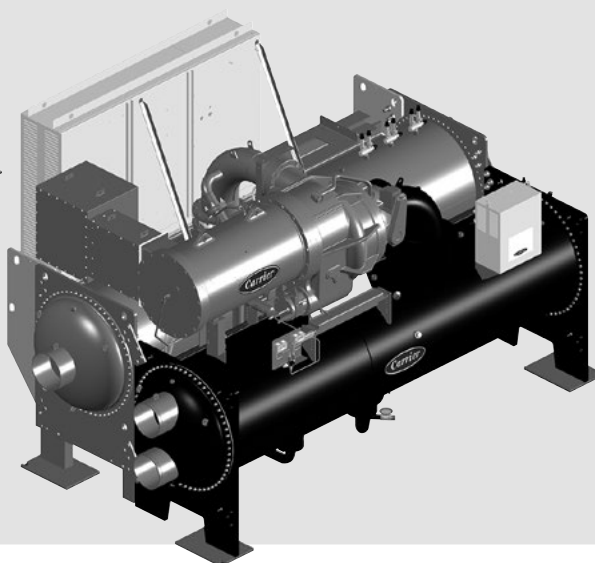
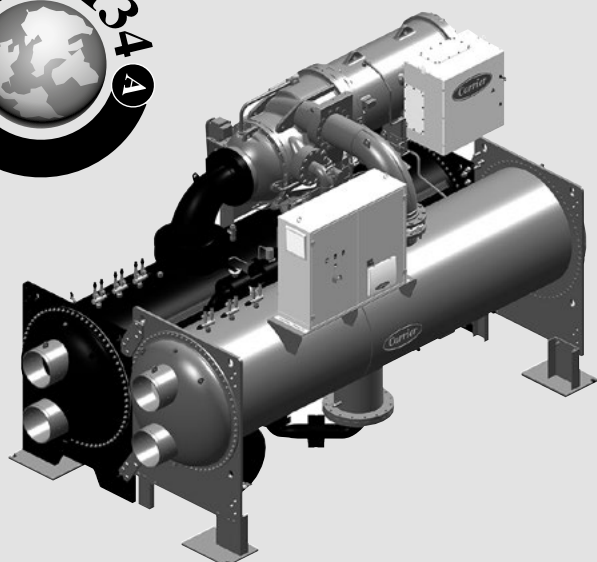




United Technologies



INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS



Hermetic Centrifugal Liquid Chillers SINGLE STAGE / DUAL STAGE 19XR PIC II/19XRV PIC III 19XR/XRV PIC 5

Nominal cooling capacity 1000 - 5300kW - 50 Hz

CONTENTS

INITIAL START-UP CHECKLIST FOR 19XR HERMETIC CENTRIFUGAL LIQUID CHILLERS.....	7
19XR HERMETIC CENTRIFUGAL LIQUID CHILLER CONFIGURATION SETTINGS LOG	9
1 - SAFETY CONSIDERATIONS	10
1.1 - Installation safety considerations	10
1.2 - Maintenance safety considerations	10
1.3 - Operating checks, valves.....	10
1.4 - Equipment and components under pressure	11
1.5 - Repair safety considerations	11
2 - INTRODUCTION AND CHILLER FAMILIARISATION.....	12
2.1 - CE marking	12
2.2 - Abbreviations and explanations	12
2.3 - Chiller familiarization 19XR.....	13
2.4 - Starting equipment.....	22
2.5 - Controls	23
3 - INSTALLATION.....	24
3.1 - Introduction	24
3.2 - Receiving the machine.....	24
3.3 - Rigging the machine and dimensional information	24
3.4 - Install machine supports.....	34
3.5 - Connection of water piping.....	37
3.6 - Make electrical connections.....	42
3.7 - Install field insulation See Fig. 29 - “Machine isolation”.	47
3.8 - Installation of a refrigerant leak detection module (option 159)	48
4 - BEFORE INITIAL START-UP.....	50
4.1 - Necessary checks	50
4.2 - Chiller tightness.....	51
4.3 - Standing vacuum test	52
4.4 - Chiller dehydration.....	52
4.5 - Inspect wiring.....	54
4.6 - Oil charge	54
4.7 - Power-up the controls and check the oil heater.....	54
4.8 - Software Configuration	55
4.9 - Check optional pumpout system controls and compressor.....	67
4.10 - High altitude locations.....	67
4.11 - Charge refrigerant into chiller	67
4.12 - 19XR Chiller equalization without pumpout unit.....	67
4.13 - 19XR Chiller equalization with pumpout unit	68
4.14 - Trimming refrigerant charge	69
5 - INITIAL START-UP	70
5.1 - Preparation.....	70
5.2 - Dry run to test start-up sequence	70
5.3 - Check rotation	70
5.4 - Check oil pressure and compressor stop	71
5.5 - To prevent accidental start-up	71
5.6 - Check chiller operating condition	71
5.7 - Instruct the customer operator	71
6 - OPERATING INSTRUCTIONS	72
6.1 - Operator duties.....	72
6.2 - To start the chiller.....	72
6.3 - Check the running system	73
6.4 - To stop the chiller	74
6.5 - After limited shutdown.....	74
6.6 - Extended shutdown	74
6.7 - After extended shutdown	74
6.8 - Cold-weather operation.....	74
6.9 - Manual guide vane operation	74
6.10 - Refrigeration log	74

7 - MAINTENANCE.....	76
7.1 - General maintenance.....	76
7.2 - Weekly maintenance	77
7.3 - Scheduled maintenance	78
APPENDIX A: PARTICULARS OF 19XRV MACHINES - ROCKWELL LIQUID FLOW 2.....	87
8 - 19XRV - SAFETY CONSIDERATIONS FOR MAINTENANCE	87
8.1 - Electrical maintenance	87
8.2 - Mechanical maintenance	87
9 - 19XRV - EQUIPMENT PRESENTATION.....	91
9.1 - Environmental conditions	91
9.2 - CE Marking.....	91
9.3 - Description of electrical equipment elements	91
9.4 - General compressor speed control principles.....	93
9.5 - Variable-frequency drive cooling.....	93
9.6 - Flow detection by the saturated suction temperature sensor	94
9.7 - Electrical specifications	94
10 - 19XRV - INSTALLATION INSTRUCTIONS AND ELECTRICAL CONNECTION.....	94
10.1 - Introduction	94
10.2 - Receiving the machine.....	94
10.3 - Physical data	94
10.4 - Location of connection points and interfaces.....	95
10.5 - Electrical connections	95
10.6 - Equipment details	95
11 - 19XRV PIC III - BEFORE THE INITIAL START UP	96
11.1 - Before energizing the unit.....	96
11.2 - Start-up checks	96
11.3 - Control checks	96
12 - 19XRV PIC III - INITIAL START-UP	97
12.1 - Motor rotation check	97
12.2 - Compressor start-up.....	97
13 - 19XRV PIC - OPERATING MODE.....	97
13.1 - Shutdown controlled by the machine	97
13.2 - Manual override commands.....	98
13.3 - Gateway communication module status LEDs	98
13.4 - Power module status LEDs :	99
13.5 - Safety shutdowns and cuts.....	99
14 - 19XRV PIC III – MAINTENANCE.....	100
14.1 - Special precautions during maintenance	100
14.2 - Periodic maintenance.....	100
APPENDIX B: PARTICULARS OF CARRIER 19XRV PIC III MACHINES - EATON XVE DRIVES.....	101
15 - 19XRV PIC III - SAFETY CONSIDERATIONS FOR MAINTENANCE.....	101
15.1 - Electrical maintenance	101
15.2 - Mechanical maintenance	101
16 - 19XRV PIC III - EQUIPMENT PRESENTATION.....	104
16.1 - Environmental conditions	104
16.2 - CE marking	104
16.3 - Description of electrical equipment elements	104
16.4 - General compressor speed control principles.....	107
16.5 - Variable-frequency drive cooling.....	107
16.6 - Flow detection by the saturated suction temperature sensor	108
16.7 - Electrical specifications	108
19XRV PIC III - INSTALLATION INSTRUCTION AND ELECTRICAL CONNECTION	108
16.8 - Introduction	108
16.9 - Receiving the machine.....	108
16.10 - Physical data	108
16.11 - Location of connection points and interfaces.....	110
16.12 - Electrical connections	110
16.13 - Equipment details	110

17 - 19XRV PIC III - BEFORE THE INITIAL START-UP	111
17.1 - Before energizing the unit.....	111
17.2 - Start-up checks	113
18 - 19XRV PIC III - INITIAL START-UP	114
18.1 - Motor rotation check	114
18.2 - Compressor start-up.....	114
19 - 19XRV PIC III - OPERATING MODE	114
19.1 - Shutdown controlled by the machine	114
19.2 - Manual override commands.....	114
19.3 - Gateway communication module status LEDs	114
19.4 - Keypad module status Indicator.....	115
19.5 - Safety shutdowns and cuts.....	115
20 - 19XRV PIC III - MAINTENANCE	116
20.1 - Special precautions during maintenance	116
20.2 - Periodic maintenance.....	116
APPENDIX C: PARTICULARS OF 19XR UNITS WITH INTEGRATED PROGRESSIVE ELECTRONIC STARTER.....	116
21 - 19XR UNIT MOUNTED SOFTSTARTER: MAINTENANCE SAFETY CONSIDERATIONS	116
22 - EQUIPMENT PRESENTATION	116
22.1 - Environmental conditions	116
22.2 - CE marking	116
22.3 - Description of electrical equipment elements	116
22.4 - Soft starter operation.....	117
22.5 - Control box cooling.....	117
22.6 - Electrical specifications	117
23 - INSTALLATION INSTRUCTIONS AND ELECTRICAL CONNECTION.....	117
23.1 - Introduction	117
23.2 - Receiving the machine.....	117
23.3 - Physical data	117
23.4 - Location of connection points and interfaces.....	118
23.5 - Electrical connections.....	118
23.6 - Equipment details 24.6.1 - Isolation.....	118
24 - BEFORE THE INITIAL START-UP.....	119
24.1 - Wiring and installation inspection.....	119
24.2 - Start-up checks	119
24.3 - PIC control checks	120
25 - INITIAL START-UP	120
25.1 - Motor rotation check	120
25.2 - Compressor start-up and starter control adjustment.....	120
26 - OPERATION.....	120
26.1 - Machine shut-down.....	120
26.2 - Fault diagnosis	120
26.3 - Reset after a fault	120
27 - MAINTENANCE.....	121
27.1 - Isolation check.....	121
27.2 - Periodic maintenance.....	121

FIGURES

Figure 1 - Model Number nomenclature	14
Figure 2 - 19XR machine components – single stage	15
Figure 3 - 19XR-E machine components – dual stage	16
Figure 4 - Typical 19XR unit diagram – single stage (for 19XRV particulars refer to Fig. 69).....	18
Figure 5 - Typical 19XR/XRV unit diagram – dual stage	19
Figure 6 - Lubrication system – single stage	21
Figure 7 - Lubrication system – dual stage	21
Figure 8 - Gerotor oil pump	22
Figure 9 - 19XR rigging information	25
Figure 10 - Machine operating weights	28
Figure 11 - 19XR Cooler side view	28
Figure 12 - 19XR Chiller top view	29
Figure 13 - Compressor control details	29
Figure 14 - 19XR Rear view	30
Figure 15 – Service spaces location.....	32
Figure 16 - Standard isolation	34
Figure 17 - 19XR Chiller footprint	35
Figure 18 - Levelling accessory for 19XR units.....	36
Figure 19 - 19XR Spring isolation.....	36
Figure 20 - Typical nozzle piping (not supplied by Carrier)	37
Figure 21 - Standard waterboxes and nozzle arrangements (19XR).....	38
Figure 22 - Optional pumpout system piping schematic with storage tank.....	39
Figure 23 - Pumpout system piping schematic without storage tan.....	40
Figure 24 - Relief device locations.....	41
Figure 25 - Unit with unit-mounted starter/variable-frequency drive.....	44
Figure 26 - Unit with separate starter/variable-frequency drive.....	45
Figure 27 - Diameter and distance between terminals for the wiring between compressor starter and motor	46
Figure 28 - COMM1 CCN communication wiring for multiple 19XR chillers (typical).....	47
Figure 29 - Machine Isolation.....	48
Figure 30 - View of module in the control box.....	49
Figure 31 - Detector support fixing.....	49
Figure 32 - Detector fixing.....	49
Figure 33 - Changing SW2 switch 1	49
Figure 34 - Dehydration cold trap	52
Figure 35 - 19XR leak detection procedure	53
Figure 36 - Effect of SURGE/HGBP DELTA TSMIN on Surge Prevention.....	58
Figure 37 - Effect of SURGE/HGBP DELTA TSMAX on Surge Prevention	58
Figure 38 - Effect of SURGE LINE SHAPE FACTOR on Surge Prevention.....	58
Figure 39 - Effect of SURGE LINE SPEED FACTOR on Surge Prevention	59
Figure 40 - Main Menu Icon	61
Figure 41 - Main Menu — Setpoint Table Icon.....	62
Figure 42 - Setpoint Table Screen	62
Figure 43 - Screen Structure, Basic Level (All) Access (No Password Required)	62
Figure 44 - Screen Structure, User Level Access (User Password Required)	62
Figure 45 - Screen Structure, Service (Advanced User) /Factory Level Access Password Required)	62
Figure 46 - Lock Icon	63
Figure 47 - User Login Screen.....	63
Figure 48 - Pressure sensor calibration screen	67
Figure 49 - Rotation diagram	70
Figure 50 - Chiller OFF Icon.....	72
Figure 51 - Local On.....	72
Figure 52- Control Timing Sequence for Normal Start-Up.....	73
Figure 53 - Guide vane actuator linkage.....	77
Figure 54 - 19XR float valve design.....	79
Figure 55 - Economizer Float system (2 stage compressor chiller)	79
Figure 56 - Economizer Float system (2 stage compressor chiller)	79
Figure 57 - Compressor fits and clearances – single stage compressor	80
Figure 58 - Compressor fits and clearances – two stage compressors	83
Figure 59 - Motor lead installation labels	85
Figure 60 - VFD cooling circuit.....	88
Figure 61 - VFD box installation (rear view)	88
Figure 62 - VFD tunnel-side view	89
Figure 63 - Lifting the VFD.....	89

Figure 64 - Detailed perspective view of the unit	90
Figure 65 - VFD box support installation (rear view)	91
Figure 66 - VFD box installation (front view).....	91
Figure 67 - Variable-frequency drive cabinet for machines with maximum nominal current up to 608 A (19XR-506---912 and 19XR-506---922)	92
Figure 68 - Variable-frequency drive cabinet for machines with maximum nominal current above 608 A (19XR-507---802 and 19XR-507---812).....	92
Figure 69- Typical 19XRV unit diagram.....	93
Figure 70 - Height of 19XRV with variable-frequency	94
Figure 71 - Height of 19XRV with variable-frequency drive - 19XR-507---802 and 19XR-507---812	95
Figure 72 - Location of the 19XRV isolation valves.....	96
Figure 73 - 19XRV PIC 3 Communication gateway.....	98
Figure 74 - 19XRV PIC 5 Communication gateway.....	99
Figure 75 - 19XRV Communication interface board	100
Figure 76 - VFD cooling circuit view.....	102
Figure 77 - VFD mounted view.....	102
Figure 78 - Lifting the VFD	103
Figure 79 - Variable-frequency drive cabinet for machines with maximum nominal current up to 680A (19XVE0485, 19XVE0550, 19XVE0605 and 19XVE0680).....	105
Figure 80 - Variable-frequency drive cabinet for machines with maximum nominal current up to 1070A (19XVE0765, 19XVE0855, 19XVE0960 and 19XVE1070).....	106
Figure 81 - Variable-frequency drive cabinet for machines with maximum nominal current up to 1530A (19XVE1275 and 19XVE1530).....	106
Figure 82 - Typical 19XRV unit diagram.....	107
Figure 83 - Height of 19XRV with variable-frequency drive – 19XVE0485, 19XVE0550, 19XVE0605 and 19XVE0680.....	109
Figure 84 - Height of 19XRV with variable-frequency drive – 19XVE0765, 19XVE0855, 19XVE0960 and 19XVE1070.....	109
Figure 85 - Height of 19XRV with variable-frequency drive – 19XVE1275, 19XVE1530.....	110
Figure 86 - Location of the 19XRV isolation valves.....	111
Figure 87 - Jumpers configuration of OPTA9 card and card emplacement	112
Figure 88 - 19XRV Communication gateway.....	114
Figure 89 - 19XRV Communication interface board Location of the keypad module status LEDs and indicator for variable-frequency drives	115
Figure 90 - Access to the motor terminals	119

TABLES

Table 1 - Chiller dimensions and weight data	26
Table 2 - Chiller operating weights – weight distribution	27
Table 3 - Service spaces recommendation	31
Table 4 - Job Site Parameters	56
Table 5 - Control Test Menu Functions.....	60
Table 6 - Job Site Parameters	64
Table 7 - Quick Test Table.....	66
Table 8 - Prestart Checks	73
Table 9 - Refrigeration log.....	75

NOTE: The images in this document are for illustrative purposes only and are not part of any offer for sale or contract.

INITIAL START-UP CHECKLIST FOR 19XR HERMETIC CENTRIFUGAL LIQUID CHILLERS

Name:
 Address:
 Town:
 Country:
 Post code:
 Job No.:
 Model:
 Serial No.:

Design conditions

	Cooling capacity	Brine	Flow rate	Temperature in	Temperature out	Pressure drop	Pass	Suction temperature	Condensing temperature
Evaporator									
Condenser									

Compressor: Voltage RLA OLTA
 Starter: Manufacturer Type
 Oil pump: Voltage RLA..... OLTA

Control circuit/crankcase heater: 115 Volts 230 Volts
 Refrigerant: Type Charge, kg

Carrier obligations:

Assemble: Yes/No
 Leak test: Yes/No
 Dehydrate: Yes/No
 Charging: Yes/No
 Operating instructions:Hours

Start-up to be performed in accordance with appropriate machine start-up instructions

Job data required:

- Machine installation instructions 19XR Yes/No.....
- Machine assembly, wiring and piping diagrams Yes/No.....
- Starting equipment details and wiring diagrams Yes/No.....
- Applicable design data (see above) Yes/No.....
- Diagrams and instructions for special controls Yes/No.....

Initial machine pressure:

Was machine tight? Yes/No
 If not, were leaks corrected? Yes/No
 Was machine dehydrated after repairs? Yes/No

Check oil level and record:

Add oil: Yes/No.....
 Amount:

Top sight glass

..... 3/4
 1/2
 1/4

Bottom sight glass

..... 3/4
 1/2
 1/4

Water-side pressure drops: Evaporator Condenser
 Refrigerant charge: Initial charge Final charge after trim

Inspect wiring and record electrical data

Ratings

Motor voltage..... Motor current
 Oil pump voltage Start-up current

Line voltages

Motor..... Oil pump Control/oil heater.....

Field-installed starters only:

Check continuity T1 to T1, etc. (disconnect cables from terminals 4, 5 and 6 of the motor to the starter).

Megger starter: Do not megger a motor connected to a solid-state starter, unless the leads to the motor are disconnected and meggered.

Motor	Phase to phase			Phase to ground		
	T1-T2	T1-T3	T2-T3	T1-G	T2-G	T3-G
10-second readings						
60-second readings						
Polarisation ratio						

Starter:

Electro-mechanical **Electronic**

Motor load current transformer ratio : Signal resistor size Ohms
Transition timer time seconds

Check magnetic overloads: Add dash pot oil Yes/No
Solid-state overloads Yes/No
Electronic starter: Initial voltage Volts
Ramp setting seconds

Controls: safety, operating, etc

Perform controls test Yes /No

CAUTION: Compressor motor and control centre must be properly and individually connected back to the earth ground in the starter (in accordance with certified drawings). Yes

Run machine:

Do these safeties shut down the machine?

Condenser water flow switch: Yes/No

Chilled water flow switch: Yes/No

Pump interlocks: Yes/No

Initial start:

Line up all valves in accordance with instruction manual:

Start water pumps and establish water flow:

Oil level and temperature correct:

Check oil pump rotation pressure

Check compressor motor rotation (motor end sight glass) and record direction. Clockwise or not

Restart compressor. Bring up to speed. Shut down.

Any abnormal coastdown noise? Yes/No If yes, determine cause.....

Start machine and operate. Complete the following:

- A. Trim charge and record.
- B. Complete any remaining control calibration and record.
- C. Take at least 2 sets of operational log readings and record.
- D. After machine has been successfully run and set up, shut down and mark shut-down oil and refrigerant levels.
- E. Give operating instructions to owner's operating personnel. Hours given:
- F. Call your Carrier factory representative to report chiller start-up.

Date:

Carrier technician
Signature

Date:

Customer representative
Signature

19XR HERMETIC CENTRIFUGAL LIQUID CHILLER CONFIGURATION SETTINGS LOG

(Remove and use for job file)

Controller name Bus No.:
Element No.
Table description Table name: SETPOINT

Setpoint table configuration sheet 19XR

Description	Range	Units	Default	Value
Base demand limit	40 to 100	%	100	
LCW setpoint	12.2 to 48.9	°C	50	
ECW setpoint	12.2 to 48.9	°C	60	

Controller name Bus No.:
Element No.
Table description Table name: OCCP01S

Local mode time schedule configuration sheet - 19XR PIC control - OCCP01S

	Day								Hours	
	M	T	W	T	F	Sa	Su	H	Occupied time	Unoccupied time
Period 1										
Period 2										
Period 3										
Period 4										
Period 5										
Period 6										
Period 7										
Period 8										

NOTE: Default setting is occupied 24 hours/day

Controller name Bus No.:
Element No.
Table description Table name: HOLIDEFS

Holiday configuration sheet

Description	Range	Units	Value
Holiday start month	1-12	-	
Holiday start day	1-31	-	
Duration	0-99	Days	

Controller name Bus No.:
Element No.
Table description Table name: HOLIDEFS

Holiday configuration sheet

Description	Range	Units	Value
Holiday start month	1-12	-	
Holiday start day	1-31	-	
Duration	0-99	Days	

1 - SAFETY CONSIDERATIONS

19XR 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 stops are installed on ball valves. These valves are factory-supplied lead-sealed in the open position. This system permits isolating and removing the safety stop for checking and replacing. The safety stops are designed and installed to ensure protection against fire risk. Removing the safety stops 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.

Periodic check of the safety valves: See chapter 1.2 - "Maintenance safety considerations".

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.

NOTE: *The unit must never be left shut down with the liquid line valve closed.*

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.

19XRV units: *Additional precautions must be taken to ensure that the power supply has been disconnected. Please refer to chapter 8.*

If work is interrupted, confirm that all circuits are de-energized before resuming work.

1.3 - Operating checks, valves

Operating checks:

Important information regarding the refrigerant used:
This product contains fluorinated greenhouse gas covered by the Kyoto protocol.

Refrigerant type: R-134a

Global Warming Potential (GWP): 1430.

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).

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 (e.g. by a short circuit in a motor) 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 R-134a 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.

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.

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 halogenated hydrocarbons under optimum quality conditions for the products and optimum safety conditions for people, property and the environment are described in standard NFE 29795.

Any refrigerant transfer and recovery operations must be carried out using a transfer unit. A 3/8" SAE connector on the manual liquid line valve 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 19XR 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.

19XRV units: Special qualifications are required for personnel commissioning these machines or working on the variable-frequency drive.

Transport and storage of 19XR units

The minimum and maximum allowable outside temperatures are :

Minimum temperature = -20 °C

Maximum temperature = +48 °C.

Operating limits

- 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.

Operating range for 19XR/XRV units during operation

Evaporator (fresh water)		Minimum	Maximum
Evaporator entering water temperature	°C	7	28
Evaporator leaving water temperature	°C	3.3	12

Condenser (water-cooled)		Minimum	Maximum
Condenser entering water temperature	°C	12.8*	35
Condenser leaving water temperature	°C	29	45

Operating range for 19XRE/XRVE (dual stage) units during operation

Evaporator (fresh water)		Minimum	Maximum
Evaporator entering water temperature	°C	7	28
Evaporator leaving water temperature	°C	3.3	12

WARNING: Do not short or jumper between terminations on circuit boards or modules; control or board failure may result.

Condenser (water-cooled)		Minimum	Maximum
Condenser entering water temperature	°C	12.8*	55**
Condenser leaving water temperature	°C	29	65**

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

** The maximum condenser operating conditions (heating mode) combined with minimum evaporator conditions is directly linked to the lift capability of the selected compressor. Selection of the chiller shall be checked and validated by factory support.

- Negative evaporator temperature applications are possible depending on the temperature conditions at the condenser. Please refer to the selection program to determine the operating routine possibilities.
- Unit selections are available from the Carrier sales teams.

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

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

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 radiate, radio frequency energy. If not installed and used in accordance with the instruction manual, it may cause interference to radio communications.

2.1 - CE marking

The machines that carry the CE mark must comply with the following European directives:

- Pressure equipment directive (PED) 2014/68/UE
- Machinery directive 2006/42/CE, modified
- Low voltage directive 2006/95/CE
- Electromagnetic compatibility (EMC) 2004/108/EEC.

To ensure compliance with the directives, the machines were designed in conformance with the harmonised standards:

- EN60204-1: Machine safety, electrical equipment for machines, part 1: General regulations
- EN61000-6-2 and EN61000-6-4: Electromagnetic compatibility in industrial environments.

These do not apply to 19XRV units - for 19XRV particulars refer to chapters 8 to 14.

2.2 - Abbreviations and explanations

Frequently used abbreviations in this manual include:

CCM	Chiller Control Module (control of entering/leaving conditions)
CCN	Carrier Comfort Network
CW	Counterclockwise
CW	Clockwise
ECW	Entering Chilled Water
ECDW	Entering Condenser Water
EMS	Energy Management System
HGBP	Hot Gas Bypass
HMI	Human Machine Interface
IOB	Input / Output board
ICVC	Interface Chiller Visual Control (control interface)
I/O	Input/Output
ISM	Integrated Starter Module
LCD	Liquid Crystal Display
LCDW	Leaving Condenser Water
LCW	Leaving Chilled Water
LED	Light-Emitting Diode
OLTA	Overload Trip Amps
PIC	Product Integrated Control (control system)
RLA	Rated Load Amps
SI	International System of Units of Measurement
TXV	Thermostatic Expansion Valve for oil circui

The ICVC or PIC5 software version number of your 19XR unit will be located on the HMI module.

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

All information given on unit-mounted starters refers to star-delta connected starters. Electronic starters have separate documentation.

2.3 - Chiller familiarization 19XR

2.3.1 - Chiller information plate

The information plate is located on the side of the electrical control box.

2.3.2. System components

The components include the cooler and condenser heat exchangers in separate vessels, motor-compressor, lubrication package, a control box and/or a compressor starter box. All connections from pressure vessels have external threads to enable each component to be pressure tested with a threaded pipe cap during factory assembly.

2.3.2.1. Cooler

This heat exchanger (also known as the evaporator) is located underneath the compressor. It is maintained at lower temperature/pressure so that evaporating refrigerant can remove heat from water flowing through its internal tubes.

2.3.2.2. 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.

2.3.2.3. Economizer (dual stage XRE compressor)

An economizer, along with a two-stage compressor, allows for higher lift applications. The economizer is a separate vessel in the flow path after the condenser that improves the refrigerant cycle by allowing a small amount of refrigerant to flash into vapor. This phase change decreases the temperature of the remaining liquid refrigerant. The vapor is drawn into the second stage of the compressor, which saves energy because the refrigerant does not have to be compressed by both stages.

2.3.2.4. Motor-compressor

This component maintains system temperature/pressure differences and moves the heat carrying refrigerant from the cooler to the condenser.

2.3.2.5. Control equipment / Control panel :

This includes circuits and automatic controls with user interface designed to control and manage the unit, in order to adjust the capacity as required to maintain proper leaving chilled water temperature. It includes the following functions:

- Capture of sensor signals in the machine: Pressures, temperatures, status returns etc.
- Registers cooler, condenser and lubricating system pressures
- Shows chiller operating condition and alarm shutdown conditions
- Records the total chiller operating hours
- Sequences chiller start, stop and recycle under microprocessor control
- Displays status of motor starter
- Provides access to other CCN devices and energy management system
- Languages that may be pre-installed at factory include : English, Chinese, Spanish, French and German.
- Machine actuator control.
- Man-machine interface to read status parameters, configuration parameters etc.
- Remote unit control and status reporting: via dedicated signals or by bus (CCN).

The control equipment is installed in a dedicated box separated from the starter cabinet.

2.3.2.6. Power equipment

Standard 19XR units include circuits and devices designed to ensure lubrication.

19XR unit options

An electronic starter allows start-up and compressor motor power supply interruption. It is factory-installed in the unit in a cabinet that also includes the protection and power transmission elements.

Standard equipment for 19XRV units

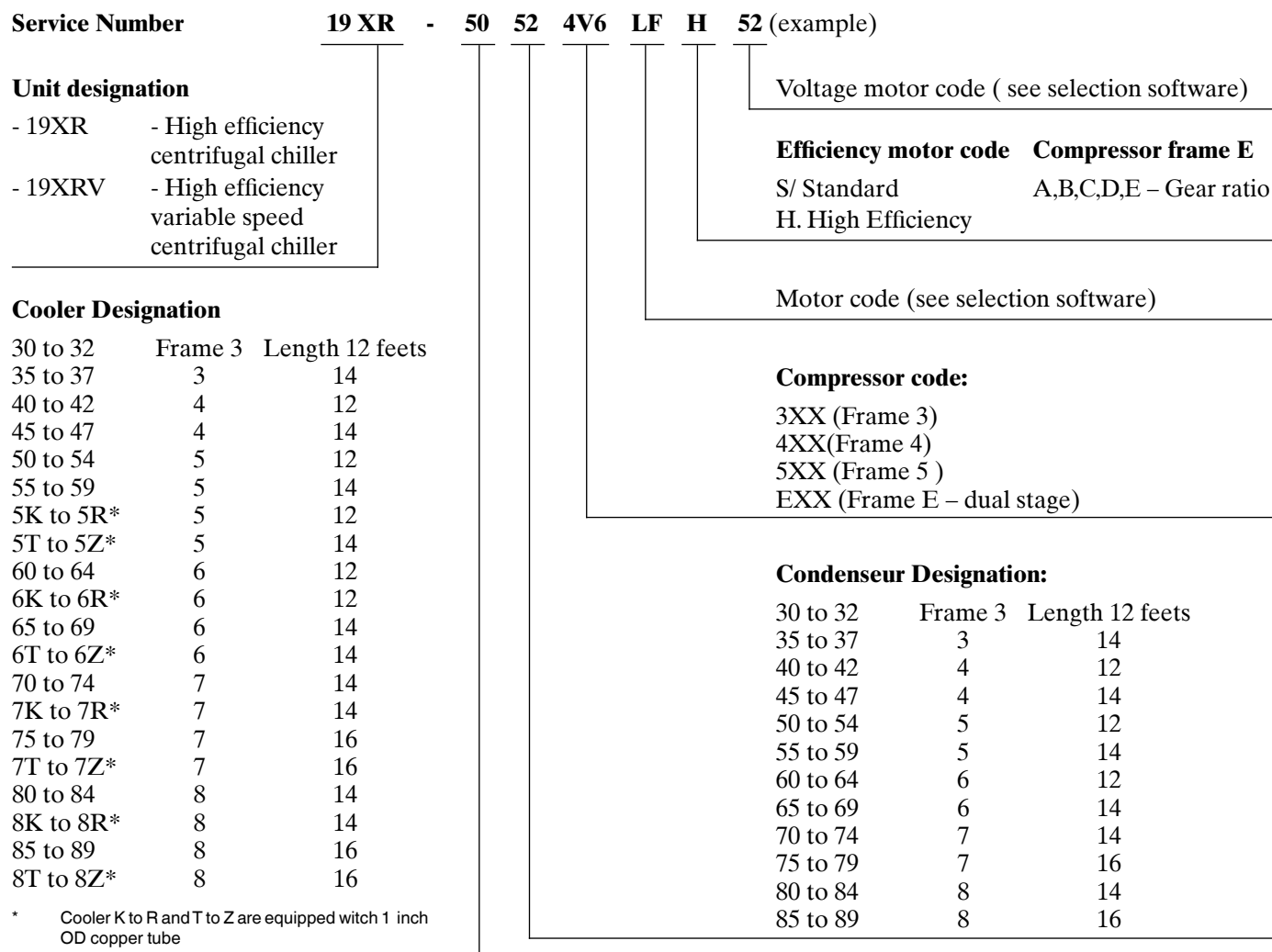
A variable-frequency drive allows start-up and compressor motor power supply interruption. It also allows adjustment of the compressor speed based on the required capacity. It is factory-installed in the unit in a cabinet that also includes the protection and power transmission elements.

2.3.2.7. 19XR Storage vessel (optional)

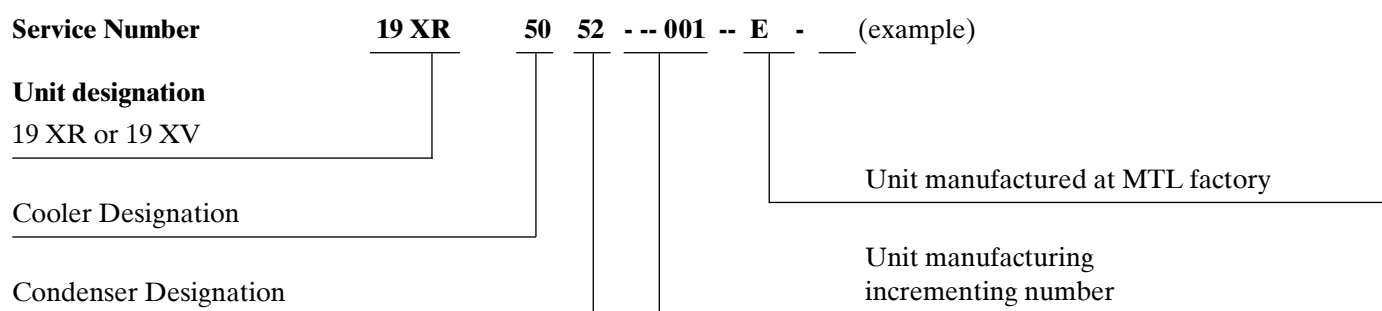
There are two sizes of storage vessel available. The vessels have relief valves, a drain valve and a male flare vapour connection for the pumpout unit.

NOTE: If a storage vessel is not used at the jobsite, factory-installed isolation valves on the chiller may be used to isolate the chiller charge in either the cooler or condenser. In this case a separate pumpout unit is used.

Figure 1 - Model Number nomenclature



Single stage:



Dual stage:

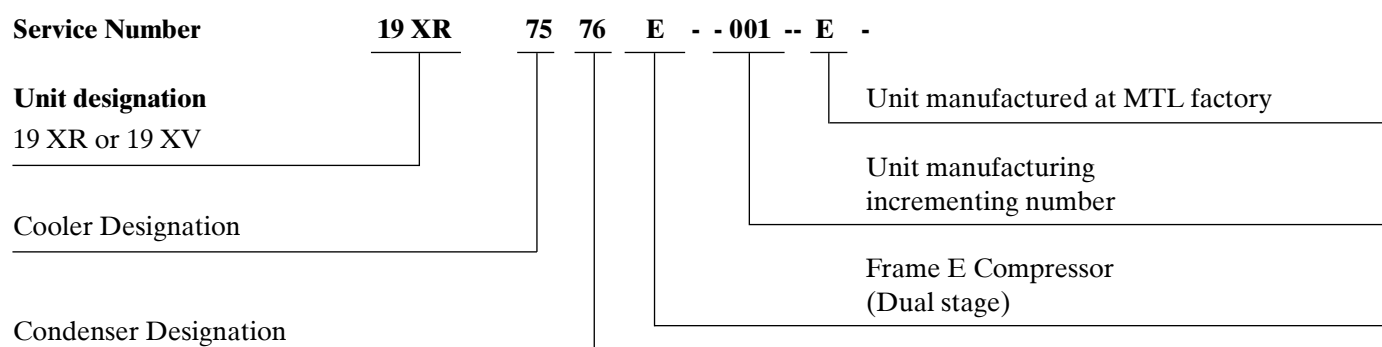
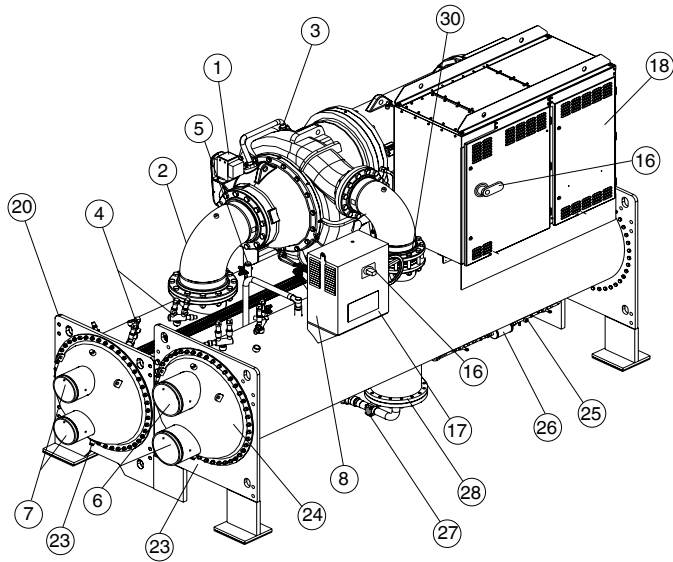
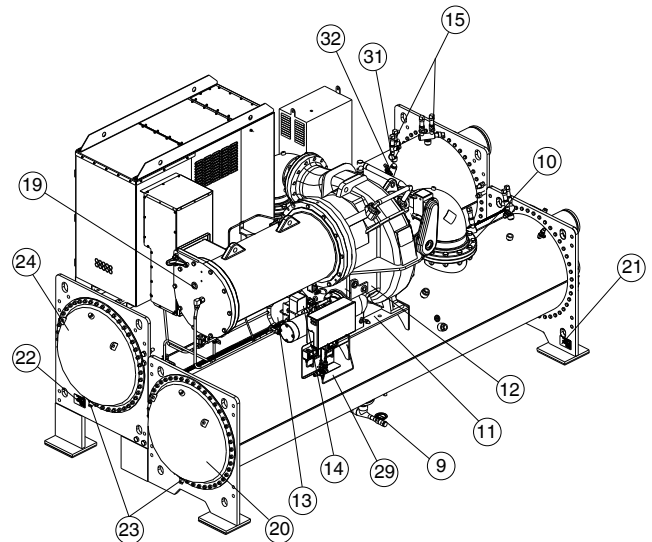


Figure 2 - 19XR machine components – single stage



Front view (View 1)

1. Guide vane actuator
2. Suction elbow
3. Compressor
4. Dual relief valve on change-over
5. Cooler pressure transducer
6. Condenser in/out temperature thermistors
7. Cooler in/out temperature thermistors
8. Machine identification nameplate (situated on the starter cabinet side) - see right-hand figure 'Rear view'
9. Refrigerant charging valve
10. Typical flange connections
11. Oil drain valve
12. Oil level sight glass
13. Refrigerant oil cooler (hidden)
14. Branch circuit control box

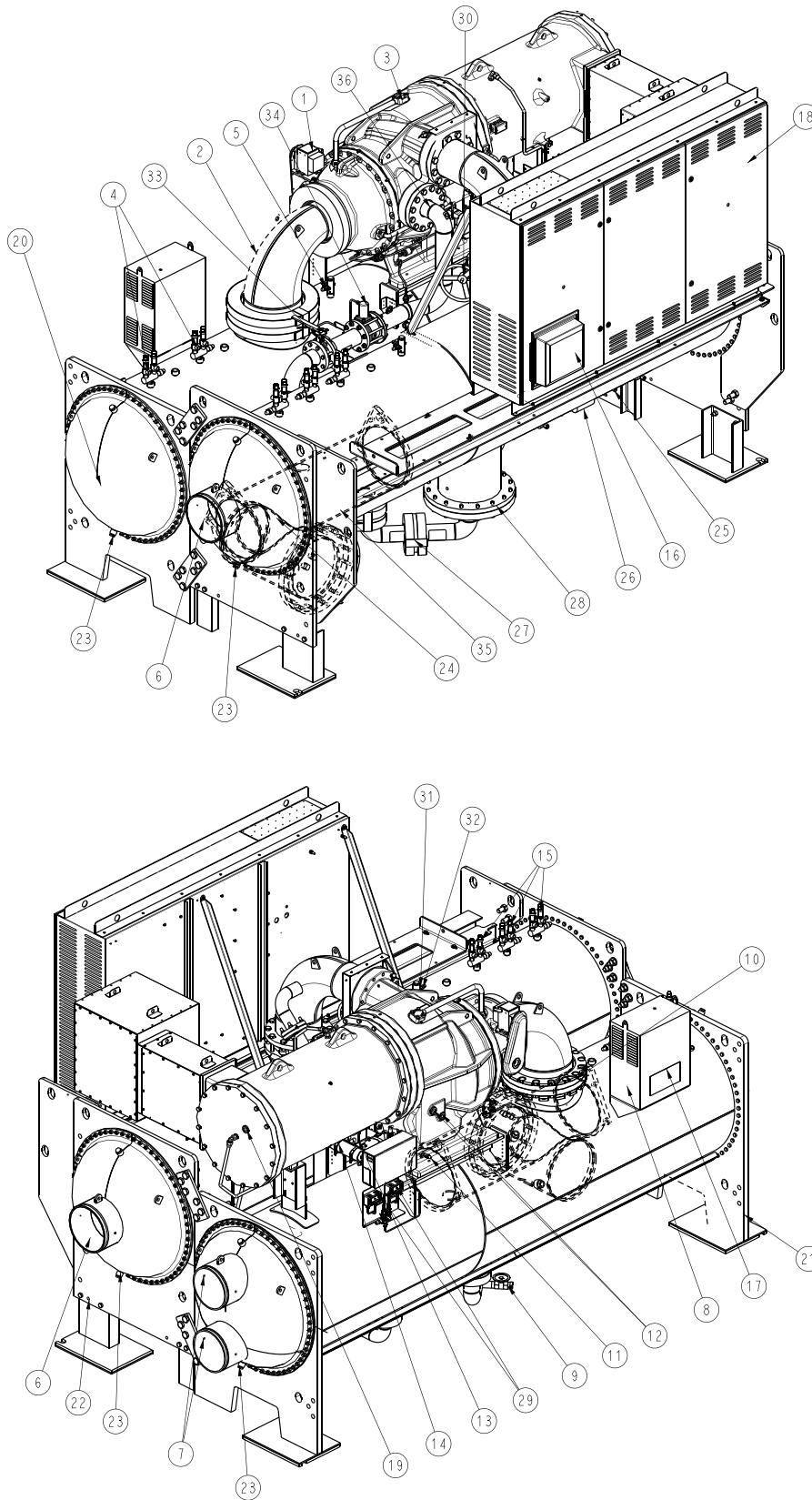


Rear view (View 2)

15. Dual relief valve on change-over
16. Circuit breaker/disconnect handle
17. Control cabinet with HMI
18. Unit-mounted starter (19XR) or variable-frequency drive (19XRV)
19. Motor sight glass
20. Cooler return-end waterbox cover
21. Cooler nameplate
22. Condenser nameplate
23. Typical waterbox drain port
24. Condenser return-end waterbox cover
25. Refrigerant moisture/flow indicator
26. Refrigerant filter/drier
27. Liquid line isolation valve (optional)
28. Linear float valve chamber
29. Pressure switches
30. Discharge isolation valve (optional)
31. Pumpout valve
32. Condenser pressure transducer

NOTE: Non-certified drawings. Refer to the certified dimensional drawings supplied with the unit or available on request, when designing an installation.

Figure 3 - 19XR-E machine components – dual stage



1. Guide vane actuator
2. Suction elbow
3. Compressor
4. Dual relief valve on change-over
5. Cooler pressure transducer
6. Condenser in/out temperature thermistors
7. Cooler in/out temperature thermistors
8. Machine identification nameplate
9. Refrigerant charging valve
10. Typical flange connections
11. Oil drain valve
12. Oil level sight glass
13. Refrigerant oil cooler (hidden)
14. Branch circuit control box (hidden)
15. Dual relief valve on change-over
16. Circuit breaker disconnect handle
17. Control cabinet with HMI
18. Unit-mounted starter (19XR) or VFD (19XRV)
19. Motor sight glass
20. Cooler return-end waterbox cover
21. Cooler nameplate
22. Condenser nameplate
23. Typical waterbox drain port
24. Condenser return-end waterbox cover
25. Refrigerant moisture/flow indicator
26. Refrigerant filter/drier
27. Liquid line isolation valve
28. Linear float valve chamber
29. Pressure switches
30. Discharge isolation valve
31. Pumpout valve
32. Condenser pressure transducer
33. Economizer isolation valve
34. Vacuum valve
35. Economizer
36. Economizer suction pipe

2.3.3 - Refrigeration cycle

The compressor continuously draws refrigerant vapour from the cooler at a rate set by the amount of guide vane opening. As the compressor suction reduces the pressure in the cooler, the remaining refrigerant evaporates at a fairly low temperature (typically 3 to 6 °C). The energy required for evaporation is obtained from the water flowing through the cooler tubes. With heat energy removed, the water becomes cold enough for use in an air conditioning circuit or process liquid cooling, light industrial or marine applications.

