pass	2 pass	3 pass
G-G	NIH	356 (DN350)	356	324 (DN300)	324	273 (DN250)	273
	MWB	356	356	324	324	273	273
H-H	NIH	356	356	324	324	324	273
	MWB	356	356	324	324	273	273

Fig. 22 - "Standard waterboxes and nozzle arrangements"



Pass	Evaporator waterboxes			Condenser waterboxes		
	In	Out	Arrangement code*	In	Out	Arrangement code*
1	8	5	A	11	2	P
	5	8	B	2	11	Q
2	7	9	C	10	12	R
	4	6	D	1	3	S
3	7	6	E	10	3	T
	4	9	F	1	12	U

* Refer to certified drawings

3.5.1 - Install water piping to heat exchanger

Install piping using job data, piping drawings, and procedures outlined below. A typical piping installation is shown in **Fig. 23.**

CAUTION: Factory-supplied insulation is not flammable but can be damaged by welding sparks and open flame. Protect insulation with a wet canvas cover.

CAUTION: To prevent damage to sensors, remove evaporator and condenser water temperature sensors before welding connecting piping to water nozzles. Replace sensors after welding is complete.

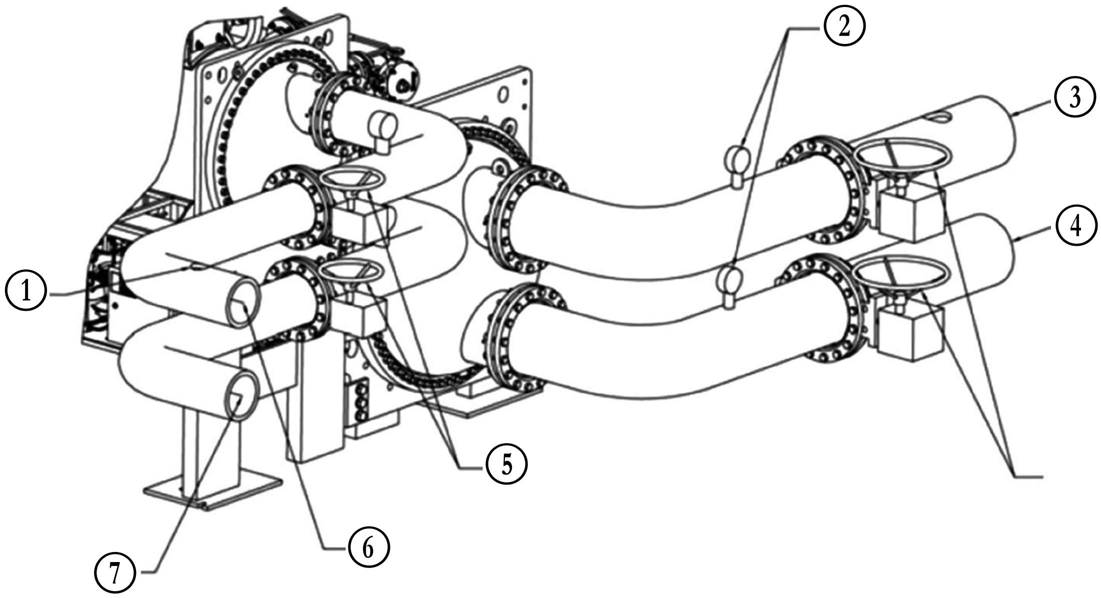
CAUTION: When flushing the water systems, isolate the chiller from the water circuits to prevent damage to the heat exchanger tubes.

1. Offset pipe flanges to permit removal of waterbox cover for maintenance and to provide clearance for pipe cleaning. No flanges are necessary with marine waterbox option; however, water piping should not cross in front of the waterbox or compressor because service access will be blocked.
2. Provide openings in water piping for required pressure gages and thermometers. For thorough mixing and temperature stabilization, wells in the leaving water pipe should extend inside pipe at least 2 in. (50 mm).
3. Install air vents at all high points in piping to remove air and prevent water hammer.
4. **Field-installed piping must be arranged and supported to avoid stress on the equipment and transmission of vibration from the equipment. Piping must be installed to prevent interference with routine access for the reading, adjusting, and servicing of the equipment. Provisions should be made for adjusting the piping in each plane for periodic and major servicing of the equipment.**

5 Water flow direction must be as specified in Fig. 23.

NOTE: Entering water is always the lower of the 2 nozzles. Leaving water is always the upper nozzle for evaporator or condenser for two and three pass arrangements.

Fig 23 - Typical nozzle piping (not supplied by Carrier)



1. Air vent
2. Pressure gages
3. Leaving chilled water
4. Entering chilled water
5. Isolation valves
6. Leaving condenser water
7. Entering condenser water

Note: It is also strongly recommended to install 1-inch diameter connection points with valves on each customer side water pipe. These connection points are used to connect an heating device (water heatpump) on closed loop to warm the water inside the cooler or condenser in case of refrigerant retrieving.

6. **Install waterbox vent and drain piping in accordance with individual job data. Consult certified drawings for connection size.**
7. **Install waterbox drain plugs in the unused waterbox and vent openings..**
8. **Isolation valves are recommended on the cooler and condenser piping to each chiller for service. The isolation valves should allow for piping between the valves and chiller to be removed without draining the system fluid.**
9. **Apply appropriate torque on the retaining bolts in a crisscross pattern for the water box covers before insulating the water box cover. The gasket can relax during transportation and storage and the water box cover requires retightening of the bolts during installation.**

3.5.2 - Install vent piping to relief devices

If the relief valves are installed on a change-over manifold, this is equipped with a relief valve on each of the two outlets. Only one of the two relief valves is in operation, the other one is isolated. Never leave the change-over valve in the intermediate position, i.e. with both ways open (Bring the actuator in abutment, front or back according to the outlet to isolate). If a relief valve is removed for checking or replacement please ensure that there is always an active relief valve on each of the change-over valves installed in the unit.

All factory-installed relief valves are lead-sealed to prevent any calibration change. The external safety valves are designed and installed to ensure damage limitation in case of a fire. In accordance with the regulations applied for the design, the European directive on equipment under pressure and in accordance with the national usage regulations:

- **These safety valves are not safety accessories but damage limitation accessories in case of a fire,**
- **The high pressure switches are the safety accessories.**

The relief valve must only be removed if the fire risk is fully controlled and after checking that this is allowed by local regulations and authorities. This is the responsibility of the operator.

The external safety valves must in principle be connected to discharge pipes for units installed in a room. Refer to the installation regulations, for example those of European standards EN 378 and EN 13136.

If a safety valve is replaced, do not leave the machine without safety valves. Only remove the safety valve, if the risk of fire is completely controlled and under the responsibility of the user. Only one safety valve at a time must be removed and replaced so that fire protection is maintained during this operation. Please refer to “Safety considerations”.

Vent relief devices to the outdoors in accordance with the applicable national standard (for example, NFE 35400 in France and EN 378 when applicable) for the safety of chilling devices as well as any other applicable codes.

DANGER: Refrigerant discharged into confined spaces can displace oxygen and cause asphyxiation.

If relief devices are manifolded, the cross-sectional area of the relief pipe must at least equal the sum of the areas required for individual relief pipes.

Provide a pipe plug near outlet side of each relief device for leak testing. Provide pipe fittings that allow vent piping to be disconnected periodically for inspection of valve mechanism.

Piping connected to relief devices must not apply stress to the device. Adequately support piping. A length of flexible tubing or piping near the device is essential on spring isolated machines.

Cover the outdoor vent with a rain cap and place a condensation drain at the low point in the vent piping to

prevent water build-up on the atmospheric side of the relief device.

Equip the piping with connections to allow disconnection of the piping for inspection.

See figure 2, item 20 and 21 for relief valves location.

3.5.3 - Purge discharge

Purge discharge shall be connected to the safety valve vent line assembly with 9.6 mm flare connection to the discharge line from purge unit.

See figure 10, item 10 for purge discharge location.

3.6 - Step 5 – Electrical connection

Field wiring must be installed in accordance with job wiring diagrams and all applicable electrical codes.

CAUTION:

Do not run any hazardous voltage wiring in the control panel sections associated with extra-low voltage wiring.

Damage to machine could occur as a result.

Do not run 50 volt or higher wiring into the PIC5+ Touch screen Panel and Control Panel. The panel should only be used for low voltage wiring (50V max).

Wiring diagrams in this publication are for reference only and are not intended for use during actual installation; follow job specific wiring diagrams.

CAUTION:

Do not attempt to start compressor or any motor (even for a rotation check) or apply test voltage of any kind to the VFD or motor while the chiller is under a dehydration vacuum. Motor insulation breakdown and serious damage may result.

NOTE: The dry contacts for the field inputs should be located as close to the unit as possible. The field wiring should be capable of preventing electrical noise or induced voltage and should not be routed with any wires with voltage over 50 v.

3.6.1 - CONNECT CONTROL INPUTS

Wiring may be specified for a spare safety switch, and a remote start/stop contact can be wired to the terminal strip. Additional spare sensors and control modules may be specified as well. Carrier Comfort Network® (CCN) communication is wired to the machine HMI panel.

Wiring may be specified for a remote start/stop contact, a remote emergency stop contact, an ice build con¬tact, a spare safety switch, a power request feedback switch, a cooler water flow switch and a condenser water flow switch can be wired to the control panel field terminal strip. Additional spare sensors may be specified for auto demand limit input, refrigerant leak sensor, common CHWS temperature sensor, auto wa¬ter temp reset and common CHWR temp sensor can be wired to the control panel field terminal strips as well. These are wired to the machine control panel. See electrical wiring diagrams.

3.6.2 - CONNECT CONTROL OUTPUTS

Wiring maybe specified for a chiller alarm relay, a free cooling mode relay and a power request relay can be wired to the control panel field terminal strip. Addition¬al analog output signals may be specified for chiller running status (on/off/ready) and head pressure output can be wired to the control panel field terminal strips as well. These are wired to the machine control panel. See electrical wiring diagrams.

Table 13 - PIC 5 - 19DV I/Os mapping list

IOB1	BLOCK	Terminal #	Point Description	Point name	Designation for wiring diagram	Comments
AI1	J16	1-5	Entering chilled water temperature	ECW	RT1	
AI2	J16	2-6	Leaving chilled water temperature	LCW	RT2	
AI3	J16	3-7	Entering condenser water temperature	ECDW	RT7	
AI4	J16	4-8	Leaving condenser water temperature	LCDW	RT8	
AI5	J15	6-12	Evap. refrigerant liquid temperature	EVAP_T	RT15	
AI6	J15	5-11	Comp Discharge temperature	DGT	RT21	
AI7	J15	4-10	Condenser pressure	COND_P	BP1	
AI8	J15	3-9	Evaporator pressure	EVAP_P	BP3	
AI9	J15	2-8				
AI10	J15	1-7	FS VFD Load current	VFDC_MA	-	For freestanding VFD option - customer terminals
AI11	J10	1-7				
AO1	J14	1-4	Chiller Status Output mA	CHST_OUT	Chiller status	used in std
AO2	J14	2-5				
AO3	J14	3-6				
DI1	J13	1-5	Evap Water Flow Switch	EVAP_FS	-	User option, dry contact "Closed" indicates "Flow" / not connected in std
DI2	J13	2-6	Cond Water Flow Switch	COND_FS	-	User option, dry contact "Closed" indicates "Flow" / not connected in std
DI3	J13	3-7	Remote contact input	REM_CON	Remote on/off	User option, dry contact "Closed" indicates Turn ON chiller
DI4	J13	4-8	Remote emergency stop input	E_STOP	Remote emergency stop	User option, dry contact "Closed" indicates Chiller Emergency stop
DO1	J12	6-7	Economizer bypass valve	ECBY_VLV	EBPV	Factory option
DO2	J12	9-10	Refrigerant Pump	REF_PUMP	KM1233	
DO3	J12	1-2	Chiller Alarm Relay	ALM	K112	
DO4	J12	4-5	Vapor Venting Line SV	VAPL_SV	-	not used / special

IOB2	BLOCK	Terminal #	Point Description	Point name	Designation for wiring diagram	Comments
AI1	J16	1-5	Motor winding temperature 1	MTRW1	RT31C	
AI2	J16	2-6				
AI3	J16	3-7	EC valve feedback Ma	HGBP_MA	Y11 13-14	factory option / 4 - 20 mA
AI4	J16	4-8				
AI5	J15	6-12	Pump Outlet Pressure	PUMPO_P	BP81	
AI6	J15	5-11	Bearing Outlet pressure	BRGO_P	BP71	
AI7	J15	4-10	Bearing inlet pressure	BRGI_P	BP70	
AI8	J15	3-9	Auto Demand limit input	AUTO_DEM	Auto demand limit	User option, 4-20 mA - customer terminals
AI9	J15	2-8	Refrigerant leak sensor	REF_LEAK		User option, 4-20 mA / not connected in std
AI10	J15	1-7	Pump inlet Pressure	PUMPI_P	BP80	
AI11	J10	1-7				
AO1	J14	1-4	Guide Vane1 output	GV1_OUT	M67 3-4	
AO2	J14	2-5				
AO3	J14	3-6	EC Valve Output mA	HGBP_OUT	Y11 15-16	factory option / 4 - 20 mA
DI1	J13	1-5				
DI2	J13	2-6	Liquid Level Switch	HF_LS	HF_LS	
DI3	J13	3-7	High Pressure Switch	HP_SW	K2	contact NO coming from Safety relay
DI4	J13	4-8	Ice build contact	ICE_CON		User option, dry contact / not connected in std
DO1	J12	6-7	Condenser Control Valve	COND_CV	CCV1	
DO2	J12	9-10	Evaporator Control Valve	EVAP_CV	ECV1	
DO3	J12	1-2	Condenser Filling Valve	COND_FCV	-	Option
DO4	J12	4-5	Economizer Isolation Valve	ECON_IV	-	Option

IOB3	BLOCK	Terminal #	Point Description	Point name	Designation for wiring diagram	Comments
AI1	J16	1-5	1st stage Bearing Temp	CBH1_T	RT39C	with spare
AI2	J16	2-6	2nd stage Bearing temp	CBH2_T	RT40C	with spare
AI3	J16	3-7	Bearing Ref Supply Temp	BRGI_T	RT41	
AI4	J16	4-8	Guide Vane 2 Actual Pos	GV2_POS	M69 5-6	
AI5	J15	6-12	Remote Reset Sensor	R_RESET	Remote reset sensor	User option, 5K thermistor / connected on terminals
AI6	J15	5-11	Guide Vane 1 Actual Pos	GV1_POS	M67 5-6	
AI7	J15	4-10	Common CHWS Temp	CHWS_T	Common CHWS Temp	Used for lead lag option / connected on terminals
AI8	J15	3-9	Auto Water Temp Reset	AUTO_RES	Auto Chiller Water Temp Reset	User option, 4-20 mA / connected on terminals
AI9	J15	2-8	Common CHWR Temp	CHWR_T	Chiller CHWR Temp	Used for lead lag option
AI10	J15	1-7				
AI11	J10	1-7				
AO1	J14	1-4	Head Pressure Output	HDPV_OUT	Condenser sea water valve	4 - 20 mA / connected on terminals
AO2	J14	2-5	Head Pressure Output 2	HDPV_OU2	-	4- 20 mA / Not used yet but can be used
AO3	J14	3-6	Guide Vane 2 Output	GV2_OUT	M69 3-4	
DI1	J13	1-5				
DI2	J13	2-6				
DI3	J13	3-7	Spare safety	SAFETY	Spare safety	User option, dry contact NO / connected on terminals
DI4	J13	4-8				
DO1	J12	6-7	Evaporator Drain Valve	EVAP_DCV	-	Not used with new design lubrication
DO2	J12	9-10	Condenser Drain Valve	COND_DCV	-	Not used with new design lubrication
DO3	J12	1-2	Chilled water pump	CHWP	-	User option / not connected
DO4	J12	4-5	Condenser water pump	CDWP	-	User option / not connected

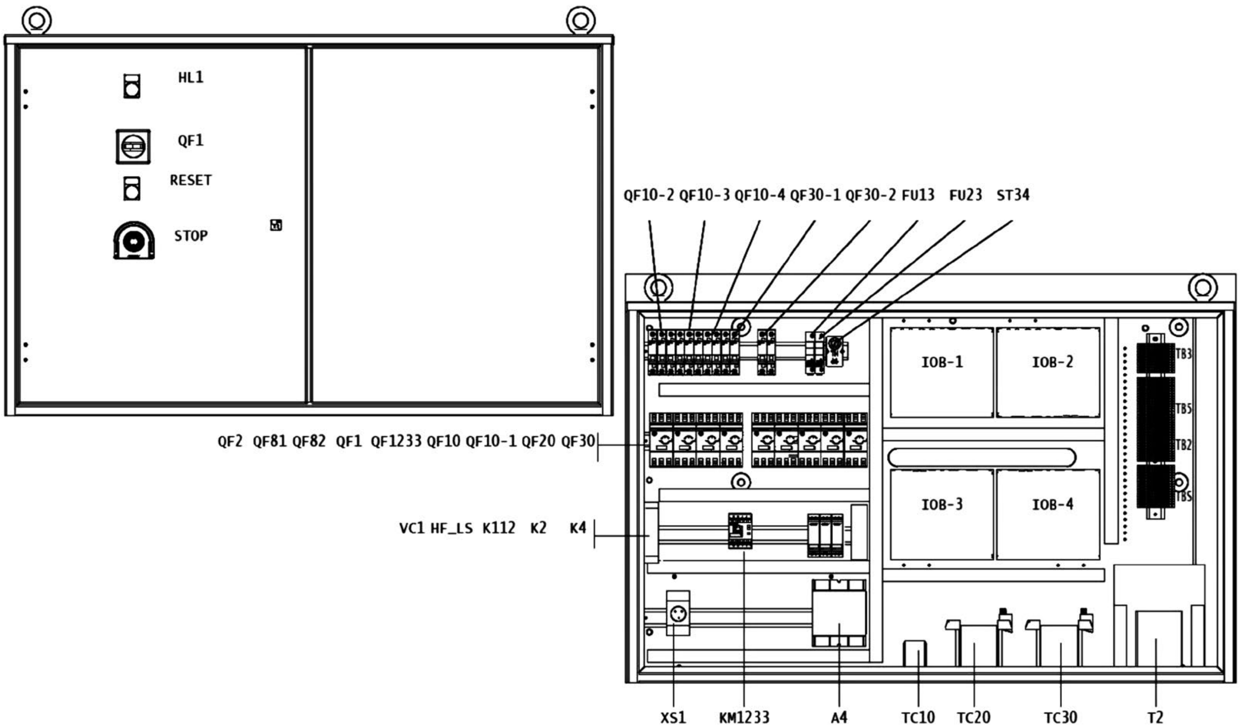
IOB4	BLOCK	Terminal #	Point Description	Point name	Designation for wiring diagram	Comments
AI1	J16	1-5				
AI2	J16	2-6				
AI3	J16	3-7	Entering Evap water pressure	EVAP_EWP	BP13	User option
AI4	J16	4-8	Leaving Evap water pressure	EVAP_LWP	BP12	User option
AI5	J15	6-12	Entering Cond water pressure	COND_ EWP	BP15	User option
AI6	J15	5-11	Leaving Cond water pressure	COND_LWP	BP14	User option
AI7	J15	4-10				
AI8	J15	3-9	Evap water flow measurement	EVAP_FL	-	User option, 4-20 mA / not connected in std
AI9	J15	2-8	Cond water flow measurement	COND_FL	-	User option, 4-20 mA / not connected in std
AI10	J15	1-7				
AI11	J10	1-7				
AO1	J14	1-4	Chilled Water Pump (Variable)	CHWP_V	Evaporator pump control	User option, 4-20 mA / 0-5 V / connected on terminals
AO2	J14	2-5	Condenser Water Pump (Variable)	CDWP_V	Condenser pump control	User option, 4-20 mA / 0-5 V / connected on terminals
AO3	J14	3-6	Tower Fan (Variable)	TOW_FAN	-	User option, 4-20 mA / 0-5 V / not connected in std
DI1	J13	1-5				
DI2	J13	2-6	Power Request Feedback	POW_FDB	Power Available	Marine option
DI3	J13	3-7	Customer Alert	CUS_ALE	ICCP 7-8	Marine option, dry contact, NO, connected on terminals to ICCP
DI4	J13	4-8	Freecooling Start Switch	FC_SS	SW2	Marine option, dry contact
DO1	J12	6-7	Free Cooling Mode	FC_MODE	K120	Factory option
DO2	J12	9-10	Power Request Output	POW_REQ	Power Request Output	Marine option
DO3	J12	1-2	Tower Fan High	TFR_HIGH	-	User option / not connected in std
DO4	J12	4-5	Tower Fan Low	TFR_LOW	-	User option / not connected in std

Table 14 - PIC 5 - 19DV I/Os terminal identification

Point description	Type	Terminal identification - TB5
Power supply 24AC for Digital Output	power supply	1-2
Chiller Alarm relay	Digital output	3-4
Chiller water pump	Digital output	9
Condenser water pump	Digital output	10
Tower fan high	Digital output	11
Tower fan low	Digital output	12
Feeback run	Digital output	13-14
Evaporator flow switch	Digital input	15-16
Condenser flow switch	Digital input	17-18
Remote contact input	Digital input	19-20
Emergency stop	Digital input	21-22
Ice build contact	Digital input	23-24
Spare safety	Digital input	25-26
Auto demand limit input	Analog input	35-36
Common CHWR Temp	Analog input	37-38
Autowater temp reset	Analog input	39-40
Common CHWS Temp	Analog input	41-42
Remote reset sensor	Analog input	43-44
Chiller status *	Analog output	45-46
Head pressure output	Analog output	47-48
Tower fan command signal	Analog output	53-54

* chiller status in standard, %capacity load in option.

Fig 24 - 19DV control box



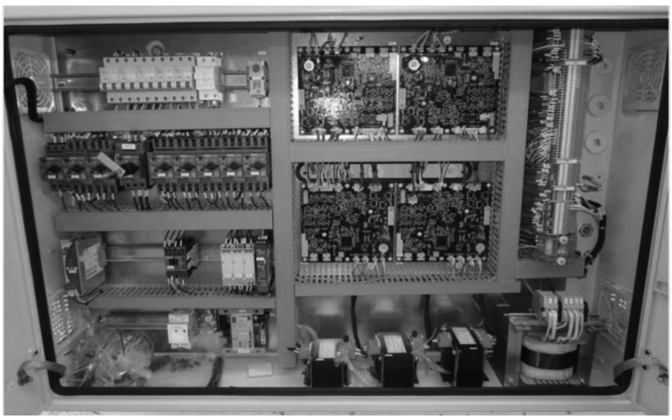
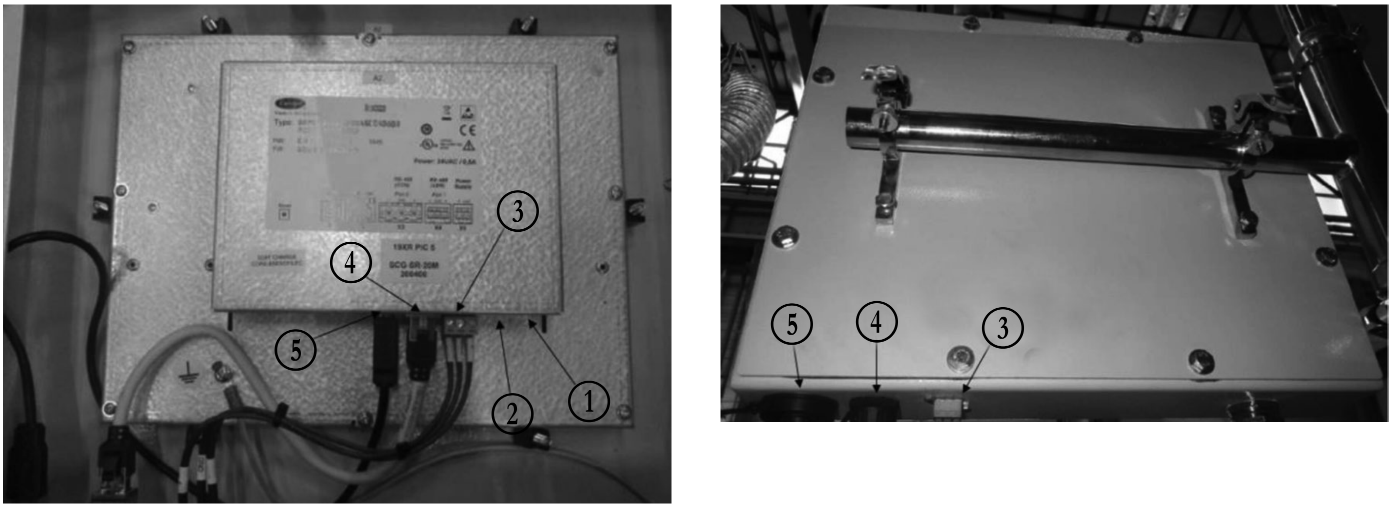


Fig 25 - 19DV HMI box rear view



1. Power supply 24V AC
2. LEN
3. CCN
4. Ethernet
5. USB

Fig 26 - 19DV - IOB1 wiring

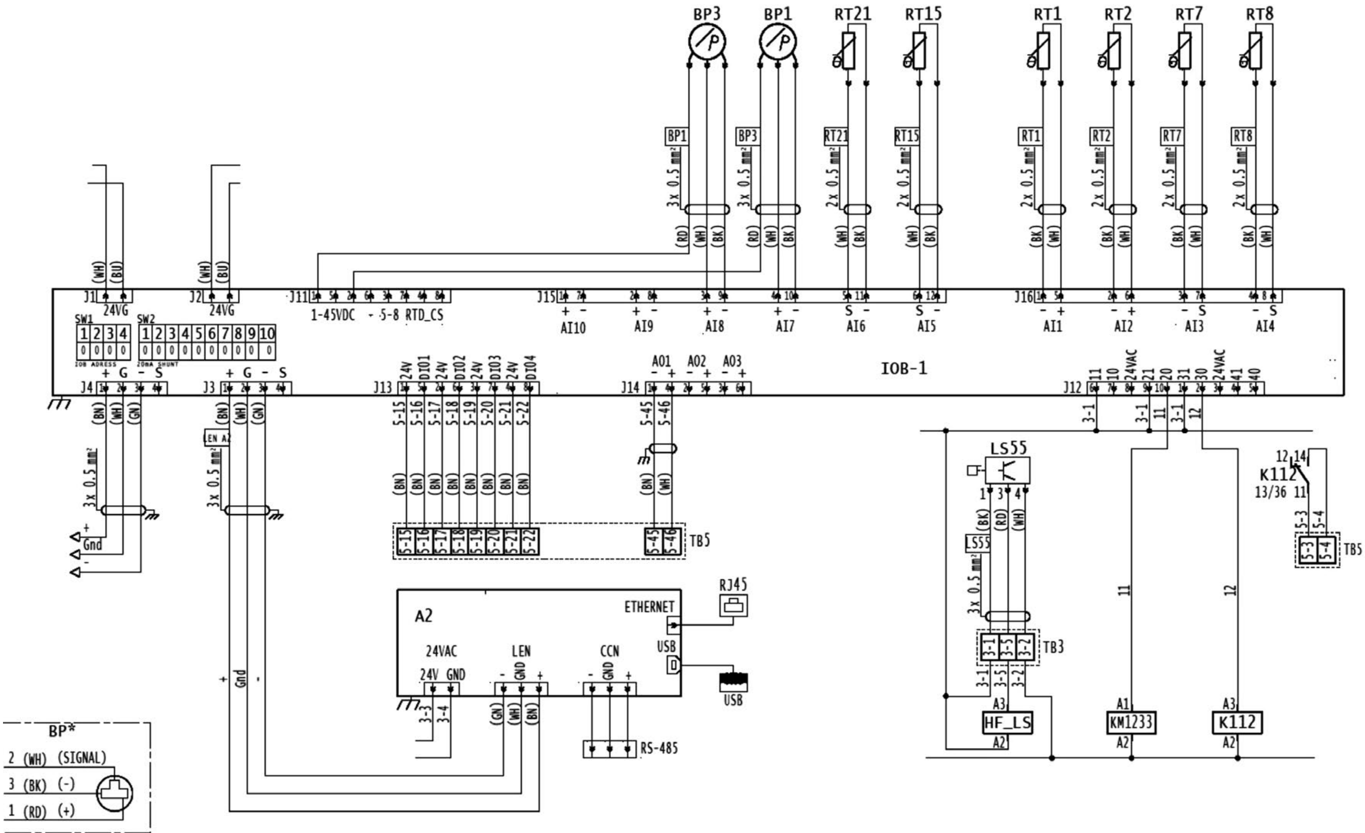


Fig 27 - 19DV - IOB2 wiring

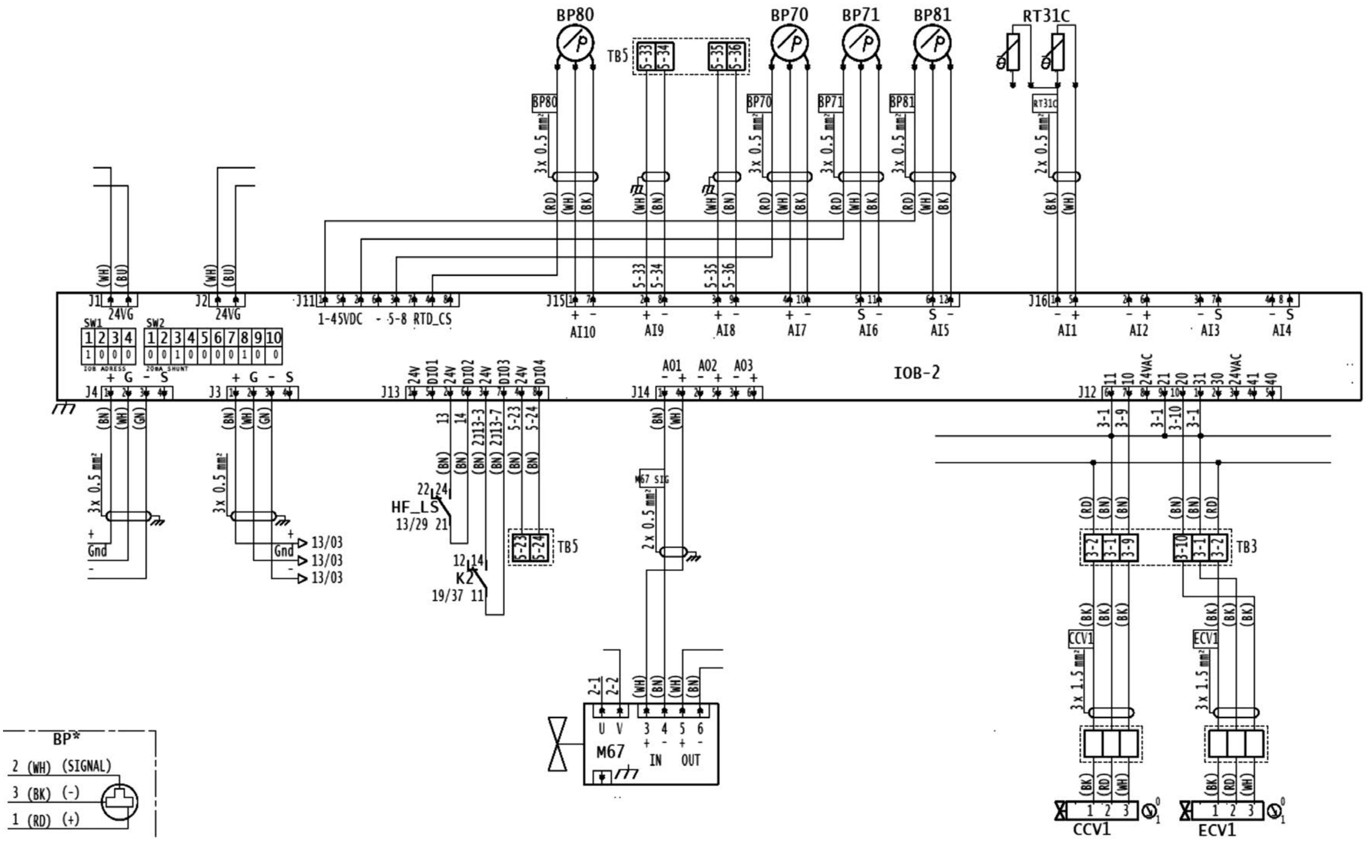


Fig 28 - 19DV - IOB3 wiring

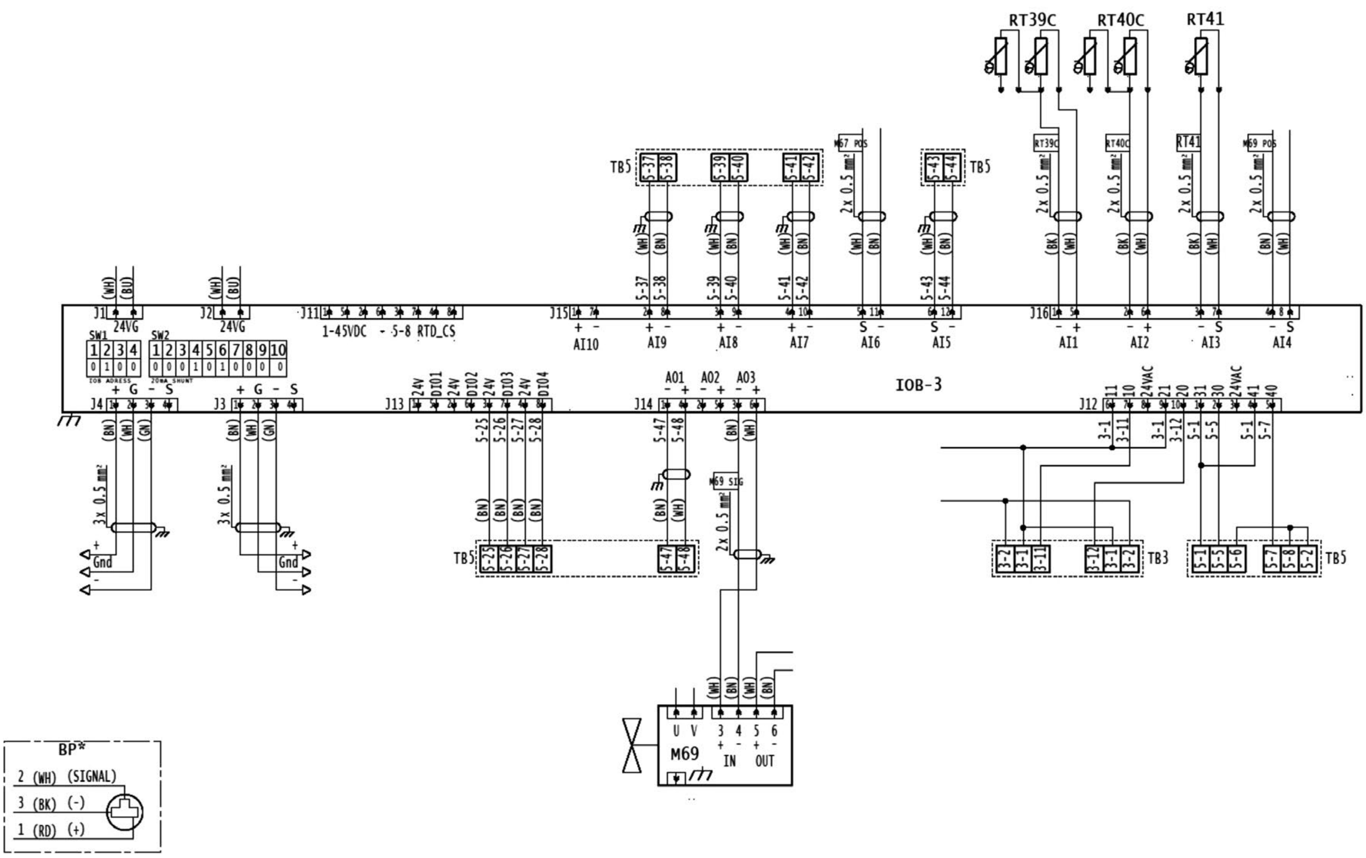
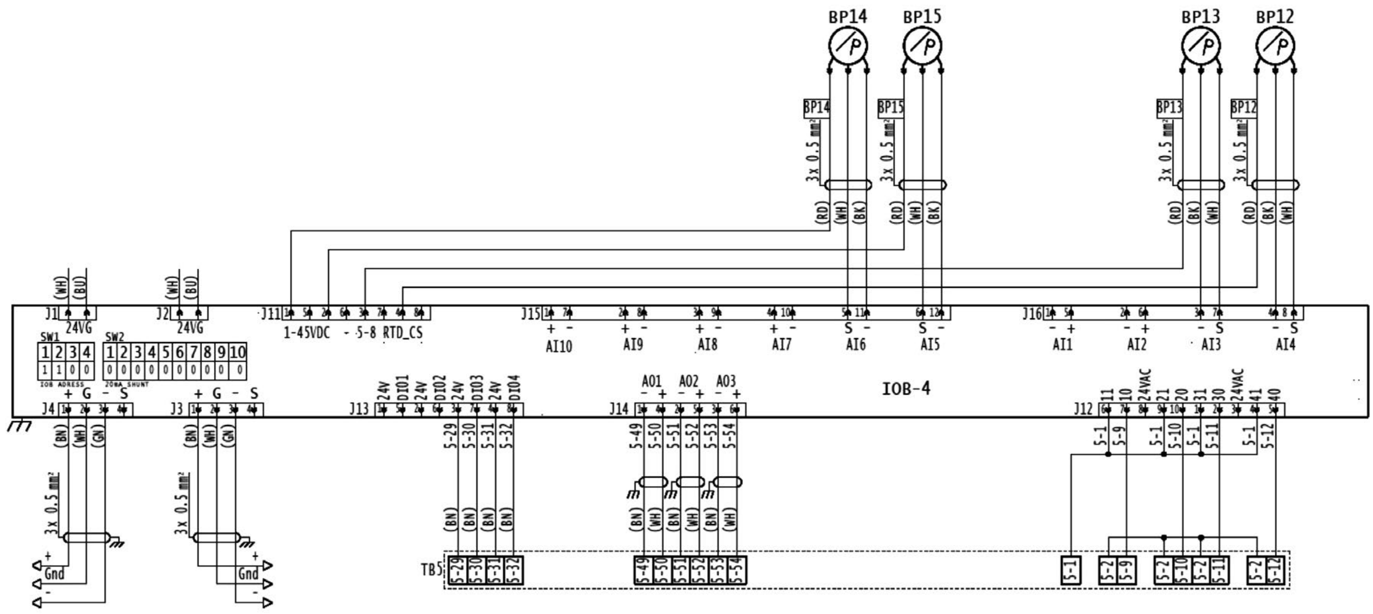


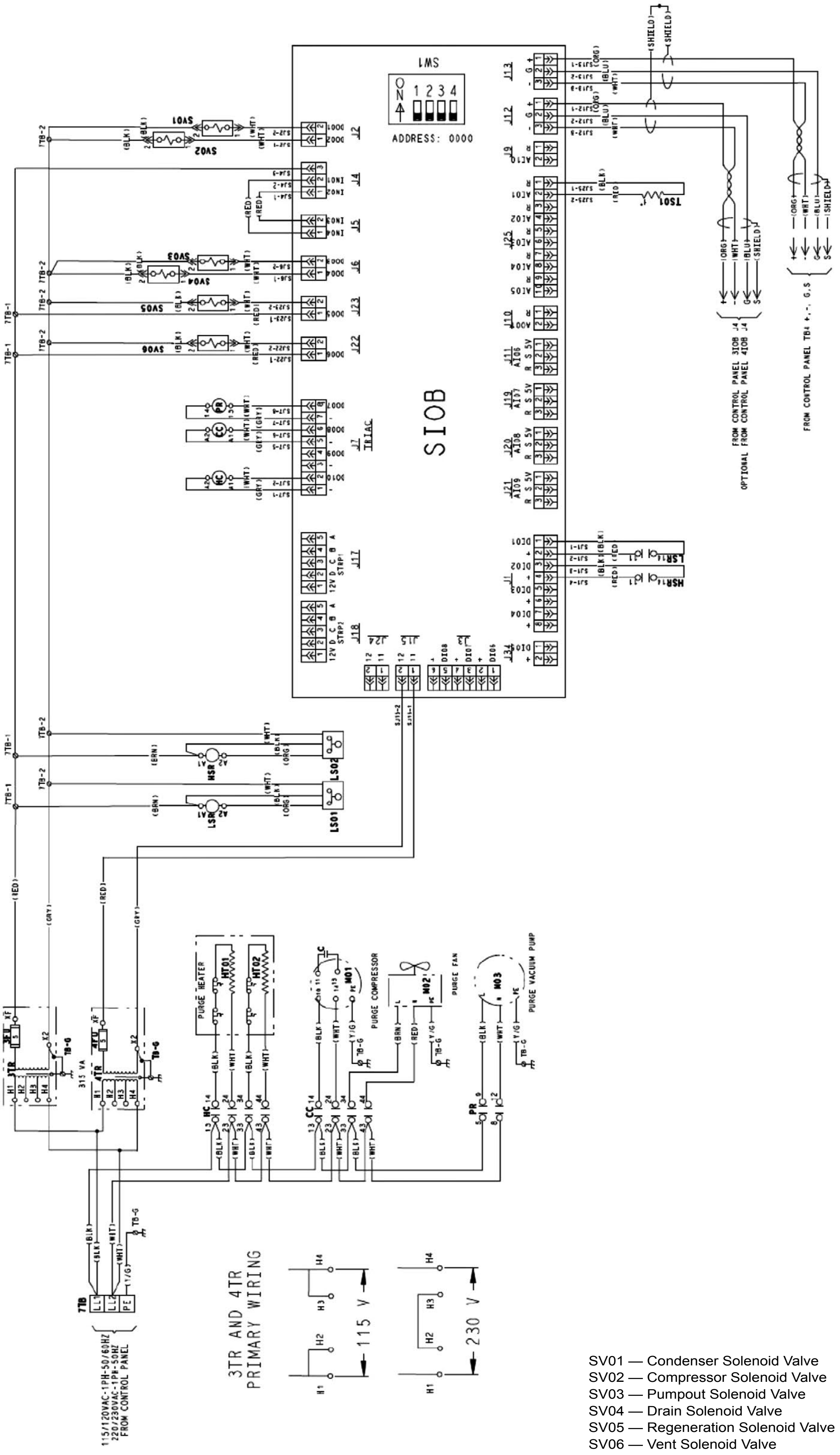
Fig 29 - 19DV - IOB4 wiring



NOTE:

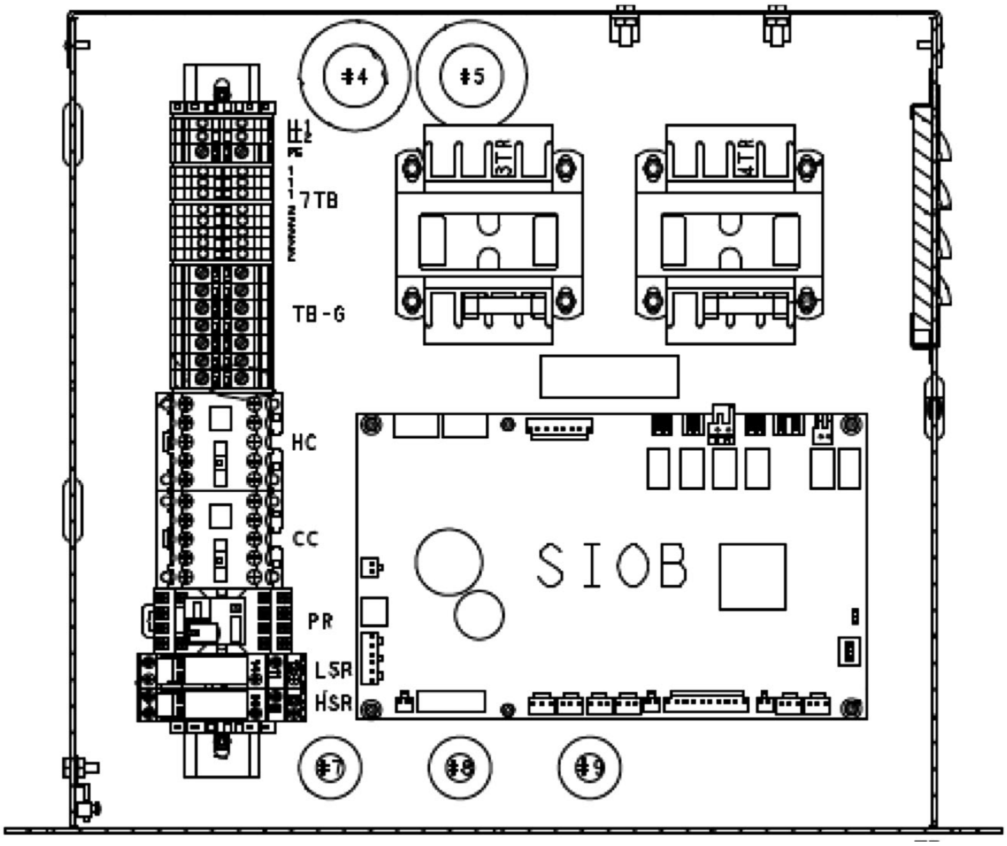
1. Field-supplied control connectors to be at least 0.75mm2 or larger. Supplied voltage of the wires in control panel should be low (limited to 50V).
2. Each digital output loop shall be limited to a maximum of 1A AC RMS steady –stat @24Vac, high load relay is recommended and the coil voltage of relay 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@20VAC. Others, power supply shall be provided by cus¬tomer fused transformer.
3. The discrete input loop is powered by internal 24VAC power supply. Field optional contactor or switch must can withstand rated 24VAC voltage, maximal 60mA and rated 20 mA current.
4. The analog input support 5kΩ/10kΩ NTC thermistor, 0/4-20mA sensor and 5VDC sensor.
5. Each analog output loop support 0/4-2OMA 0/2-10 VDC voltage output. The analog output loop is powered by board. Do not supply external power.
6. For standard discrete input (on 1/2/3/4 IOB), only when the contactor switch is closed, an alarm will be generated.
7. SW2 configured by field, if 4-20 mA signal sensor, shall turn the switch to “ON” position.
8. For 4thIOBdiscrete input, only when the contactor or switch is open, an alarm will be generated.
9. All the plug in the IOB use wire of 0.75mm².