After taking heat from the water, the refrigerant vapour is accelerated in a turbine. This increases its pressure by increasing the speed. Compression adds still more 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 (typically 18 to 32 °C) water flowing into the condenser tubes removes heat from the refrigerant and the vapour condenses to liquid.

The liquid refrigerant passes through orifices into the FLASC (Flash Subcooler) chamber (see Fig. 3 - "Typical 19XR unit diagram").

Since the FLASC chamber is at a lower pressure, part of the liquid refrigerant flashes to vapour, thereby cooling the remaining liquid.

The FLASC vapour is recondensed on the tubes which are cooled by entering condenser water. The liquid drains into a float chamber between the FLASC chamber and cooler. Here a float valve forms a liquid seal to keep FLASC chamber vapour from entering the cooler.

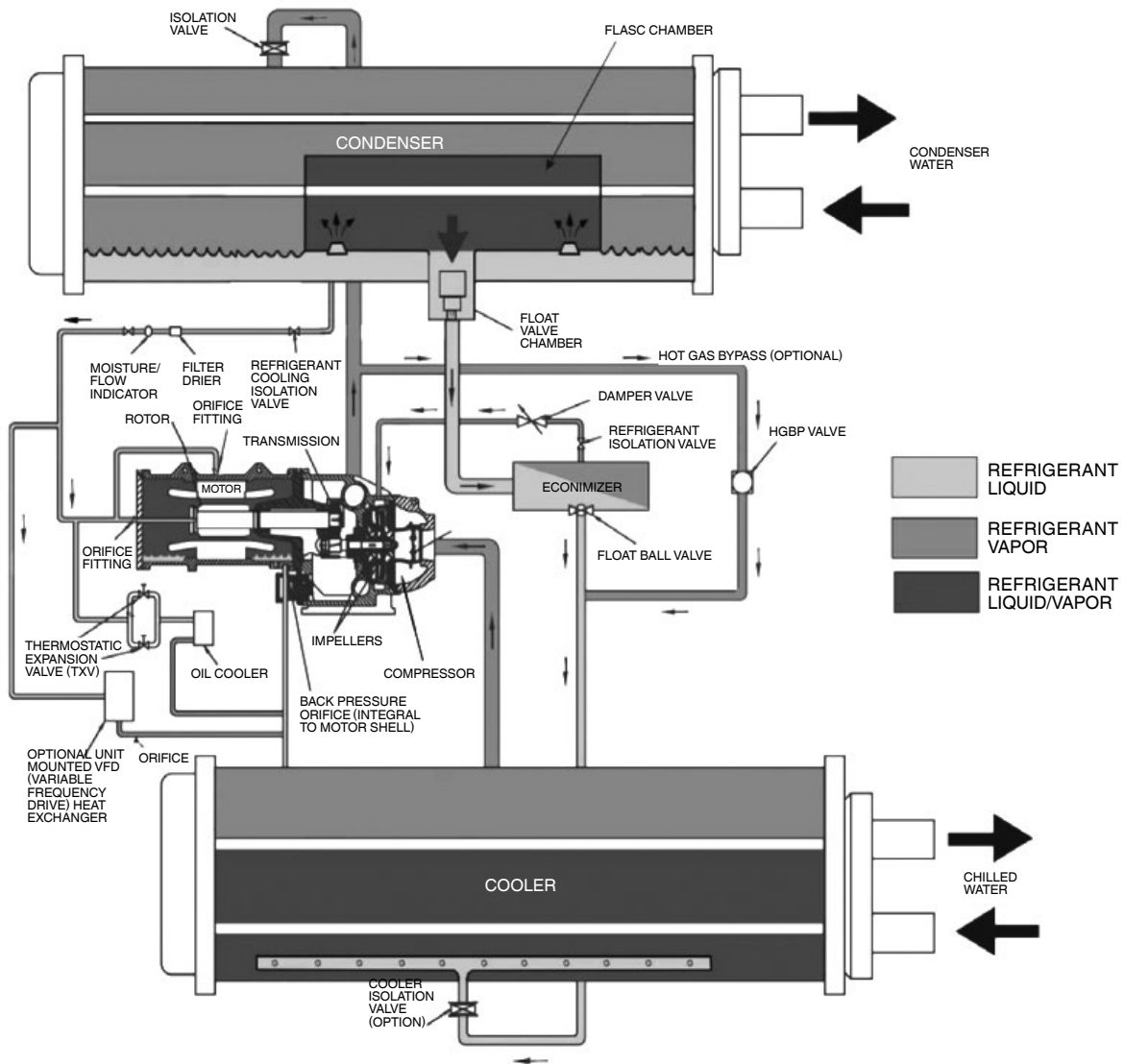
When liquid refrigerant passes through the valve, some of it flashes to vapour in the reduced pressure on the cooler side. In flashing, it removes heat from the remaining liquid. The refrigerant is now at a temperature and pressure at which the cycle began.

The refrigeration cycle for a 19XR, XRV chiller with two-stage compressor is similar to the one described above, with the following exception: Liquid refrigerant from the condenser FLASC chamber linear float valve flows into an economizer at intermediate pressure (see Fig. 5). As liquid enters the chamber, due to the lower pressure in the economizer, some liquid flashes into a vapor and cools the remaining liquid. The separated vapor flows to the second stage of the compressor for greater cycle efficiency. A damper valve located on the economizer line to the compressor acts as a pressure regulating device to stabilize low load, low condensing pressure operating conditions. The damper will back up gas flow and thereby raises the economizer pressure to permit proper refrigerant flow through the economizer valve during those conditions. The damper also is closed during start-up conditions to allow the second stage impeller to start unloaded.

The subcooled liquid remaining in the economizer flows through a float valve and then into the cooler.

NOTE: In the 19XRV units a modification has been introduced in the refrigerant circuit to ensure cooling of the variable-frequency drive that supplies the compressor. For 19XRV particulars refer to chapters 8 to 14.

Figure 5 - Typical 19XR/XRV unit diagram – dual stage



2.3.4 - Motor/oil refrigeration cooling cycle

The motor and the lubricating oil are cooled by liquid refrigerant taken from the bottom of the condenser vessel (see Fig. 3 - “Typical 19XR unit diagram”).

Flow of refrigerant is maintained by the pressure differential that exists due to compressor operation. After the refrigerant flows past a filtration system, a filter, and a sight glass/moisture indicator, the flow is split between motor cooling and oil cooling systems.

Flow to the motor flows through an orifice and into the motor. Once past the orifice, the refrigerant is directed over the motor by a spray nozzle. The refrigerant collects in the bottom of the motor casing and then is drained back into the cooler through the motor refrigerant drain line.

A check valve in this line maintains a higher pressure in the motor shell than in the cooler/oil sump. The motor is protected by a temperature sensor imbedded in the stator windings.

If the temperature exceeds the authorised threshold, a priority command limits the unit capacity control. If the temperature exceeds the threshold of 5.5 °C, the guide vanes are closed. If the temperature rises above the safety limit, the compressor will shut down.

Refrigerant that flows to the oil cooling system is regulated by thermostatic expansion valves (TXVs). The TXVs regulate flow into the oil/refrigerant plate and frame-type heat exchanger. The expansion valve bulbs control oil temperature to the bearings. The refrigerant leaving the heat exchanger then returns to the cooler.

2.3.5 - Lubrication cycle

2.3.5.1 - Summary

The oil pump, oil filter, and oil cooler make up a package located partially in the transmission casting of the compressor-motor assembly. The oil is pumped into a filter assembly to remove foreign particles and is then forced into an oil cooler heat exchanger where the oil is cooled to proper operational temperatures. After the oil cooler, part of the flow is directed to the gears and the high speed shaft bearings; the remaining flow is directed to the motor shaft bearings. Oil drains into the transmission oil sump to complete the cycle (see Fig. 6 and Fig. 7 “Lubrication system” and Fig. 8 - “Gerotor Oil Pump”).

2.3.5.2 - Details

Oil is charged into the lubrication system through a hand valve. Two sight glasses in the oil reservoir permit oil level observation. Normal oil level is between the middle of the upper sight glass and the top of the lower sight glass when the compressor is shut down. The oil level should be visible in at least one of the 2 sight glasses during operation.

Oil sump temperature is displayed on the HMI default screen. Oil sump temperature ranges during compressor operation between 52 to 66 °C. The oil pump suction is fed from the oil reservoir. An oil pressure relief valve maintains 124 to 172 kPa differential pressure in the system at the pump discharge. This differential pressure can be read directly from the HMI default screen.

The oil pump discharges oil to the oil filter assembly. This filter can be closed to permit removal of the filter without draining the entire oil system. The oil is then piped to the oil cooler. This heat exchanger uses refrigerant from the condenser as the coolant. The refrigerant cools the oil to a temperature between 49 °C and 60 °C.

As the oil leaves the oil cooler, it passes the oil pressure transducer and the thermal bulb for the refrigerant expansion valve on the oil cooler. The oil is then divided, with a portion flowing to the thrust bearing, forward pinion bearing, and gear spray. The balance then lubricates the motor shaft bearings and the rear pinion bearing. The oil temperature is measured as the oil leaves the thrust and forward journal bearings within the bearing housing. The oil then drains into the oil reservoir at the base of the compressor. The PIC (Product Integrated Control) measures the temperature of the oil in the sump and maintains the temperature during shut-down. This temperature is read on the HMI default screen.

During the chiller start-up, oil pump is energized and provide 40 seconds of prelubrication to the bearings after pressure is verified before starting the compressor. During shut down, the oil pump will run for 60 seconds to postlubricate after the compressor shuts down. The oil pump can also be energised for testing purposes in the Control Test.

Ramp loading can slow the rate of guide vane opening to minimise oil foaming at start-up. If the guide vanes open quickly, the sudden drop in suction pressure can cause the expansion/vaporisation of the refrigerant in the oil. The resulting oil foam cannot be pumped efficiently; therefore, oil pressure falls off and lubrication is poor. If oil pressure falls below 103 kPa differential, the PIC will shut down the compressor.

When the oil pump is not running and the oil heater remains energized for 30 minutes, the oil pump will be started and will run for 30 seconds to evenly distribute the heat in the oil system.

There are three pump-filter configurations. The original vane pump, in which the oil filter is contained in the pump housing, followed by the vane pump with the oil filter being external in the oil piping between the oil pump and the oil cooler. The third configuration is the gerotor pump, also with the external oil filter.

A gerotor pump has two rotors, one is inside the other and their center points are offset with respect to each other. This type of pump provides a smooth continuous flow. It is also quieter than other designs.

The gerotor pump can be most easily identified by the external location of the oil pressure regulator. The regulator is located on the bottom of the pump pointing horizontally to the left.

See Fig. 8 - “Gerotor Oil Pump”.

Oil reclaim system

The oil reclaim system returns oil lost from the compressor housing back to the oil reservoir by recovering the oil from two areas on the chiller. The guide vane housing is the primary area of recovery. Oil is also recovered by skimming it from the operating refrigerant level in the cooler vessel

Figure 6 - Lubrication system – single stage

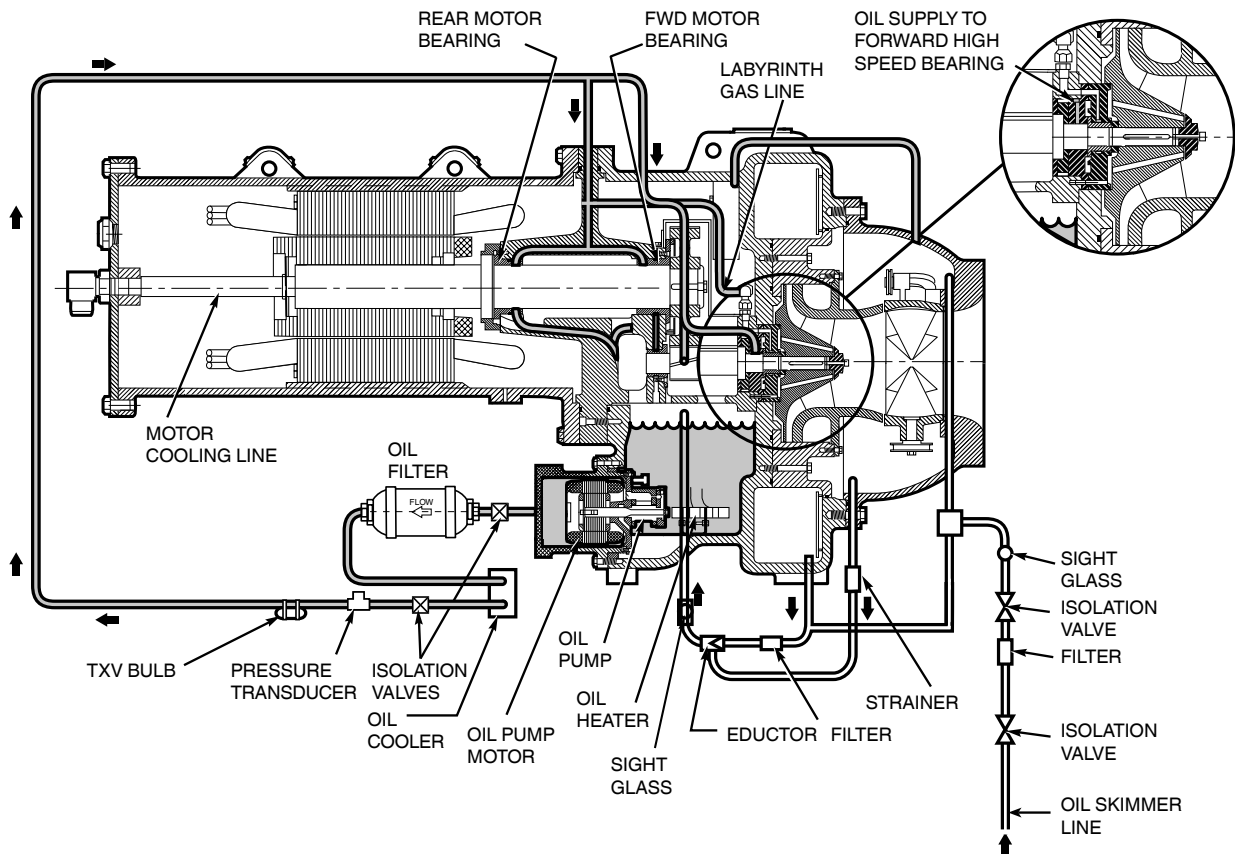


Figure 7 - Lubrication system – dual stage

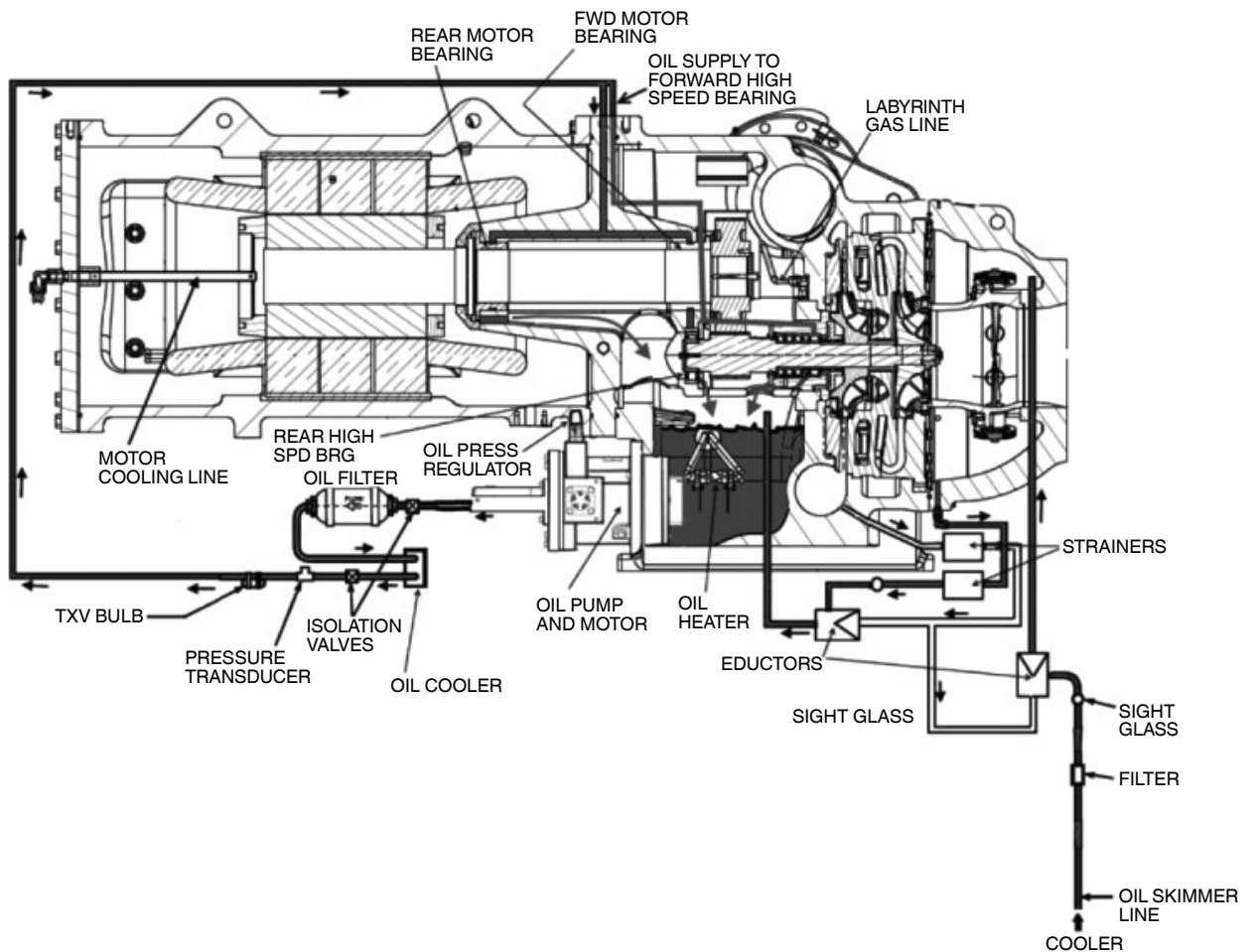
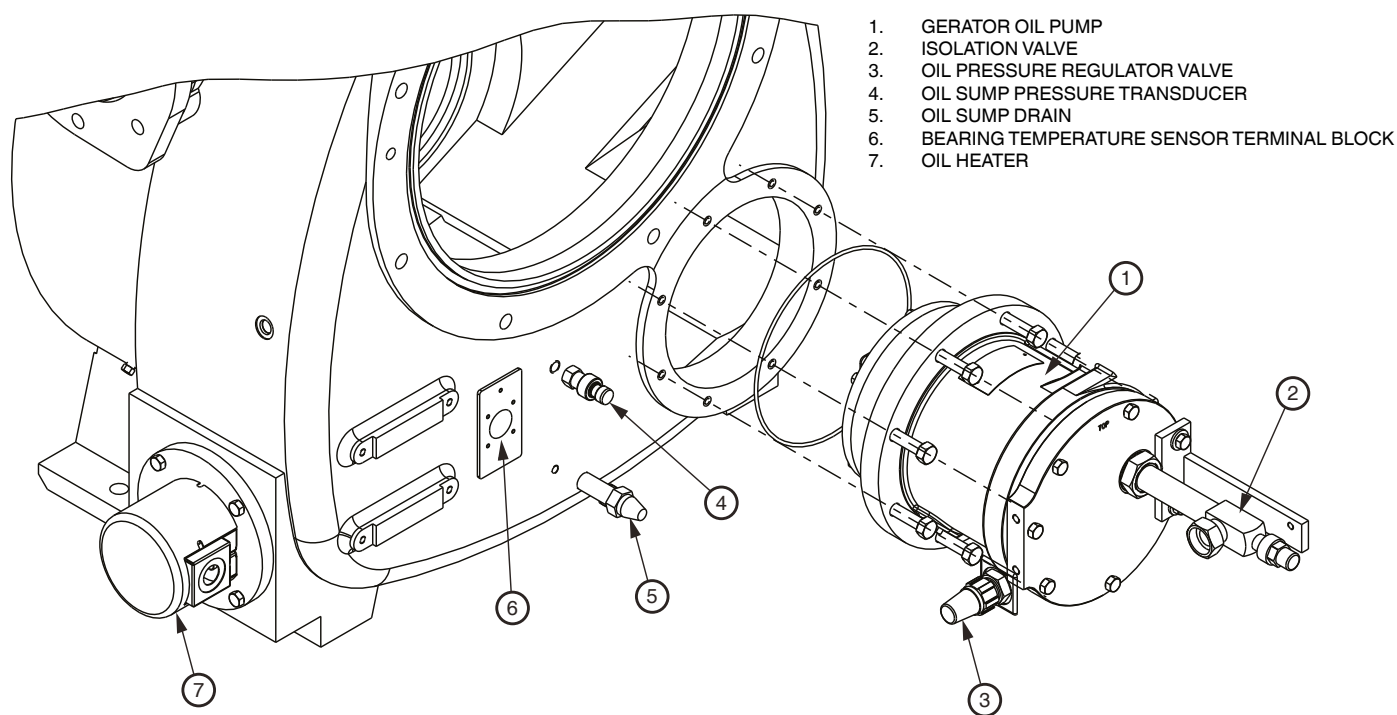


Figure 8 - Gerotor oil pump



2.3.5.3 - Primary oil recovery mode

Oil is normally recovered at the guide vane housing on the chiller, as it separates from the refrigerant forming drops that accumulate at the bottom of the guide vane housing. It is then returned into the oil reservoir, using a venturi.

2.3.5.4 - Secondary oil recovery method

At part-load conditions the refrigerant velocity is insufficient for the primary mode. The oil collects in a greater concentration at the cooler surface. This oil and refrigerant mixture is skimmed in the cooler and taken from the side of the cooler to the oil heater under the guide vanes.

Because the guide vane housing pressure is much lower than the cooler pressure, the refrigerant evaporates, leaving the oil behind to be collected by the primary oil recovery method.

2.3.6 - Control equipment

This is integrated in the unit-mounted separated cabinet. It ensures the operation of the PIC command and mainly includes:

- The built-in control circuit transformer
- The input / outputs control boards (CCM or IOB)
- The HMI control screen
- The electrical short-circuit protections.
- The pump and heater converter contactors.

2.3.7 - Power circuit equipment (starter box)

The standard power circuit equipment for the power supply includes:

- The compressor control and protection module (ISM). It controls the compressor start-up and shut-down, as well as electric and non-electric protections:
- Current draw monitoring: Overcharge, imbalance, leak current.

- Voltage monitoring: Phase order, imbalance, over/ under voltage, micro-cutouts etc.

NOTE: For low-voltage 19XR machines the compressor control and supply are available as an option:

- **Option 25: Compressor start-up via electronic starter**
- **Option 25A: Compressor start-up via star/delta starter with closed transition.**

For 19XRV machines the power cabinet supplied as standard for compressor control and supply is installed on the unit. For 19XRV particulars refer to chapters 8 to 14.

2.4 - Starting equipment

The 19XR chiller requires a motor starter to operate the centrifugal hermetic compressor motor, the oil pump, and various auxiliary equipment. The starter is the main field wiring interface for the contractor.

See Carrier's specification for specific starter requirements. All starters must meet these specifications in order to properly start and satisfy mechanical safety requirements.

Typically two separate circuit breakers are inside the starter. These includes (1) the main compressor motor circuit breaker, and (2) a circuit breaker which provides power to chiller controls and the oil heater. The latter is typically wired in parallel with the first so that power is provided to those services when the main breaker is open. The disconnect switch on the starter front cover is connected to the main breaker.

All starters and freestanding VFDs must include a Carrier control module called the Integrated Starter Module (ISM). This module controls and monitors all aspects of the starter. See the Controls Operation and Troubleshooting guide for additional ISM information. Contact Carrier's Replacement Component Division (ERCD) for replacement parts.

The 19XR chiller may be equipped with a solid-state, reduced-voltage starter. This starter's primary function is to provide on-off control of the compressor motor. This type of starter reduces the peak starting torque, controls the motor inrush current, and decreases mechanical shock. This capability is summed up by the phrase "soft starting." The solid-state starter is available as a 19XR option (factory-supplied and installed). The solid-state starter manufacturer's name is located inside the starter access door.

A solid-state, reduced-voltage starter operates by reducing the starting voltage. The starting torque of a motor at full voltage is typically 125% to 175% of the running torque. When the voltage and the current are reduced at start-up, the starting torque is reduced as well. The object is to reduce the starting voltage to adjust the voltage necessary to develop the torque re-quired to get the motor moving. The voltage is reduced by silicon controlled rectifiers (SCRs). The voltage and current are then ramped up in a desired period of time. Once full voltage is reached, a bypass contactor is energized to bypass the SCRs.

2.5 - Controls

2.5.1 - 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.)

2.5.2 - General

The 19XR hermetic 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 vane via a mechanically linked actuator motor.

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.

2.5.3 - PIC System Components

The chiller control system is called the PIC (Product Integrated Control). The PIC controls the operation of the chiller by monitoring all operating conditions. The PIC can diagnose a problem and let the operator know what the problem is and what to check. It promptly positions the guide vanes to maintain leaving chilled water temperature. It can interface with auxiliary equipment such as pumps and cooling tower fans to turn them on when required. It continually checks all safeties to prevent any unsafe operating condition. It also regulates the oil heater while the compressor is off and regulates the hot gas by-pass valve, if installed. The PIC controls provide critical protection for the compressor motor and controls the motor starter.

The PIC can interface with the Carrier Comfort Network® (CCN) if desired. It can communicate with other PIC equipped chillers and other CCN devices.

INTERNATIONAL CHILLER VISUAL CONTROLLER (ICVC) — The ICVC (International Chiller Visual Controller) is a display/processor module that comes preprogrammed to display all tables in the following optional character sets (languages): English, Mandarin Chinese, Korean, and Japanese. The language selection appears at the bottom of the Service/ ICVC Configuration screen. Other languages can be translated and downloaded in place of the Chinese, Korean and Japanese languages in the field using the ILT (International Language Translator) utility software. English cannot be overwritten and will always be resident in the ICVC.

The ICVC may be identified by viewing the back of the plate on which the display is mounted. (Open up the control panel door to view.)

CONTROLLER	COLOR OF PLATE	CEPL NO. (Hardware)	SOFTWARE NO.*	OTHER MARKINGS
ICVC	Metallic	CEPL 130455-03-R	CESR 131294-14	"PIC II" mark-ing on back of green cir-cuit board

The ICVC has a stop button, an alarm light, four buttons for logic inputs, and a backlight display. The backlight will automatically turn off after 15 minutes of non-use. The functions of the four buttons or "softkeys" are menu driven and are shown on the display directly above the softkeys.

The viewing angle of the ICVC can be adjusted for optimum viewing. Remove the 2 bolts connecting the control panel to the brackets attached to the cooler. Place them in one of the holes to pivot the control panel forward to backward to change the viewing angle. See Fig. 13. To change the contrast of the display, access the adjustment on the back of the ICVC.

English is the default language.

Three other programmed languages are available as options:

Chinese
Japanese
Korean

NOTE: Pressing any one of the four softkey buttons will activate the backlight display **without** implementing a softkey function.

If Chiller is equipped with PIC5, the HMI is a SAIA 10' where all the functions are described into Control User Manual for PIC 5.

3 - INSTALLATION

3.1 - Introduction

The 19XR/19XRV 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.

Check the tightening of waterbox covers before water loading.

The recommended torque is between 105-150 ft*lb (142-202 N-m).

3.2 - Receiving the machine

3.2.1 - Inspect the product delivered

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

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.

- 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.

		High pressure		Low pressure	
		Min.	Max.	Min.	Max.
PS (see in the list above)	kPa	-90	1250	-90	1250
TS (see in the list above)	°C	-20	48	-20	48
Pressure switch cut-out pressure	kPa	1100	-	-	-
Valve cut-out pressure	kPa	1250	-	1250	-
Test pressure, unit leak test	kPa	1000	-	-	-

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

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 oil charge is placed in the oil sump before shipment.

3.2.2 - 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 19XR 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.

3.3 - Rigging the machine and dimensional information

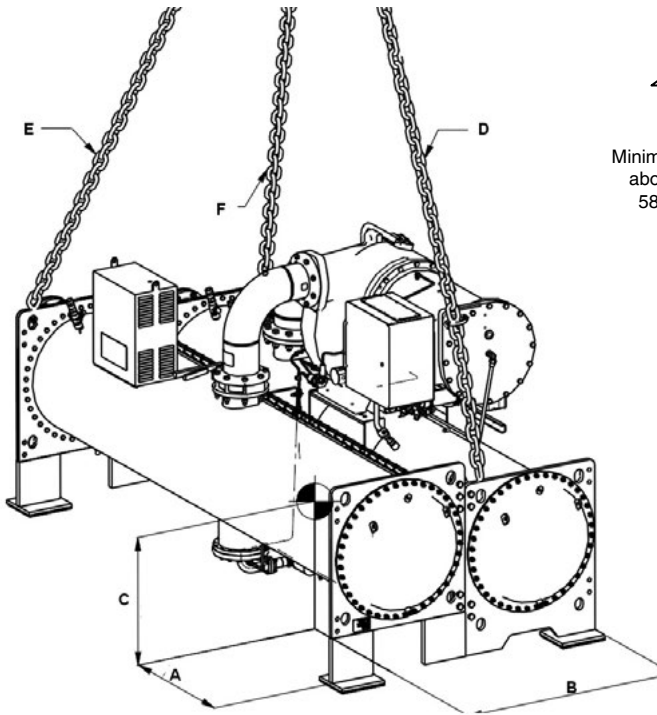
The 19XR machine can be rigged as an entire assembly. It also has flanged connections that allow the compressor, cooler, and condenser sections to be separated and rigged individually.

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.

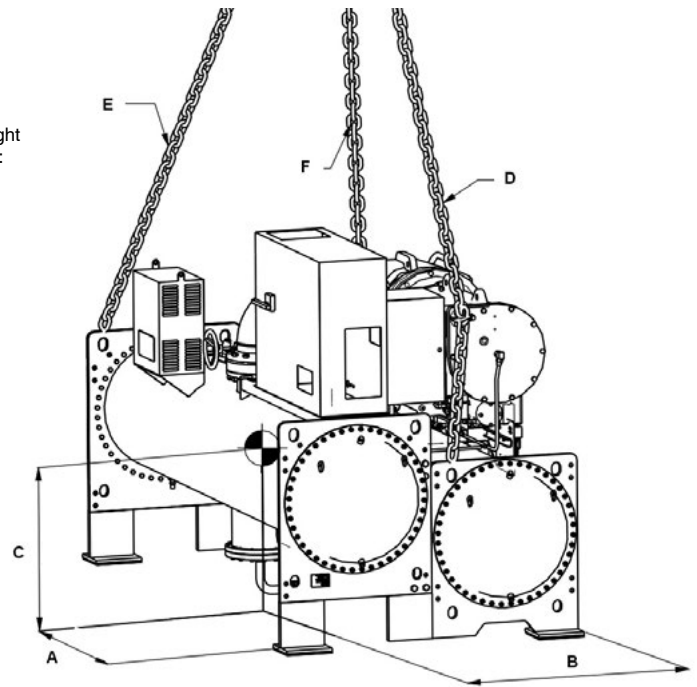
WARNING: Lifting machine from points other than those specified may result in serious damage to the unit and personal injury. Rigging equipment and procedures must be adequate for machine weight. See table in Fig. 6 for the machine weights.

Figure 9 - 19XR rigging information



Example of unit with HMI control box only (freestanding starter)

↑
Minimum height
above floor:
5850 mm



Example of unit with HMI control box + mounted starter cabinet

NOTES:

- 1 – Each chain must be capable of supporting the entire weight of the chiller. The maximum weight of each chiller is listed in the table below.
- 2 – Chain length shown Chain lengths shown are typical for 5850 mm lifting height. Some minor adjustment may be required.
- 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 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 1 - Chiller dimensions and weight data

Unit code	Compressor frame	Electrical box configuration	Dimensions (mm +/- 10 mm)*			Weight max (kg)**	COG position (mm)			Rigging Chain lengths (mm)		
			Lenght (max)	Height (max)	Width (max)		A	B	C	D	E	F
19XR3232	3	HMI control box only	4290	2055	1670	7200	1765	760	1065	4930	4900	4920
19XR3232	3	HMI control box + starter box	4290	2130	1670	7150	1765	760	1065	4930	4900	4920
19XR3737	3	HMI control box only	4820	2060	1670	7700	2235	760	1065	4990	5090	5100
19XR3737	3	HMI control box + starter box	4820	2130	1670	7900	2235	760	1065	4990	5090	5100
19XR4242	3	HMI control box only	4430	2140	1880	7600	2235	760	1065	4870	4830	4940
19XR4242	3	HMI control box + starter box	4430	2300	1880	7900	2235	760	1065	4870	4830	4940
19XR4747	3	HMI control box only	4950	2140	1880	8100	2080	790	965	4970	4980	5090
19XR4747	3	HMI control box + starter box	4950	2300	1880	8300	2080	790	965	4970	4980	5090
19XR5454	3	HMI control box only	4460	2150	2000	9100	1750	790	960	4870	4720	5000
19XR5454	3	HMI control box + starter box	4460	2485	2000	9330	1750	790	960	4870	4720	5000
19XR5454	4	HMI control box only	4460	2250	2060	9950	1750	810	1016	4870	4720	5000
19XR5454	4	HMI control + starter box with motor frame DB to DJ	4460	2490	2060	10190	1750	810	1016	4870	4720	5000
19XR5454	4	HMI control + starter box with motor frame LB to LC	4460	2620	2060	10790	1750	810	1016	4870	4720	5000
19XR5454	4	HMI control + starter box with motor frame LD to LH	4460	2620	2060	11010	1750	810	1016	4870	4720	5000
19XR5959	3	HMI control box only	4990	2150	2060	9800	2080	790	965	4980	4860	5130
19XR5959	3	HMI control box + starter box	4990	2490	2060	10000	1750	790	960	4980	4860	5130
19XR5959	4	HMI control box only	4990	2260	2060	10700	1880	810	1016	4980	4860	5130
19XR5959	4	HMI control + starter box with motor frame DB to DJ and LB-LC	4990	2620	2060	10900	1880	810	1016	4980	4860	5130
19XR5959	4	HMI control + starter box with motor frame LD to LH	4990	2620	2060	10900	1880	813	1016	4980	4860	5130
19XR6464	4	HMI control box only	4480	2365	2150	10650	1750	810	1016	4710	4730	4930
19XR6464	4	HMI control box + starter box	4480	2720	2150	10900	1750	810	1016	4710	4730	4930
19XR6969	4	HMI control box only	5010	2365	2130	11400	1880	810	1016	4880	4800	5000
19XR6969	4	HMI control box + starter box	5010	2720	2130	11700	1880	810	1016	4880	4800	5000
19XR7474	4	HMI control box only	5125	2860	2430	14700	1990	1021	1041	4380	4600	4750
19XR7474	4	HMI control box + starter box	5125	3120	2430	14900	1981	1041	1321	4380	4600	4750
19XR7474	5	HMI control box only	5235	3015	2470	17200	1870	1060	1090	4380	4600	4750
19XR7474	5	HMI control box + starter box	5235	3095	2430	17400	1870	1060	1090	4380	4600	4750
19XR7979	5	HMI control box only	5845	3015	2430	18300	2115	1069	1070	4500	4790	4940
19XR7979	5	HMI control box + starter box	5845	3095	2430	18500	2115	1069	1070	4500	4790	4940
19XR8484	5	HMI control box only	5280	3035	2710	20200	1870	1060	1090	4250	4680	4810
19XR8484	5	HMI control box + starter box	5280	3165	2710	20500	1870	1060	1090	4250	4680	4810
19XR8989	5	HMI control box only	5885	3060	2710	21700	2115	1069	1070	4350	4890	5030
19XR8989	5	HMI control box + starter box	5885	3195	2710	21900	2115	1069	1070	4350	4890	5030
19XR7474	E	HMI control box only	5235	3015	2470	17700	1870	1060	1090	4380	4600	4750
19XR7474	E	HMI control box + starter box	5235	3095	2430	17800	1870	1060	1090	4380	4600	4750
19XR7979	E	HMI control box only	5845	3015	2430	18770	2115	1069	1070	4500	4790	4940
19XR7979	E	HMI control box + starter box	5845	3095	2430	18900	2115	1069	1070	4500	4790	4940
19XR8484	E	HMI control box only	5280	3035	2710	20700	1870	1060	1090	4250	4680	4810
19XR8484	E	HMI control box + starter box	5280	3165	2710	20900	1870	1060	1090	4250	4680	4810
19XR8989	E	HMI control box only	5885	3060	2710	22100	2115	1069	1070	4350	4890	5030
19XR8989	E	HMI control box + starter box	5885	3195	2710	22400	2115	1069	1070	4350	4890	5030

* Dimensions given for chiller equipped with flanges on waterbox nozzles.

** Weight given for chiller loaded with refrigerant

3.3.2 - Rig machine components

If the unit is disassembled for rigging, the weight of each machine element must be known: Motor, compressor, heat exchangers with and without refrigerant charges, electrical equipment, special waterboxes, isolation valves, etc. This information is available on the dimensional drawing supplied with the machine.

Follow the instructions given below and refer to the views of the unit and Fig. 10 to Fig. 14.

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.

NOTE: If the cooler 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 starter from the machine, remove wiring for the oil pump, oil heater, control wiring at the control box, 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.

3.3.3 - Physical data and dimensions

3.3.3.1 - Standard operating machine weights *

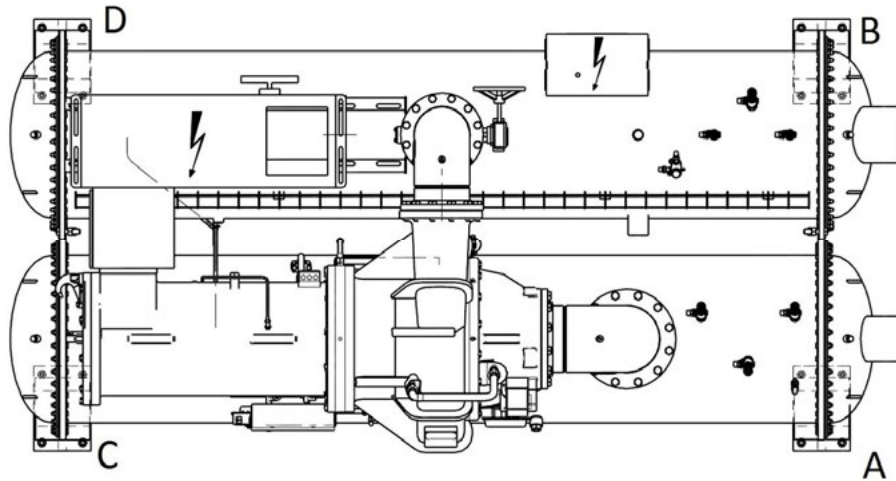
Table 2 - Chiller operating weights – weight distribution

Unit model	Compressor frame	Electrical box	Corners weight (kg)			
			A	B	C	D
19XR3232	3	HMI control box only	2090	1430	2400	1850
19XR3232	3	HMI control box + starter box	2150	1470	2460	1900
19XR3737	3	HMI control box only	2290	1450	2590	1970
19XR3737	3	HMI control box + starter box	2350	1480	2660	2020
19XR4242	3	HMI control box only	2320	1570	2710	1930
19XR4242	3	HMI control box + starter box	2390	1620	2790	1990
19XR4747	3	HMI control box only	2470	1680	2890	2060
19XR4747	3	HMI control box + starter box	2540	1720	2960	2110
19XR5454	3	HMI control box only	2740	2000	3150	2370
19XR5454	3	HMI control box + starter box	2800	2050	3220	2430
19XR5454	4	HMI control box only	3080	2010	3660	2380
19XR5454	4	HMI control + starter box with motor frame DB to DJ	3140	2050	3730	2430
19XR5454	4	HMI control + starter box with motor frame LB to LC	3140	2050	3730	2430
19XR5454	4	HMI control + starter box with motor frame LD to LH	3370	2445	3780	2800
19XR5959	3	HMI control box only	2950	2150	3400	2550
19XR5959	3	HMI control box + starter box	3010	2200	3460	2600
19XR5959	4	HMI control box only	3290	2150	3910	2550
19XR5959	4	HMI control + starter box with motor frame DB to DJ and LB-LC	3395	2475	3805	2825
19XR5959	4	HMI control + starter box with motor frame LD to LH	3395	2475	3805	2825
19XR6464	4	HMI control box only	3340	2230	3910	2590
19XR6464	4	HMI control box + starter box	3400	2270	3980	2650
19XR6969	4	HMI control box only	3580	2400	4200	2800
19XR6969	4	HMI control box + starter box	3650	2450	4280	2850
19XR7474	4	HMI control box only	4450	3480	5010	3890
19XR7474	4	HMI control box + starter box	4500	3530	5080	3940
19XR7474	5	HMI control box only	5390	3590	6450	3840
19XR7474	5	HMI control box + starter box	5450	3630	6530	3890
19XR7979	5	HMI control box only	5760	3850	6900	4100
19XR7979	5	HMI control box + starter box	5830	3880	6980	4150
19XR8484	5	HMI control box only	6360	4480	7450	4740
19XR8484	5	HMI control box + starter box	6420	4530	7520	4790
19XR8989	5	HMI control box only	6830	4810	7990	5090
19XR8989	5	HMI control box + starter box	6890	4860	8070	5140
19XR7474	E	HMI control box only	3980	4020	5870	5920
19XR7474	E	HMI control box + starter box	4000	4040	5900	5950
19XR7979	E	HMI control box only	4250	4290	6270	6320
19XR7979	E	HMI control box + starter box	4270	4310	6300	6350
19XR8484	E	HMI control box only	5320	4180	7840	6160
19XR8484	E	HMI control box + starter box	5370	4220	7920	6220
19XR8989	E	HMI control box only	5700	4480	8400	6600
19XR8989	E	HMI control box + starter box	5750	4520	8480	6670

* with water

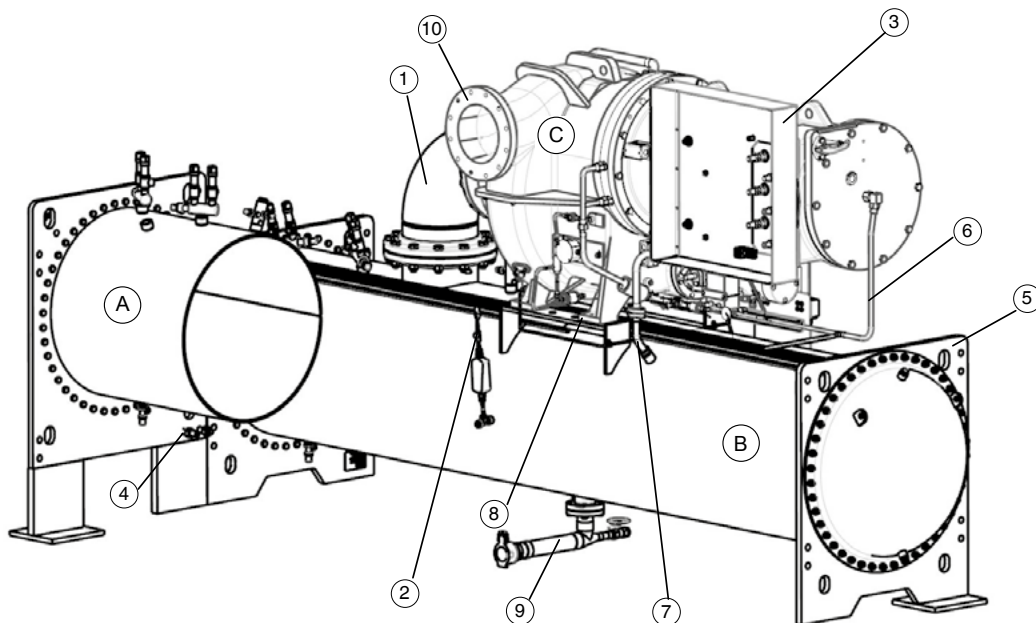
For the 19XRV machines please refer to chapter 8.