Fig 30 - Purge system wiring



SV01 — Condenser Solenoid Valve
SV02 — Compressor Solenoid Valve
SV03 — Pumpout Solenoid Valve
SV04 — Drain Solenoid Valve
SV05 — Regeneration Solenoid Valve
SV06 — Vent Solenoid Valve
TS01 — Purge Compressor Inlet Temperature

Fig 31 - Purge system control box



3TR	—	Transformer
4TR	—	Transformer
7TB 1,2	—	24VAC Low Voltage Wiring Terminal Block
7TB LL1, LL2	—	Main One Phase Power
7TB PE	—	Ground
CC	—	Purge Compressor/Fan Contactor
HC	—	Purge Heater Contactor
HSR	—	High Level Switch Relay
LSR	—	Low Level Switch Relay
PR	—	Purge Vacuum Pump Relay
SIOB	—	Purge Input/Output Board

3.6.3 - High pressure safety accessory: SRMCR – Chiller equipped with VFD LF2

3.6.3.1 - General description :

The unit is equipped with a safety loop, also called measurement, control and regulation devices playing a role in safety (SRMCR for protection against overpressure that could be created by the compressor).

Made of :
- 2 active pressure switches (HPS) at compressor discharge
- Safety relay K4 inside the control cabinet
- Power contactor K101 inside the LF2 VFD
- LF2 VFD

See chiller wiring diagram and bill of material (part numbers).

This SRMCR is designed in accordance with EN ISO 13849-1: 2016 according to the following characteristics:
- PL d
- Category 3.
- Mission duration 20 years.

A periodic annual check is required. See annex maintenance test section.

The K4 safety relay monitors the status of the HPS switches as well as the compressor power contactor.

His security contacts are closed under the following conditions :
- No overpressure, closed HPS contacts and no short circuit
- No failure of the power contactor

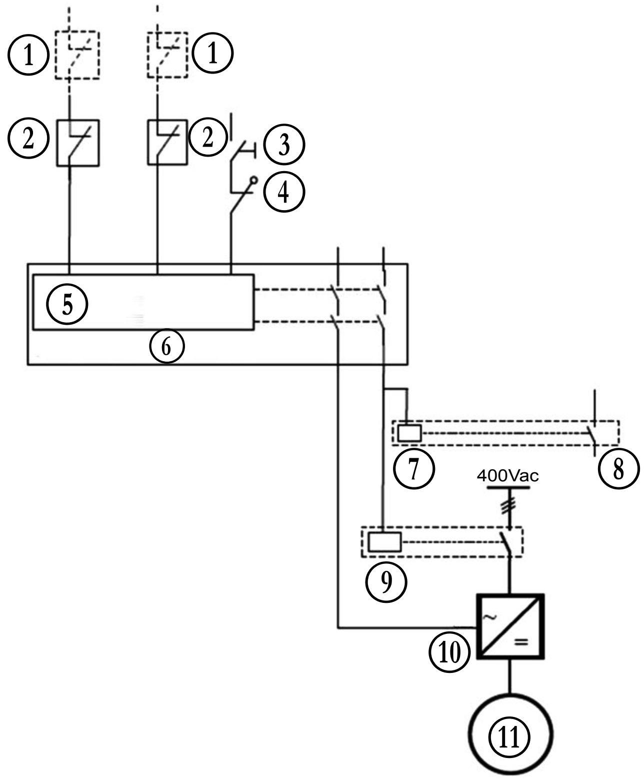
Activation of one of the two HPS causes the opening of the safety contacts of the K4 relay which causes the opening of the power contactor and the activation of the gate kill input of the VFD.

The functionality and setting of this safety loop must be checked at least annually, in accordance with the applicable national regulations. **See annex XX for the test procedure.**

3.6.3.2 - Operation, commissioning and reset

The diagram below is for illustration: refer to the wiring diagram supplied with the machine for detailed information.

Figure 32 - SRMCR description



1. HPS spare : Non active pressure switch
2. HPS : active pressure switch
3. Reset : button reset
4. K101 : main power contactor
5. Logic
6. Safety relay K4
7. K2 control relay
8. To control (status feedback)
9. K101
10. Gate kill
11. Compressor

The K4 safety relay monitors the status of the two active pressure switch (HPS) sensors, the absence of a short-circuit between the sensors, and the position of the K101 contactor power contacts.

After switching on, the closing of its safety contacts is carried out by pressing the Reset button if the following conditions are met:

The contacts of the pressure switches are closed (no overpressure)

Contactor K101 is open: its auxiliary NC contact is closed.

The safety contacts open when an HPS sensor is opened.

This causes the opening of the contactor K101 by removing the voltage that supplies its coil. The drive power is off (K101) and the Gate Kill input of the drive is open; each of his actions being sufficient to stop the compressor.

Relay K2 provides feedback to machine control with no effect on the safety function.

The architecture is two-channel:

A first functional channel consisting of the pressure switches sensors, the safety relay and the contactor K101.

A second functional channel consisting of the pressure switch sensors, the safety relay and the LF2 drive, with its Gate-Kill function.

The reset of the HPS sensors is automatic when the pressure has dropped to an acceptable level. However, the safety relay is configured for a controlled manual reset: closing its safety contacts always requires an action on the reset button (see below).

3.6.3.3 - Restart after triggering a High pressure switch

If a single pressure switch (HPS) is opened, the safety relay detects an inconsistency between the two sensors and is de-energized to allow a change of state.

In this case, the restart procedure is as follows:
- Switch off the safety relay.
- Wait 5 seconds
- Switch on the safety relay again
- Wait 5 seconds
- Press the reset button

The duration of pressing the reset button is controlled: it must be between 250ms and 3s.

3.6.3.4 - Feedback state of pre-actionning relay contacts

The state of the power contactor is linked to the relay SI 440R by a mirror contact circuit. Relay safety contacts can only go into the closed position when the state is closed.

This good feedback is checked at each relay initialization and at each activation of the safety loop, annually during the functional test of the loop.

The proper operation of the Gate Kill function is self-controlled by the drive.

3.6.3.5 - Detection of crossed short circuits

The safety relay also has the function of detecting any short-circuit that may occur between the inputs of the safety pressure switches (HPS).

3.6.3.6 - Safety relay LED state

The state of the relay can be visually verified with the status LEDs present on the component:

LED status	Status	Description
PWR/Fault	Continuous green	Normal operating
	Blinking red	Non-resettable fault. Need Cycling of supply voltage Example: only one pressure switch open.
	Green + red blinking	Resettable fault.
	Continuous red	Internal fault ; Need Cycling of supply voltage
IN	ON	HPS closed
	OFF	HPS opened

3.6.4 - VFD wiring :

Incoming power is connected to the line side of the cir¬cuit breaker inside the VFD.

Connect Wiring to VFD — Connect control wiring to the VFD. All control wiring must use shielded cable. Also, connect the communications cable. Refer to the job wiring diagrams for cable type and cable number. Make sure the control circuit is grounded in accord¬ance with applicable electrical codes and instructions on machine control wiring label.

For Rockwell VFD, UPS can not be conn¬ected directly without VFD modification.

NOTE:

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 main circuit breaker before drilling. Do not drill into any other VFD cabi¬net 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. Circuit breaker lugs will accommodate the quantity (#) and size cables (per phase) as fol¬lows.

If larger lugs are required, they can be purchased from the manufacturer of the circuit breaker (Cutler-Hammer or Square D).

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

VFD type	Maximum connectable wire sections		
	VFD max input amps	Conductors qty	Sections (mm^2)
Rockwell 2CC	608	3	95 to 240
Rockwell 4CC	900	4	50 to 300

IMPORTANT: Before connection of the main power cables (L1 - L2 - L3) on the terminal block, it is imperative to check the correct order of the 3 phases before proceeding to the connection on then terminal block or the main disconnect/ isolator switch.

3.6.5 - Carrier Comfort Network Interface (CCN)

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 communi¬cation bus in a daisy chain arrangement. The positive pin of each system element communication connec¬tor 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 Fig. 33** for location of the CCN network connections on the terminal strip labelled CCN.

Conductors and drain wire must be 0.5mm2 minimum stranded, tinned copper. Individual conductors must be insulated with PVC, PVC/nylon, vinyl, Teflon, or polyethylene. An alumi¬num/polyester 100% foil shield and an outer jacket of PVC, PVC/nylon, chrome vinyl, or Teflon with a minimum operating temperature range of -20 °C to 60 °C is required. See table below for cables that meet the requirements.

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

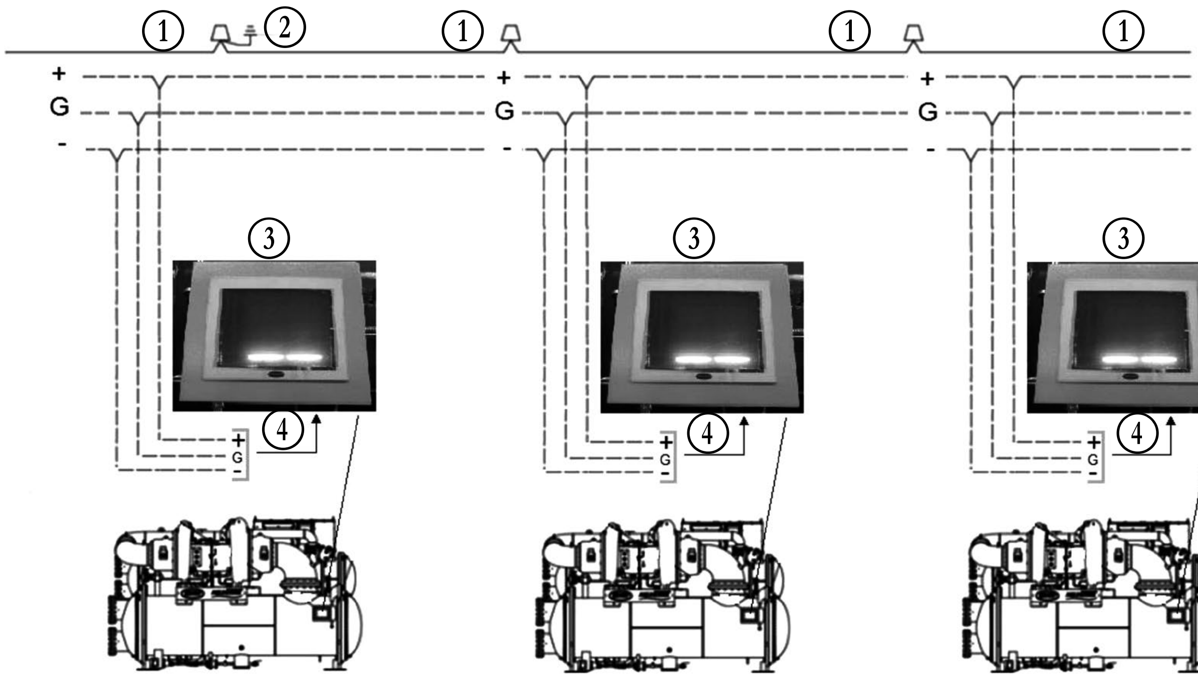
Signal type	CCN Bus Conductor Insulation Color	CCN Network Interface (PIC5+ Touch Screen Panel)
+	Red	+
Ground	White	G
-	Black	-

If a cable with a different color scheme is selected, a similar color code should be adopted for the entire network. at each system element, the shields of its communication bus cables must be tied together. If the communication bus is entirely within one building, the resulting continuous shield must be connected to ground at only one single point. **See Fig. 33**. If the communication bus cable exits from one building and enters another, the shields must be connected to ground at the lightening suppressor in each building where the cable enters or exits the building (one point only).

To connect the 19DV chiller to the network, proceed as follows (**see Fig. 33**):

1. Route wire through knockout in back of control panel.
2. Strip back leads.
3. Crimp one no. 8 size spring spade terminal on each conductor.
4. Attach red to “+” terminal and white to “G” terminal and black to “–” terminal of CCN Network interface located in the PIC5+ touch screen panel.

Fig 33 - CCN network wiring

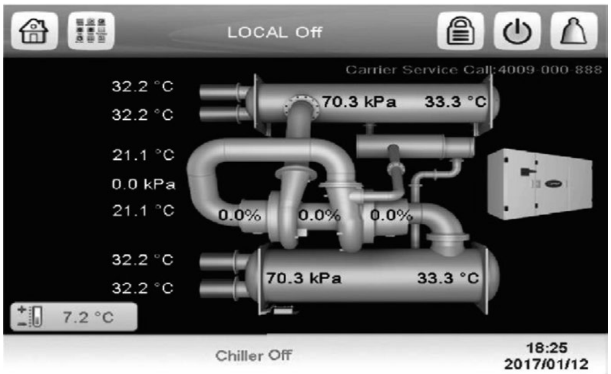


1: drain wire
2 : ground drain wire
3 : PIC5+ touch screen panel
4 : CCN wiring
______ : factory wiring
- - - - - - : field wiring

4.1 - Local Start/Stop Control

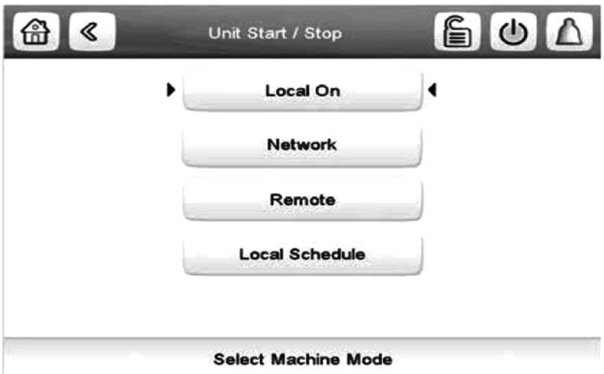
Local start-up (or manual start-up) is initiated by pressing the gray Start/Stop icon on the HMI interface. See fig 34

Fig 34 - 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. 35.**

Fig 35 - Operating mode / 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.

When start-up is initiated, the status screen displays the startup 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 XX 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 34.5 kPa, the refrigerant pump relay energizes.

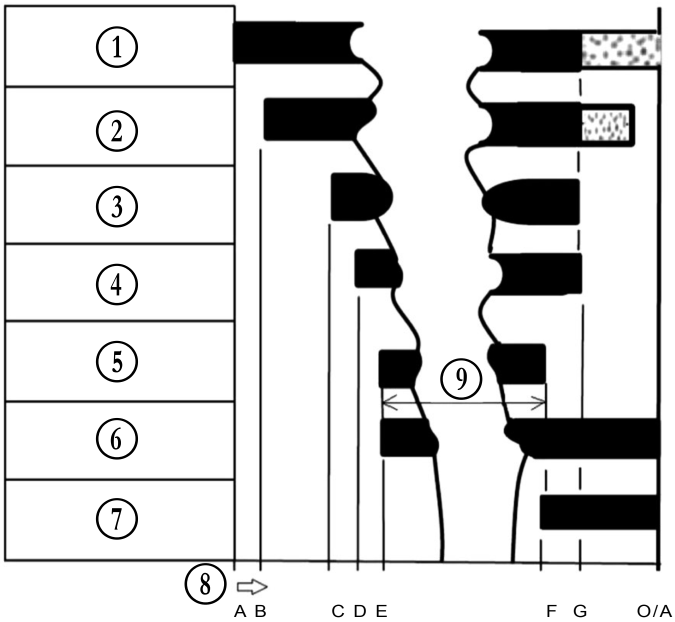
The PIC5+ control system then waits until the refrigerant pressure (REF PRESS VERIFY TIME, operator-configured, default of 40 seconds) reaches a maximum of 82.7 kPa. After refrigerant pressure is verified, if high side float chamber has adequate liquid level, refrigerant pump will be kept ON for 20 seconds 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 on-time and service on-time 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 compressor 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. 36** for normal start-up timing sequence. See **Table 15** for a list of prestart checks.

Fig 36 – Control Timing Sequence for Normal Start-Up



1. Machine safeties evaporator pump
2. Condenser water pump
3. Waterflow chilled water temp, guide vanes, refrigerant pump, and tower fan control
4. Refrigerant pump
5. Compressor, compressor on time, service on time
6. 15-minute start-to-start
7. 2 minute stop-to-start
8. Elapsed time
9. Compressor running

A. START INITIATED: Pre-start 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 af-ter 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 ontime and service ontime start, 15-minute inhibit timer starts (20seconds after D), total compressor starts advances by one, and the num-ber of starts over a 12-hour period advances by one.
F. SHUTDOWN INITIATED — Compressor motor stops; compressor ontimeand service ontime stop, and 2-minute inhibit timer starts.
G. Ref pump and cooler pumps de-energized (120 seconds after F).Condenser pump and tower fan control may contin-ue 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 minute after F).

* Autorestart after power failure timing sequence will be faster.

Table 15 - Prestart check / alert – alarm conditions

Prestart check / alert - alarm condition *	State Number	Alarm or Alert
STARTS IN 12 HOURS >= 8 (not counting recycle restarts or auto restarts after power failure)	100	Alert
CONDENSER PRESSURE >= COND PRESS OVERRIDE /186.2kPa	102	Alert
Number of recycle restart in the last 4 hours is greater than 5	103	Alert
COMP BEARING TEMP >= COMP BEARING ALERT/ 5.6°C	230	Alarm
COMP MOTOR WINDING TEMP >= MOTOR TEMP OVERRIDE / 5.6°C	231	Alarm
COMP DISCHARGE TEMP >= COMP DISCHARGE ALERT/ 5.6°C	232	Alarm
EVAP_SAT < Evap. trip point** + EVAP OVERRIDE DELTA T OR EVAP REFRIG LIQUID TEMP < Evap. trip point + EVAP OVERRIDE DELTA T NOTE: Evap. trip point = 0.56°C(water) or EVAP REFRIG TRIPPOINT(brine)	233	Alarm
ACTUAL LINE VOLTAGE <= UNDERVOLTAGE THRESHOLD (Not applicable for Rockwell UM VFDs)	234	Alarm
ACTUAL LINE VOLTAGE >= OVERVOLTAGE THRESHOLD (Not applicable for Rockwell UM VFDs)	235	Alarm
Guide vane 1 has not been calibrated successfully	236	Alarm
Guide vane 2 has not been calibrated successfully	238	Alarm

* If prestart Check condition is true, then resulting state is as indicated in the state number column.

The compressor RUN STATUS parameter on the default screen line now reads PRESTART. If one test is not successful, the start-up is delayed or aborted. If all the tests are successful, the chilled water pump relay energizes, and the main screen line now reads STARTUP.

4.2 - 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 See Fig. 37 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.

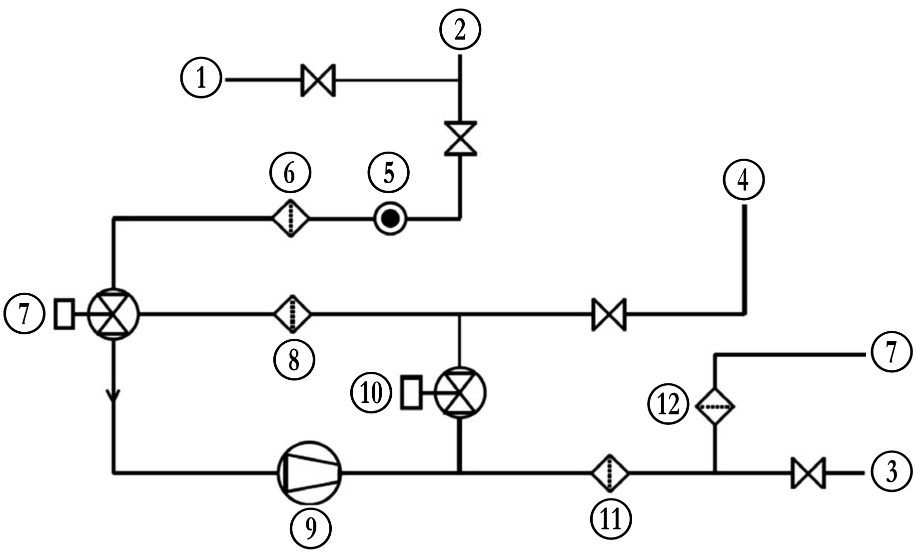
When Refrigerant Pump request is on for pre-lube and the bearing pressure difference is OK for start, if cooler temperature minus leaving condenser water temperature is less than 5.6°C, pump refrigerant from Cooler to Condenser until compressor is ON. Else, if cooler temperature plus leaving condenser water is equal or larger than 5.6°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 55.2 kPa for 8 seconds continuously, the chiller will shut down. To proceed to start-up, the bearing pressure difference needs to exceed 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 68.9 kPa for 10 seconds continuously, the chiller will shut down.

Fig 37 - Lube control assembly schematic



1. Purge drain,
2. Cooler,
3. Pumpout drain,
4. High side float chamber,
5. Sight glass,
6. Strainer,
7. 3-way actuated valve,
8. Strainer,
9. pump,
10. 2-way actuated valve,
11. Refrigerant filter,
12. Bearing filter,
13. Pumpout drain.

4.3 - 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. 38**).

Fig. 38 - 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.

5.1 - Necessary checks

5.1.1 - Job data required

Checks before system start-up: Before the start-up of the refrigeration system, the complete installation, including the refrigeration system must be verified against the installation drawings, dimensional drawings, system piping and instrumentation diagrams and the wiring diagrams.

During the installation test national regulations must be followed. If no national regulation exists, paragraph 9-5 of standard EN 378-2 can be used as a guide.

External visual installation checks:

- Compare the complete installation with the refrigeration system and power circuit diagrams.
- Check that all components comply with the design specifications.
- Check that all safety documents and equipments required by the applicable European standard are present.
- Verify that all safety and environmental protection devices and arrangements are in place and comply with the applicable European standard.
- Verify that all documents for pressure containers, certificates, name plates, files, instruction manuals required by the applicable European standard are present.
- Verify the free passage of access and safety routes.
- Check that ventilation in the plant room is adequate.
- Check that refrigerant detectors are present.
- Verify that the instructions and directives to prevent the deliberate removal of refrigerant gases that are harmful to the environment are being applied.
- Verify the installation of connections.
- Verify the supports and fixing elements (materials, routing and connection).
- Verify the quality of welds and other joints.
- Check the mechanical integrity of the machine.
- Check the protection against heat.
- Check the protection of moving parts.
- Verify the accessibility for maintenance or repair and to check the piping.
- Verify the status of the valves.
- Verify the quality of the thermal insulation and of the vapour barriers.

5.1.2 - Equipment required

- mechanic's tools (refrigeration)
- digital volt-ohmmeter (DVM)
- true RMS (root mean square) digital multimeter with clamp-on current probe or true RMS digital clamp-on ammeter rated for at least 480 vac
- electronic leak detector absolute pressure manometer or electronic micron gage (**see Fig. 39**)
- drum charging valve (unless refrigerant bottles already have charging valves)
- charging hose
- Refrigerant charge device

Fig 39 - Digital Vacuum gage

5.1.3 - Remove shipping packaging

After receipt remove any packaging material from the unit, VFD, and control panels.

5.1.4 - Lubrication and purge circuit valves

Check if the motorized valves on lubrication circuit are open and all solenoid valves and service valves are open on purging circuit.

5.1.5 - 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 16** for bolt torque requirements.

Table 16 - Bolt torque requirements N.m (gasket or O-ring joint)

BOLT SIZE	CLASS 8.8, SAE 5, SA499(N•m)			CLASS10.9, SAE 8, SA354 GR BD(N•m)		
	SOCKET HEAD OR HEX WITH 3 RADIAL LINES MEDIUM CARBON STEEL			HEX HEAD WITH 6 RADIAL LINES MEDIUM CARBON STEEL		
mm	Minimum	Maximum	Set	Minimum	Maximum	Set
6	8,1	12,2	10±1	12,2	17,6	14±1
8	17,6	24,4	20±1	27,1	38	34±1
10	29,8	42	34±1	43,4	62,3	47±1
7/16’’	47,4	67,8	61±7	71,8	101,6	81±7
12	71,8	101,6	81±7	108,4	155,8	122±7
14	101,6	149,1	122±14	155,8	223,6	176±14
16	142,3	203,3	163±14	216,8	304,9	244±14
18, 20	237,1	388,8	285±34	352,3	501,4	393±34
22	359,1	514,9	407±34	562,3	799,5	610±34
24	555,6	785,9	597±34	846,9	1210	894±34
27	738,5	1056,9	786±34	1334,7	1910,6	1382±34
30	1043,4	1490,5	1084±34	1870	2655,8	1911±34
33, 36	1382,1	1978,3	1423±34	2493,2	3563,7	2534±34
39	1653,1	2371,3	1721±68	2981	4268,3	3049±68
42	2262,9	3238,5	2331±68	4092,1	5840,1	4160±68
45	2953,9	4214,1	3022±68	5325,2	7601,6	5393±68
48	3970,2	5677,5	4038±68	7154,4	10230,3	7222±68
52	4268,3	6165,3	4336±68	7682,9	10975,5	7751±68
56, 60	6165,3	8807,5	6233±68	11111	15867,1	11179±68
64	6775	96747	6843±68	15379,3	21964,6	15447±68
68	11463,3	16382	11531±68	221287,1	30406,2	21355±68
72, 76	14959,2	21368,4	15027±68	26964,5	38536,2	27032±68

5.1.6 - Check Chiller Tightness

Chillers can be shipped either with full refrigerant charge or with 1 bar dry nitrogen-holding charge.

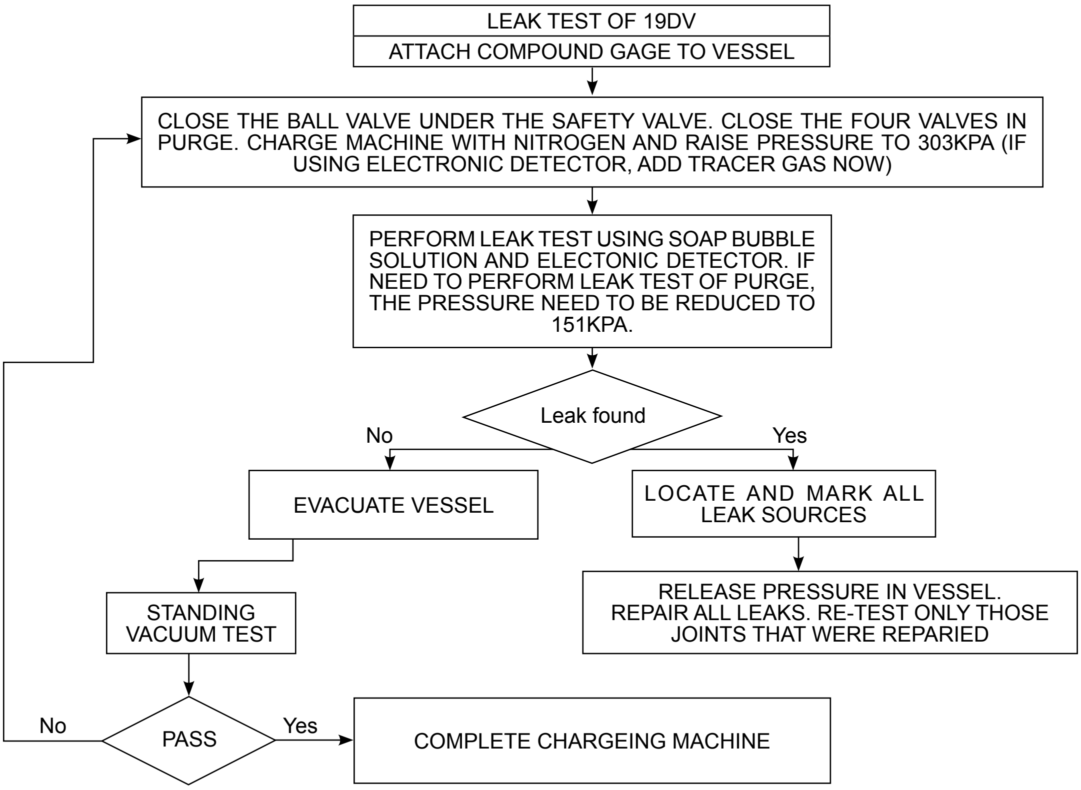
5.1.6.1 - Chiller shipped with 1 bar nitrogen-holding charge / without refrigerant:

Follow chart **figure 40** – 19DV leak test procedure

To check leaks in chiller, in addition to the nitrogen gas, the chiller should be charged with helium tracer gas. Use an electronic leak detector to check all flang¬es and solder joints after the chiller is pressurized. If any leak is detected, follow the leak test procedure.

If the chiller is spring isolated, keep all springs blocked in both directions to prevent possible pipe stress and damage during the transfer of refrigerant from vessel to vessel during the leak test process, or any other time refrigerant is transferred. Before initial start, en¬sure that springs are adjusted, chiller is charged with refrigerant, and water circuits are full with water

Fig 40 - 19DV leak test procedure



5.1.6.2 - 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.

5.1.6.3 - 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 XX 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 R-1233zd(E) saturation pressure corresponding to local temperature. 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 a. 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 138 kPa; maximum allowable test pressure 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. 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 38°C which corresponds to a pressure of 99.3 kPag.

Table 17 - R1233zd(E) Pressure / Temperature

Temperature / °C	Pressure / kPag	Pressure / kPa abs	% vaccum
-12,2	-74,1	27,3	75
-9,4	-70,1	31,3	70
-6,7	-65,8	35,6	65
-3,9	-60,9	40,5	60
-1,1	-55,5	45,9	55
1,7	-49,6	51,8	49
4,4	-43	58,4	42
7,2	-35,8	65,6	36
10	-28	73,4	28
12,8	-19,3	82,1	19
15,6	-10	91,4	10
18,3	0,3	101,7	-
21,1	11,4	112,8	-
23,9	23,4	124,8	-
26,7	36,4	137,8	-
29,4	50,5	151,9	-
32,2	65,6	167	-
35	81,9	183,3	-
37,8	99,3	200,7	-
40,6	118,1	219,5	-
43,3	138,1	239,5	-
46,1	159,6	261	-
48,9	182,4	283,8	-
51,7	206,8	308,2	-
54,4	232,7	334,1	-
57,2	260,3	361,7	-
60	289,6	391	-

5.1.7 - 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 ac¬ceptable 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 0.06 kPa [abs], us¬ing a vacuum pump.
3. Shut off pump valve to hold the vacuum and re¬cord the manometer or wet bulb indicator reading.
4. If the pressure rise is less than 56 Pa within 8 hours, the chiller is sufficiently tight.

If the pressure rise exceeds above criteria, re-pres¬surize the vessel and conduct leak test and repair the leak point.

5.1.8 - Chiller dehydration

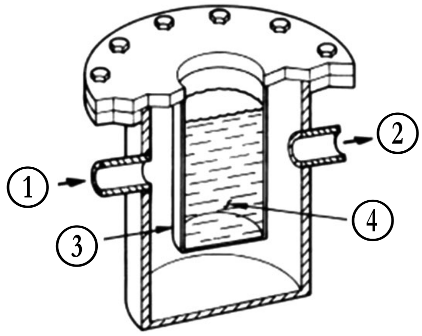
Dehydration is recommended if the chiller has been open for a considerable period of time, if the chiller is known to contain moisture, or if there has been a complete loss of chiller holding charge or refrigerant pressure.

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

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

Dehydration can be done at room temperatures. Using a cold trap (**Fig. 41**) 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 for boiling off any moisture. If the ambient temperatures are low, contact a qualified service representative for the dehydration techniques required.

Fig 41 - dehydration cold trap



1. From system
2. To vacuum pump
3. Moisture condenses on cold surfaces
4. Mixture of dry ice and methyl alcohol

Perform dehydration as follows:

1. Connect a high capacity vacuum pump (0.002 m3/s or larger is recommended) to the refrigerant vacuum/ charging valve. Tubing from the pump to the chiller should be as short in length with a minimum diameter of 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 15.6°C or higher, operate the vacuum pump until the manometer reads 757 mm Hg (vac), (-100.9 kPag), or a vacuum indicator reads 1.7°C. Operate the pump an additional 2 hours. Do not apply a greater vacuum than 100.1 kPa (757 mm Hg) or go below 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 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 0.3 kPa [abs] or less.

5.1.9 - Inspect water piping

Refer to piping diagrams provided in the certified drawings, Inspect the piping to the cooler and condenser. Be sure that flow directions are correct and that all piping specifications have been met. Check the tightening of waterboxes mounting. Check if there's no water leak between tube-sheet and waterbox. Do not introduce any significant static or dynamic pressure into the heat exchange circuit (with regard to the design operating pressures).

Before any start-up verify that the heat exchange fluid is compatible with the materials and the water circuit coating. In case additives or other fluids than those recommended by Carrier are used, ensure that the fluids are not considered as a gas, and that they belong to class 2, as defined in directive 97/23/EC.

Carrier recommendations on heat exchange fluids:

- No NH_4^+ ammonium ions in the water, they are very detrimental for copper. This is one of the most important factors for the operating life of copper piping. A content of several tenths of mg/l will badly corrode the copper over time.
- Cl- Chloride ions are detrimental for copper with a risk of perforations by corrosion by puncture. If possible keep below 10 mg/l.
- SO_4^{2-} sulphate ions can cause perforating corrosion, if their content is above 30 mg/l.
- No fluoride ions (<0.1 mg/l).
- No Fe^{2+} and Fe^{3+} ions with non negligible levels of dissolved oxygen must be present. Dissolved iron < 5 mg/l with dissolved oxygen < 5 mg/l.
- Dissolved silica: Silica is an acid element of water and can also lead to corrosion risks. Content < 1mg/l.
- Water hardness: >0.5 mmol/l. Values between 1 and 2.5 mmol/l can be recommended. This will facilitate scale deposit that can limit corrosion of copper. Values that are too high can cause piping blockage over time. A carbonate hardness (TAC) below 100 is desirable.
- Dissolved oxygen: Any sudden change in water oxygenation conditions must be avoided. It is as detrimental to deoxygenate the water by mixing it with inert gas as it is to over-oxygenate it by mixing it with pure oxygen. The disturbance of the oxygenation conditions encourages destabilisation of copper hydroxides and enlargement of particles.
- Specific resistance - electric conductivity: The higher the specific resistance, the slower the corrosion tendency. Values above 30 Ohm·m are desirable. A neutral environment favours maximum specific resistance values. For electric conductivity values in the order of 20-60 mS/m can be recommended.
- pH: Ideal case pH neutral at 20-25 °C 7 < pH < 8

If the water circuit must be emptied for longer than one month, the complete circuit must be placed under nitrogen charge to avoid any risk of corrosion by differential aeration. Charging and removing heat exchange fluids should be done with devices that must be included on the water circuit by the installer. Never use the unit heat exchangers to add heat exchange fluid.

Piping systems must be properly vented, with no stress on waterbox pipes and covers. Use flexible connections to reduce the transmission of vibrations. Water flows through the cooler and condenser must meet job requirements. Measure the pressure drop across cooler and across condenser and compare this with the nominal values (see selection document).

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.

5.1.10 - Check relief devices

Be sure that relief devices have been piped to the outdoors in compliance with standard EN 378-2. Piping connections must allow for access to the valve mechanism for periodic inspection and leak testing. The standard 19DV relief valves are set to relieve at 500 kPa pressure.

5.2 - 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. 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.

5.3 - Ground Fault Troubleshooting

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

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

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

2. 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.

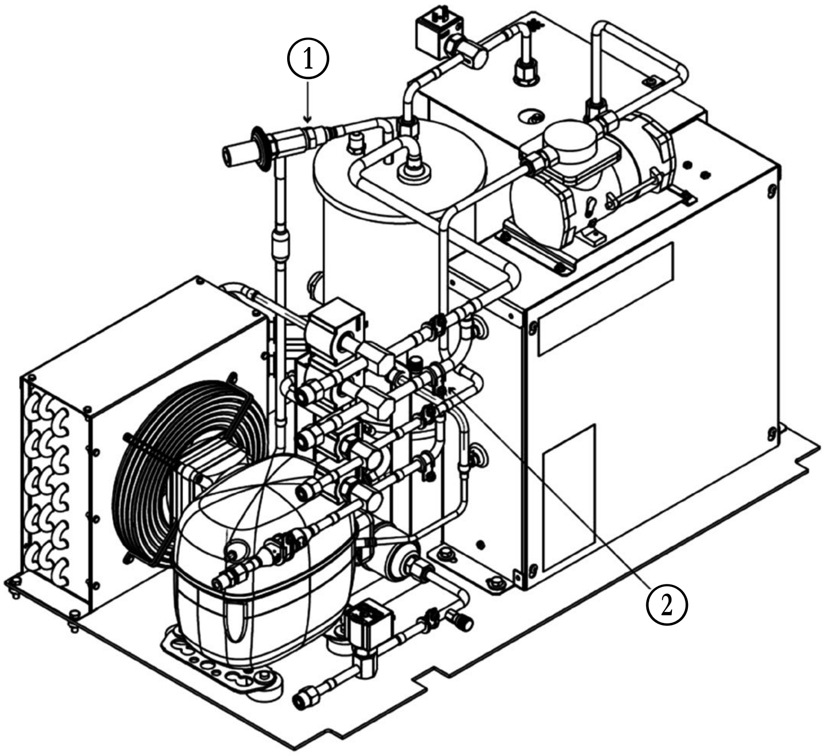
If the readings are unsatisfactory, repeat the test at the motor with the power leads disconnected. Satisfactory readings in this second test indicate the fault is in the power leads.

5.4 - Check Purge Compressor Operation

Enter Quick Test menu (under Main Menu), select “Quick Test Purge Comp.” Connect a pressure gauge to purge compressor inlet Schrader valve (suction is top fitting). The purge system is shown in **Fig. 10**. The reading should be about 62.1+/- 6.9 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.

Fig 42 - purge system setting



1. Expansion valve
2. Suction Schrader valve

Note : Clockwise rotation of expansion valve adjustment screw increases the pressure setting and counterclockwise rotation decreases pressure setting.

5.5 - 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.
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 ±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.

5.6 - Check Lubrication Circuit system

Please check condenser float chamber liquid level. If lubrication system works properly, the liquid level sen-sor should indicate ON.

5.7 - Charge unit with refrigerant

Standard 19DV is shipped with refrigerant but it can also be shipped with holding nitrogen charge of 103 kPa. Chiller has to be loaded on job site 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).

Charge the unit from refrigerant cylinders. Use **Table 18** 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:

a. Standing vacuum test completed
b. Only initiate refrigerant charging into a deep vacuum
c. 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 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 18 - refrigerant charge

Compressor frame size	Condenser HX designation	Evaporator HX designation	R-1233zd(E) charge (+/- 11kg)
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	660
	G23, G28, G2D, G2J		656
	G24, G29		655
	G2E, G2K		653
	G42, G47, G4C, G4H	G40, G41, G42, G43, G44, G45, G46, G47, G48, G49,G4A, G4B, G4C, G4D, G4E, G4F, G4G, G4H, G4J, G4K	748
	G43, G48, G4D, G4J		744
	G44, G49		743
	G4E, G4K		740

5.8 - 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 PIC 5+ Controls Operation and Troubleshooting manual for instructions on using the PIC 5+ interface to configure the 19DV unit. As the unit is configured, all configuration settings should be written down.

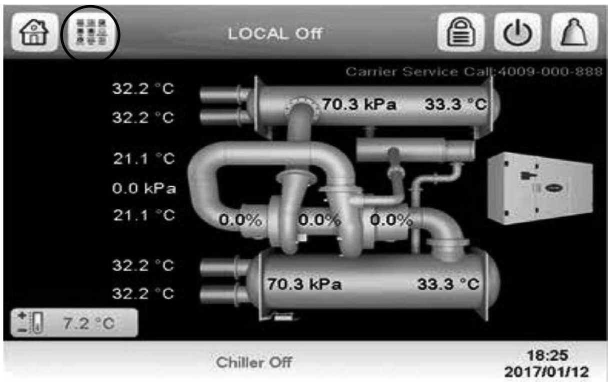
The welcome screen is the first screen shown after switching the unit on or after the re-animation of the screen. It displays the application name as well as current software version number.

Fig 43 - Welcome screen

5.8.1 - Input the Design Set Points

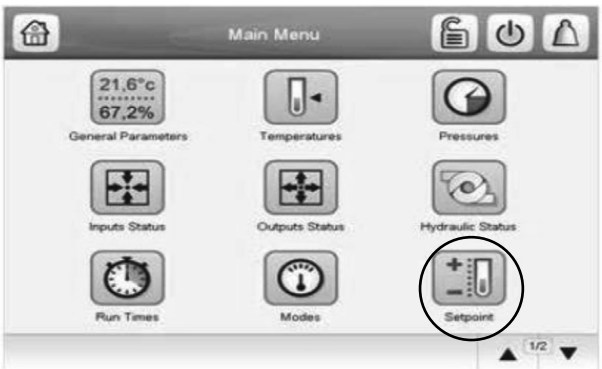
To access the set point screen, press the Main Menu icon on the home screen. See **Fig. 44**

Fig 44 - main menu icon



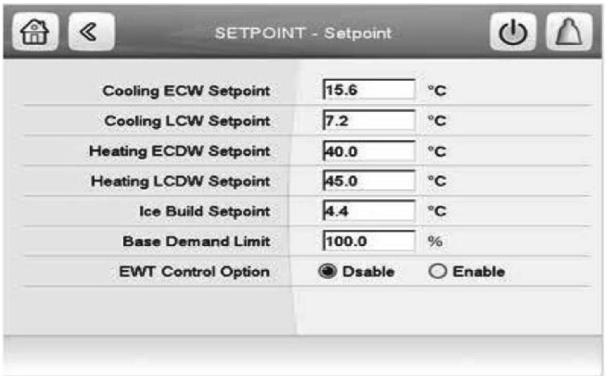
The Main Menu screen is displayed. Press the Set¬point Table **icon (Fig. 45)**.

Fig 45 - main menu - setpoint table icon



The Setpoint screen is displayed (**see Fig. 46**). Set the base demand limit set point, 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.

Fig 46 - Setpoint table screen



5.8.2 - 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.

5.8.3 - Input service configurations

For specific values or the following configurations, refer to the chiller performance data or job-specific data sheet:

- password
- log in/logout
- input time and date
- service parameters
- equipment configuration
- automated control test

PASSWORD — The PIC 5+ control system provides different levels of access: Basic access, User access, Advanced User/ Service access and Factory access. User access provides basic access to the chiller controls. Advanced User access has access to all Service tables, and Factory user has access to factory tables. The PIC 5+ default password configurations are as follows:

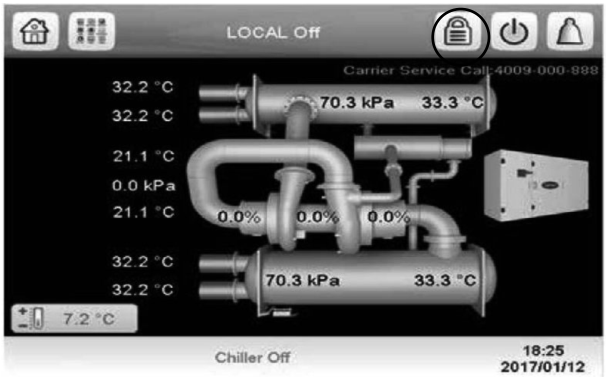
- Basic User: No password required
- User: 1111
- Advanced User / Service Access: 2222
- Factory: 4444

When accessing the SERVICE tables, a password must be entered. The password can be changed from the Configuration Menu. USER CONFIGURATION allows change of the User access password. SERVICE PARAMETERS allows change of the Advanced User/Service password, and FACTORY PARAMETERS allows change of the Factory password. Passwords must be 4 digits (from 1111 to 9999).

IMPORTANT: Be sure to remember the password. Retain a copy for future reference. Without the password, access to the SERVICE menu will not be possible unless accessed by a Carrier representative.

LOGIN/LOGOUT — Press the lock icon on the home screen to enter the password.

Fig 47 - Lock icon



The User Login Screen is displayed. Enter the password on this screen. The language and system of measurement can also be changed on this screen. For details, see the PIC 5+ Controls Operation and Troubleshooting guide.

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 MM-DD-YY for English units and DD-MM-YY 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 to modify or view job site parameters shown in 19DV Configuration tables. Table 19 should be verified or configured during startup/commissioning. Consult chiller nameplates as indicated.