Figure 10 - Machine operating weights



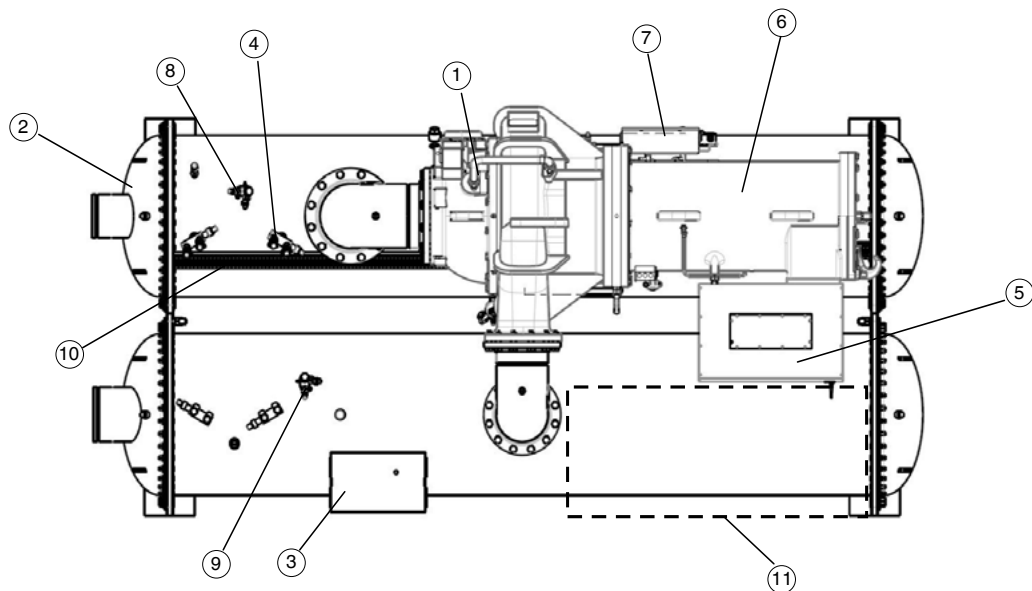
- A = Right-hand foot, evaporator
- B = Right-hand rear foot, condenser
- C = Left-hand foot, evaporator
- D = Left-hand rear foot, condenser

Figure 11 - 19XR Cooler side view



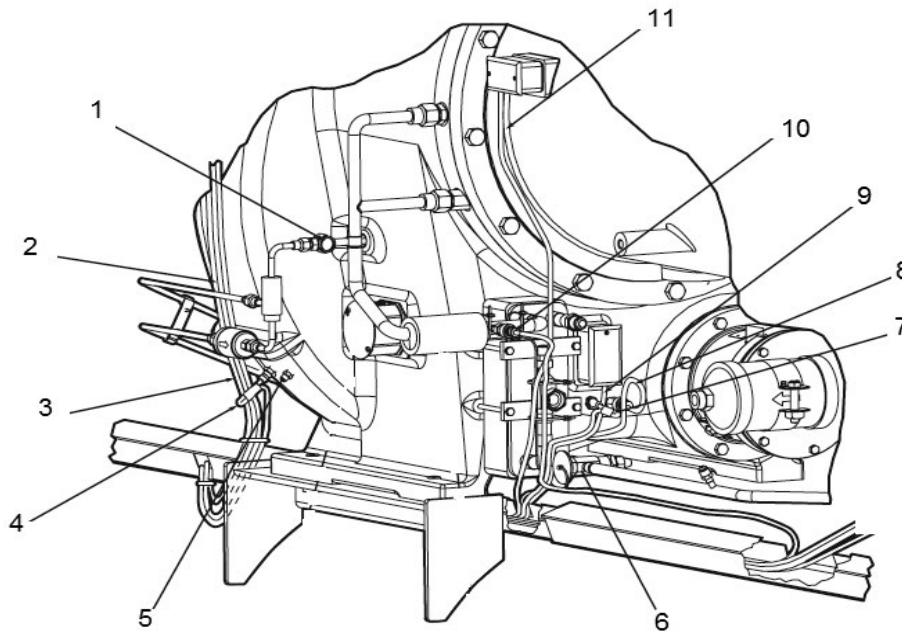
- | | |
|---|---------------------------------|
| 1. Compressor suction elbow (unbolt) | 8. Compressor mounting (unbolt) |
| 2. Oil reclaim line | 9. Cooler liquid feed line |
| 3. Terminal box | 10. Compressor Discharge pipe |
| 4. Heat exchanger assembly (unbolt) | A. Condenser |
| 5. Tube sheet | B. Cooler |
| 6. Refrigerant motor cooling line (cut) | C. Compressor |
| 7. Motor drain | |

Figure 12 - 19XR Chiller top view



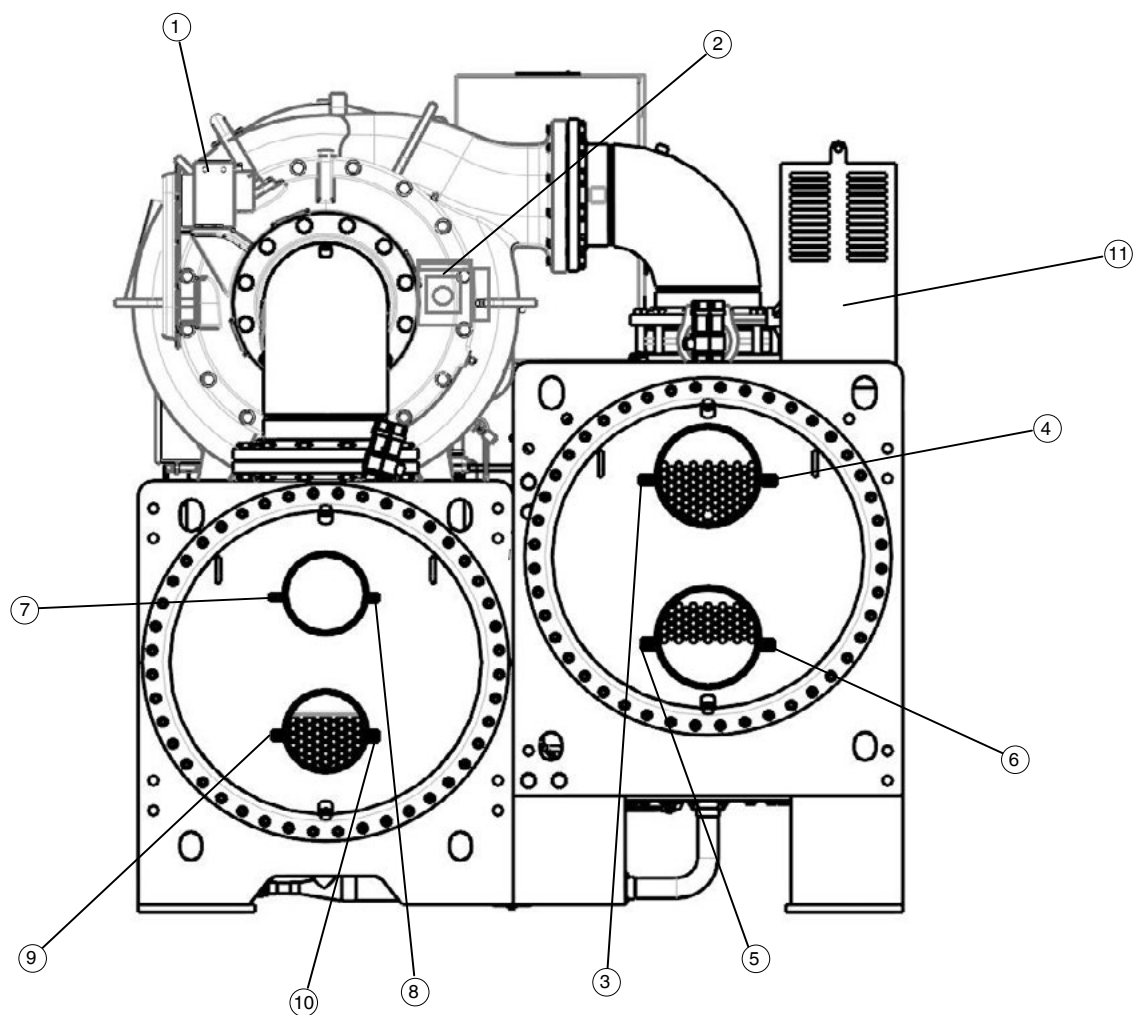
- | | |
|--|---|
| 1. Guide vane motor | 7. HP pressure switches |
| 2. Waterbox | 8. Pressure sensor position for refrigerant low pressure |
| 3. PIC control cabinet | 9. Pressure sensor position for refrigerant high pressure |
| 4. Relief valve on changeover | 10. Cable tray |
| 5. Terminal box with power supply customer access on top | 11. Location of starter cabinet |
| 6. Compressor motor | |

Figure 13 - Compressor control details



- | | |
|--|---|
| 1. Oil reclaim sight glass | 7. Compressor oil sump temperature sensor |
| 2. Diffuser pressure and diffuser actuator (Some frame 4 & all frame 5 only) | 8. Compressor oil sump pressure cable |
| 3. Guide valve actuator cable | 9. Bearing temperature sensor cable |
| 4. Compressor discharge temperature sensor | 10. Compressor oil discharge pressure cable |
| 5. High pressure switch location (DBK/SDBK) | 11. Motor temperature sensor cable |
| 6. Oil cooler thermostatic expansion valve (TXV) | |

Figure 14 - 19XR Rear view



1. Moteur des aubes
2. Moteur diffuseur (pour CP4 et tous les CP5)
3. Prise de pression de sortie d'eau au condenseur
4. Prise de température de sortie d'eau au condenseur
5. Prise de pression d'entrée d'eau au condenseur
6. Prise de température d'entrée d'eau au condenseur
7. Prise de pression de sortie d'eau à l'évaporateur
8. Prise de température de sortie d'eau à l'évaporateur
9. Prise de pression d'entrée d'eau à l'évaporateur
10. Prise de température d'entrée d'eau à l'évaporateur
11. Coffret de contrôle ICVC

3.3.3.2 - Dimensions/clearances

For units with marine waterboxes, please refer to the dimensional drawings supplied with the unit.

Table 3 - Service spaces recommendation

Unit code	Compressor frame	Electrical box configuration	Dimensions (mm)			Horizontal space for motor removing (A)	Vertical space above the chiller (B) (mm)	Vertical space for relief valves (C) (mm)	Horizontal space for HX tubes (D) mm	Vertical space for floatvalve (E) (mm)	Side space for cooler (F) (mm)	Side space for condenser (G) (mm)
			Lenght (max)	Height (max)	Width (max)							
19XR3232	3	HMI control box only	4290	2050	1700	1220	915	300	3750	230	362	610
19XR3232	3	HMI control box + starter box	4290	2130	1700	1220	915	300	3750	230	362	610
19XR3737	3	HMI control box only	4820	1920	1700	1220	915	300	4280	230	362	610
19XR3737	3	HMI control box + starter box	4820	2130	1700	1220	915	300	4280	230	362	610
19XR4242	3	HMI control box only	4430	2140	1880	1220	915	300	3750	230	362	610
19XR4242	3	HMI control box + starter box	4430	2300	1880	1220	915	300	3750	230	362	610
19XR4747	3	HMI control box only	4890	2140	1880	1220	915	300	4280	230	362	610
19XR4747	3	HMI control box + starter box	4890	2300	1880	1220	915	300	4280	230	362	610
19XR5454	3	HMI control box only	4460	2150	2000	1220	915	300	3750	315	362	610
19XR5454	3	HMI control box + starter box	4460	2470	2000	1220	915	300	3750	315	362	610
19XR5454	4	HMI control box only	4460	2250	2000	1220	915	300	3750	315	362	610
19XR5454	4	HMI control + starter box with motor frame DB to DJ	4460	2490	2000	1220	915	300	3750	315	362	610
19XR5454	4	HMI control + starter box with motor frame LB to LC	4460	2490	2000	1220	915	300	3750	315	362	610
19XR5454	4	HMI control + starter box with motor frame LD to LH	4460	2620	2055	1220	915	300	3750	315	362	610
19XR5959	3	HMI control box only	4990	2200	2000	1220	915	300	4280	315	362	610
19XR5959	3	HMI control box + starter box	4990	2490	2000	1220	915	300	4280	315	362	610
19XR5959	4	HMI control box only	4990	2260	2000	1220	915	300	4280	315	362	610
19XR5959	4	HMI control + starter box with motor frame DB to DJ and LB-LC	4990	2480	2000	1220	915	300	4280	315	362	610
19XR5959	4	HMI control + starter box with motor frame LD to LH	4990	2620	2000	1220	915	300	4280	315	362	610
19XR6464	4	HMI control box only	4480	2325	2100	1220	915	300	3750	280	362	610
19XR6464	4	HMI control box + starter box	4480	2580	2100	1220	915	300	3750	280	362	610
19XR6969	4	HMI control box only	5010	2325	2100	1220	915	300	4280	280	362	610
19XR6969	4	HMI control box + starter box	5010	2580	2100	1220	915	300	4280	280	362	610
19XR7474	4	HMI control box only	5125	2810	2430	1220	915	300	4280	460	362	610
19XR7474	4	HMI control box + starter box	5125	2985	2430	1220	915	300	4280	460	362	610
19XR7474	5	HMI control box only	5235	2990	2430	1220	915	300	4280	460	362	610
19XR7474	5	HMI control box + starter box	5235	2990	2430	1220	915	300	4280	460	362	610
19XR7979	5	HMI control box only	5845	2970	2430	1220	915	300	4880	460	362	610
19XR7979	5	HMI control box + starter box	5845	3090	2430	1220	915	300	4880	460	362	610
19XR8484	5	HMI control box only	5280	3035	2710	1220	915	300	4280	460	362	610
19XR8484	5	HMI control box + starter box	5280	3035	2710	1220	915	300	4280	460	362	610
19XR8989	5	HMI control box only	5885	3035	2710	1220	915	300	4880	460	362	610
19XR8989	5	HMI control box + starter box	5885	3195	2710	1220	915	300	4880	460	362	610
19XR7474	E	HMI control box only	5235	2990	2430	1220	915	300	4280	460	362	610
19XR7474	E	HMI control box + starter box	5235	2990	2430	1220	915	300	4280	460	362	610
19XR7979	E	HMI control box only	5845	2970	2430	1220	915	300	4880	460	362	610
19XR7979	E	HMI control box + starter box	5845	3090	2430	1220	915	300	4880	460	362	610
19XR8484	E	HMI control box only	5280	3035	2710	1220	915	300	4280	460	362	610
19XR8484	E	HMI control box + starter box	5280	3035	2710	1220	915	300	4280	460	362	610
19XR8989	E	HMI control box only	5885	3035	2710	1220	915	300	4880	460	362	610
19XR8989	E	HMI control box + starter box	5885	3195	2710	1220	915	300	4880	460	362	610

* Assumes that both cooler and condenser nozzles are on the same end of the chiller.

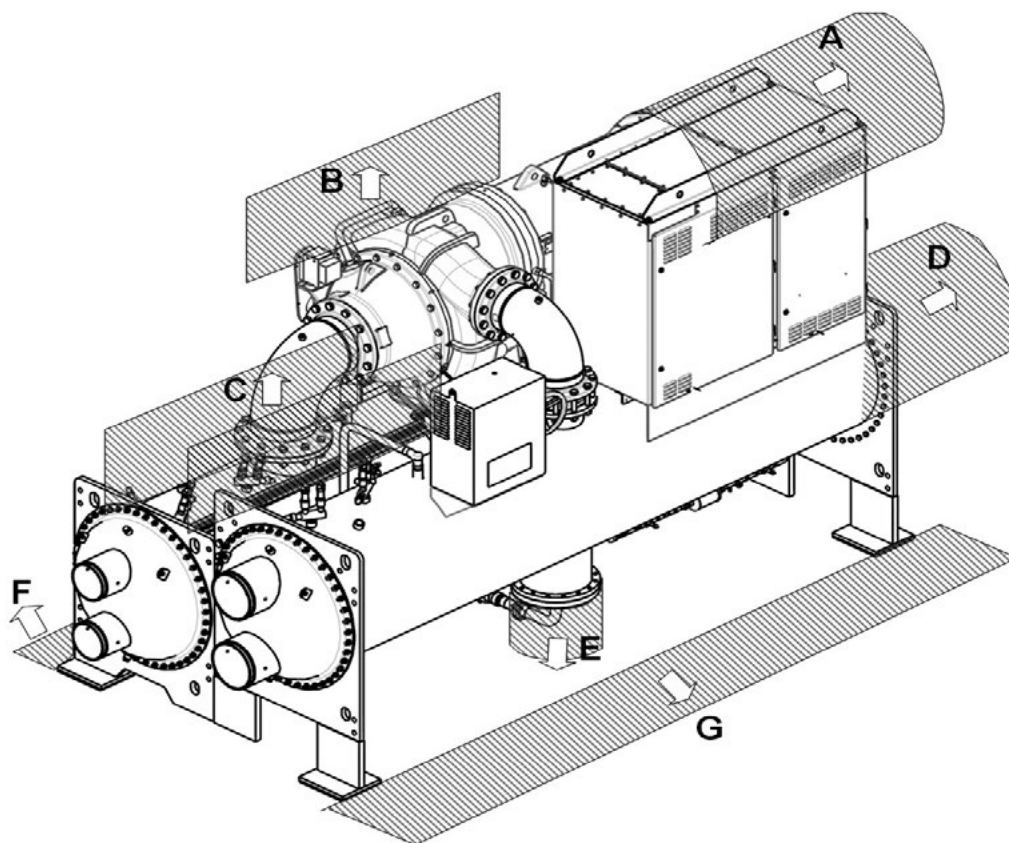
** 1 or 3 pass length applies, if either (or both) cooler or condenser is a 1 or 3 pass design.

See dimensional drawings for each unit for more details

Data given for 2 passes unit on heat exchangers with DS or CR nozzle code. If the nozzle code is different, please refer to dimensional drawing specific of the unit.

NOTE: Refer to Fig. 15

Figure 15 – Service spaces location



NOTE: Non-certified drawings. Refer to the certified dimensional drawings supplied with the unit or available on request, when designing an installation.

3.3.3.3 - Maximum and minimum 19XR heat exchanger flow rates (l/s)

Evaporator*								Condenser*							
Evaporator Size	No of tubes	1 pass		2 pass		3 pass		Condenser Size	No of tubes	1 pass		2 pass		3 pass	
		min (l/s)	max (l/s)	min (l/s)	max (l/s)	min (l/s)	max (l/s)			min (l/s)	max (l/s)	min (l/s)	max (l/s)	min (l/s)	max (l/s)
30	200	40	161	20	81	13	54	30	218	40	162	20	81	13	54
31	240	48	193	24	97	16	64	31	266	49	197	25	99	16	66
32	282	56	227	28	114	19	76	32	315	58	234	29	117	19	78
35	200	40	161	20	81	13	54	35	218	40	162	20	81	13	54
36	240	48	193	24	97	16	64	36	266	49	197	25	99	16	66
37	282	56	227	28	114	19	76	37	315	58	234	29	117	19	78
40	324	65	261	32	130	22	87	40	366	67	271	34	136	22	90
41	364	73	293	36	147	24	98	41	415	77	308	38	154	26	103
42	400	80	322	40	161	27	107	42	464	86	344	43	172	29	115
45	324	65	261	32	130	22	87	45	366	67	271	34	136	22	90
46	364	73	293	36	147	24	98	46	415	77	308	38	154	26	103
47	400	80	322	40	161	27	107	47	464	86	344	43	172	29	115
50	431	86	347	43	174	29	116	50	507	93	376	47	188	31	125
51	485	97	391	49	195	32	130	51	556	102	412	51	206	34	137
52	519	104	418	52	209	35	139	52	602	111	446	55	223	37	149
53	536					36	144	53	621					38	153
54	551	110	444	55	222	37	148	54	639	118	474	59	237	39	158
55	431	86	347	43	174	29	116	55	507	93	376	47	188	31	125
56	485	97	391	49	195	32	130	56	556	102	412	51	206	34	137
57	519	104	418	52	209	35	139	57	602	111	446	55	223	37	149
58	536					36	144	58	621					38	153
59	551	110	444	55	222	37	148	59	639	118	474	59	237	39	158
5K	203					26	103								
5L	218					28	111								
5M	231					29	117								
5P	216	82	329	41	165										
5Q	229	87	349	43	175										
5R	244	93	372	46	186										
5T	203					26	103								
5U	218					28	111								
5V	231					29	117								
5X	216	82	329	41	165										
5Y	229	87	349	43	175										
5Z	244	93	372	46	186										

Evaporator*							Condenser*								
Evaporator Size	No of tubes	1 pass		2 pass		3 pass		Condenser Size		1 pass		2 pass		3 pass	
		min (l/s)	max (l/s)	min (l/s)	max (l/s)	min (l/s)	max (l/s)			min (l/s)	max (l/s)	min (l/s)	max (l/s)		
60	557	112	448	56	224	37	149	60	648	119	480	60	240	40	160
61	599	120	482	60	241	40	161	61	695	128	515	64	258	43	172
62	633	127	510	63	255	42	170	62	741	137	549	68	275	46	183
63	652					44	175	63	761					47	188
64	669	134	539	67	269	45	180	64	780	144	578	72	289	48	193
65	557	112	448	56	224	37	149	65	648	119	480	60	240	40	160
66	599	120	482	60	241	40	161	66	695	128	515	64	258	43	172
67	633	127	510	63	255	42	170	67	741	137	549	68	275	46	183
68	652					44	175	68	761					47	188
69	669	134	539	67	269	45	180	69	780	144	578	72	289	48	193
6K	243					31	124								
6L	258					33	131								
6M	275					35	140								
6P	257	97	392	49	196										
6Q	271	103	413	51	207										
6R	287	109	438	54	219										
6T	243					31	124								
6U	258					33	131								
6V	275					35	140								
6X	257	97	392	49	196										
6Y	271	103	413	51	207										
6Z	287	109	438	54	219										
70	644	129	519	64	259	43	173	70	781	144	579	72	290	48	193
71	726	145	585	73	292	48	195	71	870	160	645	80	323	53	215
72	790	158	636	79	318	53	212	72	956	176	709	88	354	59	236
73	812					54	218	73	986					61	244
74	832	167	670	83	335	56	223	74	996	184	738	92	369	61	246
75	644	129	519	64	259	43	173	75	781	144	579	72	290	48	193
76	726	145	585	73	292	48	195	76	870	160	645	80	323	53	215
77	790	158	636	79	318	53	212	77	956	176	709	88	354	59	236
78	812					54	218	78	986					61	244
79	832	167	670	83	335	56	223	79	996	184	738	92	369	61	246
7K	303					38	154								
7L	341					43	173								
7M	376					48	191								
7P	319	121	487	60	243										
7Q	357	135	545	68	272										
7R	393	149	599	75	300										
7T	303					38	154								
7U	341					43	173								
7V	376					48	191								
7X	319	121	487	60	243										
7Y	357	135	545	68	272										
7Z	393	149	599	75	300										
80	829	166	668	83	334	55	223	80	990	183	734	91	367	61	245
81	901	180	725	90	363	60	242	81	1080	199	801	100	400	66	267
82	976	195	786	98	393	65	262	82	1170	216	867	108	434	72	289
83	1001					67	269	83	1260	232	934	116	467	77	311
84	1025	205	825	103	413	68	275	84	1355	250	1005	125	502	83	335
85	829	166	668	83	334	55	223	85	990	183	734	91	367	61	245
86	901	180	725	90	363	60	242	86	1080	199	801	100	400	66	267
87	976	195	786	98	393	65	262	87	1170	216	867	108	434	72	289
88	1001					67	269	88	1260	232	934	116	467	77	311
89	1025	205	825	103	413	68	275	89	1355	250	1005	125	502	83	335
8K	419					53	213								
8L	462					58	235								
8M	504					64	256								
8P	437	166	667	83	333										
8Q	481	182	734	91	367										
8R	523	198	798	99	399										
8T	419					53	213								
8U	462					58	235								
8V	504					64	256								
8X	437	166	667	83	333										
8Y	481	182	734	91	367										
8Z	523	198	798	99	399										

* Flow rates based on standard tubes in the cooler and condenser.
Minimum flow based on tube velocity of 0.91 m/s (3 ft/s).
Maximum flow based on tube velocity of 3.66 m/s (12 ft/s).

3.4 - 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

Fig. 16 and Fig. 17 show the position of support plates and shear flex pads which together form the standard machine support system.

3.4.2 - Installation of a levelling accessory (if necessary)

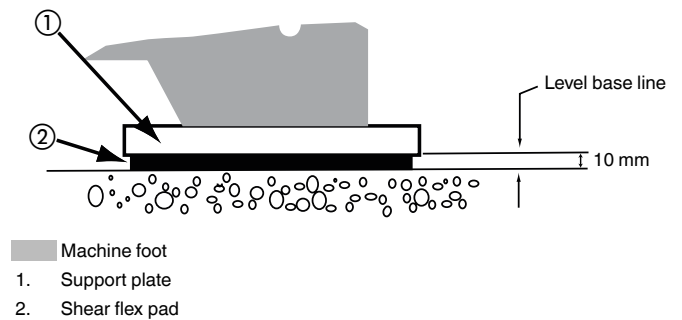
Where a floor surface is irregular or uneven, it may prove necessary to use accessory spring isolators (supplied by Carrier for field installation) and levelling pads. See Fig. 18 and Fig. 19.

Place the unit levelly, using the spring isolator jacking screws. Use a level at least 600 mm long.

In order to provide adequate, long-lasting support for the unit, it is essential to choose the right grout and to apply it properly. Carrier advise using an epoxy-type, premixed, non-shrinking grout only. Follow the manufacturer's instructions for applying the grout.

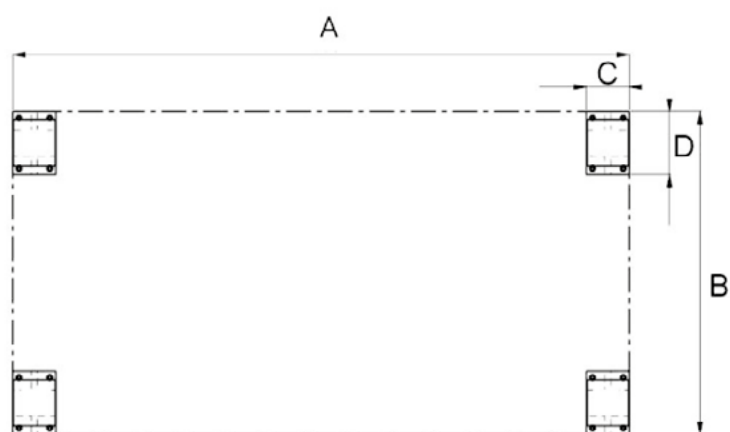
- Check the unit layout plans to determine the required grout thickness.
- Apply wax to the jacking screws to facilitate subsequent removal from the grout.
- The grout must be applied up to the top of the base of the spring isolator, and there must be no gap in the grout below the spring isolators.
- Allow the grout to dry and set in accordance with the manufacturer's instructions before starting up the unit.
- Remove the jacking screws from the soleplates once the grout has set.

Figure 16 - Standard isolation

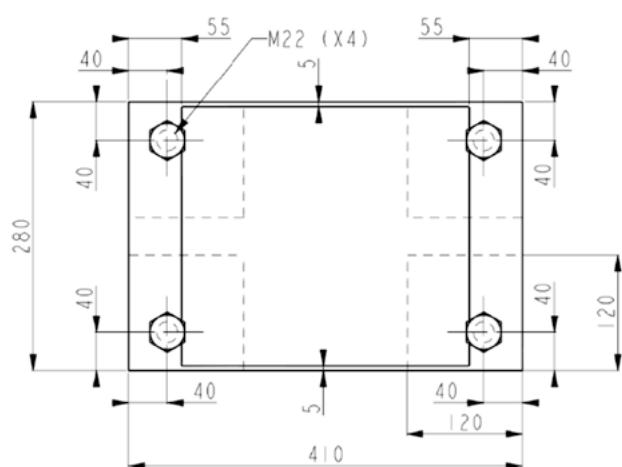


Note: The isolation package includes four shear flex pads.

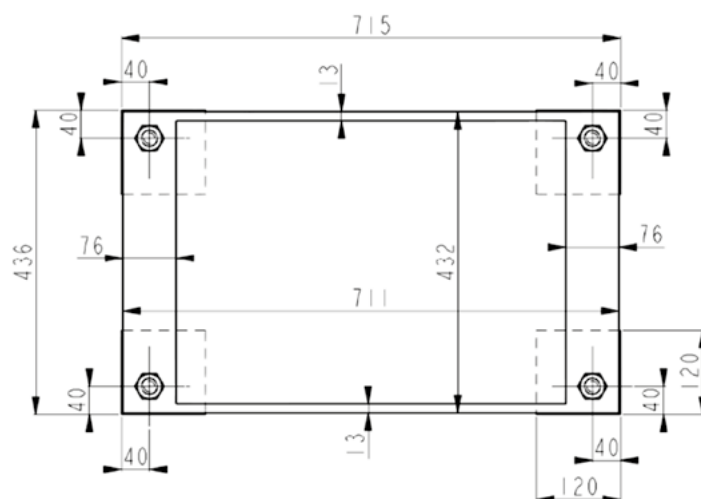
Figure 17 - 19XR Chiller footprint



Footprint (mm)				
Unit model	Length between feets A (mm)	Width between feets B (mm)	Foot length C (mm)	Food width D (mm)
XR30 > 32	4009	1775	280	410
XR35 > 37	4533	1775	280	410
XR40 > 42	4009	1985	280	410
XR45 > 47	4533	1985	280	410
XR50 > 54	4009	2100	280	410
XR55 > 59	4533	2100	280	410
XR60 > 64	4009	2200	280	410
XR65 > 69	4533	2200	280	410
XR70 > 74	4656	2578	432	711
XR75 > 79	5262	2578	432	711
XR80 > 84	4656	2862	432	711
XR85 > 89	5262	2862	432	711



For 19XR3 to 19XR6 units



For 19XR7 to 19XR8 units

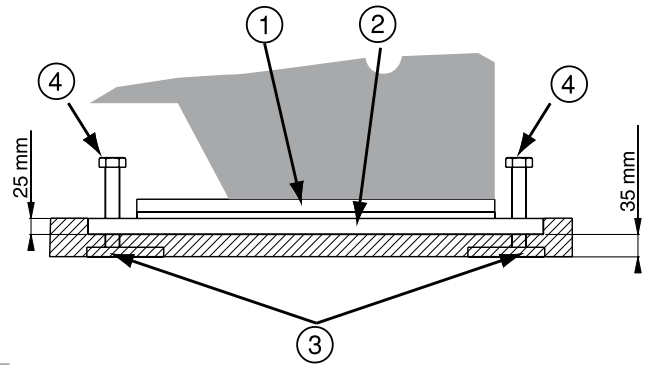
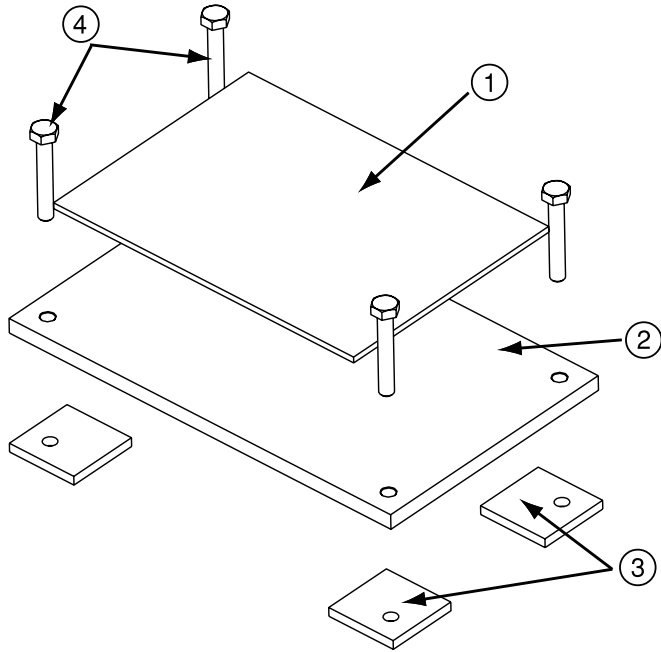
3.4.3 - Install spring isolation

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. 19 - "19XR Spring isolation".

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.

Figure 18 - Levelling accessory for 19XR units

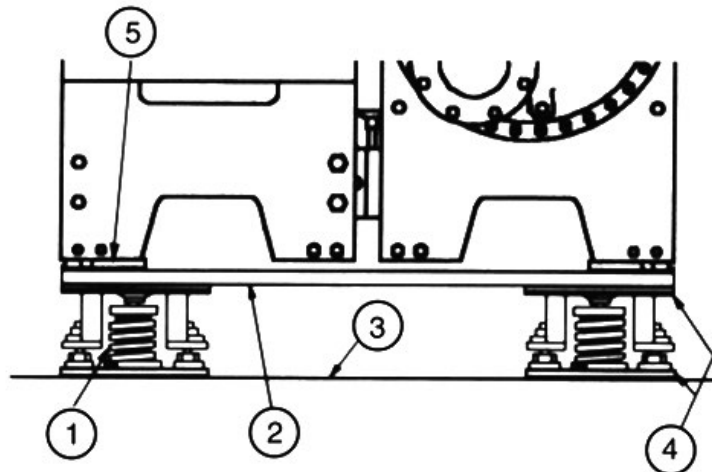


- Machine foot (side view)
- System base (concrete)
- 1. Anti-vibration platform
- 2. Soleplate
- 3. Adjusting pads
- 4. Adjusting screws

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-shrinking grout. Masterflow 648CP-Plus or Chemrex Embeco 636 Plus Grout 38 to 57 mm thick.

Figure 19 - 19XR Spring isolation



- 1. Accessory spring isolator
- 2. Soleplate (accessory) attaches securely to isolator
- 3. Level foundation
- 4. Resilient shear flex pad, bonded to top and bottom of spring mount
- 5. Support plate

3.5 - Connection of water 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. 21 - “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.

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. 20 - “Typical nozzle piping”.

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

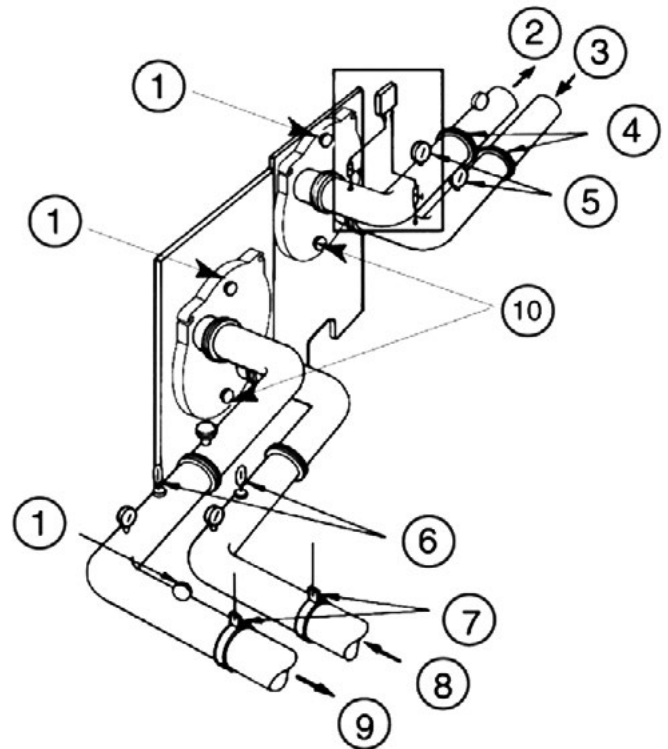
Remove chilled and condenser water sensors and probes before welding connecting piping to the connections. Refer to Fig. 14 - “19XR Rear view”. Replace sensors and probes after welding is complete.

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 access will be blocked.
2. Provide openings in water piping for required pressure gauges and thermometers. For thorough mixing and temperature stabilization, wells in the leaving water pipe should extend inside pipe at least 50 mm.
3. Install air vents at all high points in piping to remove air and prevent water hammer.
4. Install pipe hangers where needed. Make sure no weight or stress is placed on waterbox pipes or flanges.
5. Use flexible connections to reduce the transmission of vibrations.
6. Water flow direction must be as specified in Fig. 20 - “Typical nozzle piping”.

NOTE: The water outlet is always the upper nozzle for cooler or condenser.

7. Water flow switches must be of vapour-tight construction and must be installed on top of pipe in a horizontal run and at least 5 pipe diameters from any bend.
8. Install waterbox vent and drain piping in accordance with individual job data. All connections are 3/4 -in. FPT.
9. Install waterbox drain plugs in the unused waterbox drains and vent openings.
10. Install optional pumpout system or pumpout system and storage tank. Please refer to Fig. 22 and Fig. 23.

**Figure 20 - Typical nozzle piping
(not supplied by Carrier)**

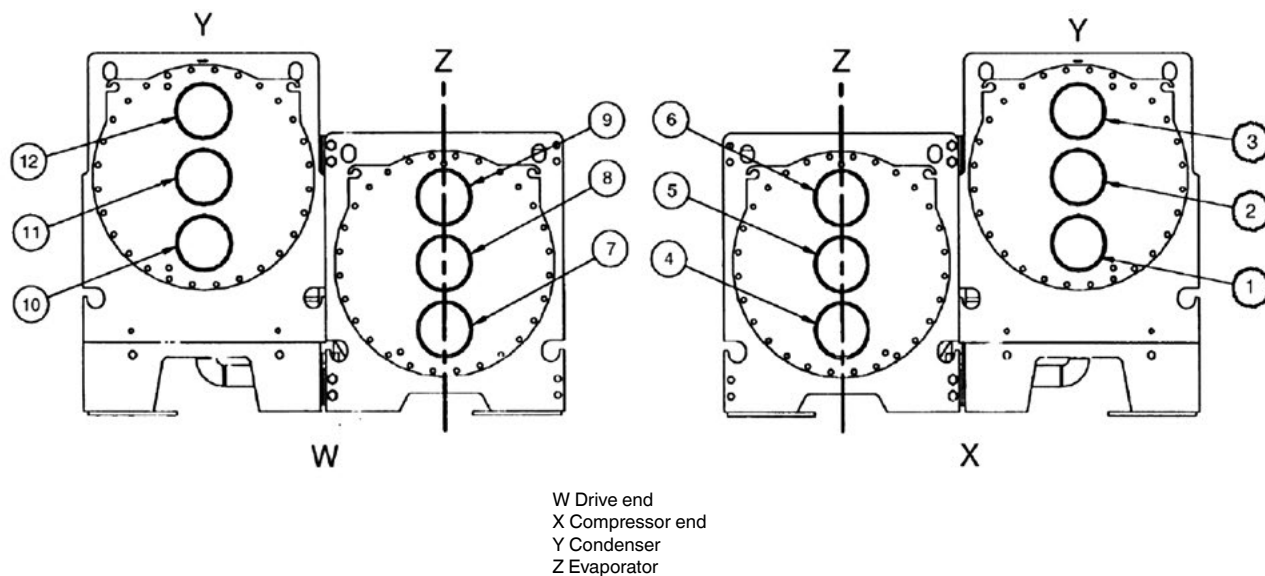


1. Air vent
2. Leaving condenser water
3. Entering condenser water
4. Isolation valve
5. Pressure gauges
6. Thermometer openings (optional)
7. Pipe hangers
8. Entering chilled water
9. Leaving chilled water
10. Water drain

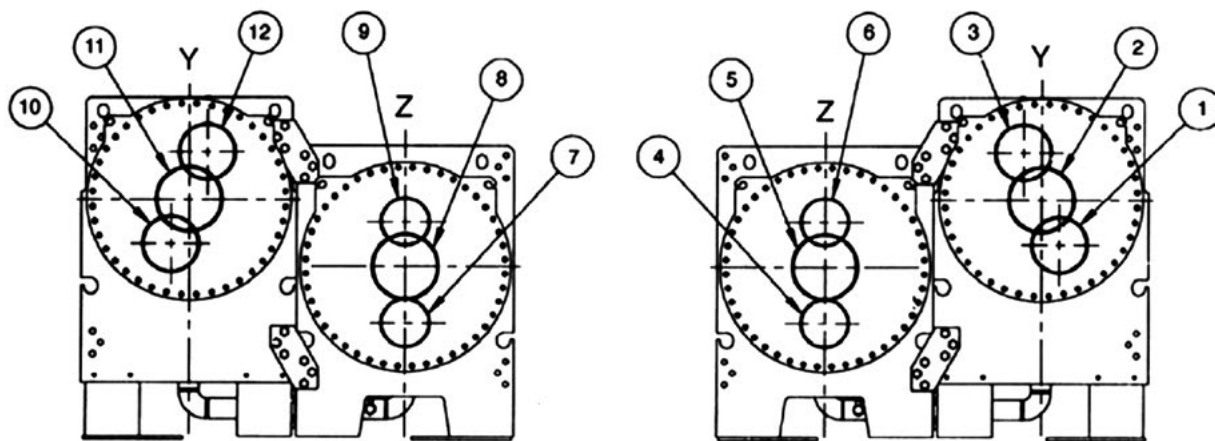
NOTE: Non-certified drawings. Refer to the certified dimensional drawings supplied with the unit or available on request, when designing an installation.

Figure 21 - Standard waterboxes and nozzle arrangements (19XR)

Frame 3 – 4 – 5 – 6 (see table below)



Frame 7 - 8 (see table below)



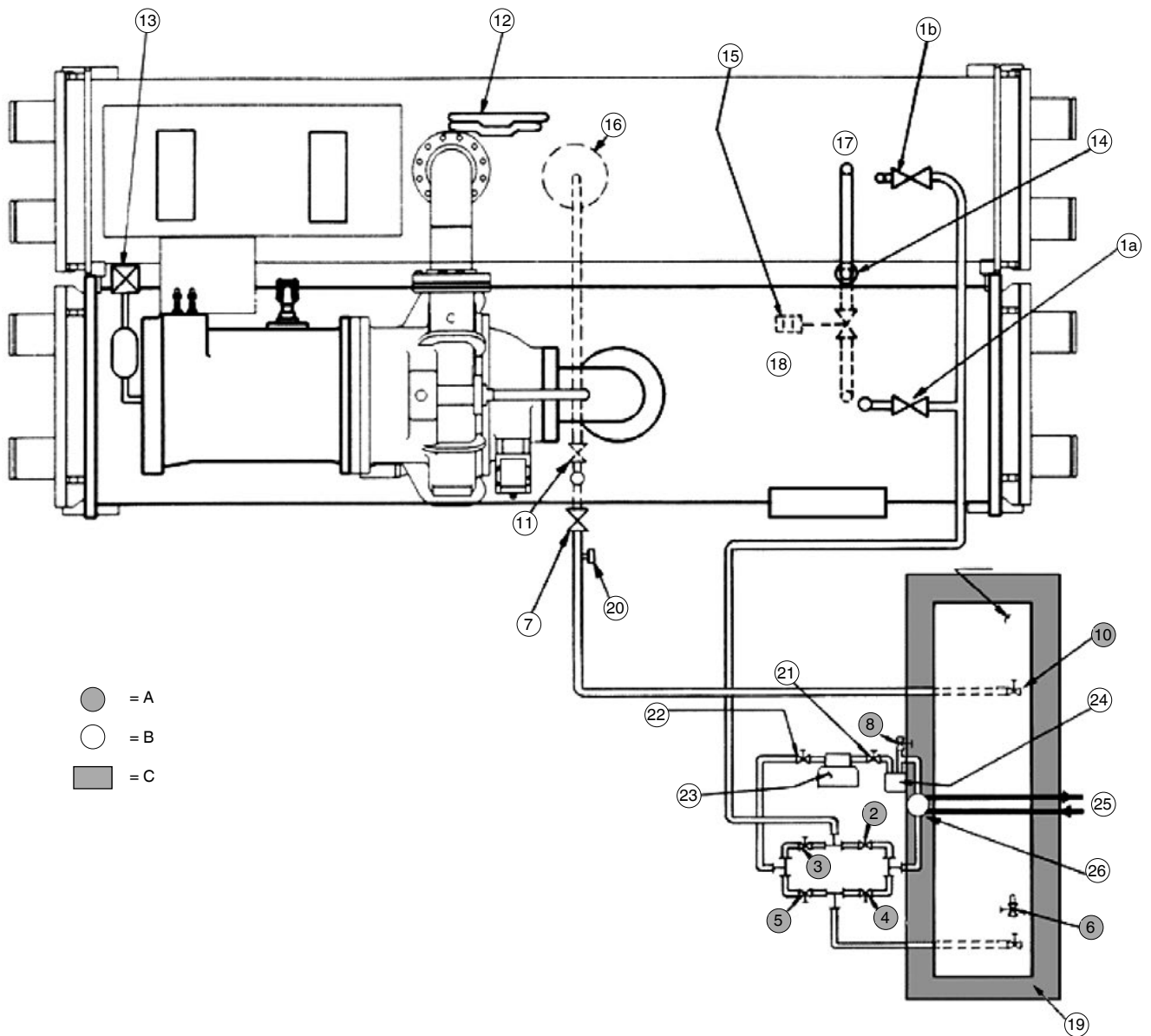
NOTE: Non-certified drawings. Refer to the certified dimensional drawings supplied with the unit or available on request, when designing an installation.