Table 19 - PIC 5 - 19DV CONFIGURATION (example for SW build SCG-SR-20M200400)

TABLE	FACTORY - Factory Parameters			
Access Menu	**Configuration Menu / Factory parameters**			
Setting	**Range**	**Units**	**Default value**	**Settings value**
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	-	0	0
19DV Comp Design Pressure 300 kPa = 0, 500 kPa= 1	0 to 1	-	0	0
Country Code	0 to 999	-	86	33
Free Cooling Option	No/yes	-	NO	per selection
VFD Option No=0,FS VFD=1,Carrier=2 RockwellLF2=3, Eaton=4, Rockwell Std=5, ABB=6, Danfoss=7	0 to 7	-	0	1, 3, or 7 per selection
IOB3 option (19XR2~E/D/V)	No/yes	-	Yes	Yes
IOB 4 Option	No/yes	-	No	Yes
Guide Vane1 Type Digital=0, Analog=1		-	0	1
VFD Feedback Voltage Sel 0-5V=0, 0-10V=1		-	0	0
Marine option	Disable/Enable	-	Dsable	Dsable
Power Request option	Disable/Enable	-	Dsable	Dsable
Cont. Power Request	Disable/Enable	-	Dsable	Dsable
Purge System Option	Disable/Enable	-	Dsable	Enable
Liquid bypass Option	Disable/Enable	-	Dsable	per selection
Heat Reclaim Option No=0, Full=1, Partial=2	0 to 2	-	0	0

TABLE	CFGSURGE - Surge Correction Config	
Access Menu	**Configuration Menu / Surge Correction Config**	
Setting	**Default value (SI units)**	**Settings value (SI)**
Surge Line Configuration PR = 0, Delta T = 1	0	1
IGV1 Pos Configuration Degree = 0, Percentage = 1	0	0
Surge Delta Ts max	38,9°C	selection output
Surge Delta Ts min	25°C	selection output
PR at Full Load Opening	3	3
PR at Minimum opening	1,5	1,5
IGV1 Full Load Open Deg	88	88
Sound Ctrl IGV1 Open Deg	27	27
IGV1 Minimum open Deg	2	2
IGV1 Actuator max deg	109	94
IGV1 minimum position	5	5
IGV1 Full load Position	100%	93,6%
Surge Line Offset	0,8	0,8
Surge Line Lower DB	0,6	0,6
Surge Line Upper DB	0,6	0,6
Surge Line Shape Factor	-0,01	selection output
Sound Line Shape Factor	0,01	selection output
Surge Line speed factor	2	selection output
Surge delay time	15 sec	15 sec
Surge Time Period	8 min	8 min
Surge Delta Amps %	20%	20%
Rampdown Factor	0,1	0,1
GV1 Close Step Surge	2%	2%
VFD Speed Step Surge	1,50%	1,50%

TABLE	CFGSURGE - Surge Correction Config	
Access Menu	Configuration Menu / Surge Correction Config	
Setting	**Default value (SI units)**	**Settings value (SI)**
EC valve Step Surge	4%	4%
Surge Profile Step	0,6	0,6
Surge Profile Offset	1,7	1,7
High Efficiency Mode	Enable	Enable
High Noise Alert	Disable	Disable

TABLE	CFGLIMIT - Protective Limit Config	
Access Menu	Configuration Menu / Protective Limit Config	
Setting	**Default value (SI units)**	**Settings value (SI)**
Evap Approach Alert	2,8	2,8
Cond Approach Alert	3,3	3,3
Cond Press Override Low	965,3	965,3
Cond Press Override High	1723,8	1723,8
Cond Press Cutout Low	1103,2	1103,2
Cond Press cutout high	1896,1	1896,1
Evap Override Delta T	1,4	2,6
Evap Refrig Trippoint	0,6	-1
High evap press override	965,3	965,3
High evap press cutout	1137,7	1137,7
Hi Evap Pre override DV	379,2	379,2
Hi Evap Pre Cutout DV	406,8	406,8
Cond Pre Override DV 44	180	180
Cond Pre Cutout DV 44	206,9	206,9
Cond Pre Override Dv 72	379,2	379,2
Cond Pre Cutout DV 72	406,8	406,8
Condenser freeze point	1,1	1,1
Comp discharge Alert	93,3	93,3
Comp Motor Temp Override	93,3	93,3
Comp Bearing Temp Alert	79,4	79,4
Comp Bearing Temp trip	85	85
Comp Bearing Alert R6/7	98,9	98,9
Comp Bearing Trip R6/7	104,4	104,4
Comp Bearing Alert DV	40	40
Comp bearing Trip DV	50	50
Minimum Brine LWT	1,1	1,1
Heating LWT Protect Set	6	6
Liquid Bypass Temp Band	1,7	1,7
Evap Flow Delta P Cutout	35	Jobsite specific
Cond Flow Delta P Cutout	35	Jobsite specific
Cond Hi Flow DP Limit	344,7	Jobsite specific
Cond Hi Flow Alarm	Disable	Disable

TABLE	General Configuration	
Access Menu	Configuration Menu / General Configuration	
Setting	**Default value (SI units)**	**Settings value (SI)**
User password	1111	1111
Stop to Start Delay	2	2
Start to Start Delay	15	15
Demand limit Type (Base demand=0, 4-20mA=1)	0	0
Pulldown rampe type (Temp=0, Load=1)	1	1
Demand limit source (Amps=0, kW=1)	0	0

TABLE	CFGEVFD - General VFD Config		
Access Menu	Configuration Menu / General VFD Config		
Setting	**Default value (SI units)**	**Settings value (SI)**	**Comments**
VFD gain	0,75	0,75	
VFD Max Speed Per	100%	100%	
VFD Min Speed Per	70%	55%	
VFD Start Speed Per	100%	100%	
VFD Current limit	250 A	872	Max current output for UM VFD
VFD Load Current 20mA	200 A	200 A	
Comp Frequency 100%	50 Hz	50 Hz	
VFD load current input	Enable	Enable	

TABLE	19DV Configure	
Access Menu	Configuration Menu / 19DV Config	
Setting	**Default value (SI units)**	**Settings value (SI)**
Pressure sensor option (Tianmu=0, Texas=1, Sensata=2)	0	0
Motor pole pair	1	1
IGV2 Travel limit	100%	96,0%
IGV2 Minimum Deg	2	2
IGV2 Full Load open Deg	88	90
IGV2 Actuator Max Deg	94	94
IGV2 Deg @IGV1 20 Deg	28,1	28,1
IGV2 Deg @IGV1 30 Deg	37,2	37,2
IGV2 Deg @IGV1 50 Deg	71,6	71,6
Comp Based Speed Hz	80,5	80,5
Purge Regen Lasting time	120	120
Daily PG Pumpout Limit	50 min	50 min
DSH_Req param VFD F	0,5	0,5
DSH_Req param VFD 2nd	-0,0059	-0,0059
DSH_Req param VFD 1st	0,9427	0,9427
DSH_Req param VFD Const	-34,5	-34,5
DSH_Req param IGV F	0,2	0,2
DSH_Req param IGV 2nd	0,0046	0,0046
DSH_Req param IGV 1st	-0,562	-0,562
DSH_Req param IGV Const	21	21
DSH_Req param Lift F	0,3	0,3
DSH_Req param Lift 2nd	0,0006	0,0006
DSH_Req param Lift 1st	-0,1104	-0,1104
DSH_Req param Lift Const	5,5	5,5
Liquid Bypass Temp Diff	11,1	11,1
Liquid Bypass Cond Appro	2,8	2,8
Bearing Sub Cooling	-5	-5
Purge Discharge Temp	-15,6	-15,6
Purge Drainage Temp	-11,1	-11,1
CLT Factory Option	disable	enable
Refrig Lube Option 7	disable	disable

TABLE	CFGUMVFD - UM VFD Configuration		
Access Menu	Configuration Menu / UM VFD Configuration		
Setting	Default value (SI units)	Settings value (SI)	Comments
Compressor Speed 100%	50 Hz	98 Hz	Nameplate
Rated line voltage	460 V	400 V	Nameplate
Motor Nameplate Current	200 A	Nameplate	
Motor Rated Load Current	200 A	Nameplate	
Motor Nameplate Voltage	460 V	Nameplate	
Motor Nameplate RPM	3000 rpm	Nameplate	
Motor Nameplate KW	1500 kW	Nameplate	
Skip Frequency 1	102 Hz	102 Hz	UM Rockwell LF2
Skip Frequency 2	102 Hz	102 Hz	UM Rockwell LF2
Skip Frequency 3	102 Hz	102 Hz	UM Rockwell LF2
Skip Frequency Band	0 Hz	0 Hz	
Increase Ramp Time	30 sec	30 sec	
Decrease Ramp Time	30 sec	30 sec	
Line Voltage % Imbalance	0,1	10%	
Line Volt Imbalance Time	10 sec	10 sec	
Line Current % Imbalance	0,4	40%	
Line Current Imbal Time	10 sec	10 sec	
Motor Current % Imbalance	0,4	40%	
Motor Current Imbal Time	10 sec	10 sec	
Single Cycle Dropout	Dsable	Dsable	
PWM Frequency (0=2 k Hz, 1=4 k Hz)	0	0	
Restore Defaults	No	No	
LEN Comm Timeout	10 sec	10 sec	
Modbus Comm Timeout	2 sec	2 sec	
Gateway Modbus Baud Rate 4800 = 1, 9600 = 2, 19200 = 3, 38400=4	2	2	
Number of GDCBs	0	0	
GDCB Startup Delay	50%	50%	

TABLE	CONF_OPT - Option configuration	
Access Menu	Configuration Menu / Option Configuration	
Setting	Default value (SI units)	Settings value (SI)
Auto Restart Option	Dsable	job site specific
Common Sensor Option	Dsable	job site specific
EC Valve Option No=0, Cont.=1, ON/OFF=2, mA=3	0	2 if selected
EC valve selection Disable =0, Surge=1, Low Load=2, Comb=3	0	job site specific
ECV Open IGV1 Position	5%	5% (adjust as required)
ECV Close IGV1 Position	10%	10% (adjust as required)
ECV Off DT for Low Load	2,2 °C	2,2 °C (adjust as required)
ECV On DT for Low Load	1,1 °C	1,1 °C (adjust as required)
ECV Low Load DB	0,6 °C	0,6 °C (adjust as required)
Head Pres Valve Option	Dsable	job site specific
Head Pres Delta P 0%	172,4 kPa	172,4 kPa (adjust as required)
Head Pres Delta P 100%	344,7 kPa	344,7 kPa (adjust as required)
Head Pressure Min Output	0%	0% (adjust as required)
Tower Fan High Setpoint	24 °C	24 °C (adjust as required)
Refrig Leakage Option	Dsable	job site specific
Refrig Leak Alarm mA	20 mA	20 mA (adjust as required)
Oil EXV Option	Dsable	Dsable
Oil Temp High Threshold	50 °C	N/A
Oil Temp Low Threshold	45 °C	N/A
Gas Torque Factor	1	1
Guide Vane/SRD Factor	0,95	0,95
Power Recovery Timeout	15 min	15 min
Condenser Flush Alert	Dsable	Dsable
Customer Alert Option	Dsable	job site specific

TABLE	CONF_OPT - Option configuration	
Access Menu	**Configuration Menu / Option Configuration**	
Setting	**Default value (SI units)**	**Settings value (SI)**
Ice Build Option	Dsable	job site specific
Ice Build Recycle	Dsable	job site specific
Ice Build Termin Source Temp=0,Contact=1,Both=2	0	job site specific
Water Pressure Option No=0, Flow Meter=1, Water Pres. D=2	0	1
Water Flow Measurement No=0, Flow Meter=1,Water PD=2	0	0
Water Flow Determination Sat Temp=0,Flow Switch=1	0	job site specific
Water Flow at 4mA	0 l/sec	adjust as required
Water Flow at 20mA	0 l/sec	adjust as required
Evap Flow Rate Baseline	0 l/sec	adjust as required
Evap Pres Drop Baseline	0 kPa	adjust as required
Cond Flow Rate Baseline	0 l/sec	adjust as required
Cond Pres Drop Baseline	0 kPa	adjust as required
Water Pres Drop @20mA	68,95 kPa	adjust as required
Max Oil Pressure Diff	344,7 kPa	N/A
Oil Pump VFD Max Step	7%	N/A
Vapor Source SV Delay	5 min	N/A
Vapor Source SV Option	Dsable	N/A
Liquid Bypass Selection	Dsable	per selection
Purge on Idle option	Dsable	adjust as required for force
Evap Liquid Temp Opt	Enable	N/A
Evap App Calc Selection Sat Temp=0, Ref Temp=1	1	1

TABLE	SERVICE - Service Parameters	
Access Menu	**Configuration Menu / Service parameters**	
Setting	**Default value (SI units)**	**Settings value (SI)**
Atmospheric Pressure	99,978 kPa	*
GV1 Travel Limit	80,70%	*
GV1 Closure at Startup	4,00%	*
Controlled Fluid DB	0,6°C	*
Derivatived EWT Gain	2	*
Proportional Dec Band	6	*
Proportional Inc Band	6,5	*
Maximum GV Movement	2,00%	*
Demand Limit at 20 mA	40%	*
Demand Limit Prop Band	10%	*
Amps or KW Ramp per Min	5%	*
Temp Ramp per Min	1,7°C	*
Recycle Shutdown Delta T	0,6°C	*
Recycle Restart Delta T	2,8°C	*
Damper Valve Act Delay	2 min	*
Damper Valve Close DB	34,5 kPa	*
Damper Valve Open DB	89,6 kPa	*
Damper Action Delta T	3,9°C	*
Oil Press Verify Time	40 sec	*
Soft Stop Amps Threshold	70%	*
Water flow verify Time	5 min	*
Power calibration factor	1	*
Purge Active Temp SP	18,3	*
Enable Excessive Starts	No	*
Oil Stir Cycle (19XR6/7) No Stir = 0, 30s/30m = 1, 1m/4h = 2, Comb. 0&1=3	1	*

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

TABLE	SETPOINT	
Access Menu	**Main Menu / Setpoint**	
Setting	**Default value (SI units)**	**Settings value (SI)**
Cooling ECW Setpoint	12	job site specific
Cooling LCW Setpoint	7	job site specific
Heating ECDW Setpoint	40	job site specific
Heating LCDW Setpoint	45	job site specific
Ice Build setpoint	4.4	job site specific
Base Demand limit	100%	100%
EWT Control Option	Disable	job site specific

TABLE	CONF_IOB - IOB configuration		
Access Menu	**Configuration Menu / IOB Configuration**		
Setting	**Default value**	**Settings value**	
IOB1 AI#1 Type	4	4	Entering chilled water temperature
IOB1 AI#2 Type	4	4	Leaving chilled water temperature
IOB1 AI#3 Type	4	4	Entering condenser water temperature
IOB1 AI#4 Type	4	4	Leaving condenser water temperature
IOB1 AI#9 Type	2	0	nothing
IOB1 AO#1 Type	1	1	Chiller status output mA
IOB2 AI#1 Type	4	4	Motor winding temperature 1
IOB2 AI#2 Type	4	0	
IOB2 AI#3 Type	4	2	EC option
IOB2 AI#4 Type	0	0	
IOB2 AI#8 Type	0	2	Auto Demand limit input
IOB2 AI#9 Type	0	0	No Refrigerant leak sensor
IOB2 AI#10 Type	5	1	
IOB2 AO#1 Type	1	1	Guide Vane1 output
IOB2 AO#2 Type	1	0	not used
IOB3 AI#1 Type	4	4	1st stage bearing temp
IOB3 AI#2 Type	4	4	2nd stage bearing temp
IOB3 AI#3 Type	4	4	Bearing ref supply temp
IOB3 AI#4 Type	4	2	Guide Vane 2 actual position
IOB3 AI#5 Type	0	4	Remote Reset Sensor
IOB3 AI#6 Type	5	2	Guide Vane 1 Actual Pos
IOB3 AI#8 Type	0	0	Auto Water Temp Reset
IOB3 AI#9 Type	0	0	Common CHWR Temp, not used
IOB3 AI#10 Type	0	0	not used
IOB3 AO#1 Type	1	1	Head Pressure Output
IOB3 AO#2 Type	1	0	not used
IOB4 AI#3 Type	0	1	Entering Evap water pressure
IOB4 AI#4 Type	0	1	Leaving Evap water pressure
IOB4 AI#5 Type	0	1	Entering Cond water pressure
IOB4 AI#6 Type	0	1	Leaving Cond water pressure
IOB4 AI#7 Type	0	0	not used
IOB4 AI#10 Type	0	0	not used
ISM Input Enable	Disable	Disable	

Information for IOB input (AI) type as below:

0. not used
1. 0 – 5V
2. 0 – 20 mA
3. 10 K
4. 5 K
5. Resist

Information for IOB output (AO) type as below:

0. disable
1. 0-20ma
2. 0-10V

5.8.4 - 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:

- Chiller identification nameplate — Located on control panel.
- VFD Nameplate data - located on 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.

5.9 - Perform a control 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 ±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.

If during the control test the guide vanes do not open, check the low pressure alarm, which shall not be active. (An active low pressure alarm causes the guide vanes close.)

The refrigerant pump test will not energize the refrigerant pump if cooler pressure is be¬low–89.63 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.

Table 20 - PIC 5 – QUICK TEST LIST

	POINT	STATUS	DEFAULT	UNITS	DESCRIPTION	LOW LIMIT	HIGH LIMIT	LEN FORCE
1	QCK_TEST	0~1	0		Quick Test Enable	0	1	X
2	Q_OILH	0~1	0		Quick Test Oil Heater	0	1	X
3	Q_OILP	0~1	0		Quick Test Oil/Ref Pump	0	1	X
4	OP_PASS	NO/YES	0		Ref Press Test Passed	0	1	
5	OIL_PDQ	-6.7~420.0		kPa	Ref Pump Delta Press	-6.7	420	
6	Q_EXV	0.0~100.0	0		Quick Test Oil EXV	0	100	X
7	Q_HDP	0.0~100.0	0	%	Quick Test Head Val Pos	0	100	
8	Q_CHST	4.0~20.0	0	mA	Quick Test Chiller Stat	4	20	
9	Q_GV1POS	0.0~100.0	0	%	Guide Vane 1 Tested Pos	0	100	
10	Q_GV2POS	0.0~100.0	0	%	Guide Vane 2 Tested Pos	0	100	
11	Q_GV1OP	0~1	0		Quick Test GV1 Open	0	1	X
12	Q_GV1CL	0~1	0		Quick Test GV1 Close	0	1	X
13	Q_GVSRD	DISABLE/ENABLE	0		GV1/SRD Joint Test	0	1	X
14	Q_SRD	0.0~100.0	0	%	Quick Test Diffuser Pos	0	100	X
15	Q_GV1ACT				Guide Vane 1 Actual Pos			
16	Q_DIFTGT				Diffuser Target Pos			
17	Q_HGBPOP	0~1	0		Quick Test ECV Open	0	1	X
18	Q_HGBPCL	0~1	0		Quick Test ECV Close	0	1	X
19	Q_HGBP_T	0.0~100.0		%	EC Valve Tested Pos	0	100	X
20	Q_DMPOP	0~1	0		Quick Test Damper Open	0	1	X
21	Q_DMPCL	0~1	0		Quick Test Damper Close	0	1	X
22	Q_ALM	0~1	0		Quick Test Alarm Output	0	1	X
23	Q_ALE	0~1	0		Quick Test Alert Output	0	1	X
24	Q_CDWP	0~1	0		Quick Test Cond Pump	0	1	X
25	CDW_FLOW	NO/YES	0		Condenser Water Flow	0	1	
26	Q_CHWP	0~1	0		Quick Test Chilled Pump	0	1	X
27	CHW_FLOW	NO/YES	0		Chilled Water Flow	0	1	
28	CDW_DT	-40.0~245.0	0	° C	Condenser Water Delta T	-40	245	
29	CHW_DT	-40.0~245.0	0	° C	Chilled Water Delta T	-40	245	
30	Q_LLCEXV	0.0~100.0	0	%	Quick Test LLC EXV	0	100	X
31	Q_VFDCOL	0~1	0		Quick Test VFD Cooling	0	1	X
32	Q_VAPLSV	0~1	0		QCK TST Vapor Venting SV	0	1	X

	POINT	STATUS	DEFAULT	UNITS	DESCRIPTION	LOW LIMIT	HIGH LIMIT	LEN FORCE
33	Q_VSSV	0~1	0		Quick Test Vapor SV	0	1	X
34	Q_CONDSV	0~1	0		Quick Test Condenser CV	0	1	X
35	Q_EVAPSV	0~1	0		Quick Test Evaporator CV	0	1	X
36	Q_OPRLUB	0~1	0		QCK TST EvapDrain CV	0	1	X
37	Q_PRELUB	0~1	0		QCK TST Cond Drain CV	0	1	X
38	Q_CDPSV	0~1	0		Quick Test Purge Cond SV	0	1	X
39	Q_CMPSV	0~1	0		Quick Test Purge Comp SV	0	1	X
40	Q_POPSV	0~1	0		Quick Test Pumpout SV	0	1	X
41	Q_DRPSV	0~1	0		Quick Test Drainage SV	0	1	X
42	Q_RGPSV	0~1	0		Quick Test Rege SV	0	1	X
43	Q_DCPSV	0~1	0		Quick Test Discharge SV	0	1	X
44	Q_PVPSV	0~1	0		Quick Test Vacuum Pump	0	1	X
45	Q_PCPSV	0~1	0		Quick Test Purge Comp	0	1	X
46	Q_PHPSV	0~1	0		Quick Test Purge Heater	0	1	X
47	Q_MRC	0~1	0		Motor Rotation Check	0	1	X
48	Q_MRC_ST				Check State			
					IDLE=0, PreLub=1			
					Rotat=2, PosLub=3, End=4			
49	Q_ECBP	0~1	0		Quick Test Eco Bypass	0	1	X
50	Q_ECONIV	0~1			QCK TST Eco Isolation	0	1	X
51	Q_CONDCV	0~1			QCK TST Cond Filling VLV	0	1	X
52	Q_LOWFAN	0~1	0		Quick Test Lo Tower Fan	0	1	X
53	Q_HIFAN	0~1	0		Quick Test Hi Tower Fan	0	1	X

5.9.1 - 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/Disable since the new values will be deleted. Values are kept by exiting the pressure sensor table.

6.1 - Preparation

Before starting the chiller, verify:

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

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

6.2 - Check Motor Rotation

1. Close the VFD 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.

IMPORTANT: Do not check motor rotation during coastdown. 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.

When rotation checking, 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.

6.3 - Check Refrigerant Lube

1. In Quick Test the refrigerant lube pressure can be checked. First open cooler valve and condenser drain valve, then run the refrigerant pump. Usually the pressure drop across bearing is above 55 kPa. If the bearing pressure drop is negative, please check pump rotation. If bearing pressure drop is below 55 kPa, please check if the moisture filter is clogged.
2. Press the Stop button and listen for any unusual sounds from the compressor as it coasts to a stop.

6.4 - 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.

6.5 - Check Chiller Operating Condition

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

6.6 - 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.

6.6.1 - Cooler - Condenser

High side float chamber, relief devices, refrigerant charging valve, temperature sensor locations, pressure transducer locations, Schrader fittings, waterboxes and tubes, and vents and drains.

6.6.2 - Motor compressor assembly

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

6.6.3 - Compressor Lubrication System

Valves, dryers and filters, liquid level switch.

6.6.4 - Economizer

Float valve, drain valve, Schrader fitting, economizer isolation valve.

6.6.5 - Control system

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

6.6.6 - Purge

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

6.6.7 - Auxiliary equipment

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

6.6.8 - Describe chiller cycles

Refrigerant, motor cooling, lubrication, and liquid reclaim.

6.6.9 - 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.

6.6.10 - Safety devices and procedures

Electrical disconnects, relief device inspection, and handling refrigerant.

6.6.11 -

6.6.12 - Check operator knowledge

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

6.7 - Surge prevention trouble shooting guide:

1. If chiller surges very frequently, the surge preven¬tion line should be decreased

   a. If chiller surges only at full load region, Delta Tsmax should be decreased by 0.28°C for each step until there is no abnormal surge oc¬curs. See Fig. 48 for the effect of delta Tsmax on surge prevention line.

   b. If chiller surges only at low load region, Delta Tsmin should be decreased by 0.28°C for each step until there is no abnormal surge occurs. See Fig. 49 for the effect of delta Tsmin on surge prevention line.

   c. If chiller surges only at medium load region, surge line shape factor should be increased by 0.01 for each step until there is no abnor¬mal surge occurs. See Fig. 50 for the effect of surge line shape factor on surge prevention line.

   d. If chiller surges at all the regions, delta Tsmax, delta Tsmin and surge line shape factor can be adjusted at the same time.

2. If chiller no surge but efficiency cannot meet the target, the surge prevention line should be in¬creased

   a. If the problem only occurs at full load region, Delta Tsmax should be increased by 0.28°C for each step until chiller enters real surge. See Fig. 48 for the effect of delta Tsmax on surge prevention line.

   b. If the problem only occurs at low load region, Delta Tsmin should be increased by 0.28°C for each step until chiller enters real surge. See Fig. 49 for the effect of delta Tsmin on surge prevention line.

   c. If the problem only occurs at medium load region, surge line shape factor should be decreased by 0.01 for each step until chiller enters real surge. See Fig. 50 for the effect of surge line shape factor on surge prevention line.

   d. It the problem occur at all the regions, delta Ts¬max, delta Tsmin and surge line shape factor can be adjusted at the same time.

   The effect of surge line speed factor on surge pre¬vention line is shown in Fig. 51.

Fig 48 - Effect of surge delta TSmax on Surge prevention

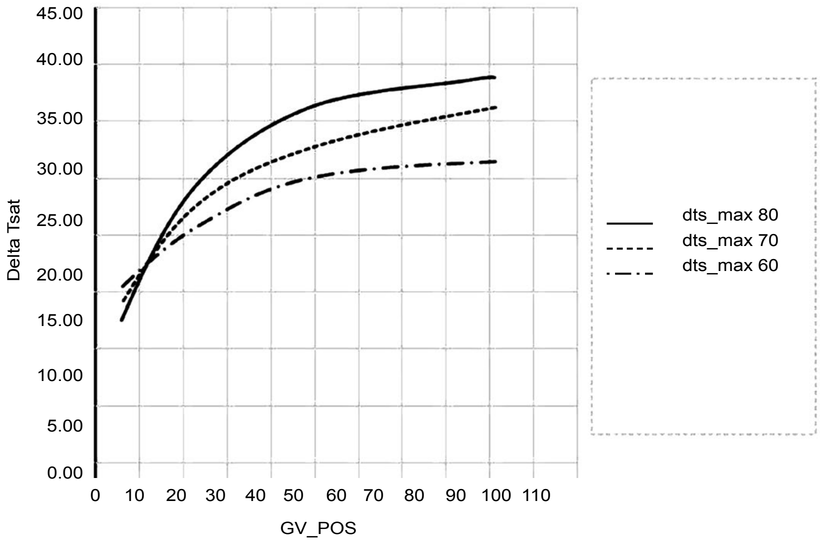


Fig 49 - Effect of surge delta TSmin on Surge prevention

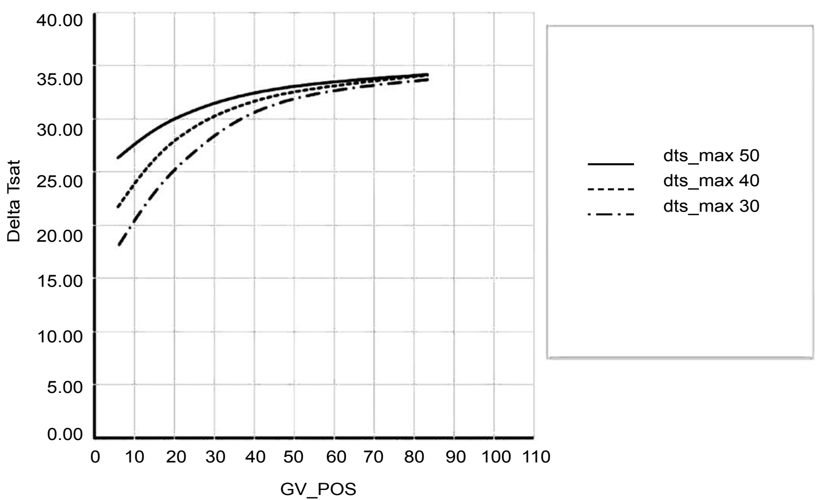


Fig 50 - Effect of surge line shape factor on Surge prevention

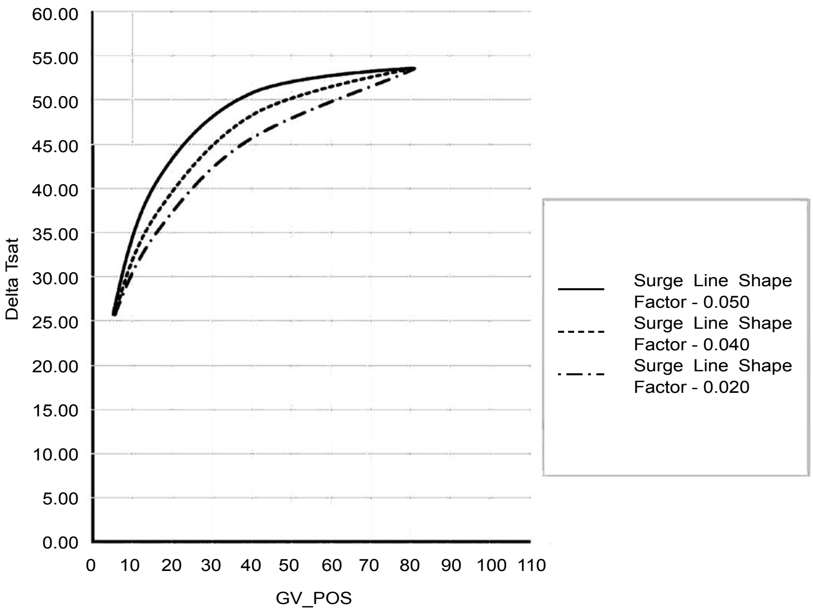
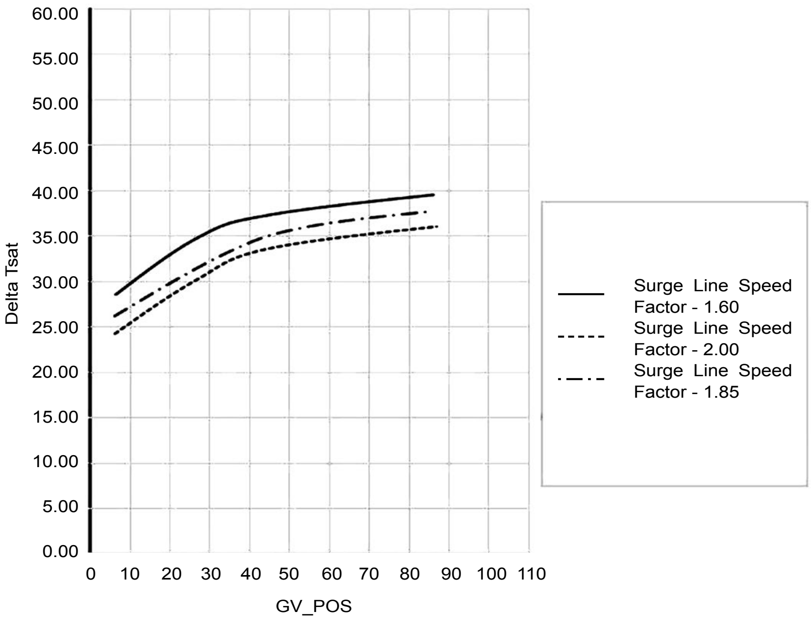


Fig 51 - Effect of surge line speed factor on Surge prevention



7.1 - 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 PIC5+ functions.

7.2 - 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.

7.3 - 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 35°C. Alert will initiate at (40°C and Alarm will be initiated at 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 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 68.9 kPa diff 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 -10.3 to 120.6 kPa. with a corresponding temperature range of 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 50.8 kPa to -35 kPa, with temperature ranging between 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. Both the high and low float chamber have two sight glasses that look into the float chamber to confirm the floats are not stuck open or closed. When the chiller is operating, the top sight glass is empty and the bottom sight glass is full.

7.4 - 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. 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.

7.5 - After Limited Shutdown

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

7.6 - 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.

7.7 - 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.

If charge was removed, recharge the chiller by transferring refrigerant from the pumpout storage tank (if supplied).

Carefully make all regular preliminary and running system checks.

7.8 - Cold Weather Operation

When the entering condenser water temperature drops below 12.8 °C, the operator should automatical¬ly cycle the cooling tower fans off to keep the temper¬ature up. Piping may also be arranged to bypass the cooling tower used to maintain a minimum refrigerant pressure differential during an inverted start condition. The PIC5+ controls have a low limit tower fan output that can be used to assist in this control with IOB 4 installed.

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.

7.9 - 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 pull¬down rate during start-up and permits the guide vanes to open at a faster rate. Motor current above the elec¬trical demand setting, capacity overrides, and chilled water temperature below the control point override the manual target and close the guide vanes. For descrip¬tions of capacity overrides and set points, please refer to separated PIC5+ Control User Manual.

7.10 - Service and operation Log

A service and operation log (as shown in **Fig. 52**), 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. 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.

SERVICE AND OPERATION LOG CARRIER 19DV SEMI-HERMETIC CENTRIFUGAL REFRIGERATION MACHINE

Fig 52 - Service and operation log

JOB SITE : ______________________ 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					

7.11 - Chiller Idle Requirement

7.11.1 - Be idle for a short time:

There is no special requirement, follow the conven¬tional procedure to check and start-up.

7.11.2 - Be idle for a long time:

1. Chiller leak prevention
   a. If chiller is idle for one month, suggest running purge every week.
   b. If chiller is idle for more than one month, sug¬gest charging nitrogen into chiller until chiller pressure is 103 kPa higher than atmosphere. Before chiller start again, carry out the dehydra¬tion process to re-charge refrigerant.
2. Need to run the refrigerant pump to avoid potential corrosion.
3. Chemically treated Water circulation through the condenser and cooler at least once per week for 1-5 minutes (if they are not drained).
4. The purge operation and refrigerant pump operation should be controlled by the PIC 5+ controller to au-tomatically address these items. The water pumps would need to be manually operated by the customer.

8 - PURGE OPERATION SEQUENCE

Refer to **fig 53**. For the Purge Operation Diagram.

8.1 - Purge Operating Modes

Purge system has two operation modes: Auto and Manual.

You can choose it in Configuration Menu->Lab Test Forced->Purge Forced. Select “0” means Auto mode. Select “1” or “2” means Manual mode, where 1 means purge will be active regardless the purge active con-dition, “2” means you can control purge related valves manually.

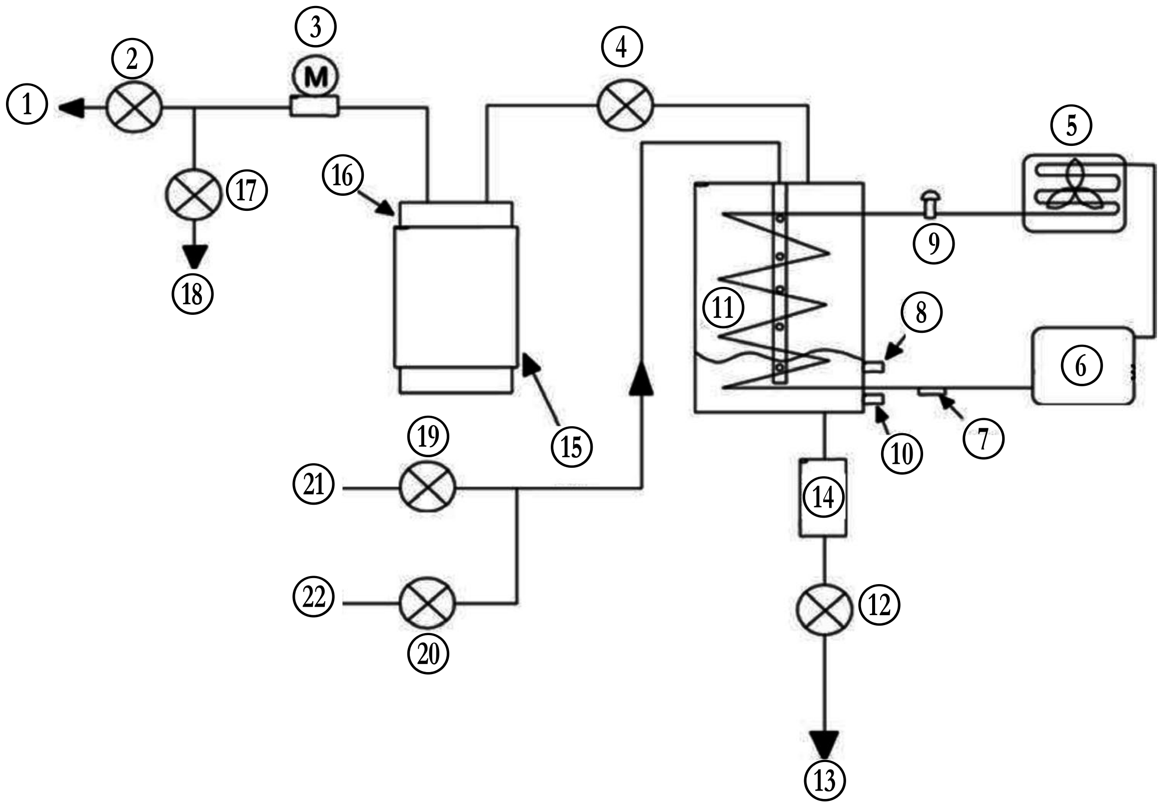
8.2 - Non-condensable Gas Pump Out

When purge tank is full of non-condensable gas, the purge compressor inlet temperature drops to -15 °C, so the discharge valve and pump out valve open, vac¬uum pump starts to pump out the non-condensable gas inside purge tank.

8.3 - Carbon Tank and Regeneration Subsystem

If the carbon filter is saturated with refrigerant, the heater can heat carbon filter to about 127 °C. The condenser valve and cooler valve is closed during this time. Only the pump out valve and regeneration valve is open. Meanwhile, the vacuum pump will operate at intervals. Regenerated refrigerant is pumped to cool¬er. After about 120 minutes, the regeneration process stops. However, purge system will wait for another 4 hours to let carbon filter to cool down before it can op¬erate normally.

Fig 53 - Purge operation sequence diagram



1. Venting line
2. Discharge valve
3. Vacuum pump
4. Pump out valve
5. Condenser
6. Compressor
7. Suction temperature
8. High level sensor
9. Expansion valve
10. Low level sensor
11. Purge cooler
12. Drain filter
13. Chiller cooler
14. Drain filter
15. Heater
16. Carbon filter
17. Regeneration valve
18. Chiller cooler
19. Compressor valve
20. Condenser valve
21. Chiller compressor
22. Chiller condenser

9.1 - General maintenance

During the unit operating life the service checks and tests must be carried out in accordance with applicable national regulations. If there are no similar criteria in local regulations, the information on checks during operation in annex C of standard EN 378-2 can be used.

External visual checks: Annex A and B of standard EN 378-Corrosion checks: Annex D of standard EN 378-2.

These controls must be carried out:

- After an intervention that is likely to affect the resistance or a change in use or change of high-pressure refrigerant, or after a shut down of more than two years. Components that do not comply, must be changed. Test pressures above the respective component design pressure must not be applied (annex B and D).
- After repair or significant modifications or significant system or component extension (annex B)
- After re-installation at another site (annexes A, B and D)

NOTE 1: High leak rates are not acceptable. The necessary steps must be taken to eliminate any leak detected.

NOTE 2: Fixed refrigerant detectors are not designed to find leaks as they cannot locate the leak.

9.1.1 - Soldering and welding

Component, piping and connection soldering and welding operations must be carried out using the correct procedures and by qualified operators. Pressurised containers must not be subjected to shocks, nor to large temperature variations during maintenance and repair operations.

9.1.2 - 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 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 standard EN 378-2 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.

9.1.3 - Adding Refrigerant

Follow the procedures described in Trim Refrigerant Charge section.

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 -53 kPa for HFO R-1233zd(E).

9.1.4 - 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.

9.1.5 - 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.

9.1.6 - Leak Rate

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.

9.1.7 - 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 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.

9.1.7.1 - 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.

9.1.7.2 - 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.

9.1.7.3 - 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 design pressure on nameplate.
5. Close the charging valve on the chiller. Remove the copper tube if it is no longer required.

9.1.8 - 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. A continuous dry nitrogen purge should be maintained during any leak repairs or when the unit is open to the atmosphere to reduce the potential for corrosion.

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 in the Before Initial Start-Up section.

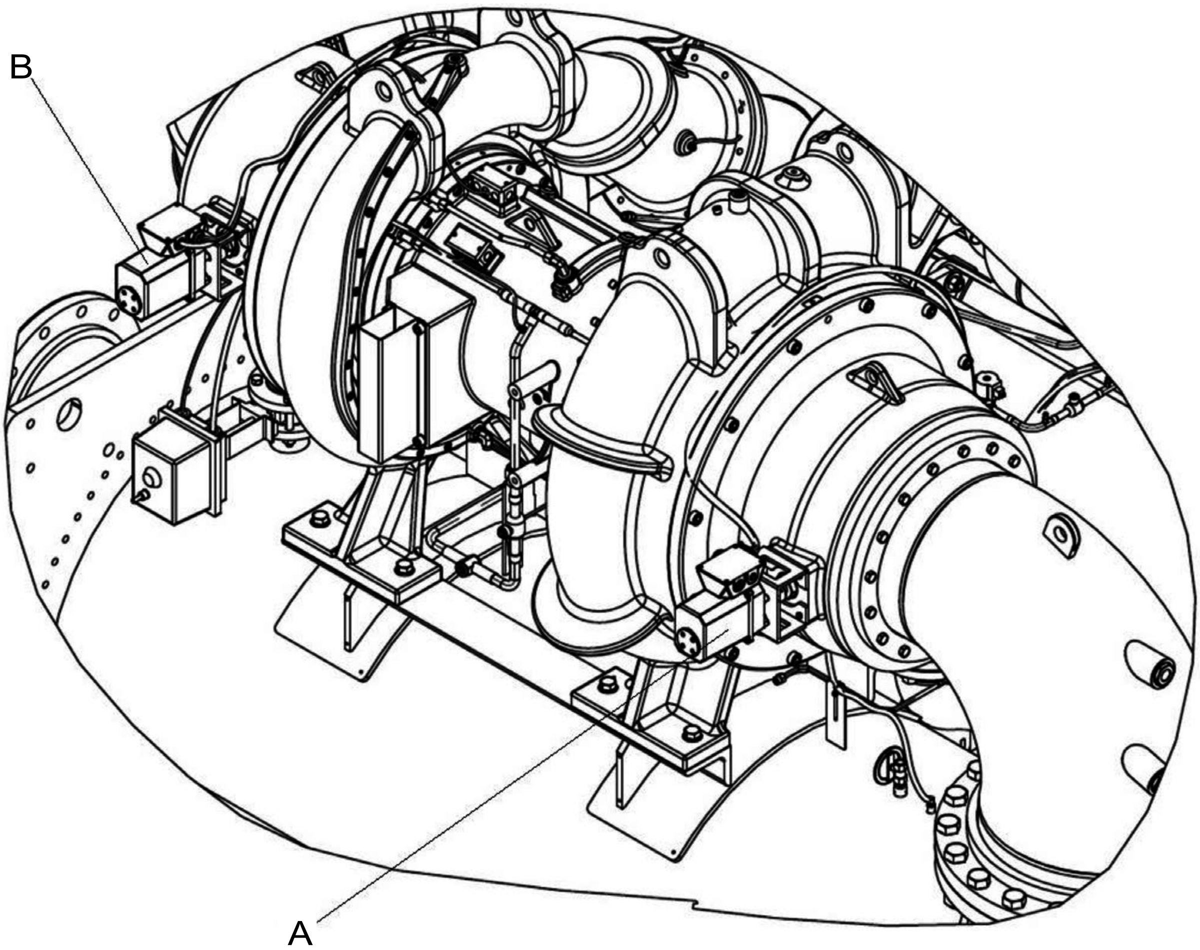
9.1.9 - Checking Guide Vanes

During normal shutdown, when the chiller is off, the guide vanes are closed.

Complete the following steps to adjust position if required (see Fig. 55):

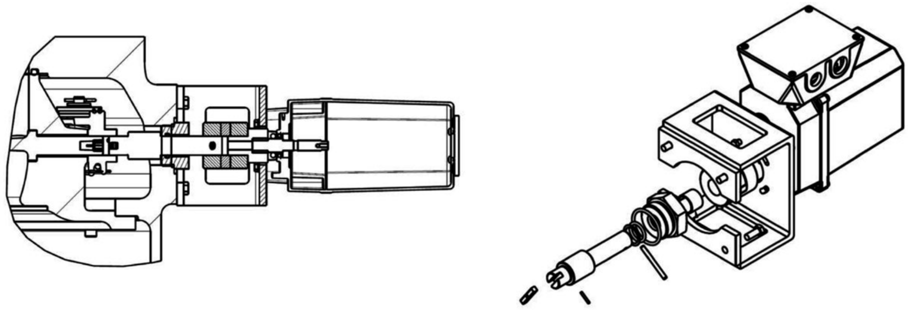
1. Remove the set screw in the guide vane coupling.
2. Loosen the hold down bolts on the guide vane actuator.
3. Pull the guide vane actuator away from the suction housing.
4. If required, rotate the guide vane sprocket fully clockwise for first stage and counterclockwise for second stage and spot-drill 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 reseated.
(Remember: Spot-drill and tighten the first set screw before spot-drilling for the second set screw.)