Number of passes	Evaporator waterbox			Condenser waterbox		
	Inlet	Outlet	Arrangement code*	Inlet	Outlet	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

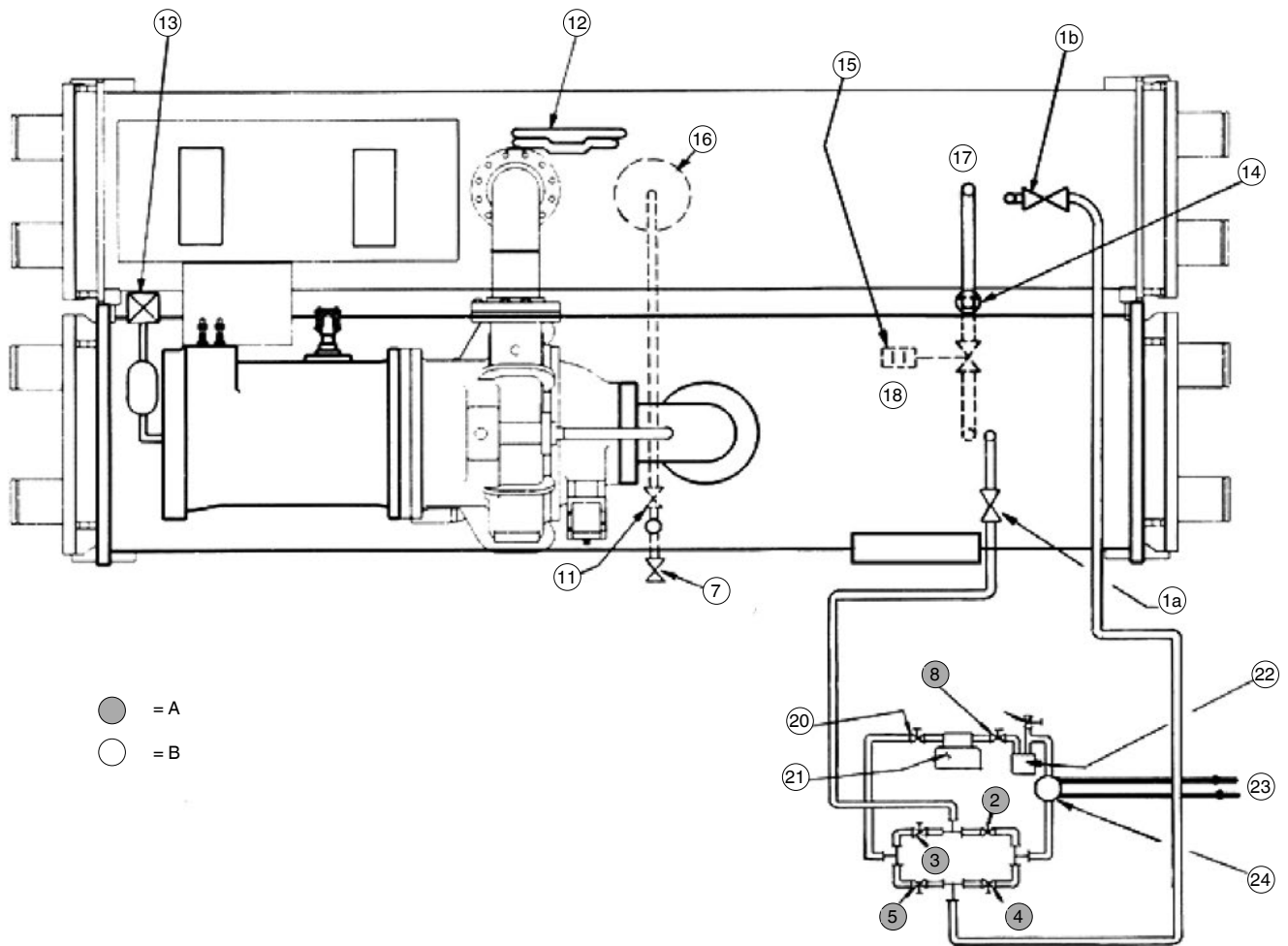
ATTENTION: For marine waterboxes, please refer to the dimensional drawings supplied with the machine.

Figure 22 - Optional pumpout system piping schematic with storage tank



- | | | | | | |
|-----|-------------------------------|-----|----------------------------------|-----|---|
| 1a | Safety valve on machine | 13. | Refrigerant cooling valve | 25. | Condenser water supply and return |
| 1b | Safety valve on machine | 14. | Optional hot gas isolation valve | 26. | Pumpout condenser |
| 2. | Service valve on pumpout unit | 15. | Hot gas bypass solenoid valve | A | Service valve on pumpout unit |
| 3. | Service valve on pumpout unit | 16. | Linear float | B | Service valve on machine |
| 4. | Service valve on pumpout unit | 17. | Condenser | C | Maintain at least 610 mm clearance around storage tank for service and operation work |
| 5. | Service valve on pumpout unit | 18. | Cooler | | |
| 6. | Storage tank vent | 19. | Storage tank | | |
| 7. | Machine charging valve | 20. | Tee for charging | | |
| 8. | Compressor discharge valve | 21. | Compressor discharge valve | | |
| 10. | Refrigerant charging valve | 22. | Compressor suction valve | | |
| 11. | Cooler isolation valve | 23. | Pumpout compressor | | |
| 12. | Condenser isolation valve | 24. | Oil separator | | |

Figure 23 - Pumpout system piping schematic without storage tan



- | | |
|--------------------------------------|---------------------------------------|
| 1a. Service valve on machine | 15. Hot gas bypass solenoid valve |
| 1b. Service valve on machine | 16. Linear float |
| 2. Service valve on pumpout unit | 17. Condenser |
| 3. Service valve on pumpout unit | 18. Evaporator |
| 4. Service valve on pumpout unit | 19. Compressor discharge valve |
| 5. Service valve on pumpout unit | 20. Compressor suction valve |
| 7. Machine charging valve | 21. Pumpout compressor |
| 8. Compressor discharge valve | 22. Oil separator |
| 11. Cooler isolation valve | 23. Condenser water supply and return |
| 12. Condenser isolation valve | 24. Pumpout condenser |
| 13. Refrigerant cooling valve | A. Service valve on pumpout unit |
| 14. Optional hot gas isolation valve | B. Service valve on machine |

3.5.2 - Install vent piping to relief devices

The 19XR chiller is factory equipped with relief devices on the cooler and condenser shells, and equipped with changeover. Refer to Fig. 20 - "Relief device locations" for size and location of relief devices.

The safety valves assy are installed on ball valves, that are sealed in the open position. These valves permit isolating and removing the safety valve for calibration and replacement.

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 and the fuses 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 and fuses 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 chapter 1 - "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.

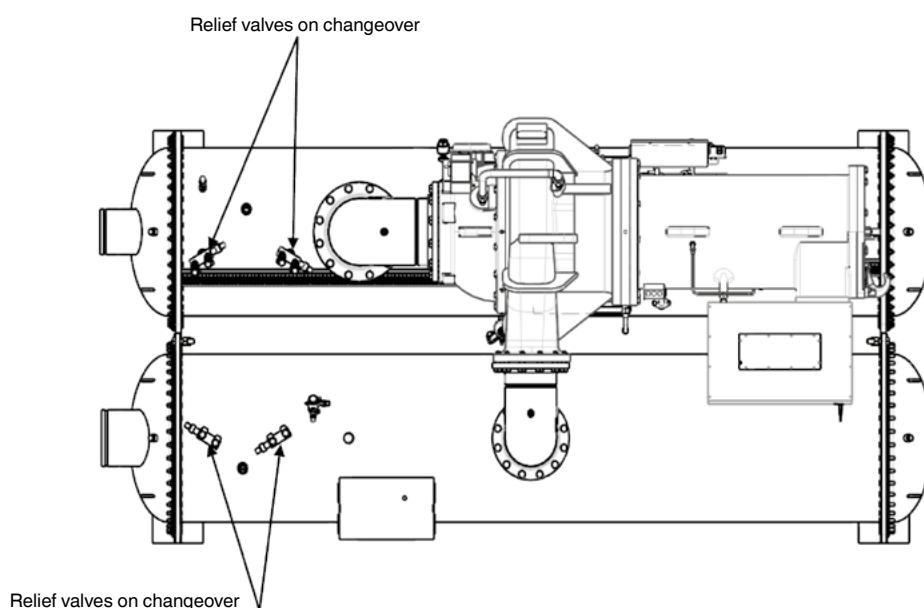
Provide a pipe plug near outlet side of each relief device for leak testing. Provide pipe fittings that allow vent piping to be disconnected periodically for inspection of valve mechanism.

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.

Figure 24 - Relief device locations



3.6 - Make electrical connections

The wiring diagrams in this manual (see Fig. 24 - “COMM 1 CCN communication wiring for multiple chillers”) are only for illustration and should not be used instead of the project-specific wiring diagrams.

Details for the wires and cables inside the factory-mounted control boxes: Except for the compressor power supply cables, the insulation is generally of the 05VK or 07VK type.

The wire colours are generally as follows: Red, black and white for the 3 bus wires, red for all the common 24, 115, 230 VAC wires, orange for all the wires of the excluded circuits, blue for the DC circuits, brown for all the other wires.

WARNING: Do not attempt to start compressor or oil pump (even for a rotation check) or apply test voltage of any kind while machine is under dehydration vacuum. Motor insulation breakdown and serious damage may result.

3.6.1 - Installation standards and precautions

The field wiring must comply with all relevant electrical regulations that apply at the installation site (see “Electrical data notes”). In France, for example, the requirements of standard NFC 15100, among others, must be met.

IMPORTANT: If particular aspects of an installation require different characteristics from those listed above (or not mentioned), contact your local Carrier office.

3.6.2 - Electrical characteristics of the motors

NOTE: For 60 Hz units contact Carrier.

The installer is responsible for the installation arrangement of the machine power supply.

This must be defined using the data supplied on the specific machine selection sheet.

	Start-up current**	Maximum continuous operating current
Across-the-line start	Motor LRDA*	Motor OLTA*
Start/delta start (Y/Δ)	Motor LRYA*	Motor OLTA*
Electronic starter	3*Motor RLA*	Motor OLTA*
Machine with variable frequency drive (19XRV)	N/A	Chiller rated line current*

* Value given on the specific machine selection sheet.

** The maximum start-up current duration is less than 10 s.

NOTE: The installation data must comply with any other short-circuit requirements supplied for the machine.

Other electrical devices to be taken into consideration

1. Nominal current draw of the oil pump = power kVA x 1000/(√3 x voltage).
2. The crankcase heater only operates when the compressor is off.
3. Power to the crankcase heater control must be on circuits that can provide continuous service when the compressor is disconnected.

3.6.3 - Recommended wire section

The section and number of connectable power supply cables for the 19XRV machine are given in the specific chapter on each starter mode (starting with chapter 8).

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.

3.6.4 - External control wiring

3.6.4.1 - Field control wiring

Refer to the 19XR PIC Controls IOM and the certified wiring diagram supplied with the unit for the field control wiring of the following features:

- Evaporator pump interlock (mandatory)
- Remote on/off switch
- Alarm report
- Condenser pump control
- Remote set point reset
- Refrigerant leak detection
- Demand limiter
- Percentage, capacity in operation
- Emergency stop

3.6.4.2 - Communication wiring

The standard external communication protocol is CCN. A JBus/ModBus communications board is available as an option.

3.6.5 - Make the necessary connections for the outgoing control signals

Connect the auxiliary equipment, the chilled water pumps and the condenser water pumps, as well as the additional alarms, as indicated in the job wiring diagrams.

3.6.6 - Connect the starting cabinet

The 19XR is available either with a unit-mounted, factory-installed starter cabinet, with its interface control box or with a separate, field-installed starter. See Fig. 21 or 22, depending on the starter type (unit mounted or separate).

3.6.6.1 - Unit-mounted factory-installed starter cabinet

Connect the power leads of the auxiliary equipment, chilled and condenser water pump as well as the associated alarms, using the conductor provided. Refer to the wiring diagram for the installation.

Electrical data notes and operating conditions

- 19XR units have one or two power connection points.
- The control box always includes the protection and control elements, as well as the power circuit for the oil pump and the heaters. As an option or as standard on the 19XRV machines, the electrical equipment also includes the start-up and protection elements for the compressor motor.

Field connections:

- All connections to the system and the electrical installations must be in full accordance with all applicable codes*.
- The Carrier 19XR units are designed and built to ensure conformance with local codes. The recommendations of European standard EN 60204-1 (corresponds to IEC 60201-1) (machine safety - electrical machine components - part 1: General regulations) are specifically taken into account, when designing the electrical equipment.

Notes:

- Generally the recommendations of IEC 60364 are accepted as compliance with the requirements of the installation directives. Conformance with EN 60204-1 is the best means of ensuring compliance with the Machines Directive and § 1.5.1.
- Annex B of EN 60204 1 describes the electrical characteristics used for the operation of the machines.

1. The operating environment for the 19XR units is specified below:

Environment* Environment as classified in IEC 60364 § 3:

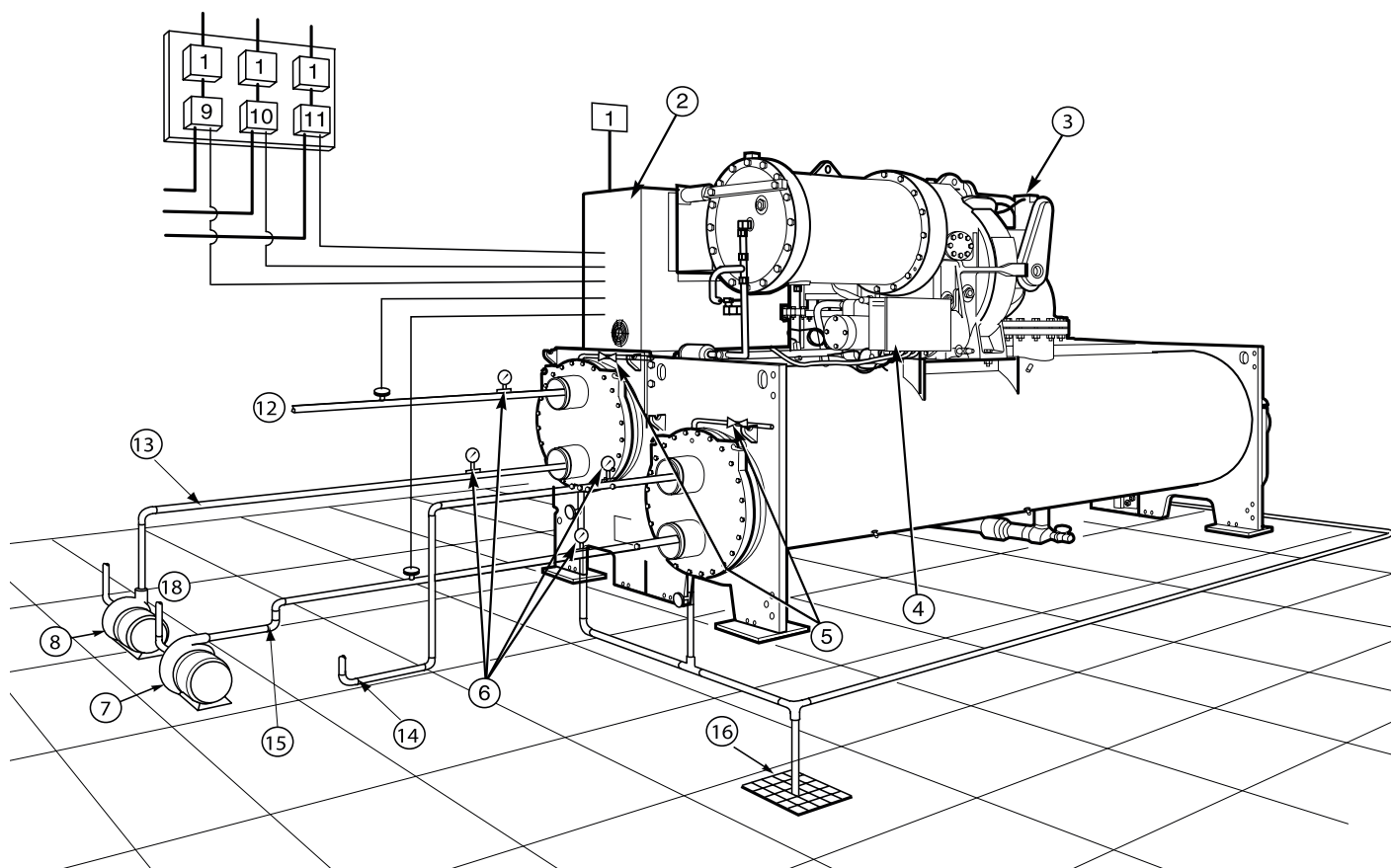
- Ambient temperature range: +5 °C to +40 °C, class AA4*
- Humidity range (non-condensing)*:
50% relative humidity at 40 °C
90% relative humidity at 20 °C

- Altitude: ≤ 2000 m for 19XR machines (≤ 1000 m for 9XRV machines)
 - indoor installation
 - Presence of water: Class AD2* (possibility of water droplets)
 - Presence of hard solids, class AE2* (no significant dust present)
 - Presence of corrosive and polluting substances, class AF1 (negligible)
 - vibration and shock, class AG2, AH2
 - Competence of personnel, class BA4* (trained personnel - IEC 60364)
2. Power supply frequency variation: ± 2 Hz.
 3. The neutral (N) conductor must not be connected directly to the unit (if necessary use a transformer).
 4. Overcurrent protection of the power supply conductors is not provided with the unit.
 5. The factory installed disconnect switch(es)/circuit breaker(s) is (are) disconnect devices of a type suitable for power interruption in accordance with EN 60947-3 (corresponds to IEC 60947-3).
 6. The units are designed for connection to TN networks (IEC 60364). For IT networks the earth connection must not be at the network earth. Provide a local earth, consult competent local organisations to complete the electrical installation.

Note: If particular aspects of an actual installation do not conform to the conditions described above, or if there are other conditions which should be considered, always contact your local Carrier representative.

- * The protection level required to conform to this class is IP21B (according to reference document IEC 60529). All 19XR units are protected to IP23 and fulfil this protection condition. They are also protected against accidental and exceptional non-pressurised water jets.

Figure 25 - Unit with unit-mounted starter/variable-frequency drive



1. Disconnect
2. Unit mounted starter with control (factory-installed)
3. Guide vane motor
4. Oil pump terminal box
5. Vents
6. Pressure gauges
7. Chilled water pump
8. Condenser water pump
9. Chilled water pump starter
10. Condenser water pump starter

11. Cooling tower fan starter
 12. To cooling tower
 13. From cooling tower
 14. To load
 15. From load
 16. Drain
17. Piping
 18. Control wiring
 19. Power wiring

IMPORTANT: Ensure correct phasing is followed for proper motor rotation (clockwise). Do not isolate the terminals until the wiring has been verified and approved by the Carrier personnel in charge of the commissioning.

NOTE: The oil pump disconnect switch can be placed near element 2, (separate starter cabinet).

NOTES:

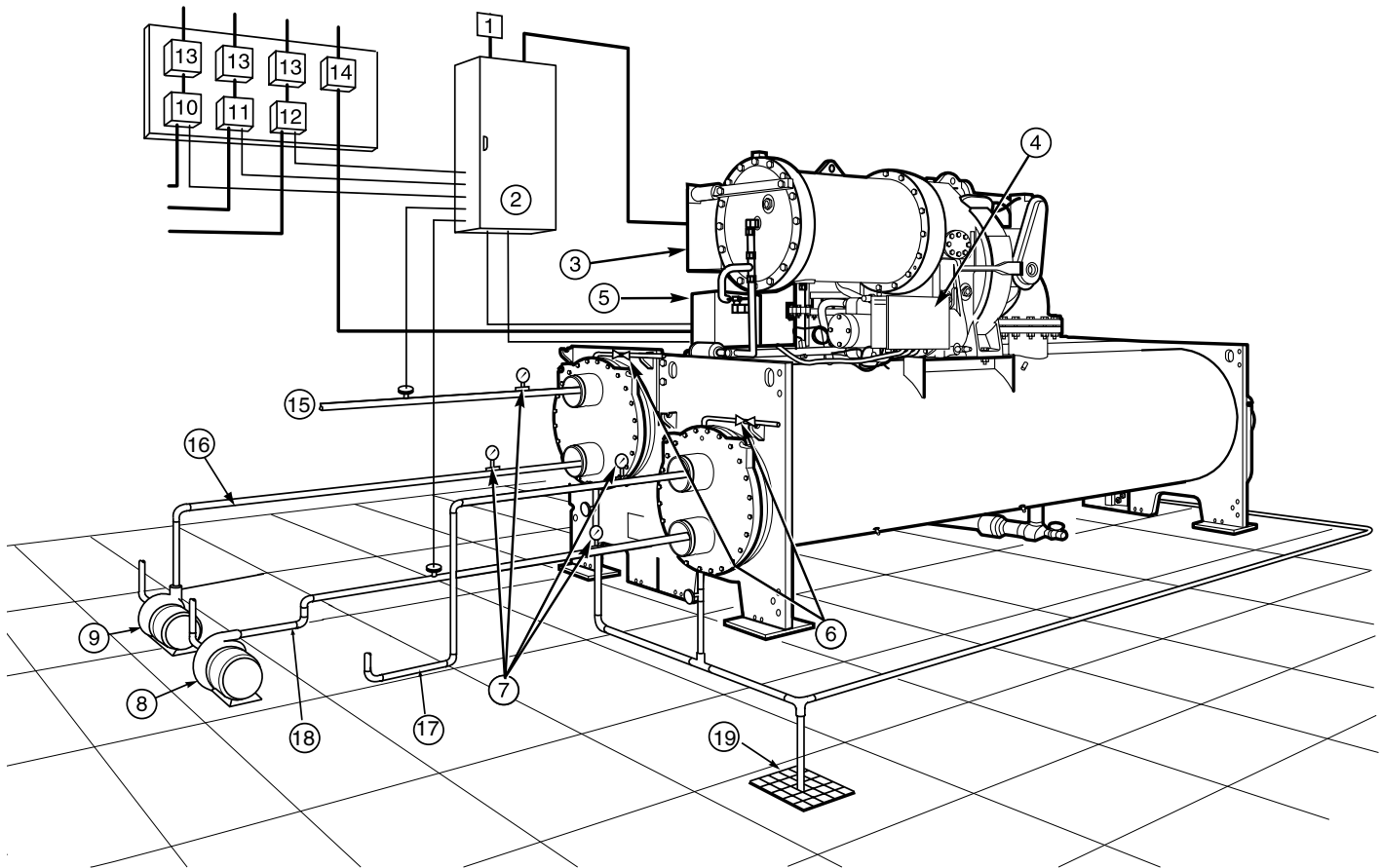
1. Wiring and piping shown are for general point-of-connection only and are not intended to show details for a specific installation. Certified field wiring and dimensional diagrams are available on request.
2. All wiring must comply with applicable codes.
3. Refer to Carrier System Design Manual for details regarding piping techniques.
4. Wiring not shown for optional devices such as:
 - Remote start-stop
 - Remote alarm
 - Optional safety device
 - 4 to 20 mA resets
 - Optional remote sensors.

3.6.6.2 - Freestanding, field-installed starter

The starters must be designed and manufactured in accordance with applicable regulations. Fig. 26 illustrates the installation principle to be observed.

IMPORTANT: Do not insulate terminals until wiring arrangement has been checked and approved by Carrier start-up personnel. Also, make sure correct phasing is followed for proper motor rotation (clockwise).

Figure 26 - Unit with separate starter/variable-frequency drive



- | | |
|---|-------------------------------|
| 1. Disconnect | 12. Cooling tower fan starter |
| 2. Freestanding compressor motor starter/variable frequency drive | 13. Disconnect |
| 3. Compressor motor terminal box | 14. Circuit breaker |
| 4. Oil pump terminal box | 15. To cooling tower |
| 5. Control cabinet | 16. From cooling tower |
| 6. Vents | 17. To load |
| 7. Pressure gauges | 18. From load |
| 8. Chilled water pump | 19. Drain |
| 9. Condenser water pump | |
| 10. Chilled water pump starter | |
| 11. Condensing water pump starter | |
- Piping
— Control wiring
— Power wiring

IMPORTANT: Ensure correct phasing is followed for proper motor rotation (clockwise). Do not isolate the terminals until the wiring has been verified and approved by the Carrier personnel in charge of the commissioning.

NOTE: The oil pump disconnect switch can be placed near element 2, (separate starter cabinet).

NOTES:

1. Wiring and piping shown are for general point-of-connection only and are not intended to show details for a specific installation. Certified field wiring and dimensional diagrams are available on request.
2. All wiring must comply with applicable codes.
3. Refer to Carrier System Design Manual for details regarding piping techniques.
4. Wiring not shown for optional devices such as:
 - Remote start-stop
 - Remote alarm
 - Optional safety device
 - 4 to 20 mA resets
 - Optional remote sensors.

3.6.6.3 - High-voltage units

High-voltage units can require special terminal preparation to prevent moisture condensation and electrical arcing. Follow electrical codes for high-voltage installation. The use of vinyl tape is not recommended; a method for high-voltage devices must be used.

3.6.6.4 - Electrical connection of the starter

The earth of the control equipment and the control box (starter) must have equipotential.

3.6.6.5 - Control wiring

The transformer that supplies the control equipment is only provided to supply the auxiliary control installation within the power reserve limit indicated on the wiring diagram supplied with the machine.

The communication bus cables and those provided for the transmission of analogue signals that go to the outside of the control boxes must be shielded. The shielding must be connected to the whole cable circumference and both ends.

3.6.6.6 - Wiring between starter and compressor motor

For high-voltage motor wiring please contact the Carrier factory.

Low-voltage (690 V or less) compressors have six terminal studs. Depending on the type of starter employed, between 3 and 6 leads must be run between the starter and the motor. If only 3 leads are used, jumper the terminals as follows: 1 to 6, 2 to 4 and 3 to 5 (see the table in Fig. 27 for the diameter and distance between terminals).

The terminal studs must not take the weight of the leads: use intermediate supports. Use a torque spanner to tighten the terminal nuts to 60 Nm maximum, maintaining the terminal with an additional spanner.

3.6.7 - Connect the starter cabinet to the control box

Connect the starter cabinet to the unit control box (Fig. 26).

In addition, connect the communication cable (SIO) from the control box to the ISM board on the power wiring box.

The pressostat and pump operation return signal cables may cross over between the control boxes.

3.6.8 - 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 metallic braiding.

The system elements are connected to the communication bus in a daisy chain arrangement. The positive pin of each system element communication connector must be wired to the positive pins of the system element on either side of it. The negative pins must be wired to the negative pins. The signal ground pins must be wired to the signal ground pins. See Fig. 24 - "COMM1 CCN communication wiring for multiple 19XR chillers" for the location of the CCN network connector on the ICVC (J1) module.

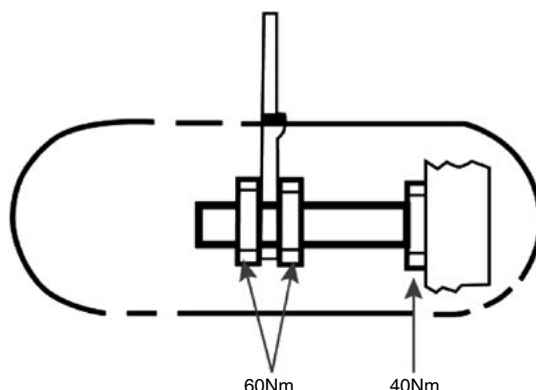
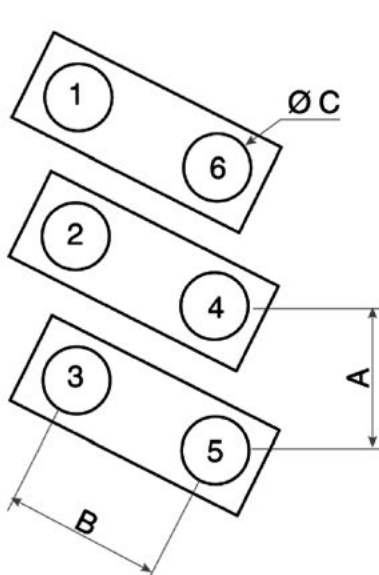
When connecting the CCN communication bus to a system element, a colour code system for the entire network is recommended to simplify installation and checkout. The following colour code is recommended:

Signal type *	ICVC connector	CCN Bus conductor insulation colour
+	1	Red
Ground	2	White
-	3	Black

* Cable type to be used: shielded cable LIYCY

If a cable with a different colour scheme is selected, a similar colour code should be adopted for the entire network. Precautions must be taken to protect the signal against external electromagnetic interference. The recommendations depend on the installation configuration.

Figure 27 - Diameter and distance between terminals for the wiring between compressor starter and motor



Motor size	Voltage 690 V or less			
	Number of terminals	A mm	B mm	Ø C mm
B	6	101,5	80	16
C	6	101,5	80	16
D	6	145	122	22,5
E	6	145	122	22,5

- **Installations with controlled earth equipotential**

If the earth potential difference is small: In general, if all elements connected to the CCN bus are installed in the same building and if the distance between the communicating devices is short:

1. Use of a twisted, unshielded cable is normally sufficient. If there is a problem created by strong radiated interference in the air (high frequency):
2. Use of a shielded cable with a 75% minimum recovery rate can increase the immunity of the cable to high-frequency radiated interference. In the first instance the shielding connection is made at a single point. If the problem persists, the shielding must also be connected near each device connected to the bus, on a site plan. In all cases the shielding connection(s) must guarantee an electrical link along the complete periphery of the cable.

- **Installations with non-controlled earth equipotential**

If the machine and the display are located in different buildings and/or if the distance between the devices is long (>200 m): A solution can only be established after an analysis of the installation and its specific characteristics, and the recommendations below are only given as basic precautions.

1. Surge absorbers must be installed at both ends of each cable conductor to prevent the risk of light-nig strikes.
2. Locating the closed metallic cable in a conduit, or even locating it in the ground are good ways of increasing the immunity of the cable against radiated interference.
3. The installation of common cores at both ends increases the immunity against interference. The ferrites are then installed so that they enclose the complete cable.

NOTE: The use of a shielded cable can cause problems.

ATTENTION: If there may be a difference in the low-frequency potential between the local earth connections, this can lead to a dangerous voltage (> 50 V) between the display and the local earth. In this case the installation of the accessory wired connection is not recommended.

To connect the 19XR chiller to the network, proceed as follows for ICVC PIC2/3 (refer to Fig. 28):

1. Cut power to the PIC control panel.
2. Find connector J1 on the ICVC.
3. Cut a CCN wire and strip the ends of the RED, WHITE, and BLACK conductors (Molex type strippable connectors - supplier ref. No. 08-50-0189).
4. Using a wirenut, connect the drain wires together.
5. Insert and secure the RED wire to Terminal 1 of the J1 connector.
6. Insert and secure the WHITE wire to Terminal 2 of the J1 connector.
7. Insert and secure the BLACK wire to Terminal 3 of the J1 connector.
8. Mount a terminal strip in a convenient location.
9. Connect the opposite ends of each conductor to separate terminals on the terminal strip.
10. Cut another CCN wire and strip the ends of the conductors.
11. Connect the RED wire to the matching location on the terminal strip.
12. Connect the WHITE wire to the matching location on the terminal strip.
13. Connect the BLACK wire to the matching location on the terminal strip.

3.7 - Install field insulation See Fig. 29 - "Machine isolation".

CAUTION: Protect insulation from weld heat damage and weld splatter. Cover with wet canvas cover during water piping installation.

When installing insulation at the job site, insulate the following components:

- Compressor motor
- Cooler shell
- Cooler tube sheets
- Suction elbow
- Motor cooling drain
- Oil reclaim piping
- Plate heat exchanger refrigerant side tubing
- Refrigerant liquid line to cooler
- Suction chamber waterbox covers.

Figure 28 - COMM1 CCN communication wiring for multiple 19XR chillers (typical)

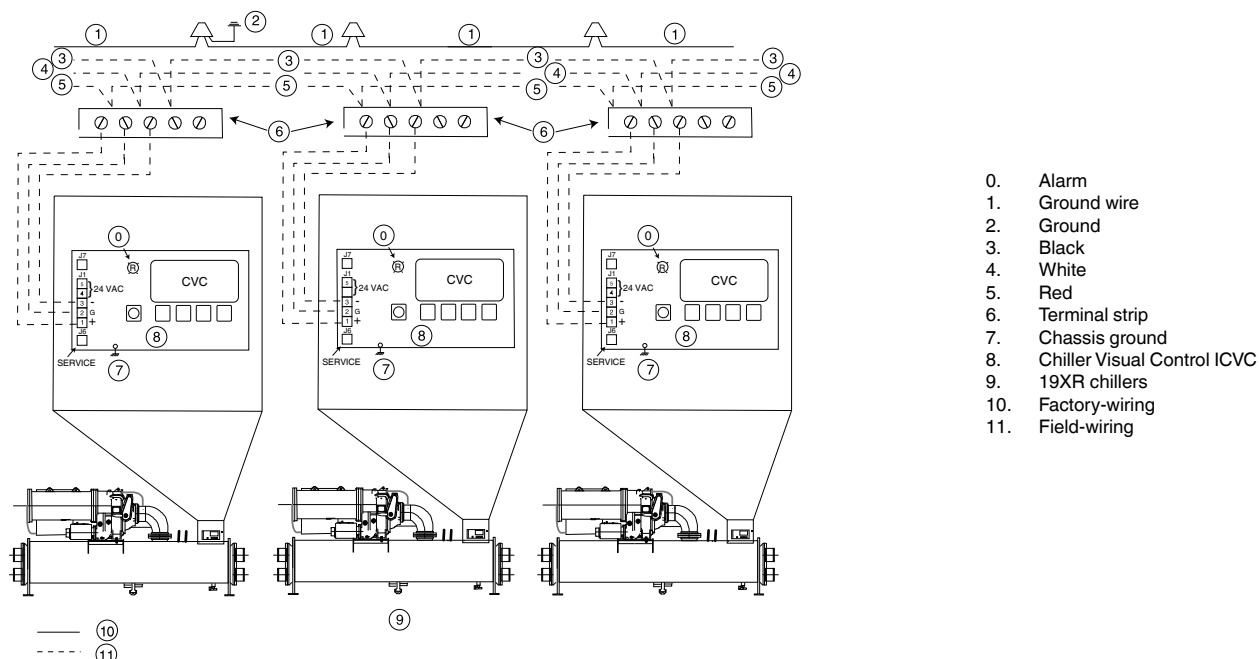
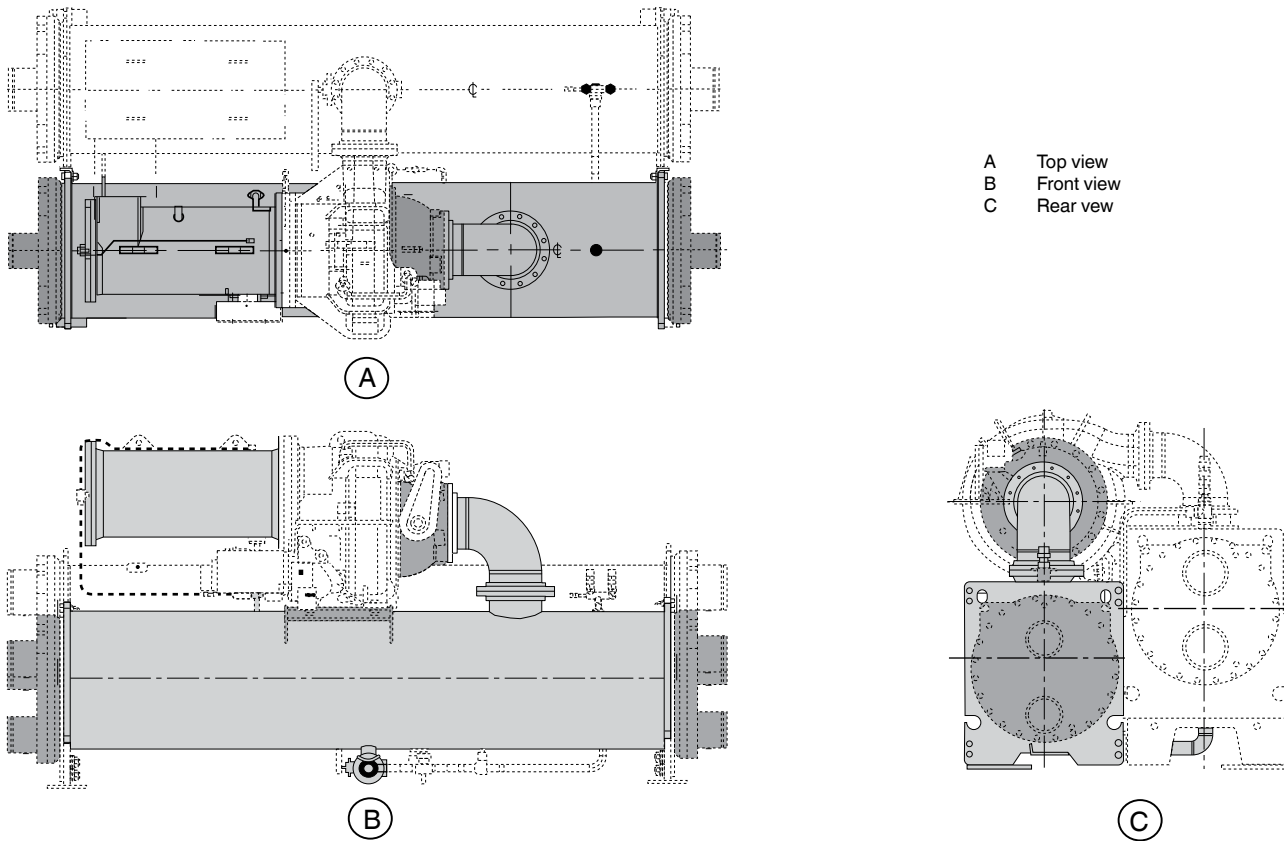


Figure 29 - Machine Isolation



3.8 - Installation of a refrigerant leak detection module (option 159)

Option 159: Independent refrigerant leak detection system.

3.8.1 - Description

The European directive concerning fluorinated greenhouse gases (F-gas regulation) now requires that installations with 300 kg or more F-gas must be leak-tested at least every three months. This applies to 95% of 19XR/19XV units.

To facilitate these periodic maintenance visits, it is recommended to install an independent optional refrigerant leak detection system on these chillers. This system can either be factory-installed or added to a machine that is already installed.

It consists of an electronic module located in the control box (see Fig. 30), that is connected to a sensor located between the two heat exchangers at the middle point of the unit (see Fig. 31). This sensor is encased and attached to a fixing bracket mounted between the oil balancing line and its fixing support (see Fig. 32).

This system permits permanent monitoring of the leak-tightness of the points where refrigerant leaks can occur in the chiller refrigerant circuit. An analogue 4-20 mA signal from the detection module at input J5-5(-)/J5-6(+) of the CCM board is available for this purpose.

3.8.2 - Control/operation

The detection threshold corresponds to an assigned 6 mA current that is equivalent to a detection of 133 ppm R-134a. The refrigerant leak alarm is configurable in the options table on the HMI.

If the sensor detects refrigerant in the air, the refrigerant leak detection alarm (No. 250) is relayed and displayed on the HMI. The system is independent and directly linked to the chiller operation. The alarm will cause the unit to shut down. The 4-20 mA input signal can be adjusted by placing DIP switch 1 of SW2 on the CCM board into the ON position (see Fig. 33).

3.8.3 - Adding the module to an installed chiller

Carrier offers a refrigerant leak detection kit (part number 19XR-509---632--EE-) that can be installed to existing chillers. This is available from the Spare Parts Department. The module can be added to any 19XR/19XV machine with a control interface box or a starter control box. The installation and wiring instructions are supplied with the kit.

Item	Quantity
Refrigerant leak detection module with sensor and 5 m cable (19ZX-561---212--EE-)	1
3 x 0.5 LiYY cable	5
Three-point KK connector	1
KK contact	3
Screw T h M4 lg 12	3
Screw T h M4 lg 20	1
Rectifier jumper (50 V, 8 A)	1
Red wire 0.93 (-5 V)	1,5
Brown wire 0.93 (+5 V)	1,5
Red wire 0.93 (0 V)	1,5
Brown wire 0.93 (24 V)	1,5
Pre-insulated red clip (6.35)	4
Machine connection piece (7 mm long)	4
DIN rail clips	2
Detector support panel	1
Sensor support panel	1
Installation and wiring instructions	1

Figure 30 - View of module in the control box

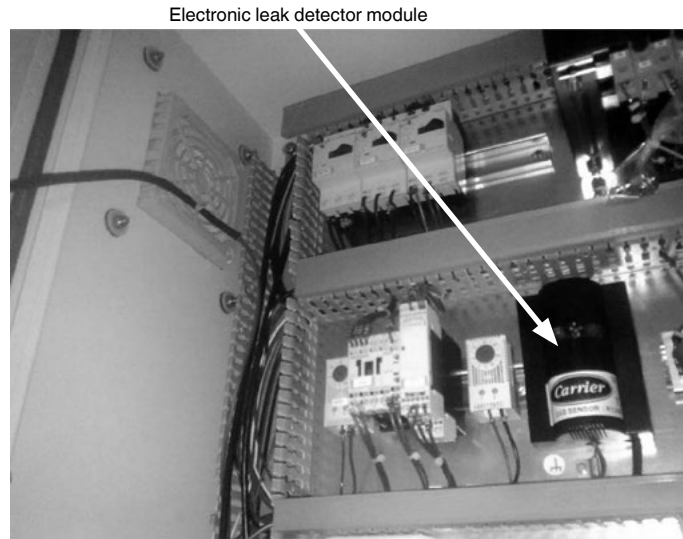


Figure 31 - Detector support fixing

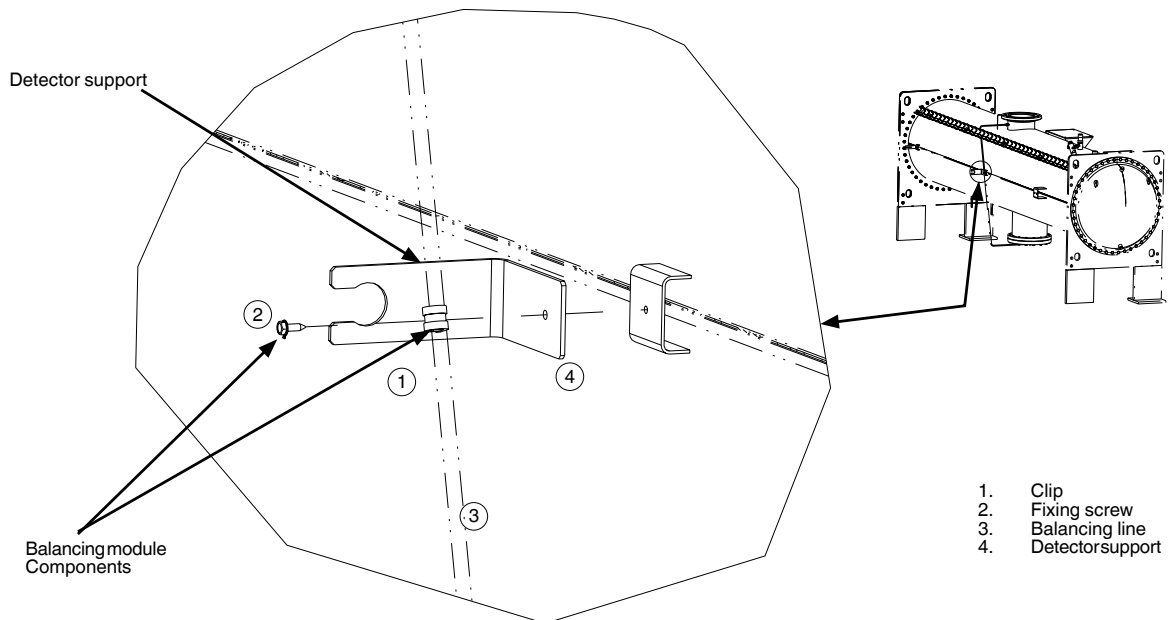


Figure 32 - Detector fixing

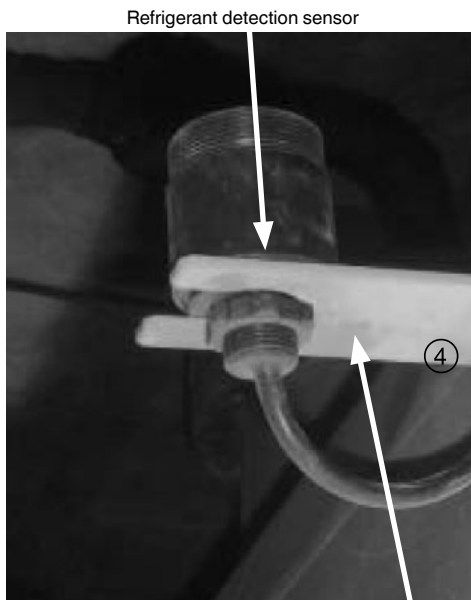
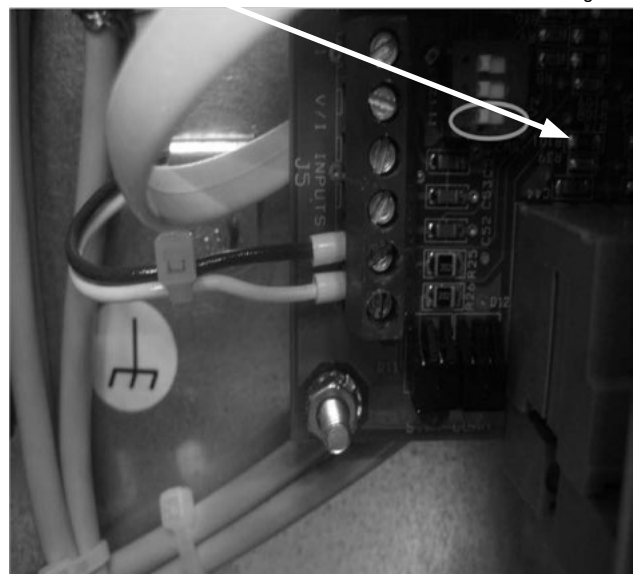


Figure 33 - Changing SW2 switch 1

SW2 switch 1 of the CCM board in the "ON" status for the 4-20 mA signal



3.8.4 - Sensor installation

- Remove the clip (item 1) and the screw (item 2) that hold the balancing line (item 3).
- Place the support supplied with the kit (item 4), between the welded jumper and the clip that holds the balancing line and re-attach everything.
- Place the sensor on the support, inserting it into the recess and tighten it with the plastic collar.

The technical documentation for the leak detection module is supplied in addition to the standard chiller documentation that is in the control box. Here you will find information about module installation, usage precautions and operation, and a detailed description as well as a trouble-shooting list.

4 - BEFORE INITIAL START-UP

The instructions below apply to the standard machine and for all cases. For 19XRV machines additional checks are required: Please refer to chapters 8 to 14 of this document

4.1 - Necessary checks

4.1.1 - 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.

4.1.2 - Equipment required

- Mechanic's tools (refrigeration)
- Digital volt-ohmmeter (DVM)
- Clamp-on ammeter
- Electronic leak detector
- Absolute pressure manometer or wet-bulb vacuum indicator
- 500-V insulation tester (megohmmeter) for compressor motors with nameplate voltage of 1000 V or less, or a 5000-V insulation tester for compressor motor rated above 1000 V.

4.1.3 - Using the optional storage tank and pumpout system

Refer to the transfer unit installation manual, document order no. 19999, chapter "Pumpout and refrigerant transfer procedures" section for: Pumpout system preparation, refrigerant transfer, and chiller evacuation.

4.1.4 - Remove shipping packaging

After receipt remove any packaging material from the unit.

4.1.5 - Open oil circuit valves

Check that the oil filter isolation valves (see Fig. 6 - "Lubrication system") are open by removing the valve cap and checking the valve stem.

4.1.6 - Tighten all gasketed joints and guide vane shaft packing (torque depends on screw diameter)

Gaskets and packing normally relax by the time the chiller arrives at the jobsite. Tighten all gasketed joints and the guide vane shaft packing to ensure a leak tight chiller.

4.1.7 - Inspect water piping

Refer to piping diagrams provided in the certified drawings, and the piping instructions in the 19XR Installation Instructions manual. 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 Fe²⁺ and Fe³⁺ 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).

If the optional pumpout storage tank and/or pumpout system are installed, check to ensure the pumpout condenser water has been piped in. Check for field-supplied isolation valves and controls as specified in the job data. Check for refrigerant leaks on field-installed piping. See Fig.22 and Fig. 23.

4.1.8 - 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. 19XR relief valves are set to relieve at 1250 kPa.

4.2 - Chiller tightness

4.2.1 - Check chiller tightness

Refer to Fig. 35.

19XR chillers are shipped with the refrigerant contained in the condenser shell and the oil charge shipped in the compressor.

The cooler will have a refrigerant charge that is compressed to 225 kPa. Units may be ordered with the refrigerant shipped separately, along with a compressed 225 kPa nitrogen-holding charge in each vessel. To detect any leaks, the chiller should be charged with refrigerant. Use an electronic leak detector to check

all flanges and solder joints after the chiller is pressurised. If any leaks are detected, follow the procedure described in chapter 4.2.2.

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

If repairs are required, do not use R-134a, as it is not designed and should not be used for leak detection.

WARNING: Do not use air or oxygen to pressurise the chiller. Mixtures of R-134a and air can undergo combustion.

Check the optional pumpout compressor piping.

4.2.2 - Leak test chiller

Due to regulations on refrigerant emissions and the difficulties associated with separating contaminants from refrigerant, Carrier recommends the following leak test procedures.

1. If the pressure readings correspond to the chiller operating conditions:
 - a. Evacuate the holding charge from the vessels, if present.
 - b. Raise the chiller pressure, if necessary, by adding refrigerant until pressure is at equivalent saturated pressure for the surrounding temperature. Follow the pumpout procedures in sections 4.11 and 4.12 "Chiller equalization without pumpout unit" and "Chiller equalization with pumpout unit".

WARNING: Never charge liquid refrigerant into the chiller, if the pressure in the chiller is less than 241 kPa for HFC-134a. Charge as a gas only, with the cooler and condenser pumps running, until this pressure is reached, using PUMPDOWN LOCKOUT and TERMINATE LOCKOUT mode on the PIC. Flashing of liquid refrigerant at low pressures can cause tube freeze-up and considerable damage.

- c. Leak test chiller as outlined in Steps 3 -9.
2. If the pressure readings do not correspond to the chiller operating conditions:
 - a. Prepare to leak test chillers shipped with refrigerant (step 2h).
 - b. Check for large leaks by connecting a nitrogen bottle and raising the pressure to 207 kPa. Soap test all joints. If the test pressure holds for 30 minutes, prepare the test for small leaks (steps 2g to h).
 - c. Plainly mark any leaks which are found.
 - d. Release the pressure in the system.
 - e. Repair all leaks.
 - f. Retest the joints that were repaired.
 - g. After successfully completing the test for large leaks, remove as much nitrogen, air, and moisture as possible, given the fact that small leaks may be present in the system. This can be accomplished by following the dehydration procedure, outlined in chapter 4.4 "Chiller dehydration".
 - h. Progressively raise the system pressure to a maximum of 1103 kPa but no less than 241 kPa for HFC-134a by adding refrigerant. Proceed with the test for small leaks (steps 3 to 9).
 3. Check the chiller carefully with an electronic leak detector, or soap bubble solution.

4. Leak determination - If an electronic leak detector indicates a leak, use a soap bubble solution to locate the leak. Total all leak rates for the entire chiller. Leakage at rates greater than 0.45 kg/year for the entire chiller must be repaired. Note total chiller leak rate on the start-up report.
5. If no leak is found during initial start-up procedures, complete the transfer of refrigerant gas from the pump-out storage tank to the chiller. For machines with the optional storage tank refer to the transfer unit installation manual, document order no. 19999, chapter "Pumpout and refrigerant transfer procedures" and chapter 4.13 "Chiller equalization with pumpout unit").
6. If no leak is found after a retest:
 - a. Transfer the refrigerant to the pumpout storage tank and perform a standing vacuum test as out-lined in chapter 4.3.
 - b. If the chiller fails this test, check for large leaks (step 2b).
 - c. Dehydrate the chiller, if it passes the standing vacuum test, as described in chapter 4.4 "Chiller dehydration". Charge chiller with refrigerant.
7. If a leak is found, pump the refrigerant back into the pumpout storage tank, or if isolation valves are present, pump into the non-leaking vessel (refer to the transfer unit installation manual, document order no. 19999, chapter "Pumpout and refrigerant transfer procedures").
8. Transfer the refrigerant until chiller pressure is at 40 kPa absolute.
9. Repair the leak and repeat the procedure, beginning from step 2h to ensure a leaktight repair. (If chiller is opened to the atmosphere for an extended period, evacuate it before repeating leak test.)
10. The circuit openings must be plugged during repair, if this does not take longer than one day. If it takes longer, the circuits must be charged with nitrogen.

4.3 - Standing vacuum test

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

1. Attach an absolute pressure manometer or wet bulb indicator to the chiller.
2. Evacuate the vessel to at least 41 kPa, using a vacuum pump or the pumpout unit (refer to the transfer unit installation manual, document order no. 19999, chapter "Pumpout and refrigerant transfer procedures").
3. Valve off the pump to hold the vacuum and record the manometer or indicator reading.
4.
 - a. If the leakage rate is less than 0.17 kPa in 24 hours, the chiller is sufficiently tight.
 - a. If the leakage rate exceeds 0.17 kPa in 24 hours, repressurise the vessel and test for leaks. If refrigerant is available in the other vessel, pressurise by following steps 2 to 10 of chapter 4.2.2 "Leak test chiller". If not, use nitrogen and a refrigerant tracer. Raise the vessel pressure in increments until the leak is detected. If refrigerant is used, the maximum gas pressure is approximately 483 kPa for R-134a at normal ambient temperature. If nitrogen is used, limit the leak test pressure to 1103 kPa maximum.
5. Repair leak, retest, and proceed with dehydration.

4.4 - 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.

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

Dehydration is readily accomplished at room temperatures. Use of a cold trap (see Fig. 34 - "Dehydration cold trap") may substantially reduce the time required to complete the dehydration. 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.

Perform dehydration as follows:

1. Connect a high-capacity dehydration pump (0.002 m³/s or larger is recommended) to the refrigerant charging valve. Tubing from the pump to the chiller should be as short and as large a diameter as possible to provide least resistance to gas flow.
2. Use an absolute pressure manometer or a wet bulb vacuum indicator to measure the vacuum. Open the isolation valve to the vacuum indicator only when taking a reading. Leave the valve open for 3 minutes to ensure pressure equalisation between detector and chiller.
3. Open all isolation valves (if present), if the entire chiller is to be dehydrated.
4. With the chiller ambient temperature at 15.6 °C or higher, operate the vacuum pump until the manometer reads -100.61 kPa or a vacuum indicator reads 1.7 °C. Operate the pump an additional 2 hours.
5. Do not apply greater vacuum than 100.97 kPa (757.4 mm Hg) or go below 0.56 °C on the wet bulb vacuum indicator. At this temperature/pressure, isolated pockets of moisture can turn into ice. The slow rate of evaporation (sublimation) of ice at these low temperatures/pressures greatly increases dehydration time.
6. Close the valve to which the vacuum pump is connected, stop the pump, and record the instrument reading.
7. After a 2-hour wait, take another instrument reading. If the reading has not changed, dehydration is complete. If the reading indicates vacuum loss, repeat steps 4 and 5.
8. If the reading continues to change after several attempts, do a leak test up to the maximum 1103 kPa pressure. Locate and repair the leak, and repeat dehydration.
9. Once dehydration is complete, the evacuation process can continue. The final vacuum prior to charging the unit with refrigerant should in all cases be 29.9 in Hg (500 microns, 0.07 kPa [abs]) or less.

Figure 34 - Dehydration cold trap

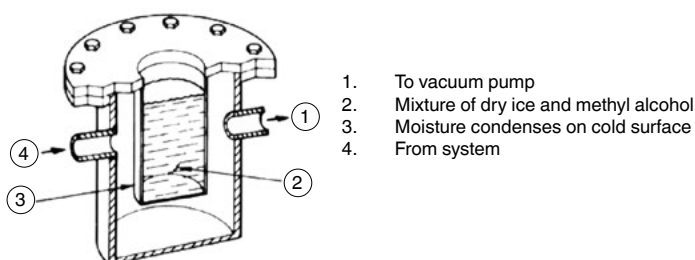
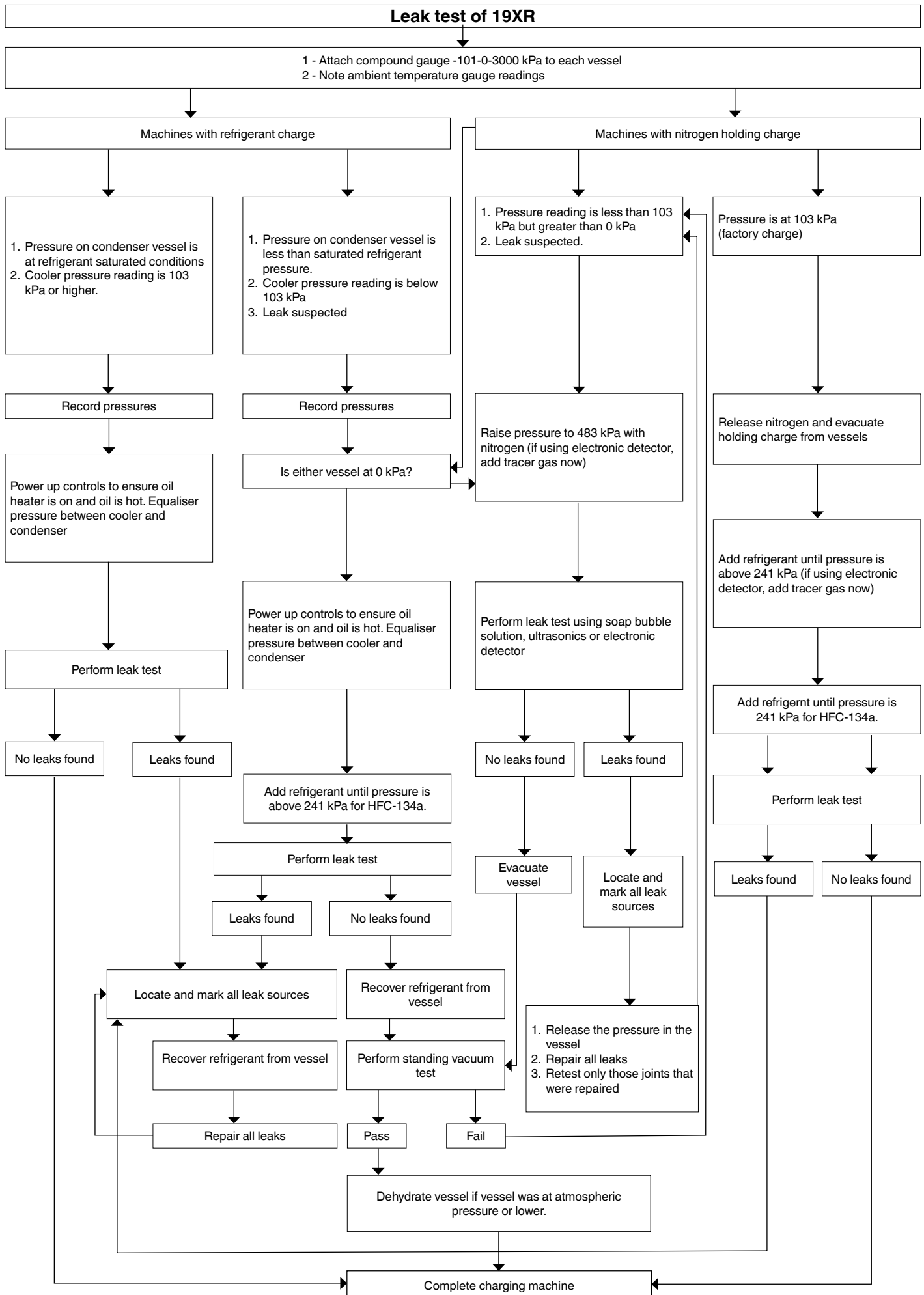


Figure 35 - 19XR leak detection procedure



4.5 - Inspect wiring

WARNING: Do not check voltage supply without proper equipment and precautions. Serious injury may result.

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 wiring for conformance to job wiring diagrams and to all applicable electrical codes.
2. Check that the voltage(s) applied to the machine agree with those on the component name plates. In particular :
 - Compressor
 - Compressor starter
 - Control circuit transformers
 - Oil pump
 - Heater(s)

For low-voltage machines the check can simply be made with a voltmeter.

3. Check that all electrical equipment and controls are properly grounded in accordance with job drawings, certified drawings, and all applicable electrical codes. Make sure that the customer's contractor has verified proper operation of the pumps, cooling tower fans, and associated auxiliary equipment.
4. Ensure that all power connections are tight.
5. Tighten up all wiring connections to the plugs on the ISM and I/O boards or CCM boards.
6. The bus cable between the I/O boards or CCM boards and the ISM modules will be supplied by the installer (refer to chapter 3.6.8 "Carrier Comfort Network interface").
7. On chillers with wiring entering and leaving the cabinet from the top debris can fall onto the contactors. Check and clean the contactors if necessary.
The checks below are not required for 19XRV machines. But they are replaced by additional checks. Please refer to the appendix starting with chapter 8.
8. Compare the ampere rating on the starter nameplate with the compressor nameplate. They must agree with the thermal protection of the Carrier ISM board to ensure that the overload trip current (OLTA) is not be more than 108% of the rated load current.
9. The starter must include correctly assigned components and terminals required for the unit PIC control. Check the certified plans.
10. Check that the anti-short-circuit protections have been installed upstream of the compressor power supply circuits.
11. Check the compressor motor and power supply cable insulation resistance: Use a 500 V insulation controller (megohmmeter) for machines with a nominal voltage below 1000 V. Use a 5000 V insulation controller for compressor motors with a voltage above 1000 V:
 - a. Disconnect the power supply and observe the usual applicable precautions.
 - b. Disconnect the motor supply wires at the starter terminals.

- c. The detector is connected to the motor wires, measure the values in megohms every 10 and 60 seconds as follows:
 - Six-lead motor: Tie all the leads together and test the insulation referred to earth. Then tie the leads in pairs, 1 and 4, 2 and 5, 3 and 6. Test between each pair while earthing the third pair.
 - Three-lead motor: Tie terminals 1, 2, and 3 together and test the insulation referred to earth.
 - Divide the 60-second resistance reading by the 10-second reading. The ratio, or polarisation index, must be one or higher. Both the 10- and 60-second readings must be at least 50 megohms.
 - If the readings on a field-installed starter are unsatisfactory, repeat the test at the motor with the power leads disconnected. Satisfactory readings in this second test indicate the fault is in the power leads.

4.6 - Oil charge

The oil charge for the 19XR compressor depends on the compressor Frame size:

- Frame 2 compressor 30 L
- Frame 3 compressor — 30 L
- Frame 4 compressor — 37.8 L
- Frame 4 compressor with split ring diffuser option — 45.0 L
- Frame 5 compressor — 67.8 L
- Frame E compressor — 67.8 L

The chiller will be shipped with oil in the compressor. When the sump is full, the oil level should be no higher than the middle of the upper sight glass, and minimum level is the bottom of the lower sight glass. If oil is added, it must meet Carrier's specification for centrifugal compressor usage as described chapter 7.3.5 "Oil changes". Charge the oil through the oil charging valve, located near the bottom of the transmission housing (refer to Fig. 2 and Fig. 3 - "19XR machine components"). The oil must be pumped from the oil container through the charging valve due to higher refrigerant pressure. The pumping device must be able to lift from 0 to 1380 kPa or above unit pressure. Oil should only be charged or removed when the chiller is shut down. The oil cylinder must not be opened until charging begins. Only use new oil cylinders.

4.7 - Power-up the controls and check the oil heater

Ensure that an oil level is visible in the compressor before energising controls. A circuit breaker in the starter energises the oil heater and the control circuit. When first powered, the HMI should display the default screen within a short period of time.

The oil heater is energised by powering the control circuit. This should be done several hours before start-up to minimise oil-refrigerant migration. The oil heater is controlled by the PIC and is powered through a contactor in the control box. The oil heater relay status can be viewed on the Status 02 table on the HMI. Oil sump temperature can be viewed on the HMI default screen.

4.8 - Software Configuration

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

4.8.1 - Configuration with ICVC

As the 19XR unit is configured, all configuration settings should be written down. A log, such as the one shown on pages CL-1 to CL-14, provides a list for configuration values.

Input the Design Set Points — Access the ICVC set point screen and view/modify the base demand limit set point, and either the LCW set point or the ECW set point. The PIC II can control a set point to either the leaving or entering chilled water. This control method is set in the EQUIPMENT SERVICE (TEMP_CTL) table.

Input the Local Occupied Schedule (OCCPC01S) — Access the schedule OCCPC01S screen on the ICVC 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 CCN Occupied Schedule (OCCPC03S) should be configured if a CCN system is being installed or if a secondary time schedule is needed.

NOTE: *The default CCN Occupied Schedule OCCPC03S is configured to be occupied.*

Input Service Configurations — The following configurations require the ICVC screen to be in the SERVICE portion of the menu.

- password
- input time and date
- ICVC configuration
- service parameters
- equipment configuration
- automated control test

PASSWORD — When accessing the SERVICE tables, a password must be entered. All ICVCs are initially set for a password of 1-1-1-1.

INPUT TIME AND DATE — Access the TIME AND DATE table on the SERVICE menu. Input the present time of day, date, and day of the week. The **HOLIDAYTODAY** parameter should only be configured to YES if the present day is a holiday.

NOTE: *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.*

CHANGE ICVC CONFIGURATION IF NECESSARY — From the SERVICE table, access the ICVC CONFIGURATION screen. From there, view or modify the ICVC CCN address, change to English or SI units, and change the password. If there is more than one chiller at the jobsite, change the ICVC address on each chiller so that each chiller has its own address. Note and record the new address. Change the screen to SI units as required, and change the password if desired.

TO CHANGE THE PASSWORD — The password may be changed from the ICVC CONFIGURATION screen.

1. Press the MENU and SERVICE softkeys. Enter the current password and highlight ICVC CONFIGURATION. Press the SELECT softkey. Only the last 5 entries on the ICVC CONFIG screen can be changed: **BUS NUMBER, ADDRESS NUMBER, BAUD RATE, US IMP/METRIC, and PASSWORD.**
2. Use the ENTER softkey to scroll to **PASSWORD.** The first digit of the password is highlighted on the screen.
3. To change the digit, press the INCREASE or DECREASE softkey. When the desired digit is seen, press the ENTER softkey.
4. The next digit is highlighted. Change it, and the third and fourth digits in the same way the first was changed.

After the last digit is changed, the ICVC goes to the **BUS NUMBER** parameter. Press the EXIT softkey to leave that screen and return to the SERVICE menu.

CAUTION: *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 the ICVC_PSWD menu on the STATUS screen is accessed by a Carrier representative.*

TO CHANGE THE ICVC DISPLAY FROM ENGLISH TO METRIC UNITS — By default, the ICVC displays information in English units. To change to metric units, access the ICVC CONFIGURATION screen.

1. Press the MENU and SERVICE softkeys. Enter the password and highlight ICVC CONFIGURATION. Press the SELECT softkey.
2. Use the ENTER softkey to scroll to **US IMP/METRIC.**
3. Press the softkey that corresponds to the units desired for display on the ICVC (e.g., US or METRIC).

CHANGE LANGUAGE — By default, the ICVC displays information in English. To change to another Language, access the ICVC CONFIGURATION screen:

1. Press the MENU and SERVICE softkeys. Enter the password and highlight ICVC CONFIGURATION. Press the SELECT softkey.
2. Use the ENTER softkey to scroll to **LID LANGUAGE.**
3. Press the INCREASE or DECREASE softkey until the desired language is displayed. Press ENTER to confirm desired language.

MODIFY CONTROLLER IDENTIFICATION IF NECESSARY — The ICVC module address can be changed from the ICVC CONFIGURATION screen. Change this address for each chiller if there is more than one chiller at the jobsite. Write the new address on the ICVC module for future reference.

INPUT EQUIPMENT SERVICE PARAMETERS IF NECESSARY — The EQUIPMENT SERVICE menu has six or seven service tables depending on the ICVC software version.

Configure SERVICE Tables — Access the SERVICE tables, shown in Table 3, to modify or view job site parameters shown in Table 12.

Table 4 - Job Site Parameters

PARAMETER	TABLE
Starter Type	ISM_CONF — Select 0 for full voltage, 1 for reduced voltage, or 2 for solid state or 3 for variable frequency drive.
Motor Rated Line Voltage	ISM_CONF — Motor rated voltage from chiller information nameplate.
Volt Transformer Ratio	ISM_CONF — Enter ratio (reduced to a ratio to 1) of power transformer wired to terminal J3 of ISM. If no transformer is used enter 1.
Motor Rated Load Amps	ISM_CONF — Per chiller nameplate data. RL AMPS on compressor nameplate.
Motor Locked Rotor Trip	ISM_CONF — Per chiller identification name-plate.
Starter LRA Rating	ISM_CONF — Enter value from nameplate in starter cabinet MAXIMUM FUSE. This value shall always be "9999" for Benshaw RediStart MX3 wye-delta and solid-state starters.
Motor Current CT Ratio	ISM_CONF — Enter ratio (reduced to a ratio to 1) of current transformers wired to terminal J4 of ISM. This value shall always be "100" for Ben-shaw RediStart MX3 wye-delta and solid-state starters.
Current% Imbalance	ISM_CONF — Current imbalance trip threshold. Enter up to 100% for starter type 3 (VFD).
Ground Fault Current Transformers	ISM_CONF — Enter 0 if no ground fault CTs are wired to terminal J5 of ISM. Enter 1 if ground fault CTs are used.
Ground Fault CT Ratio	ISM_CONF — Enter ratio (reduced to a ratio to 1) of ground fault CT.
Single Cycle Dropout	ISM_CONF — ENABLE if motor protection required from drop in line voltage within one cycle.
Line Frequency	ISM_CONF — Enter YES for 60 Hz or NO for 50 Hz.
Line Frequency Faulting	ISM_CONF — ENABLE if motor protection required for drop in line frequency.
Surge Limit/Hot Gas Bypass Option	OPTIONS — Enter 1 or 2 if HGBP is installed. Enter 0 otherwise.

* With variable flow systems this point may be configured to the lower end of the range.

NOTE: Other parameters: Screens are normally left at the default settings; they may be changed by the operator as required. The time and persistence settings on the ISM_CONF table can be adjusted to increase or decrease the sensitivity to a fault condition. Increasing time or persistence decreases sensitivity. Decreasing time or persistence increases sensitivity to the fault condition.

Configure Surge parameters :

1. Press MENU
2. Press SERVICE.

Select EQUIPMENT SERVICE and OPTIONS to verify that the parameters in the applicable table below match the surge prevention parameters for the design conditions of the chiller. These parameters are described on configuration data sheet inside the control cabinet with the chiller documents. These parameters are defined with the Aquaedge selection outputs data.

DESCRIPTION	SETTINGS
SURGE/HGBP DELTA TSMIN	See datasheet
SURGE/HGBP IGVMIN	See datasheet
SURGE/HGBP DELTA TSMAX	See datasheet
SURGE/HGBP IGVMAX	See datasheet
SURGE LINE SHAPE FACTOR	See datasheet

PARAMETER	TABLE
Minimum Load	
Points (Tsmín, IGVmin)	OPTIONS — Per Chiller Requisition (Tsmín, IGVmin) if available or per job data — See modify load points section. Refer to table located in the control panel.
Full (Maximum) Load Points (Tsmáx, IGVmax)	OPTIONS — Per Chiller Requisition (Tsmáx, IGVmax) if available or per job data — See modify load points section. Refer to table located in the control panel.
Surge Line Shape Factor (shapefac)	OPTIONS — Per Chiller Requisition (shapefac). Refer to table located in the control panel.
Chilled Medium	SETUP1 — Enter water or brine.
Evaporator Refrigerant Trippoint	SETUP1 — Usually 3° F (1.7° C) below design refrigerant temperature.
Evaporator Flow Delta P Cutout	SETUP1 — Per Chiller Requisition if available or enter 50% of design pressure drop to 0.5 psi (3.4 kPa).*
Condenser Flow Delta P Cutout	SETUP1 — Per Chiller Requisition if available or enter 50% of design pressure drop to 0.5 psi (3.4 kPa).*
High Condenser Water Delta P	SETUP1 — Enter the maximum allowable value for condenser water pressure drop.
VFD Option	SETUP2 — ENABLE if a VFD is supplied for the chiller.
VFD Current List	SETUP2 — Enter the value for the full load output amps of the VFD.
Diffuser Option (Compressors with Split Ring Diffusers)	VDO_SRD — ENABLE for 4 and 5 size compressor with split ring diffusers. See model number nomenclature.
Diffuser Full Span mA (Compressors with Split Ring Diffusers)	SETUP2 VDO_SRD — Enter diffuser actuator full span mA rating for 4 and 5 size compressor. Value is located on label on side of diffuser actuator motor.
Motor Rated Kilowatts	RAMP_DEM — Enter value from chiller requisition form (product data submittal) if DEMAND LIMIT SOURCE is set to kW.

HAND CALCULATE SURGE PREVENTION CONFIGURATIONS — The configurations entered determine the Surge Prevention line that the controls use to raise the speed of the VFD if the compressor operating point nears this line.

Calculate AP maximum and AP minimum using 2 point method in the preceding section. If the original selection configuration points are available, use AP1 and AP4 from that selection as AP maximum and AP minimum. If the original selection configuration was for a 2 point surge line, use AP1 and AP2.

Use the default values for the following configurations:

- Surge / HGBP IGV min. = 5.0
- Surge / HGBP IGV max = 100.0
- Surge Line Shape Factor = -0.040
- Surge Line Speed Factor = 1.85
- Surge Line High Offset = 1.0
- Surge/ HGBP Deadband = 1

Calculate Surge/ HGBP Delta Tsmín — Convert design suction temp to pressure using an R-134a pressure/temperature chart.

Min. Cond. Pressure = (suction pressure) + (AP minimum)

Convert Min. Cond. Pressure to Min. Cond. Temperature using a saturation pressure/temperature chart for R-134a.

Surge / HGBPTsmín = (Min. Cond. Temp.) – (design suction temperature)

Calculate Surge/ HGBP Delta Tsmáx

Max. Cond. Pressure = (suction pressure) + (AP maximum)

Convert Max. Cond. Pressure to Max. Cond. Temperature using a saturation pressure/temperature chart for R-134a.

Surge / HGBPTsmáx = (Max. Cond. Temp) – (design suction temperature)

VPF Surge Prevention Configurations are defined as follows:

- Surge/HGBP Delta T_{min} is the minimum difference between cooler and condenser saturation temperatures. (See Fig. 36.)
- Surge/HGBP IGV_{min} is the lowest position of the guide vanes that affects Surge prevention. This is not likely to require adjustment at the jobsite other than to ensure that it matches the value supplied with the machine selection. These values produce the minimum load point of the Surge Prevention line:
- Surge/HGBP Delta T_{max} is the maximum difference between cooler and condenser saturation temperatures. (See Fig. 37.)
- Surge/HGBP IGV_{max} is the highest position of the guide vanes that affects Surge prevention. This is not likely to require adjustment at the jobsite other than to ensure that it matches the value supplied with the machine selection.

NOTE: *The preceding two values produce the full load point of the surge prevention line.*

- Surge Line Shape Factor determines the curvature of the line mainly in the low load zone. (See Fig. 38.)
- Surge Line Speed Factor determines how much the surge line moves to accommodate lower compressor speed. As compressor speed drops the AT values on the surge prevention line decrease. Increasing the Speed Factor causes Surge Prevention to activate sooner as the compressor speed drops. (See Fig. 39.)
- Surge Line High Offset determines the AT increase beyond the surge prevention line where the high stage of Surge Prevention takes effect. The high stage produces larger RPM increase steps. This is not likely to require adjustment at the jobsite other than to ensure that it matches the value supplied with the machine selection
- Surge/HGBP Deadband controls the amount the ACTIVE DELTA TSAT must drop below the Surge Prevention to de-activate Surge Prevention.

Fine Tuning VPF Surge Prevention — Figures 36-39 show how the parameters defined below will affect the configured surge line.

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

If capacity is not reached
and

1. ACTUAL GUIDE VANE POSITION < GUIDE VANE TRAVEL RANGE
and
2. SURGE PREVENTION ACTIVE = YES and
3. PERCENT LINE CURRENT < 100% then the surge line is probably too conservative.

Note the following parameters from ICVC when maximum AVERAGE LINE CURRENT achieved:

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

The ACTIVE DELTA Tsat and the SURGE LINE DELTA TSAT can be monitored on the VPF_STAT screen. When DELTA TSAT exceeds SURGE LINE DELTA TSAT surge prevention will occur.

If ACTUAL GUIDE VANE POSITION is less than 30%, then increase SURGE/HGBP DELTA T_{MIN} in steps of 2° F until one of the three conditions listed above no longer applies. Do not change SURGE/HGBP DELTA T_{MAX}.

If ACTUAL GUIDE VANE POSITION is greater than 60%, then increase SURGE/HGBP DELTA T_{MAX} in steps of 2° F until cooling capacity is reached or one of conditions listed above no longer applies. Do not change SURGE/HGBP DELTA T_{MIN}.

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

1. Increase SURGE/HGBP DELTA T_{MIN} in steps of 2° F.
2. Increase SURGE/HGBP DELTA T_{MAX} in steps of 2° F.
3. Repeat Steps 1 and 2 until one of the conditions listed above no longer applies.

NOTE: *DELTA T_{MIN} should seldom need to be increased more than 10 degrees above the selection program value. Like-wise, DELTA T_{MAX} rarely requires more than a 2 degree increase.*

If surge is encountered then the surge line is probably too optimistic or high. Note following parameters from ICVC at surge:

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

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

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

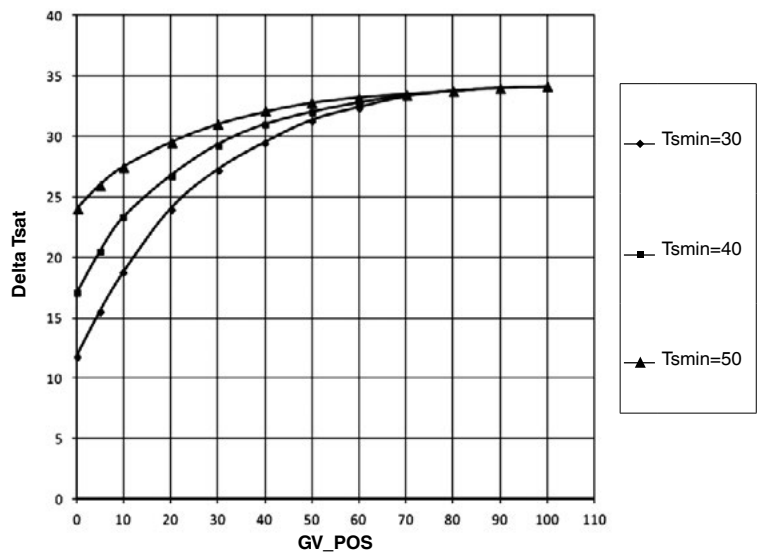


Figure 36 - Effect of SURGE/HGBP DELTA TSMIN on Surge Prevention

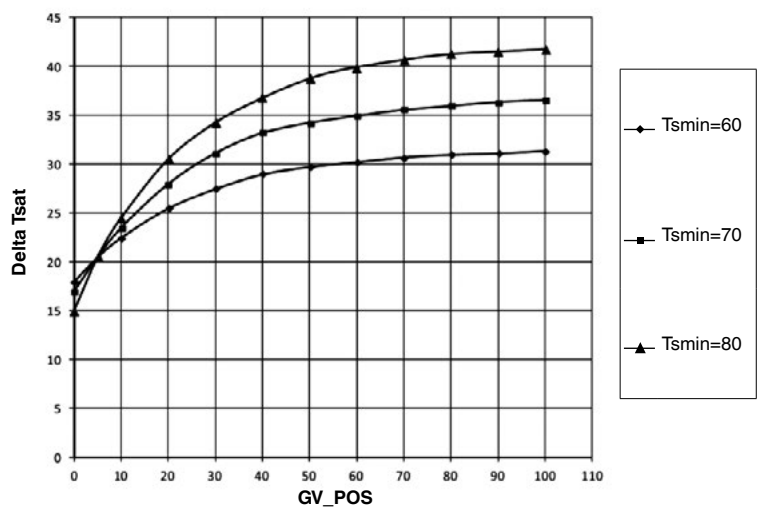


Figure 37 - Effect of SURGE/HGBP DELTA TSMAX on Surge Prevention

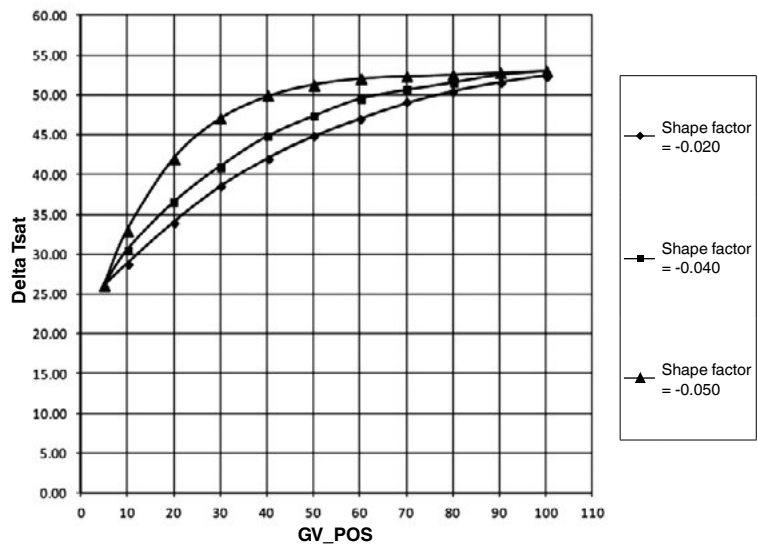


Figure 38 - Effect of SURGE LINE SHAPE FACTOR on Surge Prevention

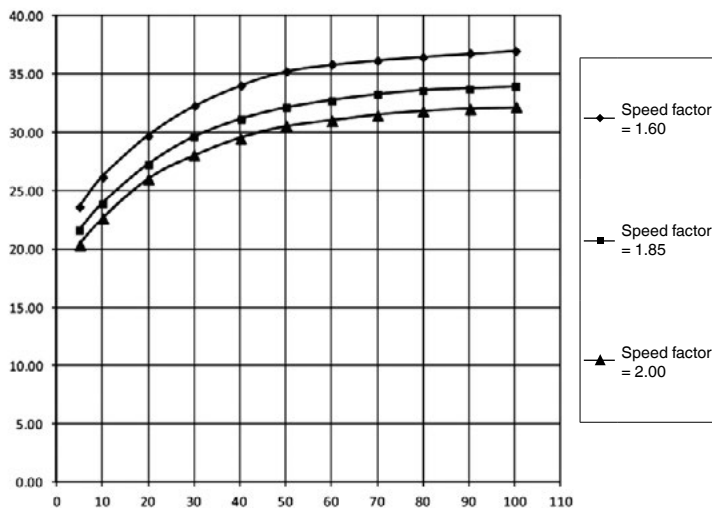


Figure 39 - Effect of SURGE LINE SPEED FACTOR on Surge Prevention

5. If ACTUAL GUIDE VANE POSITION is greater than 30% but less than 60% or if Step 2 failed (with ACTUAL GUIDE VANE POSITION less than 30) or if Step 4 failed (with ACTUAL GUIDE VANE POSITION greater than 60), then perform this step. Do not change SURGE LINE SHAPE FACTOR from the value specified by Chiller Builder (ECAT). Reset SURGE/HGBP DELTA TSMIN and SURGE/HGBP DELTA TSMAX to the value specified by Chiller Builder (ECAT). Decrease SURGE/HGBP DELTA TSMIN and SURGE/HGBP DELTA TSMAX in steps of 1° F up to 5 times. Monitor chiller for surge.

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.

CONFIGURE DIFFUSER CONTROL IF NECESSARY — If the compressor is equipped with a variable diffuser, (size 4 or 5 compressor) access the VDO_SRD screen. Scroll to DIFFUSER CONTROL and press the ENABLE softkey. Compare the diffuser and guide vane values (GUIDE VANE 25% LOAD PT, GUIDE VANE 50% LOAD PT, GUIDE VANE 75% LOAD PT, DIFFUSER 25% LOAD POINT, DIFFUSER 50% LOAD POINT, DIFFUSER 75% LOAD POINT) to the values described in chiller config data sheet.

Compressors with variable diffuser control have actuators tested and stamped with the milliamp (mA) value that results in 100% actuator rotation. In addition to the diffuser position schedule, the DIFFUSER FULL SPAN mA of the split ring diffuser actuator must be entered in the SETUP2 screen. This information is printed on a label affixed under the solidstate controller box on the right side of the split ring diffuser actuator when viewing the compressor from the suction end.

Units with VFD — On units with VFD further adjustments can be made if response to surge prevention or protection is not functioning as desired. VFD GAIN and VFD INCREASE STEP can be adjusted to allow for more aggressive changes in speed when surge prevention or protection is active.

EQUIPMENT SERVICE Screen Modifications — Change the values on these screens according to specific job data. See the certified drawings for the correct values. 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)

Owner-Modified CCN Tables — The following EQUIPMENT CONFIGURATION screens are described for reference only.

OCCDEFCS — The OCCDEFCS screen contains the Local and CCN time schedules, which can be modified here or on the SCHEDULE screen as described previously.

HOLIDAYS — From the HOLIDAYS screen, the days of the year that holidays are in effect can be configured. See the holiday paragraphs in the Controls section for more details.

BRODEF — The BRODEF screen defines the start and end of daylight savings time. By default this feature is enabled. Enter the dates for the start and end of daylight savings if required for your location. Note that for Day of Week, 1 represents Monday. Start Week and Stop Week refer to the instance of the selected Day of Week during the selected month and year. To disable the feature, change START ADVANCE and STOP BACK times to 0 (minutes). In the BRODEF table the user may also identify a chiller as the time broadcaster for a CCN network. There should be only one device on a CCN network which is designated as the Time Broadcaster.

ALARM ROUTING — This is in the table SERVICE->

EQUIPMENT CONFIGURATION->NET_OPT under the heading Alarm Configuration. ALARM ROUTING consists

of an 8-bit binary number. Only bits 1, 2, and 4 (counting from the left, first) are used. The others do not matter. The bits can be set by any device which can access and change configuration tables. If any of these 3 bits is set to 1, the controller (ICVC, for example) will broadcast any alarms which occur.

- first bit = 1 indicates that the alarm should be read and processed by a “front end” device, such as a Comfort-WORKS® device.
- second bit = 1 indicates that the alarm should be read and processed by a TeLINKTM or Autodial Gateway module.
- fourth bit = 1 indicates that the alarm should be read and processed by an alarm printer interface (an optional module) or ServiceLinkTM modules.

The RE-ALARM time is a time period after which, if a preex-isting and previously broadcast alarm has not been cleared, it will be rebroadcast on the CCN network.

Other Tables — The CONSUME, NET_OPT, and RUN-TIME screens contain parameters used with a CCN system. See the applicable CCN manual for more information on these screens. These tables can only be defined from a CCN Building Supervisor.

Perform a Control Test — Check the safety controls status by performing an automated control test. Press the STOP button on the ICVC to place the chiller in STOP mode. The CONTROL TEST screen can only be accessed when the chiller is in STOP mode. Access the CONTROL TEST table and select a test to be performed function (Table 15).

The Automated Control Test checks all outputs and inputs for function. In order to successfully proceed with the controls test, the compressor should be off, no alarms showing, and voltage should be within $\pm 10\%$ of rating plate value. The compressor can be put in OFF mode by pressing the STOP push-button on the ICVC. 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.