Fig 54 - IGV actuators position

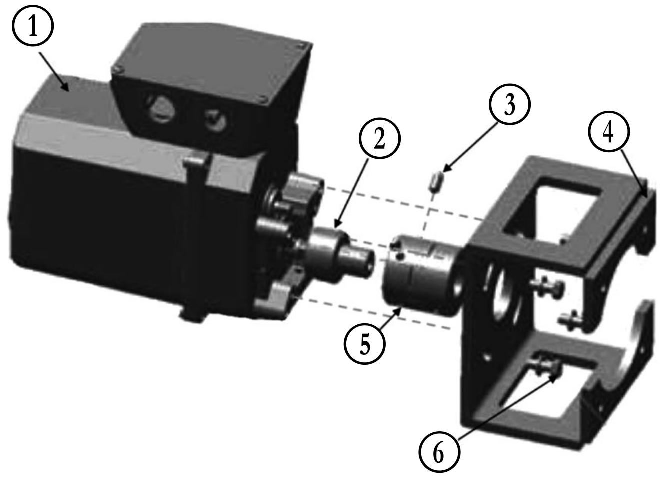


A First stage IGV actuator (IGV1 – M67) Open CCW – Close CW
B Second stage IGV actuator (IGV2 – M69) Open CW – Close CCW

Fig 55 - IGV actuator details

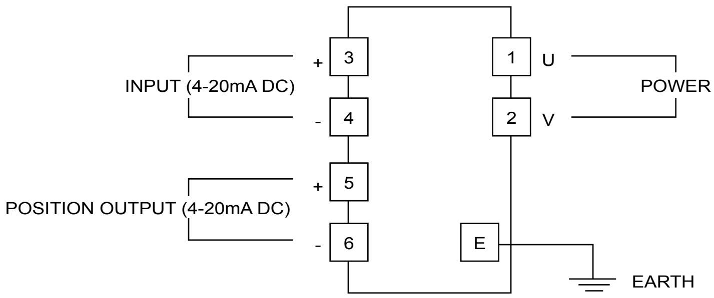


NOTE: For first stage, rotate coupling clockwise to close guide vanes; rotate coupling counterclockwise to open guide vanes.
For second stage, rotate coupling counterclockwise to close guide vanes; rotate coupling clockwise to open guide vanes.



1 actuator
2 Connector
3 Set screw
4 Bracket
5 Coupling
6 Holddown bolts and washers

The guide vane actuator wiring of 19DV is as below :



9.1.10 - 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 glass to check the liquid level. The level must be in the middle of sight glass for correct refrigerant charge in operation. During steady state op¬eration at 80-100% of capacity, the boiling pool tubes should be covered with liquid refrigerant at all times. There is no benefit to have a refrigerant level higher than the tubes and capacity will be lost if the tubes are not covered with liquid.

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

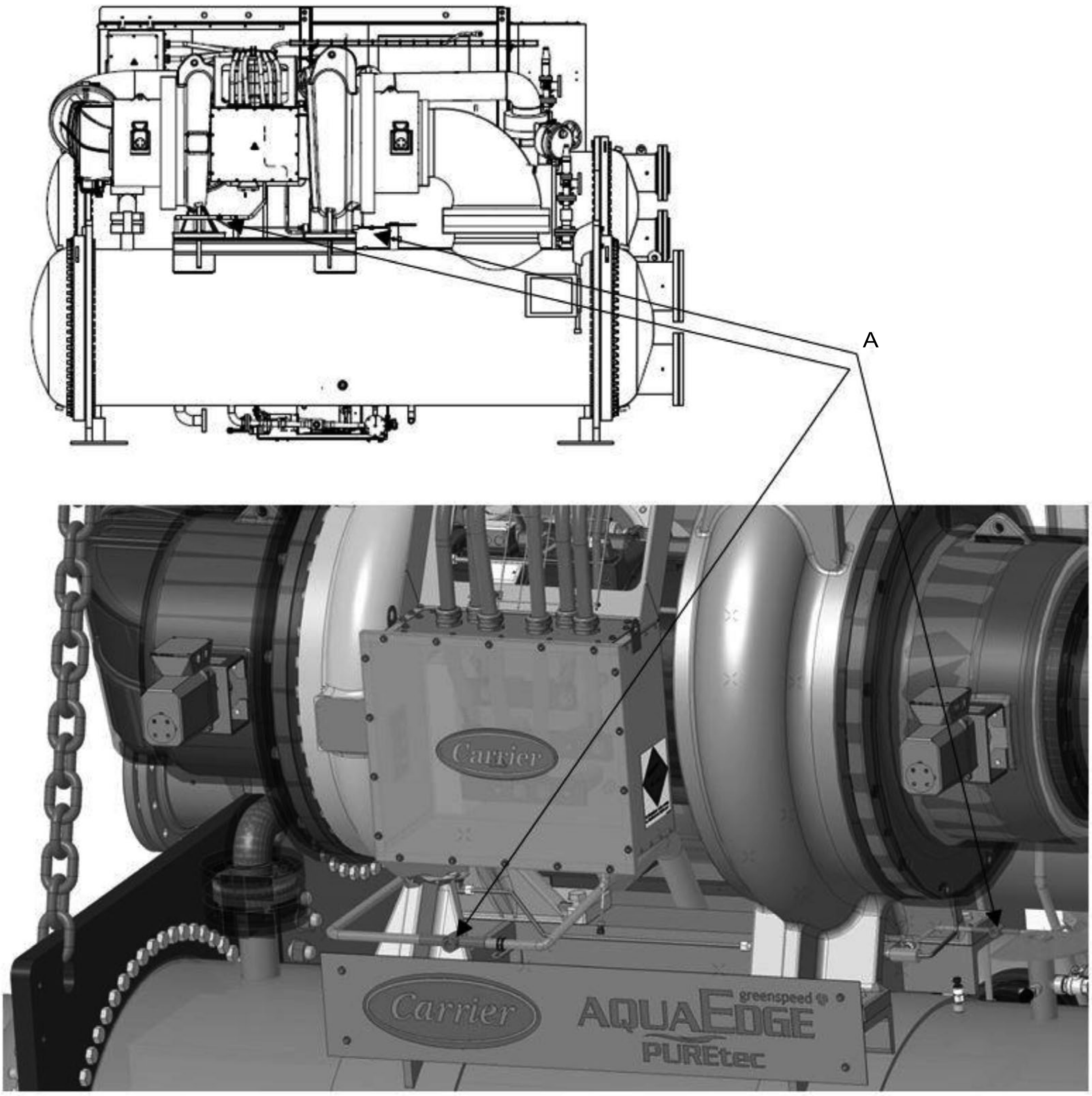
9.2 - Weekly maintenance

9.2.1 - Check the Refrigerant Lubrication System

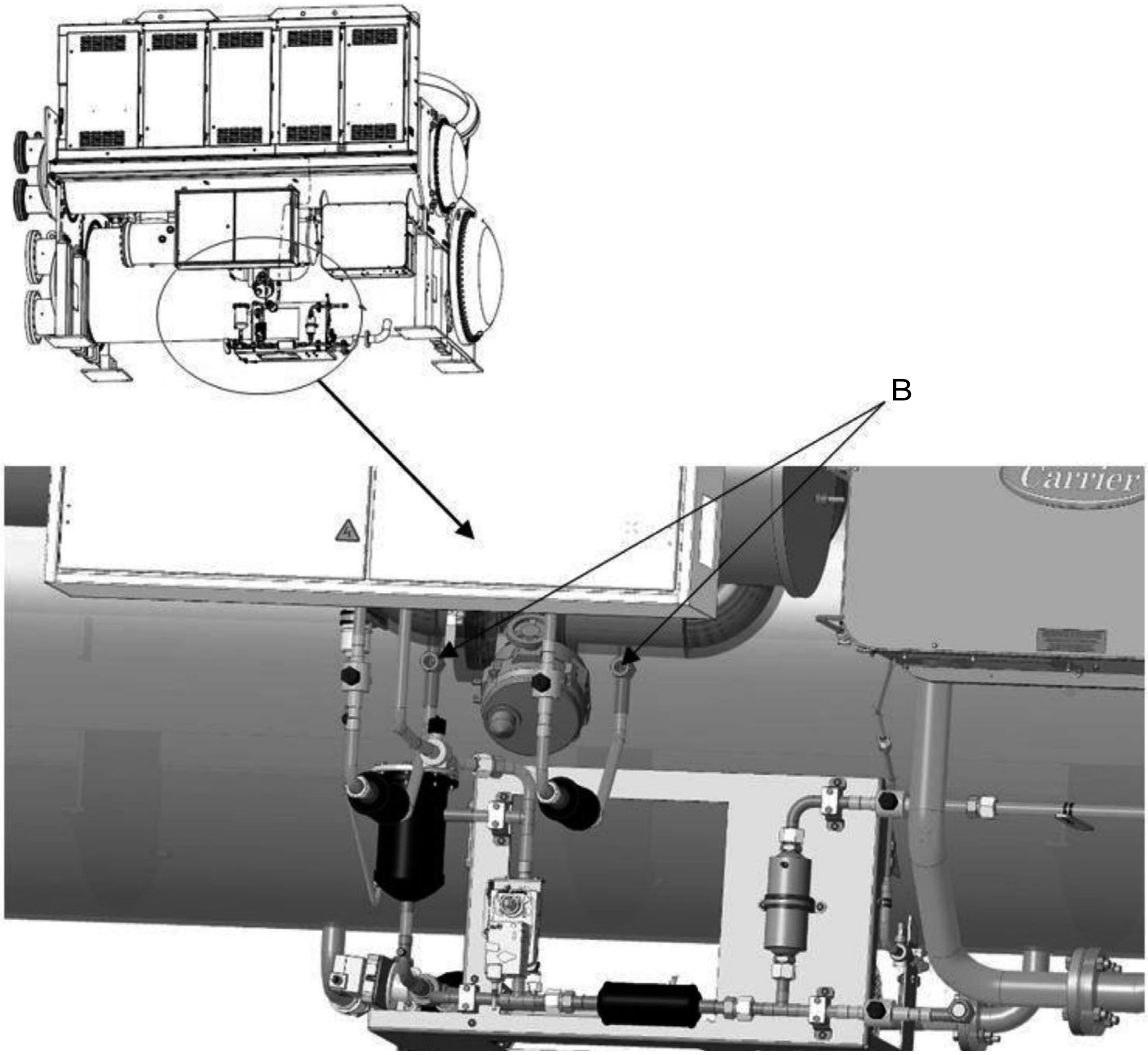
1. Enter INPUT menu and verify that Liquid Level Switch is closed (if compressor is on).
2. Check moisture indicating sight glass on bearing supply line (**Fig. 56**) as well as on the motor/VFD liquid

   cooling line (located between vessels feeding of the high side float chamber; sight glass is located downstream of filter drier)

Fig 56 - Moisture indicating sightglass for inspection



A Moisture indicating sightglass cooler side



B Moisture indicating sightglass condenser side

3. Check that pressure Ref Pump Delta P (PRESSURE Menu) is above 89.6 kPa. Check the sight glass on bearing inlet line. If it shows wet, please replace the moisture filter on refrigerant lubrication line.

9.2.2 - Check for Leaks / purge operation

Frequent purge pumpout operation is an indication of a leak. When the daily pumpout limit is exceed, 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.

9.3 - 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.

9.3.1 - Service On time

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.

9.3.2 - 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 for control checks and adjustments.

9.3.3 - Inspect Purge

A purge protects the machine against non-condensa¬ble gases.

Make sure below procedures are done when chiller is OFF.

1. First drain the liquid in purge tank using refrig¬erant pump. In Quick Test menu, open purge drain valve, purge condenser valve, cooler valve and condenser drain valve. Then run refrigerant pump to drain the refrigerant liquid. It’ll take about 15mins.
2. Close all the valves connect purge and chiller. Enter Quick Test menu, check if all the solenoid valves can work and if vacuum pump can run.

9.3.4 - Purge Unit Maintenance

1. Annually inspect the condenser coil and clean if necessary. Begin to clean the coil from the fan side with use of high-pressure air or condenser coil cleaner.
2. Inspect all the parts in purge system to see wheth¬er there is corrosion, terminal loosen or overheat¬ing.
3. Yearlychange the drain filter assembly on the liq¬uid returning line of the purge unit.

9.3.5 - 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, 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.

Moisture Removal Filter:

The filter located on the refrigerant lubrication line to bearing and motor cooling should be replaced once a year or more often if filter condition indicates a need for more frequent replacement. A moisture indicator sight glass is located downstream of this filter to indi¬cate the moisture level in refrigerant. If the moisture indicator turns yellow, locate the water source immedi¬ately by performing a thorough leak check and replace the filter.

9.3.6 - Purge Carbon Filter

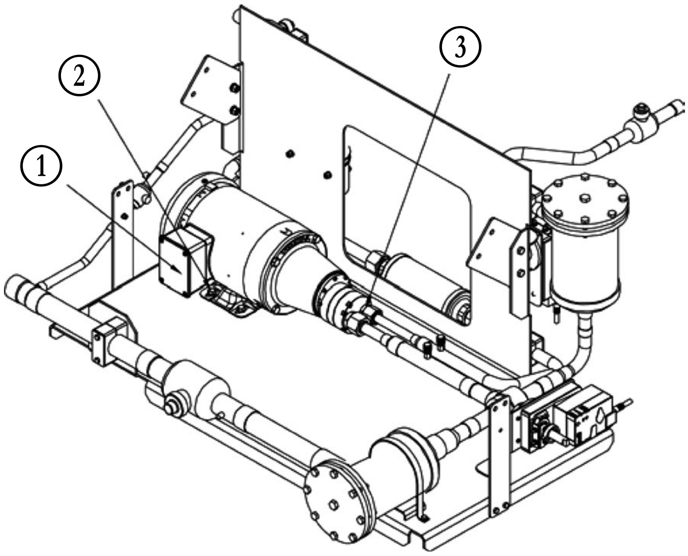
Replace only when the filter is damaged or broken.

9.3.7 - Changing refrigerant pump

If changing the refrigerant pump is necessary, please follow below procedures:

1. Disconnect the power supply;
2. Open the terminal box of the refrigerant pump (Item 1, Fig. 57), and disconnect the power cable of the refrigerant pump;
3. Unbolt the refrigerant pump mounting (Item 2, Fig. 57);
4. Unscrew the refrigerant pump inlet and outlet joints (Item 3, Fig. 57);
5. Install the new refrigerant pump;
6. Replace the O-rings in the joints assembly, and connect the inlet and outlet of the refrigerant pump with new joints;
7. Connect the refrigerant pump power cable to the terminal box.

Fig 57 – Refrigerant pump assembly



9.3.8 - Inspect Refrigerant Float System

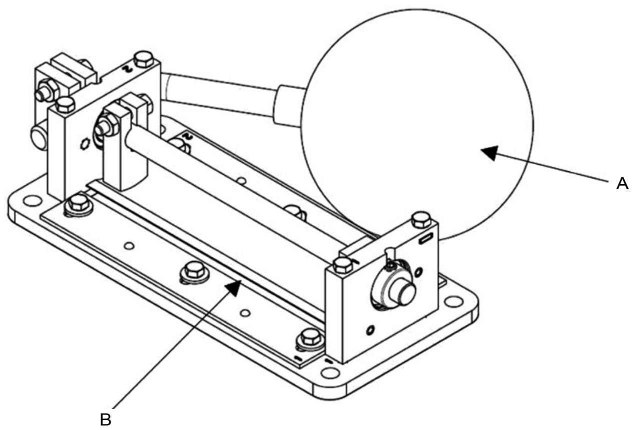
For 19DV unit, the condenser has a high side ball type float system, and the economizer has a low side ball type float system. This applies for both the high side float (first float downstream of condenser) and the low side float (second float downstream of condenser). The float refrigerant level can be observed through the sight glasses located on the float chamber. Perform the inspection every five years or if the following symptoms are seen.

- There is a simultaneous drop in cooler pressure and increase in condenser pressure. This will be accompanied by a loss of EER.
- 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.

See **Fig. 58** 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 58 - Float ball valve details



A Float ball
B refrigerant exit

9.3.9 - Inspect Safety Relief Devices and Piping

Refer to chapter 1 “Safety considerations”. The relief valves on this chiller protect the system against the potentially dangerous effects of overpressure. These devices must be kept in peak operating condition.

As a minimum, the following maintenance is required:
- At least once a year, disconnect the vent piping at the valve outlet and carefully inspect the valve body and mechanism for any evidence of internal corrosion or rust, dirt, scale, leakage, etc.
- If corrosion or foreign material is found, do not attempt to repair or recondition. Replace the valve.
- If the chiller is installed in a corrosive atmosphere or the relief valves are vented into a corrosive atmosphere, make valve inspections at more frequent intervals.

9.3.10 - Periodic check of the safety loop

Every 6 months, check the SRMCR safety loop.

The periodic tests are intended to verify the correct functioning of the following elements:
- Opening and setting of safety switches (HPS pressure switches).
- The good opening of the contactor K101 and its return of state. .
- The proper operation of the GateKill stop function.

9.3.10.1 - Checking the adjustment of safety switches

Invert the direction of the three-way valve so that the two standby switches start the operation.

Remove the first pressure switches and have their controls checked by an approved body - see Annex C, paragraph C6 of EN 378-2.

Lock the 3-way valve to prevent any mishandling.

Once the settings have been checked, reinstall the pressure switches on the three-way valve and invert the valve again to allow the operation of the pressure switch again.

9.3.10.2 - Checking the safety chain

The verification steps are described in the tables below.

Table 21 - Safety chain check

Test n ° 1:

Steps	Ok	NOK
Disconnect an active pressure switch by opening its disconnect terminal on TBS main terminal (SP1FA = S-11 ; SP1FB= S-12 ; SP2FA = S-21 ; SP2FB = S-22). 2- Check that the OUT LED of the safety relay K4 goes out.	Na	
3- Check that the round tap of the K101 contactor is not depressed. Check that the alarm corresponding to the opening of the Gate Kill input is present		
4- Reconnect the pressure switch. Switch off the power supply by acting on the QF1 circuit breaker. Wait at least 5 seconds Put the power supply back on the circuit breaker QF1. Reset the safety relay by pressing the reset button.	Na	
5- Check that the PWR, IN and OUT LED of the safety relay K4 is on. Check that the contactor tap K101 is depressed.		

Test n ° 2:

Steps	Ok	NOK
1- Machine under tension with K101 closed.		
2- Disconnect the NC contact signal from the K101 from the S-33 terminal of the TBS terminal block	Na	
3- Disconnect an active pressure switch by opening its disconnect terminal on TBS main terminal (SP1FA = S-11 ; SP1FB= S-12 ; SP2FA = S-21 ; SP2FB = S-22).	Na	
4- Check that the OUT LED of the safety relay K4 is off.		
5- Check that the contactor tap K101 is not depressed.		
6- Close the disconnect terminal of the pressure switch wiring Switch off the power supply by acting on the QF1 circuit breaker. Wait at least 5 seconds Put the power supply back on the circuit breaker QF1. Reset the safety relay by pressing the reset button.	Na	
7- Check that the OUT LED of the safety relay K4 is still off.		
8- Check that the K101 contactor tap is still not depressed.		
9- Reconnect the NC contact	Na	
10- Reset the safety relay by pressing the reset button.	Na	
11- Check that the PWR, IN and OUT LED of the safety relay K4 is on. Check that the contactor tap K101 is depressed		

9.3.11 - 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.

9.3.12 - Inspect the Heat Exchanger Tubes and Flow Devices

9.3.12.1 - 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 necessary 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.

Verify the flow and speed with the data in the Electronic Catalogue selection program for the unit.

9.3.12.2 - 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.

Verify the flow and speed with the data in the Electronic Catalogue selection program for the unit.

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.

When the refrigeration logs indicates a rise above normal condenser pressures, check the purge pump out as follow:

1. Check purge out frequency on HMI touch screen purge menu. If average pump out time per day is above 15 min. Please check the leak and repair it. Using purge to pump out remaining non-condensable inside chiller.
2. If, however, purge pump out time per day is below 15 min, the high condenser pressure is caused by dirty tubes or by abnormal conditions in the condensing water circuit such as restricted flow, etc..
3. Check operation of condensing water circuit. If water conditions (flow and temperature) appear normal, the tubes should be cleaned.

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

CAUTION: Scale may require chemical treatment for its prevention or removal. Consult a water treatment specialist for proper treatment.

9.3.13 - 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 indicates whether there is water or air leakage during chiller operation. Water leaks must be repaired immediately.

CAUTION: The chiller must be dehydrated after repair of water leaks or damage may result. See Chiller Dehydration section.

9.3.14 - 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.

9.3.15 - Inspect / remove the power cabinet equipment

Before working on the electrical equipment, shut off the chiller. Ensure that no circuit is energized and that all are isolated by a main disconnect switch.

Check the cable tightness.

Access to low-voltage electrical equipment is dangerous and can result in death or serious injury. Personnel working on the control boxes must be qualified to work on low-voltage installations in accordance with the safety regulations applicable at the site. It must be authorized for the work and familiar with the equipment and the installation, as well as the instructions and safety measures described in this document.

Never work on a unit that is energized.

Do not work on any electrical components, until the main unit power supply has been switched off using the disconnect switch(es) integrated into the control box(es).

During maintenance periods lock the power supply circuit upstream of the unit in the open position.

ATTENTION: 19DV power cabinets are equipped with capacitor coils with a discharge time after a power cut of five minutes. If the discharge circuit in the capacitor fails it is not possible to define the discharge time.

After cutting the power supply to the control box, wait five minutes before accessing the control box.

Ensure that there is no power supply to any conducting parts of the power circuit that are accessible during the work.

WARNING: On certain installations linked to a specific application (datacenter, industrial process ...), the 19DV can be equipped with a second 400/3/50 emergency power supply to permanently supply the following equipment:

- ***control of the drive***
- ***chiller control***
- ***the purge group***
- ***the refrigerant pump***

Even if the main power is turned off in the VFD compartment, when the VFD compartment is open, the 400V backed up power supply is present. Refer to the labels on the outside and inside of the compartment as well as on the equipment mentioned above for the precautions to be used and identify possible risks.

Wait five minutes before accessing the control box after disconnecting the power supply.

Ensure that no conductive part of the supply circuit accessible during the operation is energized.

These are special instructions to disassemble a chiller equipped with VFD :

IMPORTANT: Only a qualified technician can carry out these operations.

WARNING: Do not attempt to disconnect the flanges, if the chiller is under pressure. The chiller has not been purged, and this can cause injuries or damage to the machine.

Ensure that the power supply has been disconnected and that all safety measures are in place, before removing the VFD box. This procedure minimizes the number of sensors and cables that need to be disconnected.

WARNING: Do not disconnect the evaporator and condenser before VFD has been disconnected and removed. VFD box has a high-level centre of gravity and can tip over when the heat exchangers are disconnected, which can lead to material damage and/or serious injuries to personnel.