Table 5 - Control Test Menu Functions

TESTS TO BE PERFORMED	DEVICES TESTED
CCM Thermistors	Entering Chilled Water Leaving Chilled Water Entering Condenser Water Leaving Condenser Water Evap Refrig Liquid Temp Comp Discharge Temp Comp Thrust Brg Temp Oil Sump Temp Comp Motor Winding Temp Spare Temperature 1 Spare Temperature 2 Remote Reset Sensor
CCM Pressure Transducers	Evaporator Pressure Condenser Pressure Oil Pump Delta P SRD Delta P SRD Rotating Stall Chilled Water Delta P Condenser Water Delta P Transducer Voltage Ref
Pumps	Oil Pump — Confirm Delta P Chilled Water — Confirm flow and Delta P Condenser Water — Confirm flow and Delta P
Discrete Outputs	Oil Heater Relay Hot Gas Bypass Relay Tower Fan Relay Low Tower Fan Relay High Alarm Relay Shunt Trip Relay
IGV and SRD Actuator	Open/Close Guide vanes and diffuser will both move. The relative movement during Control Test does not apply to operation. During operation, guide vane and diffuser are controlled independently. Earlier software versions: If present, split ring diffuser will operate in coordination with the guide vanes per configured schedule.
Head Pressure Output	Increase/Decrease 4-20 mA output
Diffuser Actuator	Open/Close (independent of guide vanes)
Pumpdown Lockout	When using pumpdown/lockout, observe freeze up precautions when removing charge: Instructs operator which valves to close and when. Starts chilled water and condenser water pumps and confirms flows. Monitors Evaporator pressure Condenser pressure Evaporator temperature during pumpout procedures Turns pumps off after pumpdown. Locks out compressor.
Terminate Lockout	Starts pumps and monitors flows. Instructs operator which valves to open and when. Monitors Evaporator pressure Condenser pressure Evaporator temperature during charging process Terminates compressor lockout.
Guide Vane Calibration	Automatic, displays guide vane position signal voltage. This test is required before first start-up with new actuator, new con-troller, or new software. Calibrates guide vane input on CCM.

GUIDE VANE ACTUATOR CALIBRATION — This automated procedure is performed at the factory prior to new chiller shipment. During this test, the CCM outputs a discrete 24-v signal from terminal J11 to fully open and fully close the guide vanes. A 0.1 to 3.0 V nominal signal is fed back to the terminals J4-9 and J4-10 to indicate the position of the guide vanes to the CCM. This calibration will need to be repeated if the guide vane actuator or ICVC controller is replaced, or if new controller software is downloaded. A prestart alert message will re-mind the user prior to the next start-up if this has not been done.

Select the last item in the Controls Test menu. Press YES to proceed with calibration per the prompt. The guide vanes will close fully, then open to 100% (regardless of the position configured at maximum opening). The system will store voltages corresponding to 0% and 100%, then indicate the the calibration is complete.

NOTE: Enter guide vane calibration to calibrate guide input on CCM (Plug J4 upper terminal 9 and 10).

NOTE: If during the control test the guide vanes do not open, verify the low pressure alarm is not active. (An active low pressure alarm causes the guide vanes to close.)

NOTE: The oil pump test will not energize the oil pump if cooler pressure is below -5 psig (-35 kPa).

When the control test is finished or the EXIT softkey is pressed, the test stops, and the CONTROL TEST menu displays. If a specific automated test procedure is not completed, access the particular control test to test the function when ready. The CONTROL TEST menu is described in the Table 2.

COOLER AND CONDENSER PRESSURE TRANSDUCER AND WATERSIDE FLOW DEVICE CALIBRATION (waterside device optional with CCM inputs available) — Calibration can be checked by comparing the pressure readings from the transducer to an accurate refrigeration gage reading. These readings can be viewed or calibrated from the HEAT_EX screen on the CCM. The transducer can be checked and calibrated at 2 pressure points. These calibration points are 0 psig (0 kPa) and between 25 and 250 psig (173 and 1724 kPa). 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 oil pressure or flow device calibration keep transducer in place.
NOTE: If the cooler or condenser vessels are at 0 psig (0 kPa) or are open to atmospheric pressure, the transducers can be calibrated for zero without removing the transducer from the vessel.
3. Access the HEAT_EX screen and view the particular transducer reading (the EVAPORATOR PRESSURE or CONDENSER PRESSURE parameter on the HEAT_EX screen). To calibrate oil pressure or waterside flow device, view the particular reading (CHILLED WATER DELTA P and CONDENSER WATER DELTA P on the HEAT_EX screen and OIL PUMP DELTA P on the COMPRESS screen). It should read 0 psi (0 kPa). If the reading is not 0 psi (0 kPa), but within ± 5 psi (35 kPa), the value may be set to zero by pressing the SELECT softkey while the appropriate transducer parameter is highlighted on the ICVC screen. Then press the ENTER softkey. The value will now go to zero. No high end calibration is necessary for OIL 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 (TRANSDUCER VOLTAGE REF displayed in CONTROL TEST menu in the CCM PRESSURE TRANSDUCERS screen) or measure across the positive (+ red) and negative (- black) leads of the transducer. For example, the condenser transducer voltage input is measured at CCM terminals J2-4 and J25. 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 also be calibrated between 25 and 250 psig (172.4 and 1723.7 kPa) by attaching a regulated 250 psig (1724 kPa) maximum pressure (usually from a nitrogen cylinder). The high pressure point can be calibrated by accessing the appropriate transducer parameter on the HEAT_EX screen, highlighting the parameter, pressing the SELECT softkey, and then using the INCREASE DECREASE or softkeys to adjust the value to the exact pressure on the refrigerant gage. Press the ENTER softkey to finish the calibration. Pressures at high altitude locations must be compensated for, so the chiller temperature/pressure relationship is correct.

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

4.8.2 - Configuration with SAIA PIC 5 TOUCH SCREEN

See the 19XR with PIC 5 Controls Operation and Troubleshooting manual for instructions on using the PIC 5 interface to configure the 19XR unit. As the unit is configured, all configuration settings should be written down. A log, such as the one shown on pages CL-1 to CL-8, provides a list for configuration values.

Input the Design Set Points — To access the set point screen, press the Main Menu icon on the home screen. See Fig. 40.

Figure 40 - Main Menu Icon

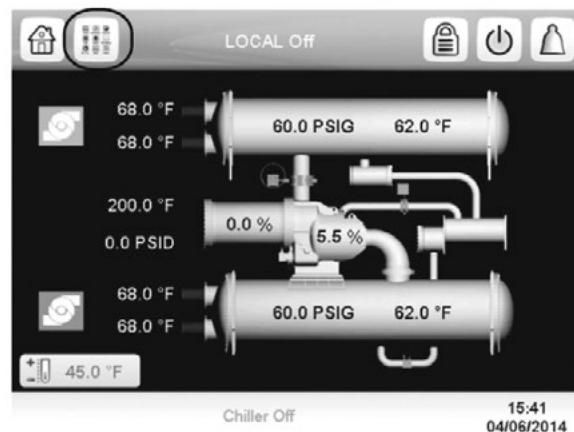


Figure 41 - Main Menu — Setpoint Table Icon

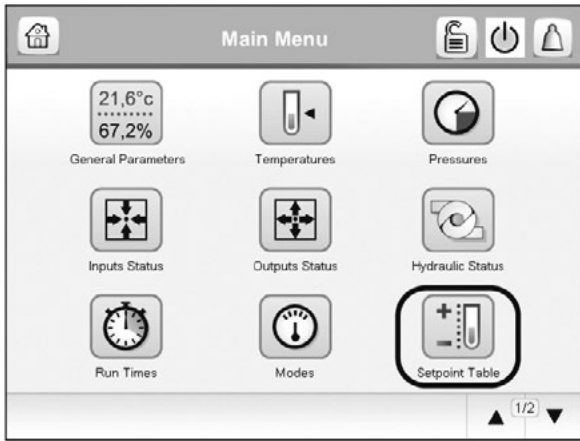


Figure 42 - Setpoint Table Screen

SETPOINT - Setpoint Table		
Heating ECDW Setpoint	104.0	°F
Cooling ECW Setpoint	60.0	°F
Ice Build Setpoint	40.0	°F
Heating LCDW Setpoint	113.0	°F
Cooling LCW Setpoint	45.0	°F
Base Demand Limit	100.0	%
EWT Control Option	Disable	▼

The Main Menu screen is displayed. Press the Setpoint Table icon (Fig. 41).

The Setpoint screen is displayed (see Fig. 42). 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 19XR with PIC 5 Controls Operation and Troubleshooting manual.

Input the Local Occupied Schedule — Access the schedule screen and set up the occupied time schedule according to the customer's requirements. If no schedule is available, the default is factory set for 24 hours occupied, 7 days per week including holidays. The Schedule Menu as well as the Holiday Menu can be reached through the Configuration Menu (see overview of the available menus on Fig 43). When the control mode is LOCAL SCHEDULE, the chiller will be automatically started if the configured local schedule is occupied and be shut down by the unoccupied schedule, EMSTOP software point, STOP button on HMI screen, or remote emergency stop contact.

The Network Schedule should be configured if a CCN system is being installed. When control mode is NETWORK, the chiller can be started and stopped by the CHIL_S_S software point as written by other equipment through the network command and network schedule. The chiller can be shut down by EMSTOP software point and remote emergency stop contact.

For more information about setting time schedules, see the 19XR with PIC 5 Controls Operation and Troubleshooting manual.

Figure 43 - Screen Structure, Basic Level (All) Access (No Password Required)

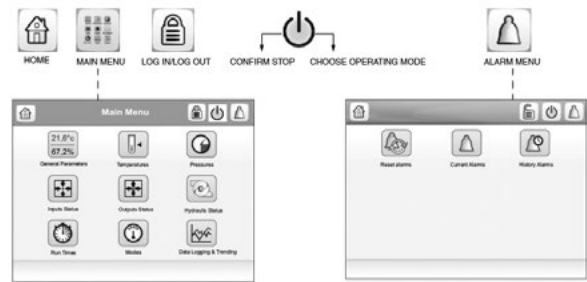


Figure 44 - Screen Structure, User Level Access (User Password Required)

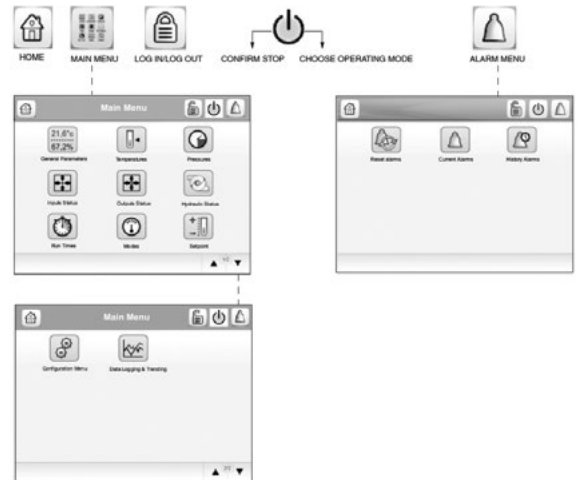
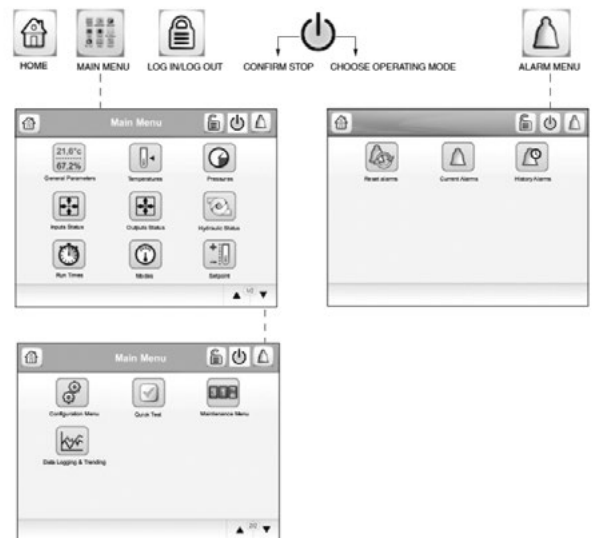


Figure 45 - Screen Structure, Service (Advanced User) /Factory Level Access Password Required)



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:

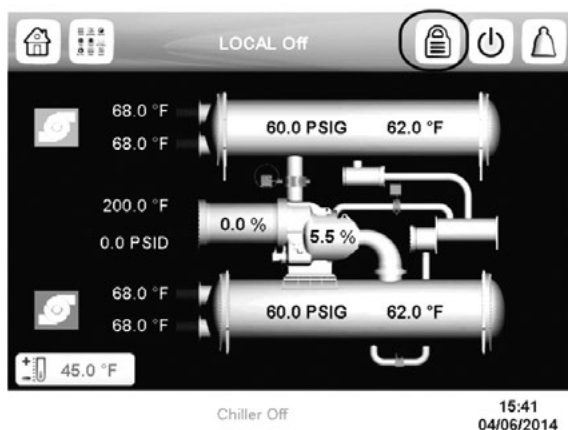
- Basic User: No password required
- User: 1111
- Advanced User / Service Access: 2222
- Factory: 4444

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. See Fig. 46.

Figure 46 - Lock Icon

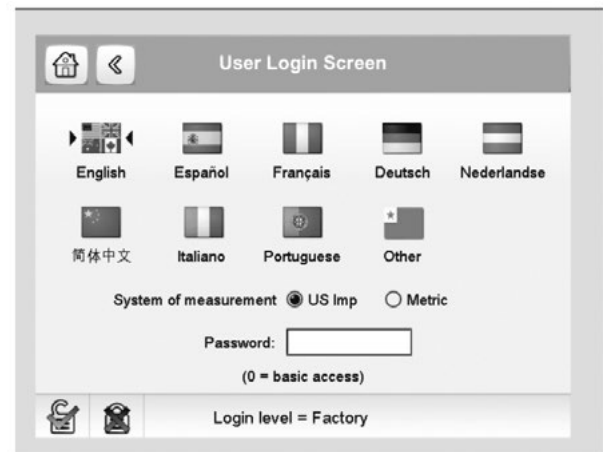


The User Login Screen is displayed. Enter the password on this screen. See Fig 47. The language and system of measurement can also be changed on this screen. For details, see the 19XR with PIC 5 Controls Operation and Troubleshooting guide.

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.*

Figure 47 - User Login Screen



MODIFY CONTROLLER IDENTIFICATION IF NECESSARY — The module 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 HMI module for future reference.

CONFIGURE SERVICE TABLES — Access the SERVICE tables through MAIN MENU - CONFIGURATION MENU to modify or view job site parameters shown in Table 6. For details, see the 19XR with PIC 5 Controls Operation and Troubleshooting guide.

Table 6 - Job Site Parameters

PARAMETER	TABLE
Starter Type	CONF_ISM — Select 0 for full voltage, 1 for reduced voltage, or 2 for solid state or 3 for variable frequency drive.
Motor Rated Line Voltage	CONF_ISM — Motor rated voltage from chiller information nameplate.
Volt Transformer Ratio	CONF_ISM — Enter ratio (reduced to a ratio to 1) of power transformer wired to terminal J3 of ISM. If no transformer is used enter 1.
Motor Rated Load Amps	CONF_ISM — Per chiller nameplate data. RL AMPS on compressor nameplate.
Motor Locked Rotor Trip	CONF_ISM — Per chiller identification nameplate.
Starter LRA Rating	CONF_ISM — Enter value from nameplate in starter cabinet MAXIMUM FUSE. This value shall always be "9999" for Benshaw RediStart MX3 wye-delta and solid-state starters.
Motor Current CT Ratio	CONF_ISM — Enter ratio (reduced to a ratio to 1) of current transformers wired to terminal J4 of ISM. This value shall always be "100" for solid-state starters.
Current % Imbalance	CONF_ISM — Current imbalance trip threshold. Enter up to 100% for starter type 3 (VFD).
Ground Fault Current Transformers	CONF_ISM — Enter 0 if no ground fault CTs are wired to terminal J5 of ISM. Enter 1 if ground fault CTs are used.
Ground Fault CT Ratio	CONF_ISM — Enter ratio (reduced to a ratio to 1) of ground fault CT.
Single Cycle Dropout	CONF_ISM — ENABLE if motor protection required from drop in line voltage within one cycle.
Line Frequency	CONF_ISM — Enter YES for 60 Hz or NO for 50 Hz.
Line Frequency Faulting	CONF_ISM — ENABLE if motor protection required for drop in line frequency.
Hot Gas Bypass Option	CONF_OPT — 1 = HGBP for Surge Correction; 2 = HGBP for Low Load Operation; 3 = Combination HGBP; 0 = no HGBP or HGBP is Disabled.
Minimum Load Points (T _{min} , IGV _{min})	CFGSURGE — Per job data — See modify load points section. Refer to table located in the control panel.
Full (Maximum) Load Points (T _{max} , IGV _{max})	CFGSURGE — Chiller Requisition (T _{min} , IGV _{min}) or per job data — See modify load points section. Refer to table located in the control panel.
Surge Line Shape Factor (shapefac)	CFGSURGE — Per Chiller Requisition (shapefac). Refer to table located in the control panel.
Chilled Medium	FACTORY — Enter water or brine.
Evaporator Refrigerant Trippoint	CFGLIMIT — Usually 3° F (1.7° C) below design refrigerant temperature.
Evaporator Flow Delta P Cutout	CFGLIMIT — Per Chiller Requisition if available or enter 50% of design pressure drop to 0.5 psi (3.4 kPa).*
Condenser Flow Delta P Cutout	CFGLIMIT — Per Chiller Requisition if available or enter 50% of design pressure drop to 0.5 psi (3.4 kPa).*
High Condenser Water Delta P	CFGLIMIT — Enter the maximum allowable value for condenser water pressure drop.
Motor Rated Kilowatts	FACTORY — Enter value from chiller requisition form (product data submittal) if DEMAND LIMIT SOURCE is set to kW.

* With variable flow systems this point may be configured to the lower end of the range.

NOTE: Other parameters: Screens are normally left at the default settings; they may be changed as required. The time and persistence settings on the CONF_ISM table can be adjusted to increase or decrease the sensitivity to a fault condition. Increasing time or persistence decreases sensitivity. Decreasing time or persistence increases sensitivity to the fault condition.

Fine Tuning VPF Surge Prevention — Figures 36-39 show how the parameters defined below will affect the configured surge line.

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

If capacity is not reached

and

5. ACTUAL GUIDE VANE POSITION < GUIDE VANE TRAVEL RANGE

and

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

and

7. PERCENT LINE CURRENT < 100% then the surge line is probably too conservative.

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

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

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

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

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

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

1. Increase SURGE DELTA T_{SMIN} in steps of 2° F.
2. Increase SURGE DELTA T_{SMAX} in steps of 2° F.
3. Repeat Steps 1 and 2 until one of the conditions listed above no longer applies.

NOTE: DELTA T_{SMIN} should seldom need to be increased more than 10 degrees above the selection program value. Like-wise, DELTA T_{SMAX} rarely requires more than a 2 degree increase.

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

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

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

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

Perform a Controls Test (Quick Test) — Check the safety controls status by performing an automated controls test. The path to the QUICK TEST is MAIN MENU - QUICK TEST TABLE. (The QUICK TEST screen can only be accessed when the chiller is in STOP mode.) On the QUICK TEST table screen, select a test to be performed (See Table 7).

The Quick Test checks all outputs and inputs for function. In order to successfully proceed with the controls test, the compressor should be off, no alarms showing, and voltage should be within $\pm 10\%$ of rating plate value. Each test asks the operator to confirm the operation is occurring and whether or not to continue. If an error occurs, the operator can try to address the problem as the test is being done or note the problem and proceed to the next test.

NOTE: If during the controls test the guide vanes do not open, verify the low pressure alarm is not active. (An active low pressure alarm causes the guide vanes to close.)

NOTE: The oil pump test will not energize the oil pump if cooler pressure is below -5 psig (-35 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.

Table 7 - Quick Test Table

CCN TABLE NAME: QCK_TEST

PIC 5 PATH: Main Menu ⇌ Quick Test

LINE	PIC 5 DESCRIPTION	CCN NAME	RANGE	DEFAULT VALUE*	UNIT	READ/WRITE
1	Quick Test Enable	QCK_TEST	DSABLE/ENABLE	DSABLE		RW
2	GV 1 Calibration Enable	GV1_CAL	DSABLE/ENABLE	DSABLE		RW
3	GV1 Calibration Status 0=No Calibration or Failure 1=In Progress, 2=Completed	GV1_STAT	0 to 2			RO
4	Guide Vane 1 Actual Ohms	GV1_OHM	0.00 to 12000.00			RO
5	Guide Vane 1 Actual mA	GV1_MAF	0.0 to 20.8		mA	RO
6	Guide Vane 1 Forced Position	Q_GV1POS	0.0 to 100.0	0.0	%	RW
7	Quick Test GV1 Open	Q_GV1OP	OFF/ON	OFF		RW
8	Quick Test GV1 Close	Q_GV1CL	OFF/ON	OFF		RW
9	Quick Test Oil Pump	Q_OILP	OFF/ON	OFF		RW
10	Oil Pres Test Passed	OP_PASS	NO/YES			RO
11	Oil Pump Delta Pressure	OIL_PDQ	-6.7 to 420.0		Psig	RO
12	Quick Test Oil Heater	Q_OILH	OFF/ON	OFF		RW
13	Quick Test HGBP Open	Q_HGBPOP	OFF/ON	OFF		RW
14	Quick Test HGBP Close	Q_HGBPCL	OFF/ON	OFF		RW
15	Quick Test Damper Open	Q_DMPOP	OFF/ON	OFF		RW
16	Quick Test Damper Close	Q_DMPCL	OFF/ON	OFF		RW
17	Quick Test Cond Pump	Q_CDWP	OFF/ON	OFF		RW
18	Condenser Water Flow	CDW_FLOW	NO/YES			RO
19	Quick Test Chilled Pump	Q_CHWP	OFF/ON	OFF		RW
20	Chilled Water Flow	CHW_FLOW	NO/YES			RO
21	Quick Test Head Val Pos	Q_HDP	0.0 to 100.0	0.0	%	RW
22	Quick Test Diffuser Pos	Q_SRD	0.0 to 100.0	0.0	%	RW
23	Quick Test Chiller Status	Q_CHST	4.0 to 20.0	4.0	mA	RW
24	Quick Test Oil EXV	Q_EXV	4.0 to 20.0	4.0	mA	RW
25	Condenser Water Delta T	CDW_DT	-40.0 to 245.0		°F	RO
26	Chilled Water Delta T	CHW_DT	-40.0 to 245.0		°F	RO
27	Cond Water Deviation	CDWT_DV	OFF/ON			RO
28	Chilled Water Deviation	CHWT_DV	OFF/ON			RO
29	Quick Test Alarm Output	Q_ALM	OFF/ON	OFF		RW
30	Quick Test Alert Output	Q_ALE	OFF/ON	OFF		RW
31	Guide Vane 1 Ohms 100%	GV1_MAXO	0.00 to 12000.00			RO
32	Guide Vane 1 Ohms 0%	GV1_MINO	0.00 to 12000.00			RO
33	Guide Vane 1 mA 100%	GV1_MAXA	0.0 to 20.8		mA	RO
34	Guide Vane 1 mA 0%	GV1_MINA	0.0 to 20.8		mA	RO

LEGEND

GV Guide Vane
HGBP Hot Gas Bypass
RO Read Only
RW Read Write

* Default value is shown only if configurable in this table.

NOTES

1. Quick Test ENABLE defaults back to DISABLE after 1 hour.
2. During any of the tests, an out-of-range reading will have an asterisk (*) next to the reading and a message will be displayed if the diffuser control is enabled.

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 100 and 250 psig (690 and 1724 kPa).

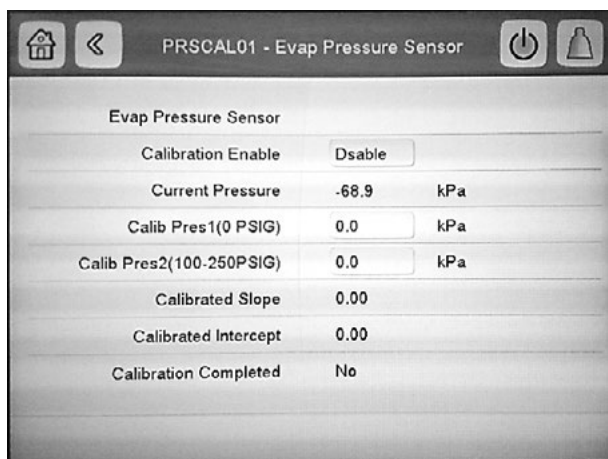
1. Shut down the compressor and the cooler and condenser pumps.
NOTE: There should be no flow through the heat exchangers.
2. Disconnect the transducer in question from its Schrader fitting for cooler or condenser transducer calibration. For oil pressure or flow device calibration keep transducer in place.
NOTE: If the cooler or condenser vessels are at 0 psig (0 kPa) or are open to atmospheric pressure, the transducers can be calibrated for zero without removing the transducer from the vessel.
3. Access the PRESSURES screen from the Main Menu and view the particular transducer reading (the evaporator pressure, condenser pressure, economizer pressure, oil discharge, sump pressure, etc.) To calibrate a device, view the particular reading on the screen. It should read 0 psig (0 kPa). If the reading is not 0 psig (0 kPa), but within ± 5 psig (35 kPa), the value may be set to zero while the appropriate transducer parameter is highlighted
The value will now go to zero. No high end calibration is necessary for OIL PUMP DELTA P or flow devices.

MAIN MENU > MAINTENANCE MENU > PRESSURE SENSOR CALIB

You have access to all pressure transducers.

On each, you have the calibration screen (Fig 48):

Figure 48 - Pressure sensor calibration screen



When pressure transducer calibration is performed, entering value shall result in a recalculation for the slope and intercept of the 2 values. Thereafter, the new slope and intercept values shall be used for voltage ratio to pressure conversions.

Step 1: Set CALIBRATION ENABLE for pressure transducer

Step 2: Put the transducer at atmosphere and enter 0 PSIG(0 kPa) to CALIB PRESS1

Step 3: Give the transducer a known pressure (100-250 PSI (690-1700 kPa) via Tool and enter this pressure to CALIB PRESS2

Step 4: Recalculate calibrated Slope and Intercept

Calibration is done when Calibration completed is YES.

4.9 - Check optional pumpout system controls and compressor

Controls include an on/off switch, the compressor overloads, an internal thermostat, a compressor contactor, and a refrigerant high pressure cutout. The high pressure cutout is factory set to open at a pressure which depends on the approval code. Check that the water-cooled condenser has been connected. Loosen the compressor hold down bolts to allow free spring travel. Open the compressor suction and discharge service valves. Check that oil is visible in the compressor sight glass. Add oil if necessary.

For more details on refrigerant transfer, oil characteristics etc. see sections 4.12 “Chiller equalization without pumpout unit” and 4.13 “Chiller equalization with pumpout unit”.

4.10 - High altitude locations

Recalibration of the pressure transducers will be necessary, because the chiller was initially calibrated at sea level.

4.11 - Charge refrigerant into chiller

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

The standard 19XR chiller will have the refrigerant already charged in the vessels. The 19XR may be ordered with a nitrogen holding charge. Evacuate the entire chiller, and charge chiller from refrigerant cylinders.

4.12 - 19XR Chiller equalization without pumpout unit

WARNING: When equalizing refrigerant pressure on the 19XR chiller after service work or during the initial chiller start-up, do not use the discharge isolation valve to equalize. Either the motor cooling isolation valve or charging hose (connected between pumpout valves on top of cooler and condenser) is to be used as the equalization valve.

For safety reasons this valve is supplied locked from the factory. To manipulate the other valves a special tool (key type) is required.

Manipulation of the valves must always be done by a qualified person.

To equalize the pressure differential on a refrigerant isolated 19XR chiller, use the TERMINATE LOCKOUT function of the Control Test in the SERVICE menu. This will help to turn on pumps and advise the proper procedure. The following procedure describes how to equalize refrigerant pressure on an isolated 19XR chiller without a pumpout unit:

- Access TERMINATE LOCKOUT function on the Control Test.
- Turn on the evaporator and condenser water pumps to prevent freezing.
- Progressively open the refrigerant cooling isolation valve. The chiller cooler and condenser pressures will gradually equalize. This process will take approximately 15 minutes.
- Once the pressures have equalized, the cooler isolation valve, the condenser isolation valve and the hot gas isolation valve may now be opened.

WARNING: Whenever turning the discharge isolation valve, be sure to attach the valve locking device. This will prevent the valve from opening or closing during service work or during chiller operation.

The valve is opened counter-clockwise, and closed clockwise.

4.13 - 19XR Chiller equalization with pumpout unit

The following procedure describes how to equalize refrigerant pressure on an isolated 19XR chiller using the pump-out unit:

- Access the TERMINATE LOCKOUT mode in the Control Test menu of the ICVC.
- Turn on the evaporator and condenser water pumps to prevent freezing.
- Open valve 4 on the pumpout unit and open valves 1a and 1b on the chiller cooler and condenser (see Fig. 22 and Fig. 23). Progressively open valve 2 on the pumpout unit to equalize the pressure. This process will take approximately 15 minutes.
- Once the pressures have equalised, the discharge isolation valve, cooler isolation valve, optional hot gas bypass isolation valve, and the refrigerant isolation valve can be opened. Close valves 1a and 1b, and all pumpout unit valves.

The full refrigerant charge on the 19XR will vary with chiller components and design conditions, indicated on the job data specifications. An approximate charge is given on the dimensional drawing supplied with the machine.

Always operate the water pumps during charging operations to prevent freeze-ups. Use the Control Test TERMINATE LOCKOUT to monitor conditions and start the pumps.

If the chiller has been shipped with a holding charge, the refrigerant will be added through the refrigerant charging valve (see item 7 in Fig. 22 and Fig. 23) or through the pumpout charging connection. First evacuate the nitrogen holding charge from the chiller vessels. Charge the refrigerant as a gas until the system pressure exceeds 141 kPa for HFC-134a. After the chiller is beyond this pressure the refrigerant should be charged as a liquid until all the recommended refrigerant charge has been added.

4.14 - Trimming refrigerant charge

The 19XR is shipped with the correct charge for the design duty of the chiller. Trimming the charge can best be accomplished when design load is available. To trim, check the temperature difference between leaving chilled water temperature and cooler refrigerant temperature at full load

design conditions. If necessary, add or remove refrigerant to bring the temperature difference to design conditions or minimum differential. If the unit incorporates a sight glass (option) and has a full charge, bubbling must take place in the upper level of the vessel.

For inlet/outlet nozzles on compressor suction side			For inlet/outlet nozzles on motor side		
HX size	refrigerant load (kg)		HX size	refrigerant load (kg)	
	Cooler	Condenser		Cooler	Condenser
30	159	118	30	232	140
31	191	118	31	257	140
32	222	118	32	284	140
35	181	141	35	262	158
36	218	141	36	290	158
37	249	141	37	322	158
40	254	127	40	330	153
41	286	127	41	355	153
42	313	127	42	381	153
45	290	150	45	373	174
46	327	150	46	397	174
47	358	150	47	431	174
50	340	181	50	407	202
51	381	181	51	442	202
52	408	181	52	464	202
53	409	182	53	459	202
54	409	182	54	448	202
55	395	222	55	460	229
56	426	222	56	500	229
57	445	222	57	524	229
58	445	222	58	519	229
59	445	222	59	507	229
5K	306		5K	306	
5L	321		5L	321	
5M	337		5M	337	
5P	291		5P	291	
5Q	308		5Q	308	
5R	322		5R	322	
5T	349		5T	349	
5U	364		5U	364	
5V	383		5V	383	
5X	331		5X	331	
5Y	349		5Y	349	
5Z	365		5Z	365	
60	420	426	60	495	217
61	420	445	61	522	217
62	420	463	62	546	217
63	420	463	63	546	217
64	420	463	64	535	217
65	510	463	65	563	246
66	510	481	66	594	246
67	510	494	67	622	246
68	510	495	68	617	246
69	510	495	69	605	246
6K	345		6K	345	
6L	362		6L	362	
6M	376		6M	376	
6P	329		6P	329	
6Q	347		6Q	347	
6R	362		6R	362	
6T	392		6T	392	
6U	411		6U	411	
6V	427		6V	427	
6X	374		6X	374	
6Y	394		6Y	394	
6Z	411		6Z	411	
70	553	354	70	640	381
71	608	354	71	699	381

For inlet/outlet nozzles on compressor suction side			For inlet/outlet nozzles on motor side		
HX size	refrigerant load (kg)		HX size	refrigerant load (kg)	
	Cooler	Condenser		Cooler	Condenser
72	653	354	72	747	381
73	654	354	73	736	381
74	654	354	74	719	381
75	619	420	75	726	431
76	683	420	76	793	431
77	737	420	77	849	431
78	738	420	78	839	431
79	738	420	79	820	431
7K	475		7K	475	
7L	514		7L	514	
7M	551		7M	551	
7P	455		7P	455	
7Q	493		7Q	493	
7R	530		7R	530	
7T	542		7T	542	
7U	587		7U	587	
7V	637		7V	637	
7X	518		7X	518	
7Y	563		7Y	563	
7Z	612		7Z	612	
80	680	327	80	772	380
81	735	327	81	823	380
82	785	327	82	875	380
83	785	327	83	852	380
84	785	327	84	835	380
85	767	390	85	875	429
86	826	390	86	933	429
87	880	390	87	992	429
88	881	390	88	972	429
89	881	390	89	953	429
8K	629		8K	629	
8L	674		8L	674	
8M	721		8M	721	
8P	606		8P	606	
8Q	649		8Q	649	
8R	697		8R	697	
8T	717		8T	717	
8U	769		8U	769	
8V	824		8V	824	
8X	691		8X	691	
8Y	741		8Y	741	
8Z	795		8Z	795	

* The optimised charge can be different from the charge shown above.

NOTE: The total quantity of refrigerant is the cooler load + condenser load.
Ex: For a 19XR5657 chiller with nozzles on compressor side, the total quantity is 426+222 = 648 kg.

5 - INITIAL START-UP

5.1 - Preparation

Before starting the chiller, check that the:

1. Power is on to the main starter, oil pump relay, tower fan starter, oil heater relay, and the chiller control centre.
2. Cooling tower water is at proper level and at or below design entering temperature.
3. Chiller is charged with refrigerant and all refrigerant and oil valves are in their proper operating position.
4. Oil is at the proper level in the reservoir sight glasses.
5. Oil reservoir temperature is above 60 °C or evaporator saturated refrigerant temperature plus 28 °C.
6. Evaporator and condenser water circuit valves are open.

NOTE: *If the pumps are not automatic check that the water is circulating correctly.*

WARNING: *Do not permit water or brine that is warmer than 43 °C to flow through the cooler or condenser. Refrigerant overpressure may discharge through the relief devices and result in the loss of refrigerant charge.*

7. Access the 'Control test' screen.
For chiller with ICVC:
Scroll down to the PUMPDOWN/LOCKOUT option.
Press the SELECT button to permit chiller start-up and select 'YES' to restart the unit in the operating mode..

For chiller with PIC5 SAIA HMI:

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

NOTE: *The unit is locked at the factory to prevent accidental start-up.*

5.2 - Dry run to test start-up sequence

NOTE: *This does not apply to 19XRV machines.*

ATTENTION: *To comply with normal safety precautions during start-up of electrical equipment the control box must be closed during the initialization tests on the compressor supply circuit: It must be possible to carry out all checks from outside the control box.*

1. Disconnect the main power supply so that there is no power to the compressor starter. Ensure direct supply upstream of disconnect switch QF11. Ensure that voltage is present at the control circuit terminals, oil pump and heater. Ensure that no voltage is present at the compressor starter terminals in particular. There must be no voltage return from the supply from QF11.
2. If an electronic starter is used, install a voltmeter to read the compressor starter control voltage. If necessary short-circuit the starter fault return terminals on the PIC control (102/103 or directly J27/8 on the ISM board - please refer to the wiring diagram).
3. Look at the default screen on the HMI: The status message in the upper left-hand corner "OCCUPIED MODE" shows that the unit is in occupied mode and ready to start. If this is not the case, go to the Schedule screen and

override the schedule or change the occupied time. Press the LOCAL softkey to begin the start-up sequences.

4. Check that chilled water and condenser water pumps energize.
5. Check that the oil pump starts and pressurises the lubrication system. After the oil pump has run about 45 seconds, the starter will be energized and go through its start-up sequence.
6. Check that the compressor starter control signal has been given: Cut-in of the main contactor or voltage present on the voltmeter at the starter terminals.
7. The PIC will eventually show an alarm for motor current not sensed. Reset this alarm and continue with the initial start-up.

5.3 - Check rotation

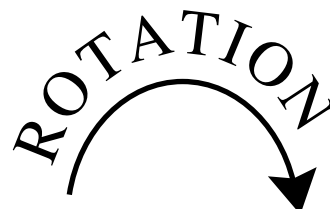
1. Switch on the supply to the starter power circuit. PIC now controls the order of the phases connected to the voltage measurement terminals on the ISM board. On the 19XRV machines this verification may be duplicated by the starter/variable frequency drive. Please refer to the appendix starting with chapter 8.
2. The ISM mounted in the starter enclosure checks for proper phase rotation as soon as power is applied to the starter and the PIC 5 controls power up.
3. 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.
4. Start the chiller by Local On (assumes LOCAL operation mode) by pressing the Start/Stop button on the HMI and following the prompts. The PIC 5 control performs start-up checks.
5. When the starter is energized and the motor begins to turn, immediately at the start-up check for clockwise rotation (see Fig. 49 - "Rotation diagram").

IF ROTATION IS CORRECT, *allow the compressor to come up to speed.*

IF THE MOTOR ROTATION IS NOT CLOCKWISE *(as viewed through the sight glass), immediately stop the motor. Specifically check the order of phases connected between starter and motor.*

CAUTION: *Do not check motor rotation during coastdown. Rotation may have reversed during equalisation of vessel pressures.*

Figure 49 - Rotation diagram



TO CHECK ROTATION, ENERGIZE COMPRESSOR MOTOR MOMENTARILY. DO NOT LET MACHINE DEVELOP CONDENSER PRESSURE. CHECK ROTATION IMMEDIATELY. ALLOWING CONDENSER PRESSURE TO BUILD OR CHECKING ROTATION WHILE MACHINE COASTS DOWN MAY GIVE A FALSE INDICATION DUE TO GAS PRESSURE EQUALIZING THROUGH COMPRESSOR

5.4 - Check oil pressure and compressor stop

- When the motor is up to full speed, note the differential oil pressure reading on the HMI default screen. It should be between 124 to 206 kPa.
- Press the Stop button and listen for any unusual sounds from the compressor as it coasts to a stop.

5.5 - To prevent accidental start-up

For chiller with ICVC : A chiller STOP override setting may be entered to prevent accidental start-up during service or whenever necessary. Access the MAINSTAT screen and using the NEXT or PREVIOUS softkeys, highlight the START/STOP parameter. Press the STOP softkey followed by the ENTER softkey. To restart the chiller the STOP override setting must be removed. Access the MAINSTAT screen and using NEXT or PREVIOUS softkeys select START/STOP. Three choices are possible:

- START - Forces the chiller ON
- STOP - Forces the chiller OFF
- RELEASE - Puts the chiller under remote schedule control.

To return the chiller to normal control, press the RELEASE softkey followed by the ENTER softkey. For more information, see the chapters relating to start-up in the Controls manual.

For chiller with PIC 5 :

From the Main Menu, access the General Parameters Menu and use the down arrow to reach Stop Override on the GENUIT 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 change the Stop Override option to No.

5.6 - Check chiller operating condition

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

5.7 - Instruct the customer operator

Check to be sure that the customer operators understand all operating and maintenance procedures. Point out the various chiller parts and explain their function as part of the complete system.

5.7.1 - Cooler-condenser

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

5.7.2 - Optional pumpout storage tank and pumpout system

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

5.7.3 - Motor compressor assembly

Guide vane actuator, transmission, motor cooling system, oil cooling system, temperature and pressure sensors, oil sight glasses, integral oil pump, isolatable oil filter, extra oil and motor temperature sensors, synthetic oil, and compressor serviceability.

5.7.4 - Motor compressor lubrication system

Oil pump, cooler filter, oil heater, oil charge and specification, operating and shutdown oil level, temperature and pressure, and oil charging connections.

5.7.5 - Economizer :

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

5.7.6 - Control system

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

5.7.7 - Auxiliary equipment

Starters and disconnects, pumps, and cooling tower.

5.7.8 - Describe chiller cycles

Refrigerant, motor cooling, lubrication, and oil reclaim.

5.7.9 - 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.

5.7.10 - Safety devices and procedures

Electrical disconnects, relief device inspection, and handling refrigerant.

5.7.11 - Check operator knowledge

Start, stop, and shut-down procedures, safety and operating controls, refrigerant and oil charging, and job safety.

6 - OPERATING INSTRUCTIONS

6.1 - Operator duties

1. Become familiar with refrigeration 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 oil and refrigerant levels.
5. Protect the system from damage during shutdown periods.
6. Maintain the set point, time schedules, and other PIC functions.

6.2 - To start the chiller

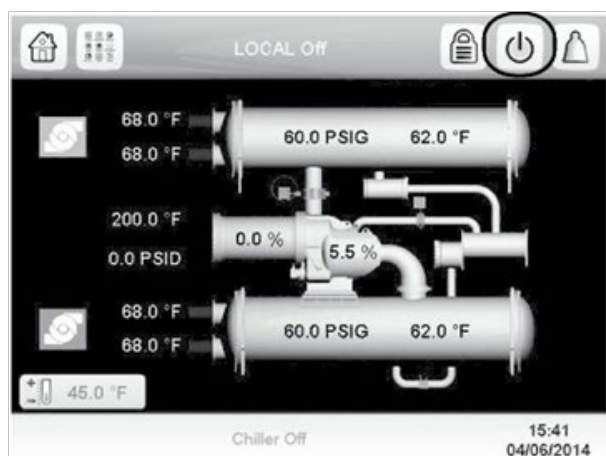
1. Start the water pumps, if they are not automatic.
2. ICVC : On the ICVC default screen, press the LOCAL or CCN softkey to start the system. If the chiller is in the OCCUPIED mode and the start timers have expired, the start sequence will begin. Follow the procedure described in chapter 5.2 “Dry run to test start-up sequence”.

PIC 5 : 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 below - Start-Up/Shut-down/Recycle Sequence section.

START-UP/SHUTDOWN/ RECYCLE SEQUENCE

Local Start/Stop Control — Local start-up (or manual start-up) is initiated by pressing the the gray Start/Stop icon on the HMI interface. See Fig. 50.

Figure 50 - Chiller OFF Icon



This initiates the PIC 5 starting sequence by displaying the list of operating modes. Press Local On to initiate start-up. See Fig. 51.

Figure 51 - 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 start-up progress and the Start/Stop icon blinks green.

Once local start-up begins, the PIC 5 control system performs a series of pre-start tests to verify that all pre-start alerts and safeties are within acceptable limits. Table 8 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 startup 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 PIC 5 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 PIC 5 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 PIC 5 control system closes the vanes. If the vanes are closed and the oil pump pressure is less than 4 psi (27.6 kPa), the oil pump relay energizes. The PIC 5 control system then waits until the oil pressure (OIL PRESS VERIFY TIME, operator-configured, default of 40 seconds) reaches a maximum of 18 psi (124 kPa). After oil pressure is verified, the PIC waits 40 seconds, and the compressor start relay (1CR) energizes to start the compressor.

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

Failure to verify any of the requirements up to this point will result in the PIC 5 control system aborting the start and displaying the applicable pre-start alert alarm state number near the bottom of the home screen on the HMI panel. A prestart failure does not advance the STARTS IN 12 HOURS counter. Any failure after the 1CR relay has energized results in a safety shut-down, 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. 52 for normal start-up timing sequence. See Table 8 for a list of prestart checks.