WARNING: Do not attempt to remove the VFD, before closing the shut-off valve on the refrigerant circuit. If this warning is not observed, the VFD removal will lead to a significant and uncontrolled refrigerant leak. A refrigerant leak can damage the machine and displace oxygen, which can cause asphyxiation.

For commissioning, installation and operation instructions for units with VFD LF2 and PIC5+ control, refer to chapter 8 of the Carrier 19XR / 19XRV manual.

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 power cabinet 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.

9.3.16 - 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 evaporator entering and leaving water pressure, as well as condenser entering and leaving water pressure.

9.3.17 - Recalibrate Temperature Thermistors

Entering chilled water (ECW), leaving chilled water (LCW), entering condenser water (ECDW), leaving condenser water (LCDW).

9.3.18 - Corrosion control

All metallic parts of the unit (chassis, cabinets, panels, heat exchangers…) are protected against corrosion by a coating of powder or liquid paint. To prevent the risk of blistering corrosion that can appear when moisture penetrates under the protective coatings, it is necessary to carry out periodic checks of the coating (paint) condition.

9.3.19 - 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.

10.1 - overview

The PIC 5+ control system has many features to help the operator and technician troubleshoot a 19DV chill-er.

- The PIC 5+ TOUCH SCREEN shows the chiller's actual operating conditions and can be viewed while the unit is running.
- The PIC 5+ TOUCH SCREEN default screen indi¬cates when an alarm occurs. Once all alarms have been cleared (by correcting the problems), the PIC 5+ TOUCH SCREEN default screen indicates normal operation. For information about display¬ing and resetting alarms and a list of alert codes, please refer to separated PIC5+ Control User Manual.
- The Configuration menu screens display informa¬tion that helps to diagnose problems with chilled water temperature control, chilled water temper¬ature control overrides, envelope control valve control, surge algorithm status, and time schedule operation.
- The quick test feature facilitates the proper oper¬ation 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. The PIC 5+ TOUCH SCREEN shows the temperatures and pressures required during these operations.
- If an operating fault is detected, an alarm indica¬tor is displayed on the PIC 5+ TOUCH SCREEN 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, please refer to separated PIC5+ Control User Manual. Press the bell icon in the top right corner of the home screen to access current alarms and alarm history, and to reset alarms.

10.2 - Checking Display Messages

The first area to check when troubleshooting the 19DV is the PIC 5+ TOUCH SCREEN display. Status mes-sages are displayed at the bottom of the screen, and the alarm icon indicates a fault. For a complete list of alarms, please refer to separated PIC5+ Control User Manual.

10.3 - Checking Temperature Sensors

All temperature sensors are NTC thermistor type sen¬sors. This means that the resistance of the sensor varies with temperature. All sensors have the same resistance characteristics. If the controls are on, de-termine 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 **Table XX.**

10.4 - Resistance Check

Turn off the control power from the module, discon¬nect the terminal plug of the sensor in question. With a digital ohmmeter, measure sensor resistance between receptacles as designated by the wiring diagram. The resistance and corresponding temperature are listed in **table 22**. Check the resistance of both wires to ground .This resistance should be infinite.

10.5 - Voltage Drop Check

The voltage drop across any energized sensor can be measured with a digital voltmeter while the control is energized. **Table 22** lists the relationship between temperature and sensor voltage drop (dv volts meas¬ured 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 22 - Voltage drop and resistance vs temperature

Temperature (°C)	Pic voltage drop (V)	Resistance (Ohms)
-33	4,722	105 616
-32	4,706	99 640
-31	4,688	93 928
-30	4,67	88 480
-29	4,65	83 297
-28	4,63	78 377
-27	4,608	73 722
-26	4,586	69 332
-25	4,562	65 205
-24	4,538	61 343
-23	4,512	57 745
-22	4,486	54 411
-21	4,458	51 341
-20	4,429	48 536
-19	4,399	45 819
-18	4,368	43 263
-17	4,336	40 858
-16	4,303	38 598
-15	4,269	36 476
-14	4,233	34 484
-13	4,196	32 613
-12	4,158	30 858
-11	4,119	29 211
-10	4,079	27 663
-9	4,037	26 208
-8	3,994	24 838
-7	3,951	23 545
-6	3,906	22 323
-5	3,861	21 163
-4	3,814	20 083
-3	3,765	19 062
-2	3,716	18 097
-1	3,667	17 185
0	3,617	16 325
1	3,565	15 513
2	3,512	14 747
3	3,459	14 023
4	3,406	13 341
5	3,353	12 696
6	3,298	12 087
7	3,242	11 510
8	3,185	10 963
9	3,129	10 444
10	3,074	9 949
11	3,016	9 486
12	2,959	9 046
13	2,901	8 628
14	2,844	8 232
15	2,788	7 855
16	2,73	7 499
17	2,672	7 160
18	2,615	6 839
19	2,559	6 535
20	2,503	6 246
21	2,447	5 972
22	2,391	5 711
23	2,335	5 463
24	2,28	5 226
25	2,227	5 000
26	2,173	4 787
27	2,12	4 583
28	2,067	4 389
29	2,015	4 204
30	1,965	4 028
31	1,914	3 861
32	1,865	3 701
33	1,816	3 549
34	1,768	3 404
35	1,721	3 266
36	1,675	3 134
37	1,629	3 008
38	1,585	2 888
39	1,542	2 773
40	1,499	2 663
41	1,457	2 559
42	1,417	2 459
43	1,377	2 363
44	1,338	2 272
45	1,3	2 184
46	1,263	2 101
47	1,227	2 021
48	1,192	1 944
49	1,158	1 871
50	1,124	1 801
51	1,091	1 734
52	1,06	1 670
53	1,029	1 609
54	0,999	1 550
55	0,969	1 493
56	0,941	1 439
57	0,913	1 387
58	0,887	1 337
59	0,861	1 290
60	0,835	1 244
61	0,811	1 200
62	0,787	1 158
63	0,764	1 117
64	0,741	1 079
65	0,719	1 041
66	0,698	1 006
67	0,677	971
68	0,657	938
69	0,638	906
70	0,619	876
71	0,601	846
72	0,583	818
73	0,566	791
74	0,549	765
75	0,533	740
76	0,518	715
77	0,503	692
78	0,488	670
79	0,474	648
80	0,46	628
81	0,447	608
82	0,434	588
83	0,422	570
84	0,41	552
85	0,398	535
86	0,387	518
87	0,376	502
88	0,365	487
89	0,355	472
90	0,344	458
91	0,335	444
92	0,325	431
93	0,316	418
94	0,308	405
95	0,299	393
96	0,291	382
97	0,283	371
98	0,275	360
99	0,267	349
100	0,26	339
101	0,253	330
102	0,246	320
103	0,239	311
104	0,233	302
105	0,227	294
106	0,221	286
107	0,215	278
108	0,21	270
109	0,205	262
110	0,198	255
111	0,193	248
112	0,188	242
113	0,183	235
114	0,178	229
115	0,174	223
116	0,17	217
117	0,165	211
118	0,161	205
119	0,157	200
120	0,153	195

10.6 - Check Sensor Accuracy

Place the sensor in a medium of known temperature and compare that temperature to the measured read-ing. The thermometer used to determine the tempera¬ture of the medium should be of laboratory quality with 0.25 °C graduations. The sensor in question should be accurate to within 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 @ 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 ± 1.2°C.

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 59 and 60.**

Fig 59 - 1st stage / 2nd stage Bearing Temperature (RT39C / RT40C) sensor wiring

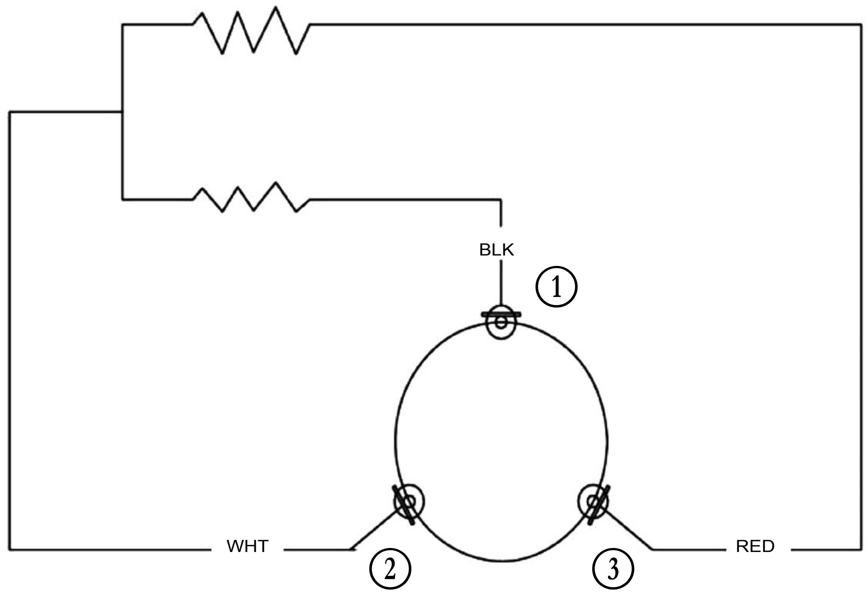


Fig 60 - Winding Temperature (RT31C) sensor wiring

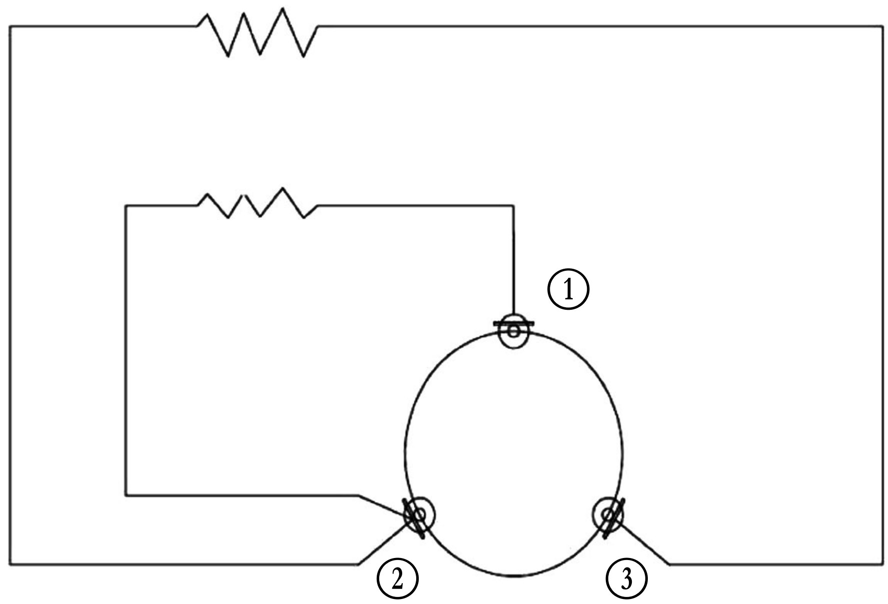
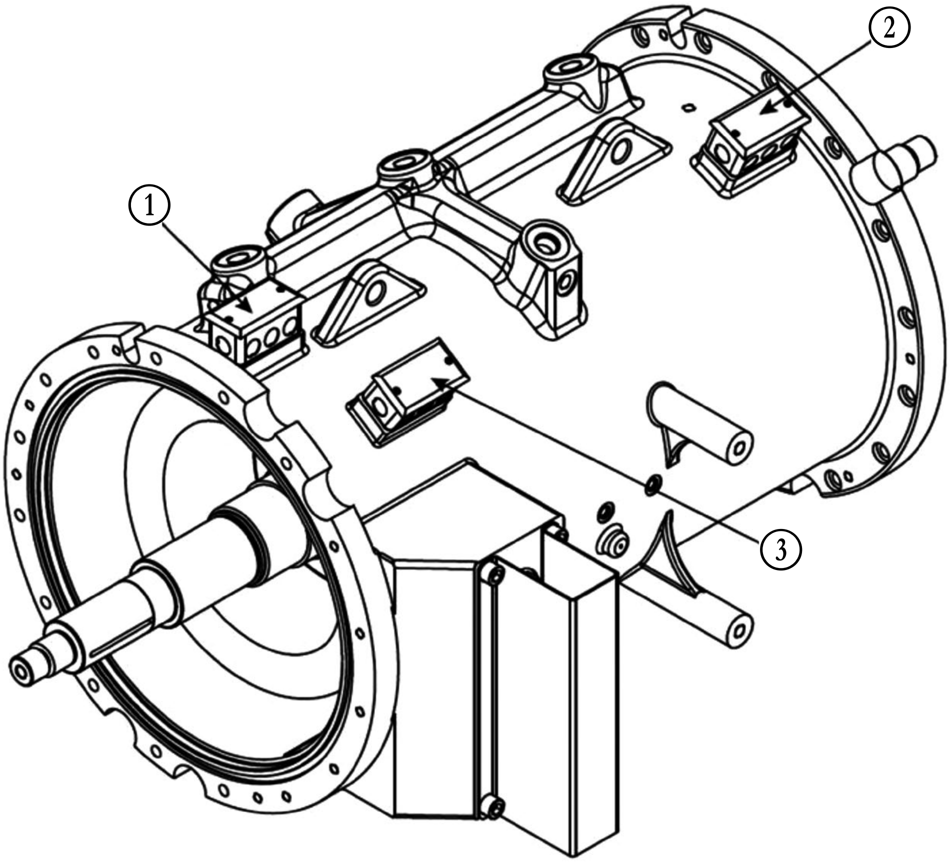


Fig 61 - Motor housing temperature sensors



1. 2nd stage bearing temperature sensor (RT40C)
2. 1st stage bearing temp. sensor (RT39C)
3. Motor winding temp sensor (RT31C)

10.7 - 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 >> 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.

10.8 - 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).

See 5.9.1 section for calibration.

10.9 - 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, envelop control valve, alarms, condenser, and chilled water pumps. The tests can help to determine whether a switch is defective or a 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.

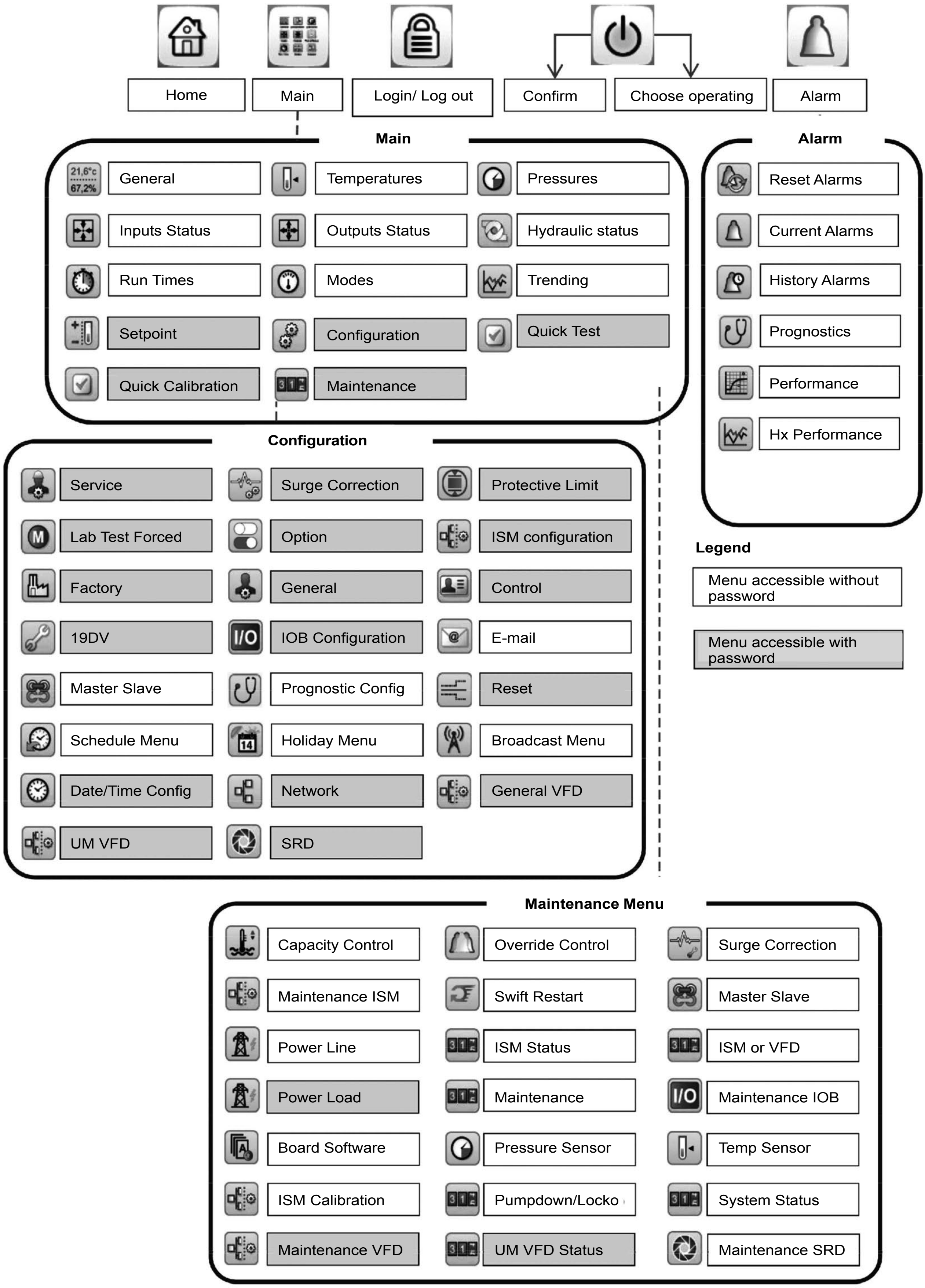
10.10 - Quick Calibration

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

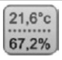
10.11 - Pumpdown/Lockout

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.

APPENDIX A — PIC 5+ SCREEN AND MENU STRUCTURE
Screen Structurea



APPENDIX A — PIC 5+ SCREEN AND MENU STRUCTURE (cont)
Detailed menu description

ICON	DISPLAYED TEXT*	Description	ASSOCIATED TABLE
	General Parameters	General Parameters	GENUINT
	Temperatures	Temperatures	TEMP
	Pressures	Pressures	PRESSURE
	Inputs Status	Inputs Status	INPUTS
	Outputs Status	Outputs Status	OUTPUTS
	Hydraulic Status	Hydraulic Status	HYDRLIC
	Run Times	Run Times	RUNTIME
	Modes	Modes	MODES
	Setpoint Table	Setpoint table	SETPOINT
	Configuration Menu	Configuration Menu	CONFIG
	Quick Test Table	Quick Test table	QCK_TEST
	Maintenance Menu	Maintenace Menu	MAINTAIN
	Trending	Trending	TRENDING

APPENDIX B — MAINTENANCE SUMMARY AND LOG SHEETS
19DV Maintenance Interval Requirements

WEEKLY			
COMPRESSOR	None.	CONTROLS	Review PIC 5+ Alarm/Alert History.
COOLER	None.	VFD	None.
CONDENSER	None.	LIQUID RECLAIM	None.
PURGE	Check average pump out counts.		
MONTHLY			
COMPRESSOR	None.	CONTROLS	Review PIC 5+ Alarm/Alert History.
COOLER	None.	VFD	None.
CONDENSER	None.	LIQUID RECLAIM	None.
PURGE	Check average pump out counts.		
FIRST YEAR			
COMPRESSOR	Change bearing filter.	CONTROLS	Perform general cleaning. Tighten connections. Check pressure transducer. Confirm accuracy of thermistor.
COOLER	Inspect and clean cooler tubes. Inspect safety valves. Leak test. Verify water pressure differential. Inspect water pumps and cooling tower	VFD	Perform general cleaning. Tighten connections. Change two liquid reclaim filters.
CONDENSER	Replace refrigerant filter/drier. Inspect safety valves. Leak test. Verify water pressure differential. Inspect water pumps and cooling tower.	LIQUID RECLAIM	
PURGE	Replace purge drain filter.		
ANNUALLY			
COMPRESSOR	Change bearing filter	CONTROLS	Perform general cleaning. Tighten connections. Check pressure transducer. Confirm accuracy of thermistor.
COOLER	Inspect and clean cooler tubes. Inspect safety valves. Leak test. Verify water pressure differential. Inspect water pumps and cooling tower.	VFD	Perform general cleaning. Tighten connections.
CONDENSER	Replace refrigerant filter/drier. Inspect safety valves. Leak test. Verify water pressure differential. Inspect water pumps and cooling tower	LIQUID RECLAIM	Change two liquid reclaim filters
PURGE	Replace purge drain filter		
EVERY 3-5 YEARS			
COMPRESSOR	None.	CONTROLS	None.
COOLER	Perform eddy current test.	VFD	None.
CONDENSER	Inspect float valve and strainer. Perform eddy current test.	LIQUID RECLAIM	None.
PURGE	None.		
EVERY 5 YEARS			
COMPRESSOR	None.	CONTROLS	None.
COOLER	None.	VFD	None.
CONDENSER	None.	LIQUID RECLAIM	Inspect two liquid reclaim filters Replace the two liquid reclaim filters..
PURGE	None.		
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 clean tubes	LIQUID RECLAIM	None.
PURGE	None.		

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

APPENDIX B — MAINTENANCE SUMMARY AND LOGSHEETS (cont.)
19DV monthly Maintenance Log

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

UNIT SECTION	ACTION	UNIT	ENTRY											
COMPRESSOR	Leak Test	kg/h												
	Inspect Compressor Rotation	yes/no												
	Bearing Inspection	yes/no												
COOLER	Inspect and Clean Cooler Tubes	yes/no												
	Inspect safety Valves	yes/no												
	Leak Test	kg/h												
	Record Water Pressure Differential	kPa												
	Inspect Water Pumps	yes/no												
	Eddy Current Test	yes/no												
CONDENSER	Leak Test	kg/h												
	Inspect and Clean Condenser Tubes	yes/no												
	Record Water Pressure Differential	kPa												
	Inspect Water Pumps and Cooling Tower	yes/no												
	Replace Refrigerant Filter Drier	yes/no												
	Inspect Float Valve and Strainer	yes/no												
	Eddy Current Test	yes/no												
CONTROLS	General Cleaning and Tightening Connections	yes/no												
	Check Pressure Transducers	yes/no												
	Confirm Accuracy of Thermistors	yes/no												
	Perform Automated Controls Test	yes/no												
VFD	General Tightening and Cleaning Connections	yes/no												
LIQUID RECLAIM	Inspect liquid reclaim filter	yes/no												

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

APPENDIX B — MAINTENANCE SUMMARY AND LOG SHEETS (cont)
19XR Seasonal Shutdown Log

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

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

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

Order No.: 10542, 07.2019. Supersedes order No.: New.
Manufacturer reserves the right to change any product specifications without notice.

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Printed in the European Union.