Figure 52- Control Timing Sequence for Normal Start-Up

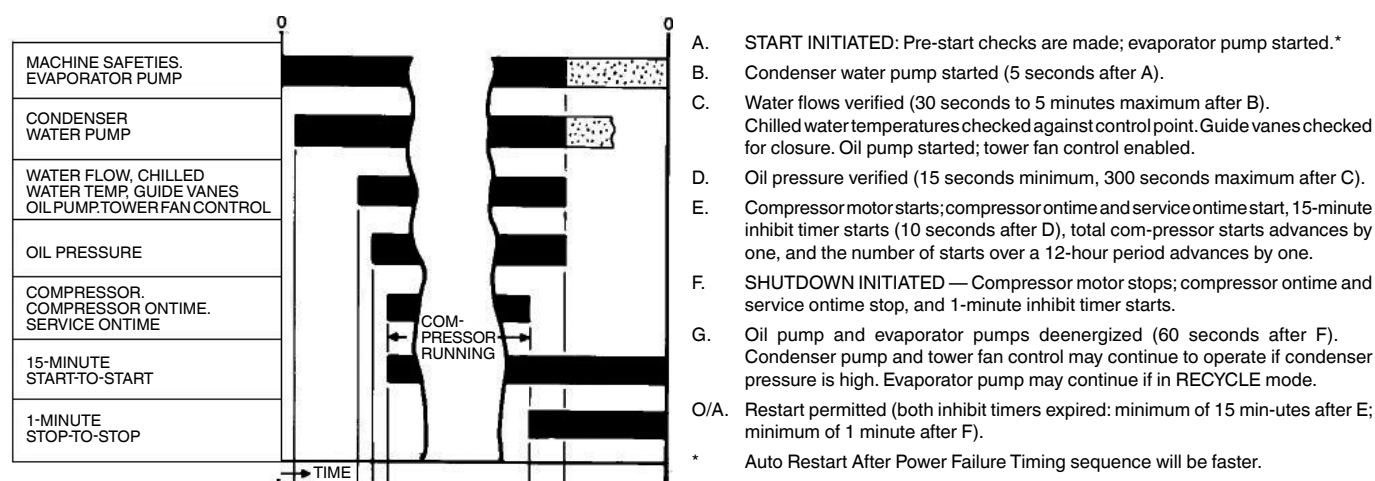


Table 8 - Prestart Checks

PRESTART CHECK CONDITION*	STATE NUMBER†
STARTS IN 12 HOURS > 8 (not counting recycle restarts or auto restarts after power failure)	Alert – 100
OIL SUMP TEMP < 140° F (60° C) and OIL SUMP TEMP < EVAP_SAT + 50° F (27.8° C)	Alert – 101
COND PRESSURE > COND PRESS OVERRIDE – 20 psi	Alert – 102
#RECYCLE RESTARTS LAST 4 HOURS > 5	Alert – 103
COMP BEARING TEMPS > COMP BEARING ALERT – 10° F (5.6° C)	Alarm – 230
COMP MOTOR WINDING TEMP > COMP MOTOR WINDING – 10° F (5.6° C)	Alarm – 231
COMP DISCHARGE TEMPERATURE > COMP DISCHARGE ALERT – 10° F (5.6° C)	Alarm – 232
EVAP_SAT < Evap trip point** + EVAP OVERRIDE DELTA T	Alarm – 233
EVAP REFRIG LIQUID TEMP < Evap trip point** + EVAP OVERRIDE DELTA T	Alarm – 233
AVERAGE LINE VOLTAGE < UNDERVOLTAGE THRESHOLD	Alarm – 234
AVERAGE LINE VOLTAGE > OVERVOLTAGE THRESHOLD	Alarm – 235
CHECK FOR GUIDE VANE CALIBRATION	Alarm – 236

* If Prestart Check Condition is True, then resulting State is as indicated in the State Number column.

** Evap trip point = 33° F (0.6° C) (water) or EVAP REFRIG TRIPPOINT (brine)

† See the Controls Operation and Troubleshooting guide for alarm and alert codes.

6.3 - Check the running system

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

1. The oil reservoir temperature should be above 49 °C during shutdown.
2. The bearing oil temperature accessed on the 'COM-PRESS' status screen should be 49 to 74 °C. For compressors with rolling element bearings, if the bearing temperature reads more than 83 °C with the oil pump running, stop the chiller and determine the cause of the high temperature. Do not restart the chiller until corrected.
3. The oil level should be visible anywhere in one of the two sight glasses. Foaming oil is acceptable as long as the oil pressure and temperature are within limits.
4. The oil pressure should be between 124 to 207 kPa differential, as seen on the HMI default screen. Typically the reading will be 18 to 35 psid (124 to 241 kPa diff) at initial start-up.
5. The moisture indicator sight glass on the refrigerant motor cooling line should indicate refrigerant flow and a dry condition.
6. The condenser pressure and temperature varies with the

chiller design conditions. Typically the pressure will range between 390 and 950 kPa with a corresponding temperature range of 15 to 41°C. The condenser entering water temperature should be controlled below the specified design return water temperature to save on compressor kilowatt requirements.

7. Cooler pressure and temperature also will vary with the design conditions. Typically the temperature range will be 1.1 to 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 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 power output or temperature rate. It is accessed on the equipment service screen 'RAMP DEM'.
9. The economizer (if installed) has two sight glasses that look into the float chamber. When the chiller is operating, the top sight glass is empty and the bottom sight glass is full.

IMPORTANT: Power equipment fault reports should be checked on the HMI first. On the 19XRV machines additional information can be obtained by a direct check on the starter device; please refer to the appendix starting with chapter 8.

6.4 - To stop the chiller

The occupancy schedule will start and stop the chiller automatically once the time schedule is set up.

By pressing the STOP button for one second, the alarm light will blink once to confirm that the button has been pressed. Then, the compressor will follow the normal shut-down sequence as described in chapter 6.2 of the Controls manual. The chiller will not restart until the CCN or LOCAL softkey is pressed. 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.

NOTE: After the compressor has stopped the oil pump must ensure post-lubrication. Other than for emergency stops initiated by the control the compressor must not be stopped by an action that also stops the oil pump. For 19XRV machines please refer to the appendix starting with chapter 8. If the machine is stopped by an alarm, do not restart it until the operating problem has been diagnosed and corrected.

6.5 - After limited shutdown

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

6.6 - Extended shutdown

The refrigerant should be transferred into the pumpout storage tank provided (refer to the transfer unit installation manual, document order no. 19999, chapter "Pumpout and refrigerant transfer procedures") in order to reduce chiller pressure and the possibility of leaks. Maintain a holding charge of 2.27 to 4.5 kg of refrigerant or nitrogen to prevent air from leaking into the chiller.

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.

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

6.7 - After extended shutdown

Be sure that the water system drains are closed. It is recommended:

- To flush the water circuits to remove any soft rust which may have formed
- To clean the tube vessel
- To inspect the probe pressure taps and change them, if necessary.

Check the cooler pressure on the HMI default screen, and compare to the original holding charge that was left in the chiller. If (after adjusting for ambient temperature changes) any loss in pressure is indicated, check for refrigerant leaks. See chapter 4.2.2 "Leak test chiller".

Recharge the chiller by transferring refrigerant from the pumpout storage tank (if supplied). Refer to transfer unit installation manual, document order no. 19999 and sections 4.11 "Chiller equalisation without pumpout unit" and 4.12 "Chiller equalisation with pumpout unit". Observe the freeze-up precautions.

Carefully make all regular preliminary and running system checks. Perform a Control Test before start-up. If the compressor oil level appears abnormally high, the oil may have absorbed refrigerant. Make sure that the oil temperature is above 60 °C or cooler refrigerant temperature 27 °C.

6.8 - Cold-weather operation

When the entering condenser water drops very low, the operator should automatically cycle the cooling tower fans off to keep the temperature up. The PIC controls have a tower fan output (terminals 11 and 12 of the ISM or J12-4 of IOB#4 with PIC 5).

6.9 - Manual guide vane operation

Manual operation of the guide vanes in order to control the guide vanes in an emergency operation is possible by overriding the target guide vane position. Access the 'COMPRESS' screen on the interface, and select TARGET GUIDE VANE POSITION. To control the position, enter a percentage of guide vane opening that is desired. Zero percent is fully closed, 100% is fully open. To release the guide vanes to AUTOMATIC mode, press the RELEASE softkey.

NOTE: Manual control will increase the guide vane opening and override the pulldown rate during start-up. Manual control of the guide vanes will not have override status in the following cases:

- Limitation overrides are active
- The chilled water temperature is below the set point.

The PIC control will then close the guide vanes.

For a description of capacity overrides and set points, see the Capacity Override section in the Installation, Operation and Maintenance Manual for the control.

6.10 - Refrigeration log

A refrigeration log, like the one shown in Table. 6 provides a convenient checklist for routine inspection and maintenance and provides a continuous record of chiller performance. It is an aid in scheduling routine maintenance and in diagnosing chiller problems.

Keep a record of the chiller pressures, temperatures, and liquid levels on a sheet similar to that shown. Automatic recording of PIC data is possible through the use of devices connected to the CCN such as the Data Collection module and a Building Supervisor. Contact your Carrier representative for more information.

7 - MAINTENANCE

7.1 - 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)
- After repair following a refrigerant leak (annex D). The frequency of refrigerant leak detection can vary from once per year for systems with less than 1% leak rate per year to once a day for systems with a leak rate of 35% per year or more. The frequency is in proportion with the leak rate.

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.

7.1.1 - 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.

7.1.2 - Refrigerant properties

HFC-134a is the standard refrigerant for the 19XR chiller. At normal atmospheric pressure, HFC-134a will boil at -25 °C and must, therefore, be kept in pressurised containers or storage tanks. The refrigerant is practically odorless when mixed with air and is non-combustible at atmospheric pressure. Read standard EN 378-2 to learn more about safe handling of this refrigerant.

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

7.1.3 - Adding refrigerant

Follow the procedures described in chapter 4.11 “Charge refrigerant into chiller”.

WARNING: Always use the compressor pumpdown function in the Control Test table to turn on the evaporator pump

and lock out the compressor when transferring refrigerant. Liquid refrigerant may flash into a gas and cause possible freeze-up when the chiller pressure is below 207 kPa for HFC-134a. Do not use used refrigerant.

7.1.4 - Removing refrigerant

If the optional pumpout system is used, the 19XR refrigerant charge may be transferred to a pumpout storage tank (see chapter 4.13) or to the chiller condenser or cooler vessels, if the machine includes isolation valves. Follow the procedures in the transfer unit installation manual, document order no. 19999, chapter “Pumpout and refrigerant transfer procedures”), when removing refrigerant from the storage tank to a chiller vessel.

A valve under the condenser permits refrigerant removal during the liquid phase.

7.1.5 - Adjusting the refrigerant charge

If the addition or removal of refrigerant is required for improved chiller performance, follow the procedures given in chapter 4.14 “Trimming refrigerant charge”.

7.1.6 - Refrigerant leak testing

Because HFC-134a is above atmospheric pressure at room temperature, leak testing can be performed with refrigerant in the chiller. Use an electronic leak detector, soap bubble solution, or ultrasonic leak detector. Be sure that the room is well ventilated and free from concentration of refrigerant to keep false readings to a minimum. Before making any necessary repairs to a leak, transfer all refrigerant from the leaking vessel.

Monitoring for and repair of leaks

National regulations issued after the Kyoto protocol and the European F-gas regulation require monitoring for leaks and repair of leaks.

Test after service, repair or major leak

If all refrigerant has been lost or if the chiller has been opened for service, the chiller or the affected vessels must be pressurised and leak tested. Refer to chapter 4.2.2 “Leak test chiller” to perform a leak test.

WARNING: HFC-134a should not be mixed with air or oxygen and pressurised 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.

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

1. Install a copper tube from the pressure relief device on the cylinder to the refrigerant charging valve.
2. Never apply full cylinder pressure to the pressurising line. Follow the listed sequence:
 - Open the charging valve fully.
 - Slowly open the cylinder regulating valve.
 - Observe the pressure gauge on the chiller and close the regulating valve when the pressure reaches test level. Do not exceed 965 kPa.
 - Close the charging valve on the chiller.
 - Remove the copper tube if no longer required.

7.1.7 - Repair the leak and apply standing vacuum test

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

After retesting and finding no leaks, apply a standing vacuum test, and then dehydrate the chiller. Refer to chapters 4.3 “Standing vacuum test” and 4.4 “Chiller Dehydration” in the section 4 “Before initial start-up”.

7.1.8 - Checking guide vane linkage

When the chiller is off, the guide vanes are closed and the actuator mechanism is in the position shown in Fig. 53 - “Guide vane actuator linkage”. Slack in the guide vane actuator’s drive chain can only be removed with the guide vane actuator fully closed and the chiller shut down. Complete the

following steps to adjust chain tension and position :

1. Remove the two set screws in the guide vane actuator sprocket.
2. Loosen the guide vane actuator’s holddown bolts.
3. Pull the guide vane actuator away from the suction housing along the slotted holes in the actuator bracket.
4. Rotate the guide vane sprocket fully clockwise and spot-drill the guide vane actuator shaft. Spot-drilling is necessary when the guide vane actuator sprocket set screws on the guide vane actuator shaft need to be re-seated. (Remember: Spot-drill and tighten the first set screw before spot-drilling for the second set screw.)

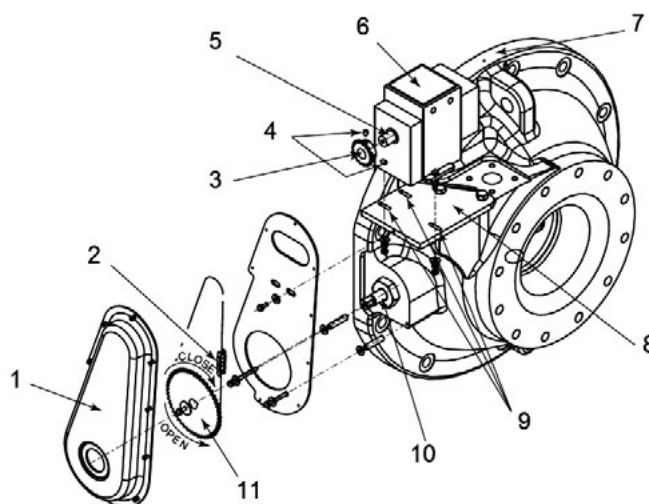
7.1.9 - Trim refrigerant charge

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 progressively until the difference between leaving chilled water temperature and the saturated evaporating temperature becomes optimal. Do not overcharge.

Refrigerant may be added either through the storage tank (see chapters 4.12 “Chiller equalization without pumpout unit” and 4.13 “Chiller equalization with pumpout unit”) or directly into the chiller as described in chapter 4.11 “Charge refrigerant into chiller”.

To remove any excess refrigerant, follow the procedures in the transfer unit installation manual, document order no. 19999, chapter “Transfer the refrigerant from chiller to pumpout storage tank”, steps 1a and 1b or use the service valve under the condenser (this transfers high-pressure liquid refrigerant).

Figure 53 - Guide vane actuator linkage



1. Chain guard
2. Drive chain
3. Guide vane actuator sprocket
4. Set screws
5. Guide vane actuator shaft
6. Guide vane actuator
7. Suction housing
8. Actuator bracket
9. Holddown bolts
10. Guide vane shaft
11. Guide vane sprocket

7.2 - Weekly maintenance

Check the lubrication system

Mark the oil level on the reservoir sight glass, and record the level each week while the chiller is shut down.

If the level goes below the lower sight glass, check the oil reclaim system for proper operation. If additional oil is required, add it through the oil drain charging valve (see Fig. 6 and Fig. 7 - “Lubrication system”). A pump is required to complete the oil charge against refrigerant pressure. The oil charge is approximately:

Compressor size	Oil charge, l
3	30
4	38
5 / E	68

The oil used must meet Carrier specifications for the 19XR. Refer to chapters 7.3.5 “Oil changes” and 7.3.7 “Oil reclaim filter”. Any additional oil used should be logged by noting the amount and date. Surplus oil will return to the sump and must be removed.

A 1800-Watt oil heater is controlled by the PIC to maintain oil temperature (see the Controls section) when the compressor is off. HMI shows whether the heater is energized or not. If the PIC shows that the heater is energised, but the sump is not heating up, the power to the oil heater may be off or the oil level may be too low. Check the oil level, the oil heater contactor voltage, and oil heater resistance.

The PIC will not permit compressor start-up if the oil temperature is too low. The control will continue with start-up only after the temperature is within limits.

7.3 - Scheduled maintenance

Any work must be done by authorised personnel. Establish a regular maintenance schedule based on the 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.

7.3.1. Service on time

The HMI will display a SERVICE ONTIME value on the 'MAINSTAT' status screen (ICVC) or MAIN MENU > RUN TIMES screen (PIC5). This value should be reset by the service person or the operator each time major service work is completed so that time between service can be viewed.

7.3.2 - Inspect the electrical equipment

Maintenance is limited to general cleaning and tightening of connections. Vacuum the cabinet to eliminate dust build-up. If the chiller control malfunctions, refer to the Troubleshooting Guide section in the controls manual for control checks and adjustments.

CAUTION: *Be sure power to the equipment is off when cleaning and tightening connections inside the unit. Access to the electrical equipment of 19XRV units requires special precautions. Please refer to the appendix starting with chapter 8.*

Check safety and operating controls monthly

Carry out the "Control test" at least once per month. Refer to the controls manual for safety control settings.

7.3.3 - Changing oil filter

Change the oil filter on a yearly basis or when the chiller is opened for repairs. The 19XR has an isolatable oil filter so that the filter may be changed with the refrigerant remaining in the chiller. Use the following procedure (refer Fig. 6 and Fig.7 - "Lubrication system"):

1. Make sure that the power supply circuits for the compressor and the oil pump are disconnected.
2. Close the oil filter isolation valves.
3. Connect an oil charging hose from the oil charging valve and place the other end in a clean container for used oil. The oil sample from the filter sump must be sent to a laboratory for proper analysis. Do not contaminate this sample.
4. Progressively open the charging valve to drain the oil from the housing.

CAUTION: *The oil filter housing is at a high pressure. Relieve this pressure slowly.*

5. Once all oil has been drained, place some rags or absorbent material under the oil filter housing to catch any drips once the filter is opened. Remove the 4 bolts from the end of the filter housing and remove the filter cover.
6. Remove the filter retainer by unscrewing the retainer nut. The filter may now be removed and disposed of properly.
7. Install a new filter. Install the filter retainer and tighten down the retainer nut. Install the filter cover and tighten the 4 bolts.

8. Evacuate the filter housing by placing a vacuum pump on the charging valve. Follow the normal evacuation procedures. Shut the charging valve when done and reconnect the valve so that new oil can be pumped into the filter housing. Fill with the same amount that was removed, then close the charging valve.
9. Remove the hose from the charging valve, open the isolation valves to the filter housing, and turn on the power to the oil pump and the compressor again.

7.3.4 - Oil specification

The oil must meet the following specifications:

- Oil that is compatible with R-134a
- Inhibited polyolester-based synthetic compressor oil formatted for use with HFC, gear-driven, hermetic compressors, viscosity grade 68.
Oil PP4731E (Carrier spec.)

7.3.5 - Oil changes

Carrier recommends changing the oil after the first year of operation and every three years thereafter in addition to an oil analysis. However, if a continuous oil monitoring system is used and a yearly oil analysis is performed (Periodic Oil Diagnosis), time between oil changes can be extended.

To change the oil :

1. Transfer the refrigerant into the chiller condenser (for isolatable vessels) or a pumpout storage tank.
2. Mark the existing oil level.
3. Open the control and oil heater circuit breaker.
4. When the chiller pressure is 34 kPa or less, drain the oil reservoir by opening the oil charging valve (refer to Fig. 2 and Fig. 3 - "19XR machine components"). Progressively open the valve against refrigerant pressure (see chapter 1 - "Safety considerations").
5. Change the oil filter at this time.
6. Change the refrigerant filter at this time.
7. Charge the chiller with oil. The oil level is visible in the upper sight glass (refer to Fig. 2 and Fig. 3 - "19XR machine components"). Turn on the power to the oil heater and let the PIC warm it up to at least 60 °C. Access the control test mode and operate the oil pump manually for 2 minutes. The oil level should be half full between the lower sight glass and the upper sight glass during shutdown.

7.3.6 - Refrigerant filter

A refrigerant filter/drier, located on the refrigerant cooling line to the motor, should be changed once a year or more often, if filter condition indicates a need for more frequent replacement. Change the filter by closing the filter isolation valves (refer to Fig. 4 and Fig. 5 - "Typical 19XR unit diagram") and progressively opening the flare fittings to relieve the pressure. A moisture indicator sight glass is located beyond this filter to indicate the volume and moisture in the refrigerant. If the moisture indicator indicates moisture, locate the source of water by performing a thorough leak check.

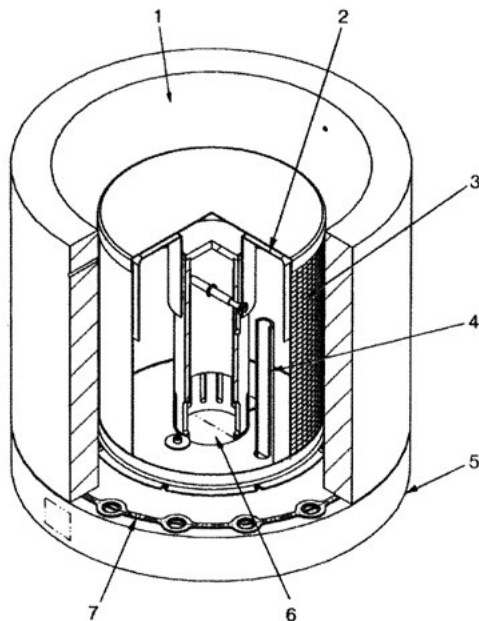
7.3.7 - Oil reclaim filter

The oil reclaim system has a strainer on the eductor suction line, a strainer on the discharge pressure line, and a filter on the cooler scavenging line. Replace the filter once per year or more often if filter condition indicates a need for more frequent replacement. Change the filter by closing the filter isolation valves (see Fig. 6 and Fig. 7 - "Lubrication circuit") and progressively opening the flare fitting to relieve the pressure. Change the strainers once every 5 years or whenever the cooler is evacuated or refrigerant.

7.3.8 - Inspect refrigerant float system

Perform inspection every year or when the condenser is opened for service. Transfer the refrigerant into the cooler vessel (if it includes isolation valves) or into a pumpout storage tank. Remove the float access cover. Clean the chamber and valve assembly thoroughly. Be sure that the valve moves freely. Make sure that all openings are free of obstructions. Examine the cover gasket and replace if necessary. See Fig. 54 - "19XR float valve design" for a view of the float valve design. For linear float valve designs, inspect orientation of the float slide pin. It must be pointed toward the bubbler tube for proper operation.

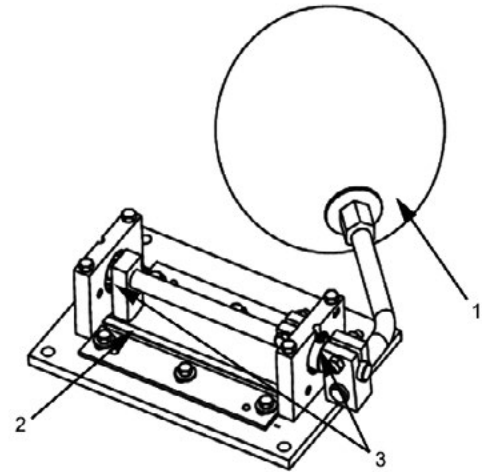
Figure 54 - 19XR float valve design



1. Refrigerant inlet from FLASC chamber
2. Linear float assembly
3. Float screen
4. Bubble line
5. Float cover
6. Refrigerant outlet to cooler
7. Gasket

ECONOMIZER FLOAT SYSTEM (Two-Stage Compressors)
For two-stage compressors, the economizer has a low side ball type float system. The float refrigerant level can be observed through the two sight glasses located on the float cover under the condenser. See Fig. 55 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.

**Figure 55 - Economizer Float system
(2 stage compressor chiller)**

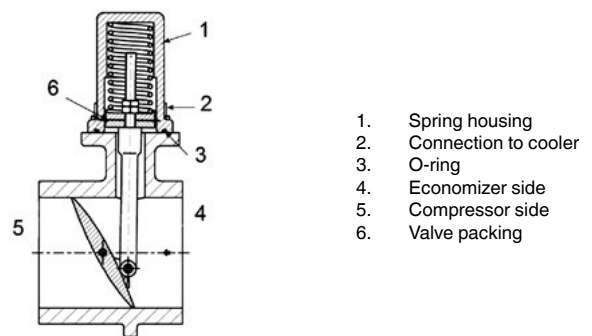


1. Float ball
2. Refrigerant exit
3. Bearings

ECONOMIZER DAMPER VALVE (Two-Stage Compressors)

The damper valve should be inspected every 5 years or when the condenser is opened for service. With the refrigerant transferred, remove the spring housing from the valve (Fig. 56). The valve spring will exert 50 lb force upward. Check the valve and linkage for free travel and loose parts. Clean the assembly thoroughly. Replace the valve packing and the housing O-ring if necessary.

**Figure 56 - Economizer Float system
(2 stage compressor chiller)**



7.3.9 - Inspect relief valves 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.

7.3.10 - Checking of pressure switch calibration

Reverse the three-way valve direction so that the standby pressure switch will start operation.

Remove the first pressure switch and have its calibration verified by a qualified body - see annex C paragraph C6-EN378-2.

Once the calibration has been verified, re-install the pressure switch on the three-way valve and again reverse the valve to again permit operation of the pressostat.

7.3.11 - Compressor bearing and gear maintenance

The key to good bearing and gear maintenance is proper lubrication. Use the proper grade of oil, maintained at recommended level, temperature, and pressure. Inspect the lubrication system regularly and thoroughly. Annual oil analyses and vibration measurements are recommended.

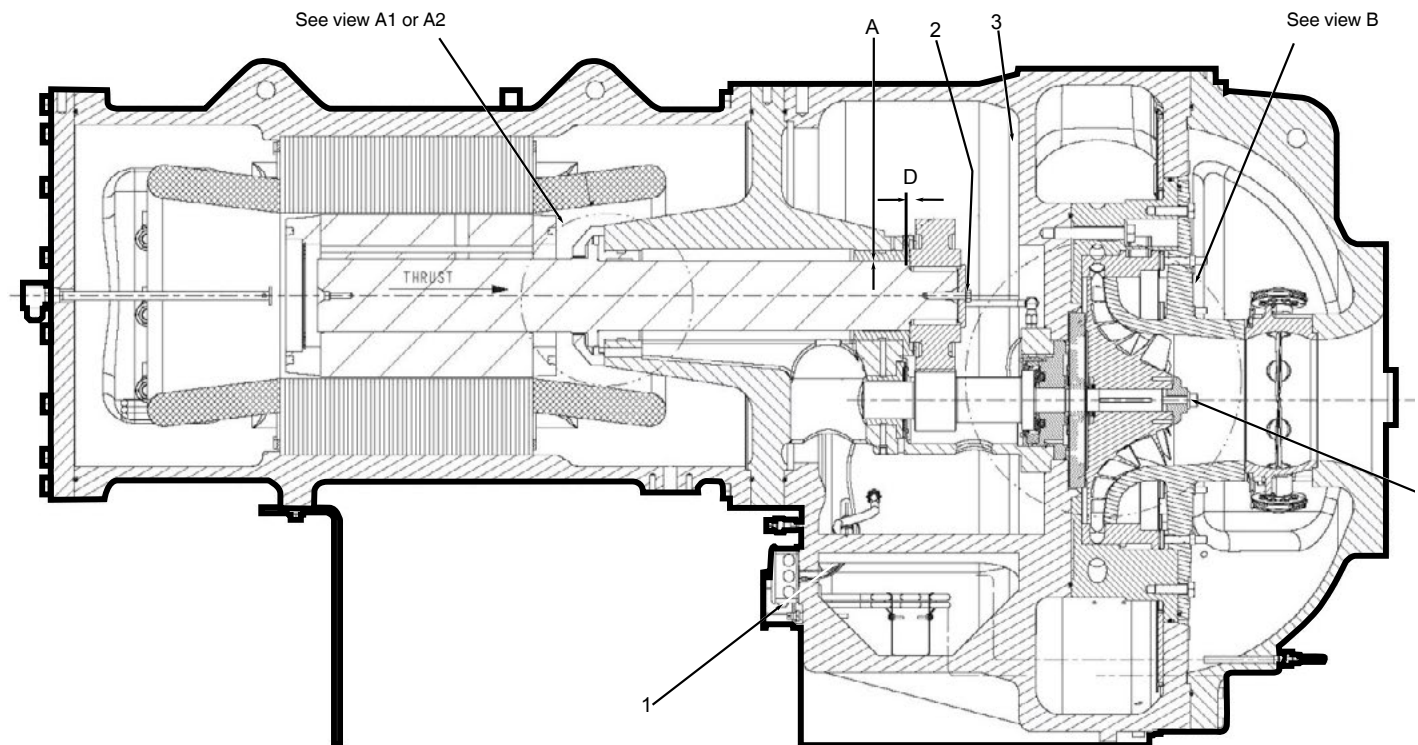
Excessive bearing wear can sometimes be detected through increased vibration or increased bearing temperature. Gears, babbitted journal, and thrust bearings should be examined for signs of wear based on the results of the annual oil analysis and vibration levels. To inspect the bearings, a complete compressor

teardown is required. Only a trained service technician should remove and examine the bearings. The frequency of examination is determined by the hours of chiller operation, load conditions during operation, and the condition of the oil and the lubrication system.

Rolling element bearings (Frame 3, 4, 5 and E compressor high speed shaft only) 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.

Figure 57 - Compressor fits and clearances – single stage compressor

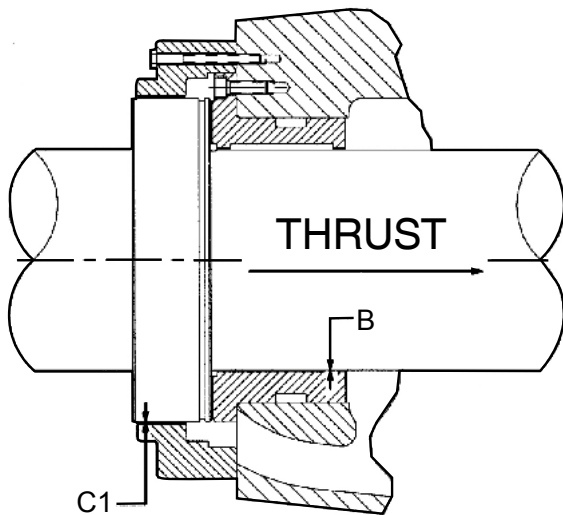
COMPRESSOR, TRANSMISSION AREA



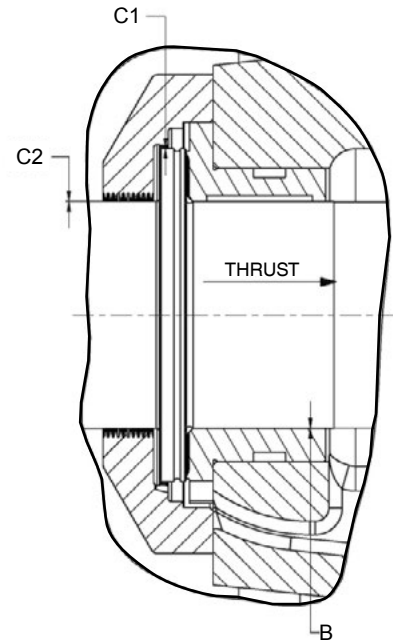
COMPRESSOR, TRANSMISSION AREA (FRAME 5 COMPRESSOR SHOWN)

1. OIL HEATER RETAINING NUT (NOT SHOWN)
2. BULL GEAR RETAINING BOLT
3. DEMISTER BOLTS (NOT SHOWN)
4. IMPELLER BOLT

VIEW A1 - LOW SPEED SHAFT THRUST DISK



VIEW A2 - LOW SPEED SHAFT THRUST DISK



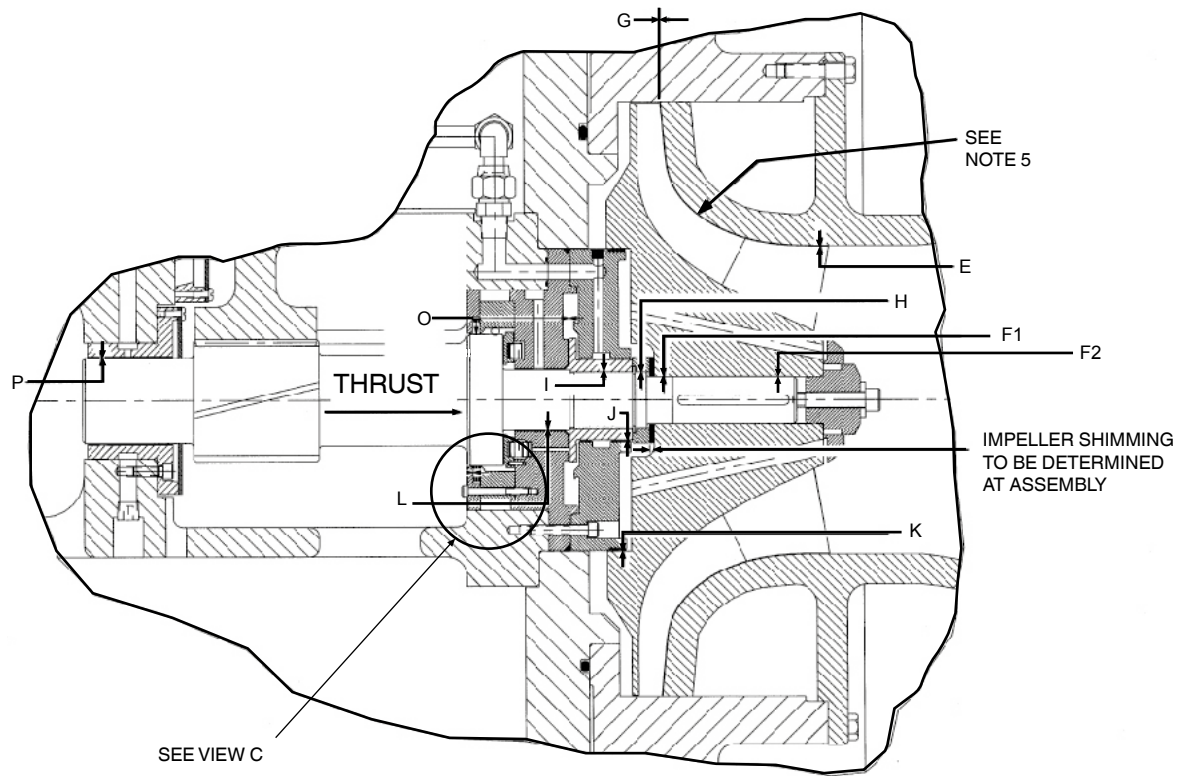
Compressor		Frame 3		Frame 4				Frame 5			
Code		321 to 389, 3ZZ		421 to 487, 4B1 to 4W7				501 to 599			
Item	Description	Rolling Element Bearings		Oil film bearings		Rolling Element Bearings		Oil film bearings		Rolling Element Bearings	
		max	min	max	min	max	min	max	min	max	min
A	Low speed Journal-Gear End	0.1270	0.1016	0.1397	0.1092	0.1397	0.1092	0.1753	0.1499	0.1753	0.1499
B	Low speed Journal-Motor End	0.1270	0.1016	0.1346	0.1092	0.1346	0.1092	0.1651	0.1397	0.1651	0.1397
C1	Low Speed Labyrinth to thrust Disk	NA		0.2540	0.1270	NA		NA		NA	
C2	Labyrinth to low speed shaft	0.2540	0.1270	0.2413	0.1397	0.2413	0.1397	0.3302	0.2286	0.3302	0.2286
D	Low speed shaft thrust float	0.5080	0.2032	0.5842	0.2032	0.5842	0.2032	0.5080	0.2032	0.5080	0.2032
E	Impeller eye to shroud	*	*	*	*	*	*	*	*	*	*
F1	Impeller Bore to Shaft-Rear	-0.0635	-0.0254	-0.0356	-0.0737	-0.0356	-0.0737	-0.0483	-0.0127	-0.0483	-0.0127
F2	Impeller Bore to Shaft-Front	NA		-0.0127	-0.0635	-0.0127	-0.0635	-0.0356	0.0000	NA	
G	Impeller Discharge to Shroud	*	*	*	*	*	*	*	*	*	*
H	Impeller Spacer to Shaft	0.0635	0.0254	0.0635	0.0254	0.0635	0.0254	0.0610	0.0254	0.0610	0.0254
I	Slinger to Shaft	0.0305	0.0102	0.0305	0.0102	0.0305	0.0102	0.0305	0.0102	0.0305	0.0102
J	Labyrinth to Slinger	0.2540	0.1524	0.2540	0.1524	0.2540	0.1524	0.2540	0.1524	0.2540	0.1524
K	Labyrinth to Impeller	0.3048	0.2032	0.3048	0.2032	0.3048	0.2032	0.3048	0.2032	0.3048	0.2032
L	High Speed Journal-Impeller end	NA		0.1016	0.0711	NA		0.1219	0.0965	NA	
M	Thrust Assembly Seal ring Axial Clearance	NA		0.1524	0.0508	NA		0.1524	0.0508	NA	
N	Thrust Assembly Seal ring to Shaft	NA		0.1143	0.0381	NA		0.1143	0.0381	NA	
O	High Speed Shaft Thrust Float	0 jeu		0.3556	0.2032	0 jeu		3.5560	0.2032	0 jeu	
P	High Speed Journal-Gear End	NA		0.1219	0.0965	NA		0.1575	0.1321	NA	

* Depends on impeller size, contact your Carrier Service Representative for more information.

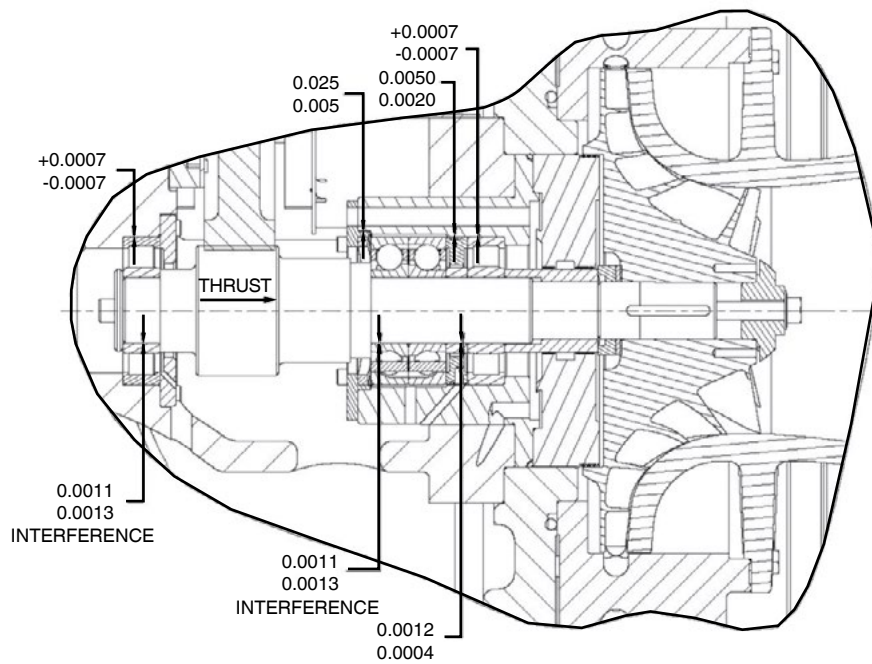
NOTES:

- 1 - All clearances for cylindrical surfaces are diametrical
- 2 - Dimensions shown are with rotors in the thrust position
- 3 - All dimensions are in millimeters..
- 4 - Frame 3 rolling element style high speed shaft and bearing assembly cannot be pulled from impeller end. The transmission assembly must be removed from the compressor casting (after the impeller is removed) and the bearing temperature sensor must be removed from the high speed shaft and bearing assembly before the high speed shaft and bearing assembly can be separated from the transmission.
- 5 - If any components within a rolling element high speed shaft and bearing assembly are damaged it is recommended that the entire high speed shaft and bearing assembly be replaced.
- 6 - Impeller spacing should be performed in accordance with the most recent Carrier Impeller Spacing Service Bulletin.

VIEW B — HIGH SPEED SHAFT, ORIGINAL DESIGN (OIL FILM BEARINGS) AND IMPELLER SECTION



VIEW B — HIGH SPEED SHAFT WITH ROLLING ELEMENT BEARINGS



VIEW C — HIGH SPEED SHAFT RING SEAL

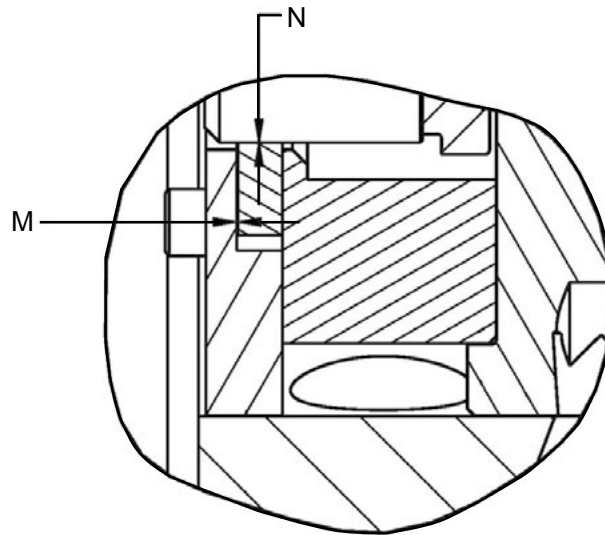
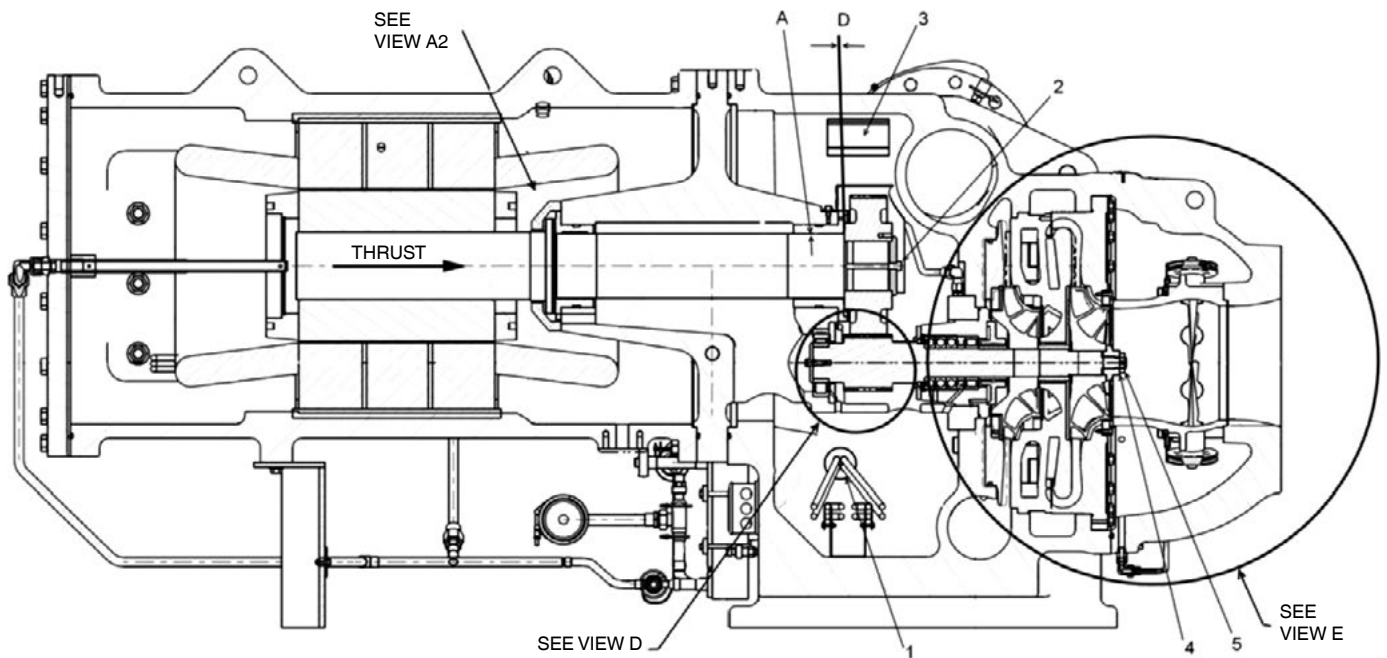


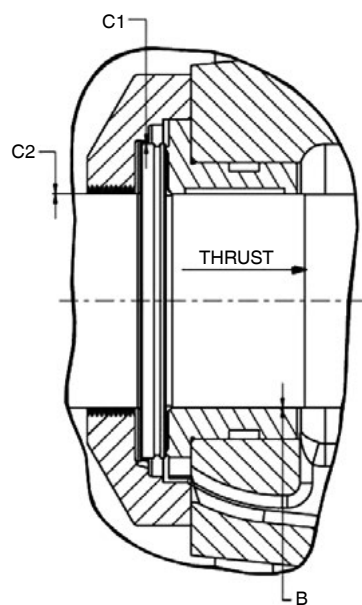
Figure 58 - Compressor fits and clearances – two stage compressors



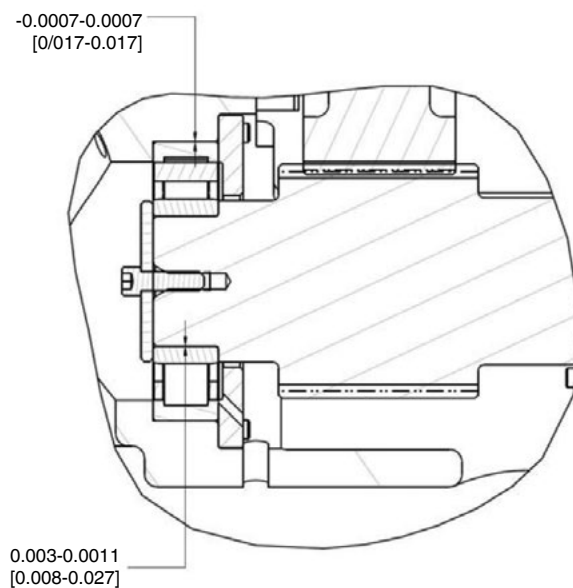
1. OIL HEATER RETAINING NUT
2. BULL GEAR RETAINING BOLT
3. DEMISTER BOLTS
4. FIRST IMPELLER NUT (INNER)
5. SECOND IMPELLER NUT (OUTER)

Compressor		Frame E	
Code		E31 – E69	
Item	Description	Rolling Element Bearings	
	Clearance in mm	max	min
A	Low speed Journal-Gear End	0.1752	0.1498
B	Low speed Journal-Motor End	0.1651	0.1498
C1	Low speed labyrinth to thrust Disk	N/A	
C2	Labyrinth to Low Speed Shaft	0.3302	0.2286
D	Low Speed Shaft thrust Float	5.08	0.2032

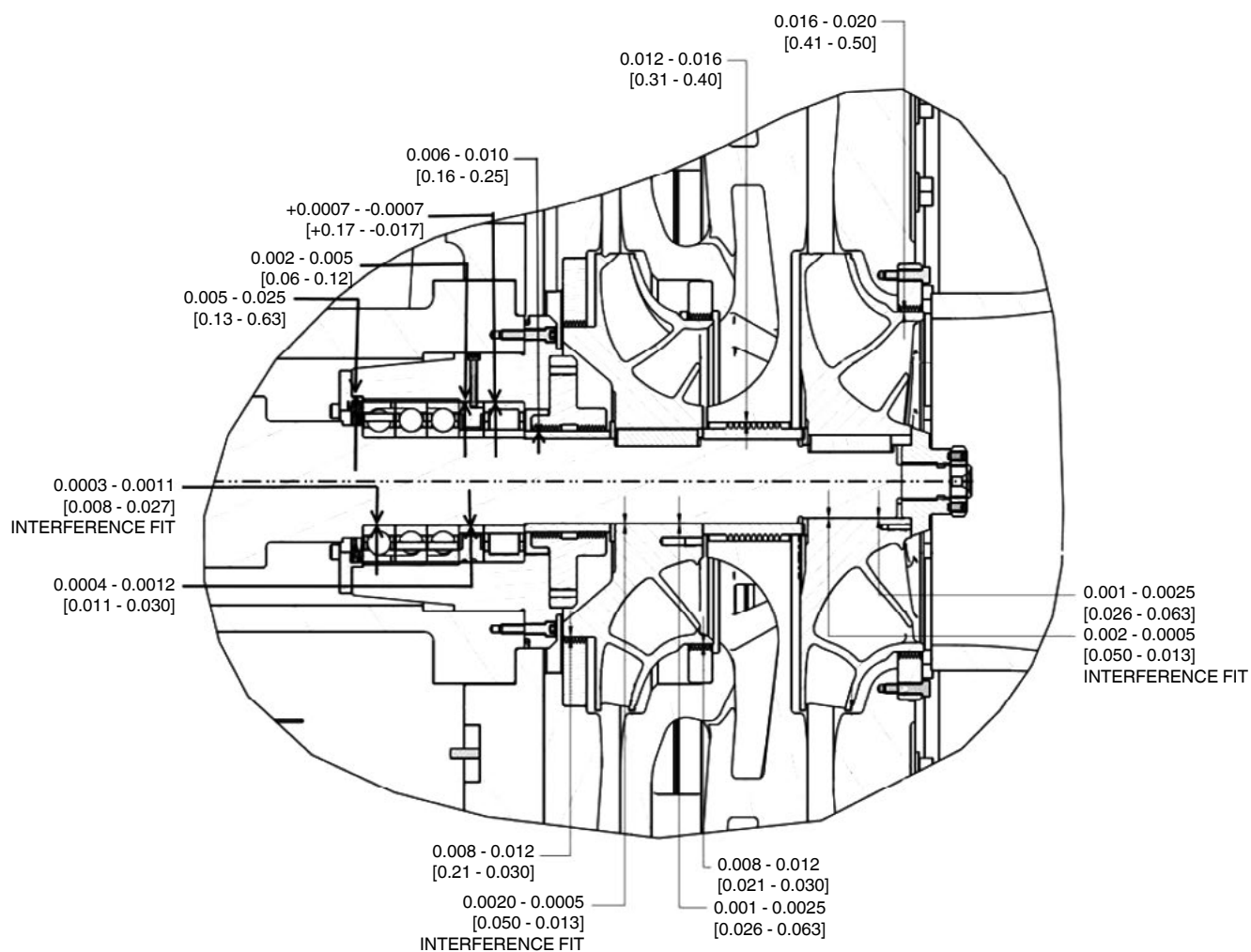
VIEW A2 — LOW SPEED SHAFT THRUST DISK



VIEW D — REAR, HIGH SPEED SHAFT BEARING

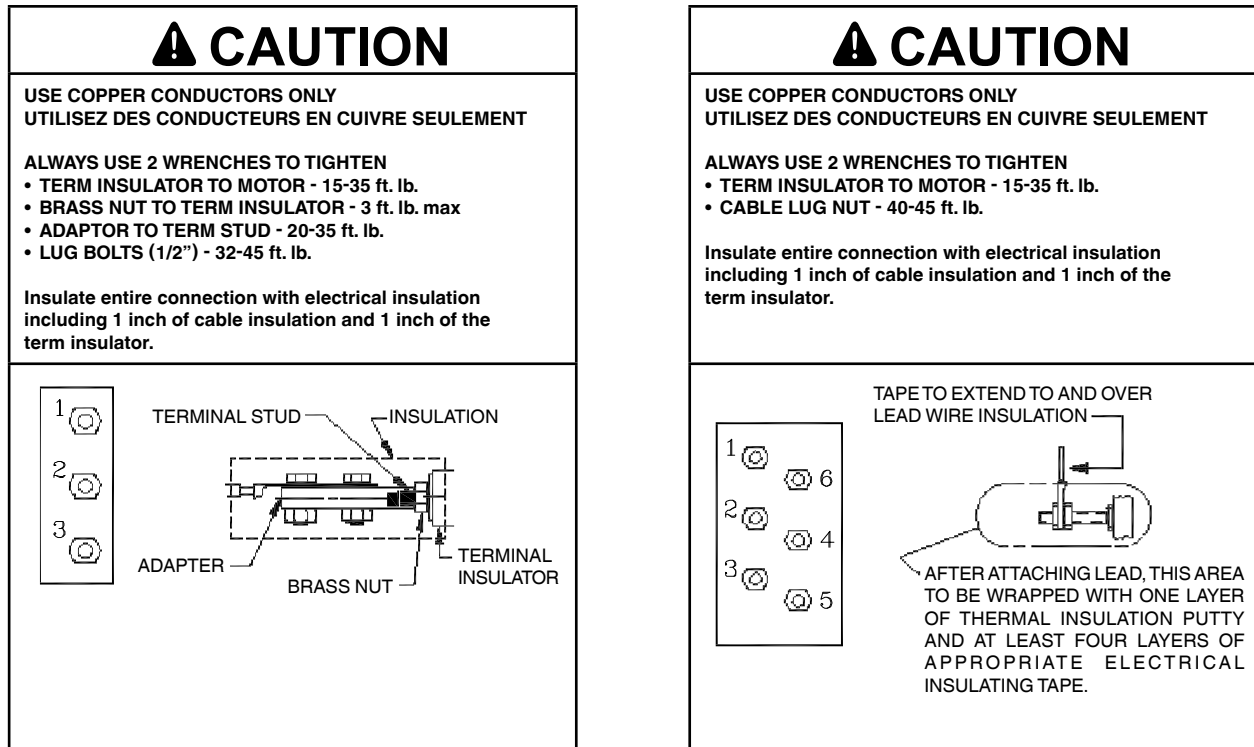


VIEW E



Dimensions and clearances shown are in inches.

Figure 59 - Motor lead installation labels



19XR COMPRESSOR ASSEMBLY TORQUES

COMPRESSOR	FRAME 2	FRAME 3	FRAME 4	FRAME 5
Code	201 to 299, 2ZZ	321 to 389, 3ZZ	421 to 487, 4B1- 4W7	501 to 599
Oil Heater Retaining Nut — ft-lb (N•m)	N/A	-18-22 (25-30)	18-22 (25-30)	18-22 (25-30)
Bull Gear Retaining Bolt — ft-lb (N•m)	80-90 (108-122)	80-90 (108-122)	80-90 (108-122)	80-90 (108-122)
Demister Bolts — ft-lb (N•m)	15-19 (20-26)	15-19 (20-26)	15-19 (20-26)	15-19 (20-26)
Impeller bolt Torque — ft-lb (N•m)	32-48 (43-65)	55-60 (75-81)	55-60 (75-81)	160-225 (217-305)
Guide Vane Shaft Seal Nut — ft-lb (N•m)	25 (34)	25 (34)	25 (34)	25 (34)
COMPRESSOR	FRAME E			
Code	E 3 1 to E 6 9			
Oil Heater Retaining Nut — ft-lb (N•m)	18 - 22 (25 -30)			
Bull Gear Retaining Bolt — ft-lb (N•m)	80-90 (108-122)			
Demister Bolts — ft-lb (N•m)	15-19 (20-26)			
Impeller Nut (inner) — ft-lb (N•m)	250 (339)			
Impeller Nut (outer) — ft-lb (N•m)	100 (136)			
Guide Vane Shaft seal Nut — ft-lb (N•m)	25 (34)			

7.3.12 - Inspect the heat exchanger tubes

Cooler

Inspect and clean the cooler tubes at the end of the first operating season. Because these tubes have internal ridges, a rotary-type tube cleaning system is necessary to fully clean the tubes. Upon inspection, the tube condition will determine the scheduled frequency for cleaning and will indicate whether water treatment is adequate in the chilled water/ brine circuit. Inspect the entering and leaving chilled water temperature sensors for signs of corrosion or scale. If a sensor or the probe connections are scaled or the water flow control probes are corroded, they should be changed.

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

Condenser

Since this water circuit is usually an open 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 for signs of corrosion or scale. Replace the sensor 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 the presence of 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, then the condenser tubes may be dirty or water flow may be incorrect. Because HFC134-a is a high-pressure refrigerant, air usually does not enter the chiller. In certain cases where a zinc anode (option) is used, regularly check its condition.

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

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

7.3.13 - Water leaks

Water is indicated during chiller operation by the refrigerant moisture indicator (see Fig. 2 and Fig. 3- “19XR machine components”) on the refrigerant motor cooling line. Water leaks must be repaired immediately.

CAUTION: Chiller must be dehydrated after repair of water leaks. See chapter 4.4 “Chiller dehydration”.

7.3.14 - 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 programme.

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.*

7.3.15 - Inspect the starting equipment

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

The specific maintenance instructions for starting equipment for 19XR machines are given in the appendix, starting with chapter 8.

Check the cable tightness.

7.3.16 - Check pressure transducers

Once a year, the pressure transducers should be checked against a pressure gauge reading. Check all transducers: the two oil differential pressure transducers, the condenser pressure transducer, and the cooler pressure transducer, and the water-side evaporation probes (two on the condenser and two on the evaporator).

There are 4 factory-installed pressure transducers measuring refrigerant and oil pressure. There is a fifth pressure transducer measuring pressure variations at the compressor discharge on compressors equipped with a split ring diffuser (SRD). This transducer is not displayed and does not require calibration.

Except for the discharge transducer, 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 $\pm$ 0.5 v as displayed in :

- CONTROL TEST under CCM Pressure Transducers (for ICVC)
- MAINTENANCE MENU • MAINTENANCE OTHERS (for PIC 5)

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 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 transducerwires. 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.

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

Note the evaporator and condenser pressure readings on the HMI status screen. Attach an accurate set of refrigeration gauges to the cooler and condenser Schrader fittings. Compare the two readings. If there is a difference in readings, the transducer can be calibrated, as described in the chapter 4.8. Oil differential pressure should be zero whenever the compressor is off.

7.3.17 - Corrosion control

All metallic parts of the unit (chassis, casing panels, control boxes, heat exchangers etc.) 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.

APPENDIX A: PARTICULARS OF 19XRV MACHINES - ROCKWELL LIQUID FLOW 2

Specific operating and maintenance instructions for machines equipped with the Rockwell Liquid-Flo 2 variable-frequency drive (VFD).

8 - 19XRV - SAFETY CONSIDERATIONS FOR MAINTENANCE

8.1 - Electrical maintenance

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 authorised 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: *19XRV control boxes 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.

8.2 - Mechanical maintenance

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

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

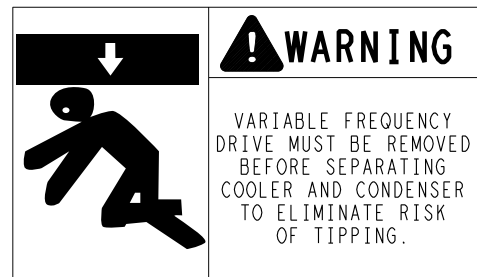
WARNING: *Do not attempt to disconnect the flanges, if the chiller is under pressure. The chiller has not been purged, and this can cause injuries or damage to the machine.*

ATTENTION: *Before lifting the compressor, disconnect all cables entering the interface box.*

8.2.1 - Removal of the VFD box

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: *For VFD box VFD 900-1169A do not disconnect the evaporator and condenser before VFD box 900-1169A has been disconnected and removed. This 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.*

1. Close the two filter-drier shut-off valves and VFD cooling circuit shut-off valve. Purge the refrigerant from the VFD heat exchanger using the Schrader valve at the side of the filter (refer to Fig. 60 - "VFD cooling circuit").
2. Remove all VFD power supply cables (see Fig. 61 "VFD box installation (rear view)").
3. Remove the middle part of the terminal boxes (see Fig. 62 - "VFD - tunnel-side view").
4. Identify and disconnect the motor terminals. Note the position of the power wiring cable lugs and use the same position during the re-assembly.
5. Remove the earth connection from the motor. Note the earth connection position and use the same position during the re-assembly.
6. Identify and disconnect the power wiring cables and all communication and connection cables between the VFD box and the interface box - see Fig. 61 - "VFD box installation (rear view)".
7. Remove the access panels at the rear of the VFD and disconnect the cooling circuit lines. Plug all openings.

Figure 60 - VFD cooling circuit

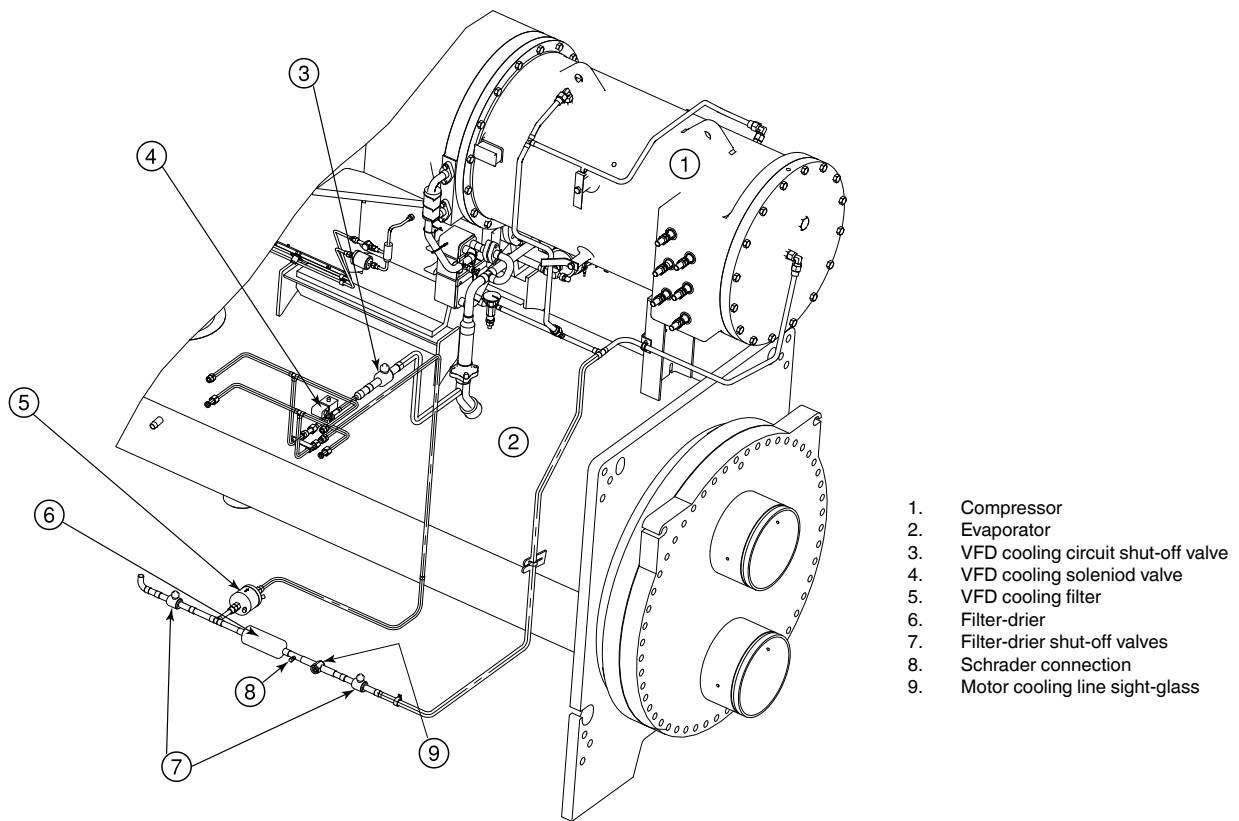


Figure 61 - VFD box installation (rear view)

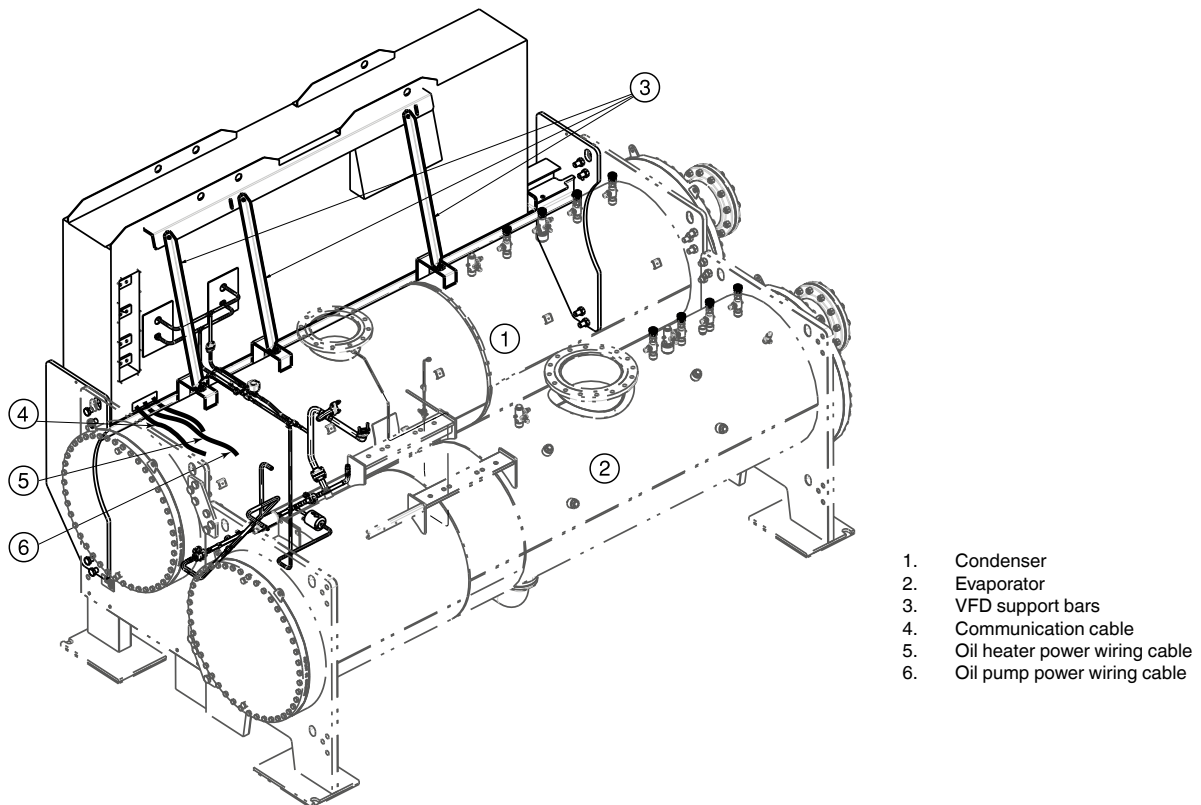
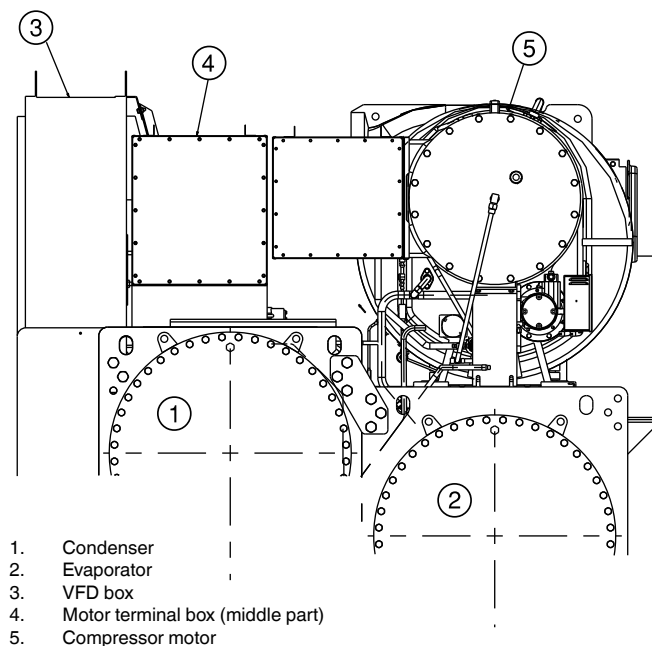


Figure 62 - VFD tunnel-side view



8.2.2 - Lifting of the VFD control box

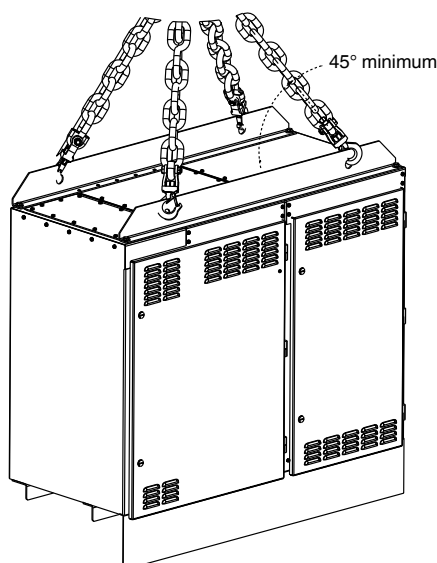
Precautions must be taken to prevent any damage due to a fall or shock, if the VFD control box is removed. A fork-lift truck or a similar lifting and transport device can be used. Place chains on the VFD so that there is an equal load at the lifting points. Use a lifting beam, if the angle of the chains is less than 45° from the horizontal level. Avoid shocks when the VFD is lifted.

CAUTION: For control box VFD 900 – 1160A, the lifting brackets on top of the control box permit attaching chains to the VFD control box. They must never be used to chain and lift the chiller.

Use the following procedure to lift the VFD

- Attach a chain to each lifting hole provided at the lifting supports (these lifting supports are factory-installed at the top of the VFD control box. Ensure that the chains do not form an angle of less than 45° to the horizontal level.

Figure 63 - Lifting the VFD



- Use an overhead or independent lifting bridge (nominal capacity of 2 tonnes minimum), attach a fall-arresting chain to each point to ensure safe lifting of the VFD.
- Lift to apply tension and remove the screws fixing the VFD control box to its support on the condenser.

NOTE: To re-assemble follow these instructions in reverse order. Connect the sensors and the cables after securing the installation of the main parts, to avoid the risk of damaging them.

8.2.3 - Separate the evaporator from the condenser

NOTE: If condenser and evaporator must be separated, the heat exchangers must be kept level by placing a support plate under the tube sheets. The support plate helps keeping the heat exchangers level and aligning them when they are re-assembled.

Remove all cables from the probes and sensors. Cut the cable paths required to separate the two heat exchangers.

ATTENTION: With VFD control box 900 or 1160A the evaporator must not be separated from the condenser without first disconnecting and removing the control box. The VFD control box type has a high-level centre of gravity and can tip over at the moment when the heat exchangers are separated, if the control box is not separated first. This can result in material damage and a serious injury risk for the personnel.

- Place a support plate under each tube sheet to keep the heat exchangers level.
- Cut the motor cooling line at the point shown in Fig. 64 - “Detailed perspective view of the unit”, item 2.
- Disconnect discharge elbow from the compressor.
- Disconnect liquid line flange from the float chamber, indicated in in Fig. 64, item 8.
- Plug all openings. Disconnect all cables that cross from one heat exchanger to the other (see Fig. 65 - “Unit rear/side”):
 - Probe and sensor cables of the water boxes.
 - Motor power wiring cables from the terminal box.
 - Communication and connecting cables between the VFD and the interface box.
- Remove the connecting plates from the tube sheets (see Fig. 64, item 5).
- Keep the disconnected heat exchangers separate.

8.2.4 - Separate the compressor from the evaporator

- Remove the suction and discharge bends (see Fig. 64, items 1 and 10).
- Cut the motor cooling line at the point shown in Fig. 64, item 2.
- Disconnect the motor cooling return line, as shown in Fig. 64, item 2.
- Disconnect the following elements:
 - The cable from the compressor oil temperature sensor.
 - The cable from the compressor bearing temperature sensor.
 - The cable from the motor temperature sensor.
 - The communication and connection cables between the VFD control box and the interface box.
 - The discharge temperature sensor cable.
 - The compressor oil pressure sensor cable.
 - The compressor oil discharge pressure sensor cable.
 - The guide vane motor cable.
 - The diffuser motor cable (for compressor 02XR5 and 02XR4 with separate diffuser (SRD)).

- The diffuser pressure sensor cable (for compressor 02XR5 and 02XR4 with separate diffuser (SRD)).
- Disconnect the oil recovery line connections “Detailed perspective view of the unit”, item 9.
- Plug all openings.
Disconnect the power wiring cables from the VFD control box.
- Remove the screws mounting the compressor on the evaporator support.
- Lift the compressor.

8.2.5 - Lifting the compressor

NOTE 1: The motor part of the compressor is heavy and leans towards the rear, unless the following precautions are taken:

- Use two wooden beams with a diameter of 100 to 150 mm of the same length as the compressor.
- Drill holes into these beams to attach them to the compressor base, using the holes provided.

NOTE 2

- Each time the O-ring is replaced, use an O-ring lubricifier.
- For all new O-rings, use a joint sealer.
- The heat exchangers must be lifted vertically. Lifting must be done at the four corners of the tube sheets, provided for this purpose.

Figure 64 - Detailed perspective view of the unit

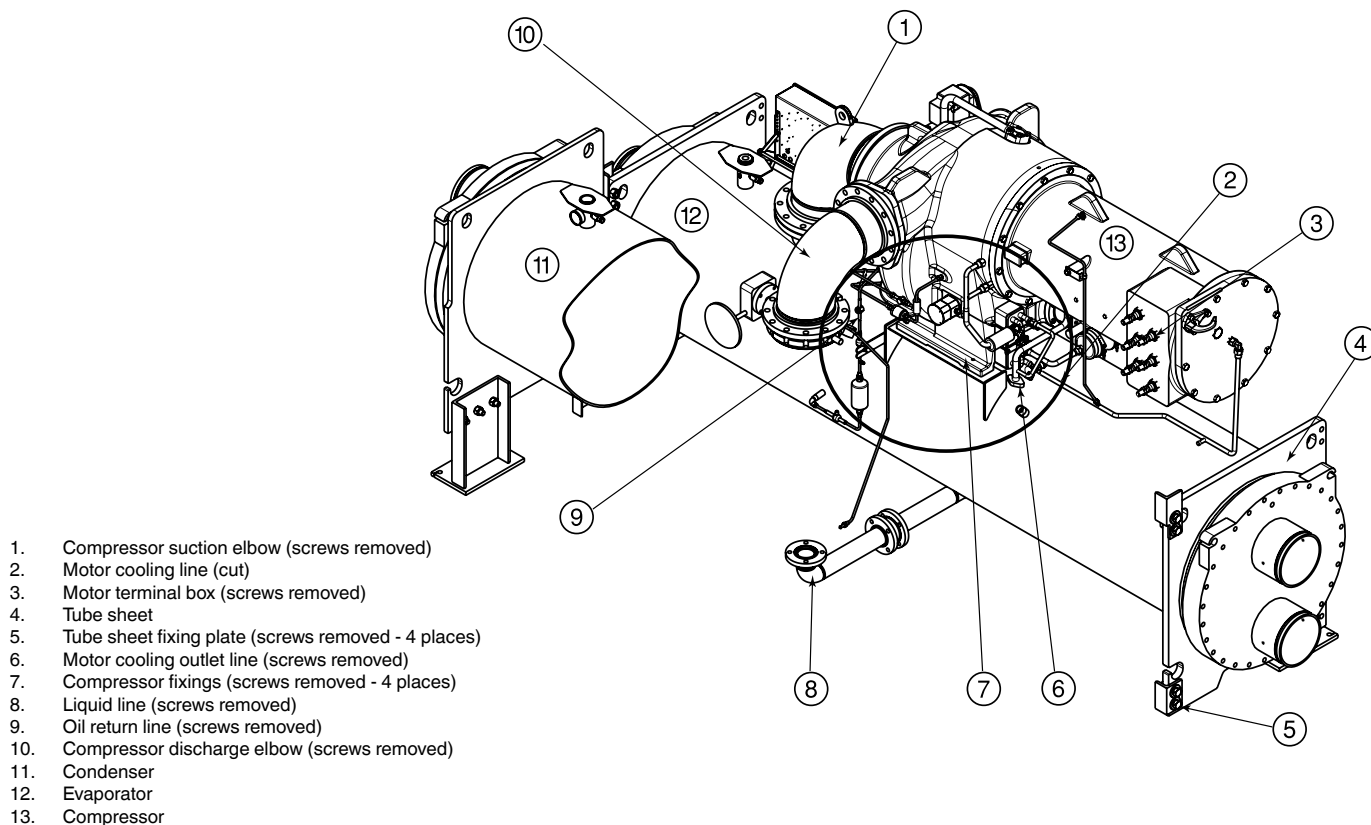
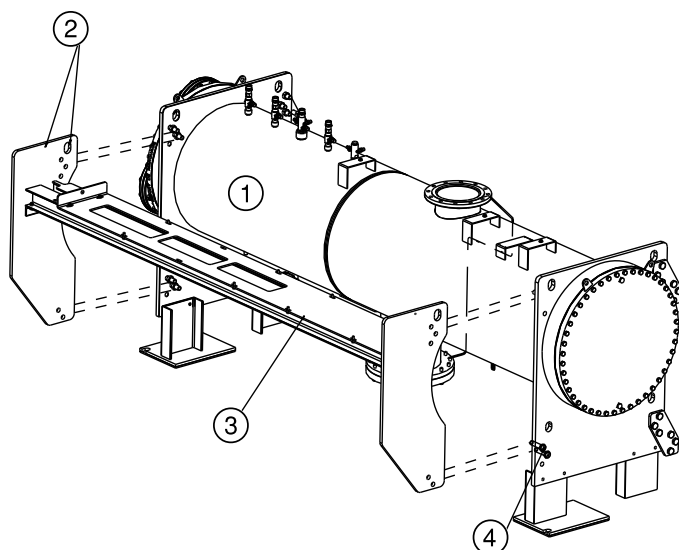
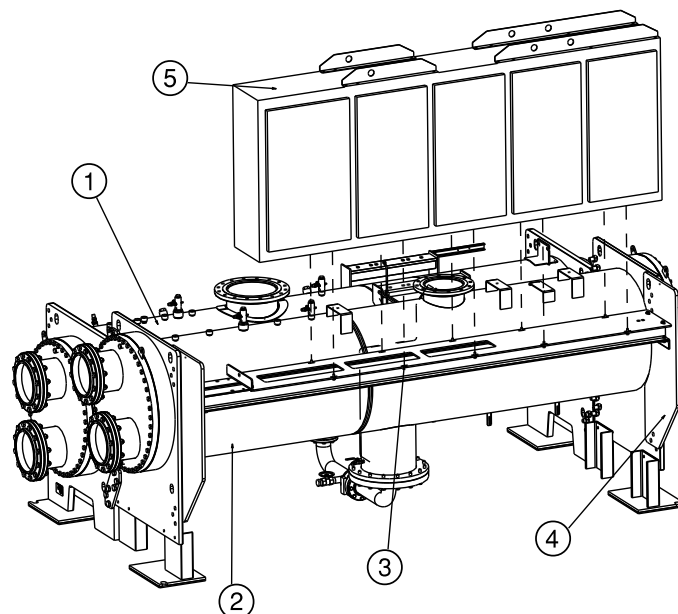


Figure 65 - VFD box support installation (rear view)



- 1. Condenser
- 2. Handling points
- 3. VFD support assembly
- 4. VFD support end plate fixings (8 places)

Figure 66 - VFD box installation (front view)



- 1. Condenser
- 2. Evaporator
- 3. VFD box fixings (10 places)
- 4. VFD support end plate
- 5. VFD box

9 - 19XRV - EQUIPMENT PRESENTATION

9.1 - Environmental conditions

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.

9.2 - CE Marking

The 19XRV electrical equipment is designed to ensure machine conformity with all applicable European directives:

- Machinery directive 98/37/EC modified and low-voltage directive 2006/90/EC:
The electrical equipment is designed in accordance with the recommendations of the harmonised European standard EN60204-1 that recommends the use of components that comply with the relevant IEC standards. The variable-frequency drive cabinet is certified in accordance with standard EN50178. Its integration in the machine complies with the directives of standard EN60204-1.
- European directive 2004/108/EEC (Electromagnetic compatibility):
Conformity is assured by application of the product standard EN61800-3 that applies to variable-speed power drives.

9.3 - Description of electrical equipment elements

The electrical equipment of 19XRV machines is included in two separate control boxes:

- The PIC control box. The dimensions and components of the control boxes are the same for the full range of all offered drives.

- The variable-frequency drive control box is available in four versions in the range up to 1169 A for LF2 drives.

Part number	Nominal voltage, V	Maximum current draw, A	Maximum current output, A	VFD model
19XR-506---912--E	380 to 400 440	440	440	2AA
19XR-506---922--E	380 to 400 608	608	608	2CC
19XR-507---802--E	380 to 400 900	900	900	4AA
19XR-507---812--E	380 to 400 1169	1169	1169	4CC

For details and the component location in the control box refer to the wiring diagram supplied with the machine.

9.3.1 - The PIC control box

The PIC control equipment mainly includes (identified in accordance with the references on the wiring diagram):

- The internal control circuit transformer (TC1) and the heater power supply transformer (TC2)
- The CCM control module (A1) if PIC III
- The IOBs boards if PIC 5
- The control screen of the HMI (A2). This is the unique machine interface. Specifically it permits consultation and configuration of the VFD. HMI can be ICVC PIC III or HMI Touchscreen PIC 5.
- The UPC board (gateway from HMI Pic 5 to VFD) if PIC 5
- The pump (KM81) and heater (KM66) change-over contactors
- The overcurrent circuit breakers:
 - QF11: Control
 - QF 4: Oil pump
 - QF1: Main protection of the control box
 - QF66: Heater
- XR terminal

(refer to wiring diagram supplied with chiller)

9.3.2 - The compressor power variable-frequency drive

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

Figure 67 - Variable-frequency drive cabinet for machines with maximum nominal current up to 608 A (19XR-506---912 and 19XR-506---922)

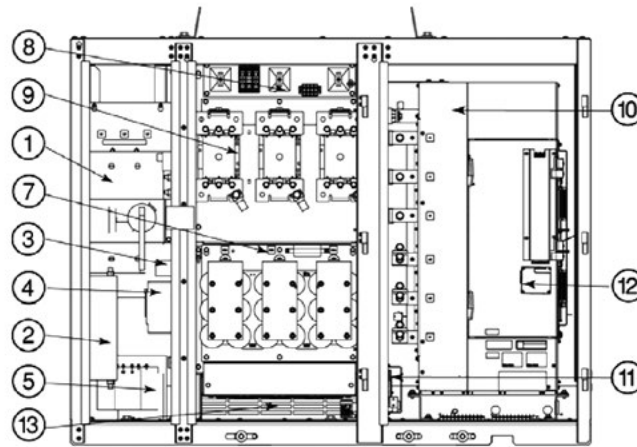
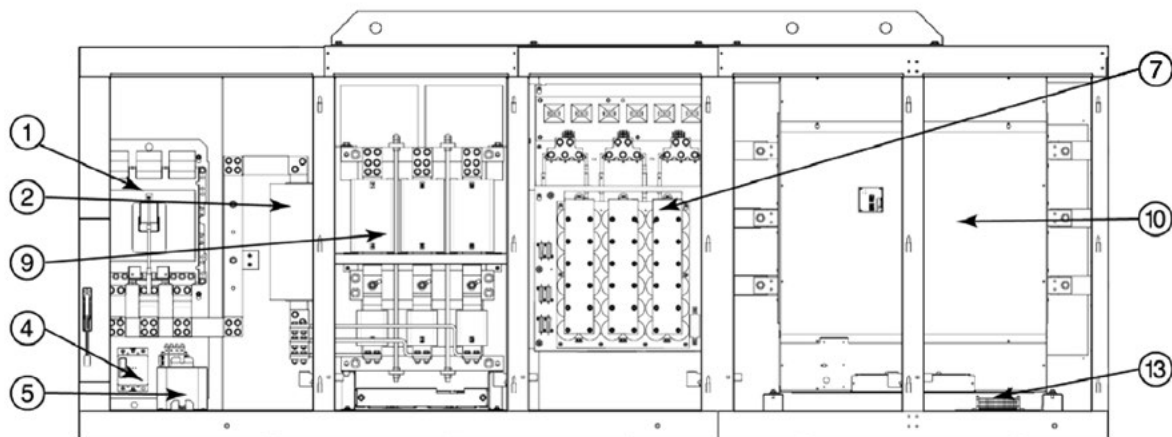


Figure 68 - Variable-frequency drive cabinet for machines with maximum nominal current above 608 A (19XR-507---802 and 19XR-507---812)



- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Circuit breaker/main disconnect switch (QF101) for the following functions: <ul style="list-style-type: none"> - 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 III control 2. Filter CEM RFI (ZGS) to limit high-frequency conductor interferences (>150 kHz). 3. Surge limiter (F). 4. Power supply circuit protection disconnect switch for the PIC III control box (QF). 5. Power transformer (T1) and fuse (FU10) for the internal control circuit of the variable-frequency drive. 6. Inductance inputs of the main circuit (LF). 7. Capacitor resistors (R1-3C) and coils for inlet filtering of the main circuit 8. 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. | <ol style="list-style-type: none"> 9. Load resistor shunt capacitors (K1-). They short-circuit the load resistors when the capacitors are loaded. 10. Power module and associated control interface board (GS) for the following functions: <ul style="list-style-type: none"> - 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. 11. Acquisition and measurement interface board (A3). Isolates and conditions the voltage measuring and temperature signals reported to the power module. 12. Communication gateway board. Provides the communication interface between the variable-frequency drive and the PIC control. 13. Internal cooling fan(s) (EV10-). |
|--|--|

9.4 - General compressor speed control principles

The compressor speed is regulated by the control of the voltage/frequency values applied to the motor. The voltage applied, generated by pulse width modulation (PWM), is proportional to the frequency.

Decreasing the compressor speed makes the machine more susceptible to surging; the prevention and protection algorithms against this phenomenon interact with the control of the speed-vane couple.

Deviation of the water temperature parameters measured, from the assigned “Control point” value and the “Chilled water deadband” parameter is calculated in the “Guide Vane Delta” parameter. This parameter leads to an adjustment of the machine capacity by a simultaneous and coordinated action on the guide vane opening and the compressor speed (“Target VFD Speed”).

“Normal” operating mode: The capacity is primarily controlled by the variation of the compressor speed within the limits defined by the “VFD Minimum Speed” and “VFD Maximum Speed” parameters (default settings 70 and 100%). If the capacity reduction objective permits, the guide vane opening is maintained at 100%. If the “VFD Minimum Speed” is reached, capacity reduction is obtained by reducing the guide vane opening.

operating mode to prevent surging: If the PIC detects a surge risk, the prevention logic requests an increase of the compressor speed up to the risk zone outlet defined in the dP-dT diagram. The capacity reduction is controlled by reducing the guide vane opening.

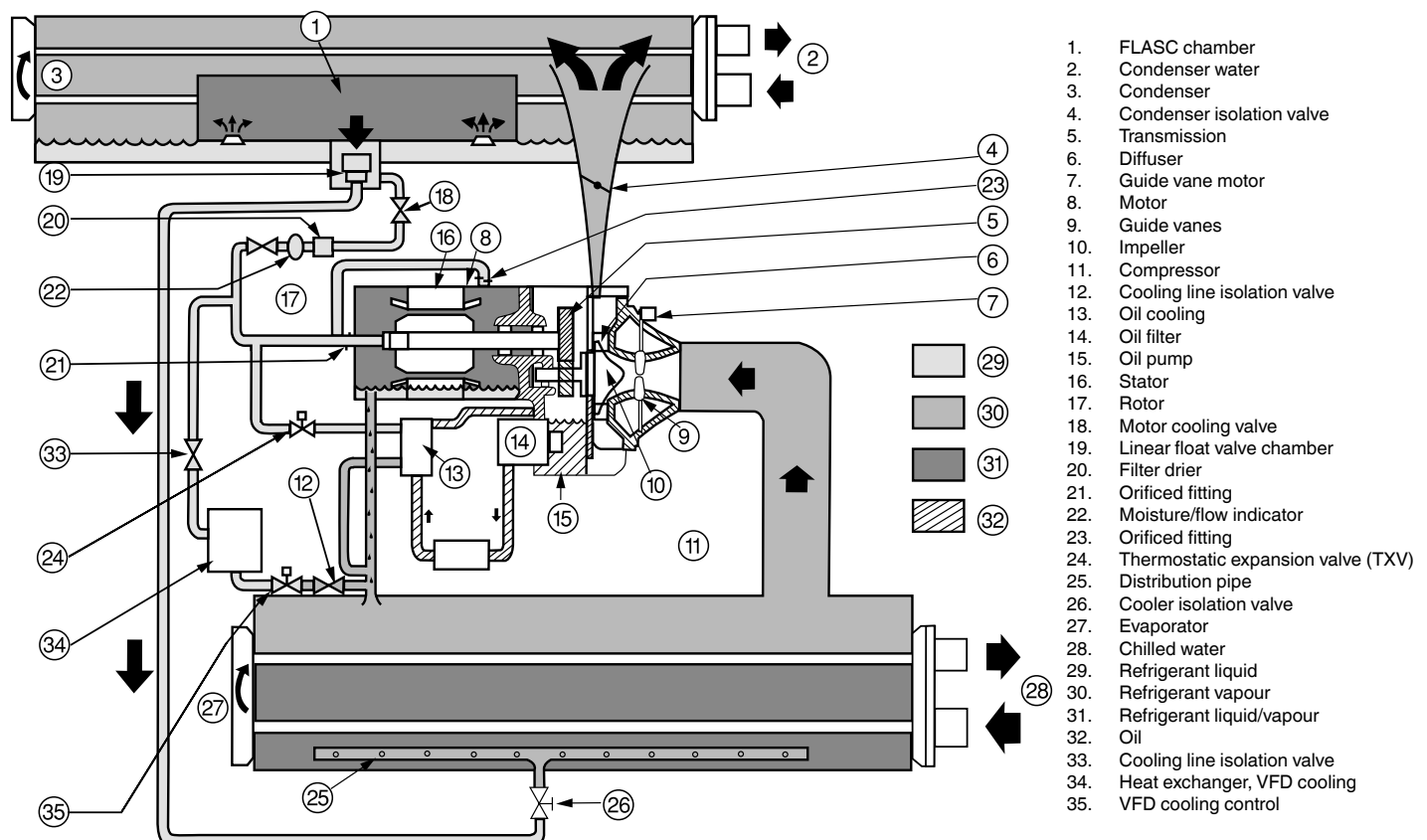
operating mode to protect against surging: Effective surging is detected by the compressor motor current fluctuations. In these conditions the compressor speed is increased. The logic that requests the compressor safety shutdown in case of prolonged surging is the same as the one for a standard machine without variable-frequency drive. Please also refer to the 19XR PIC controls manual.

9.5 - Variable-frequency drive cooling

The power module of the variable-frequency drive is equipped with a heat exchanger to provide cooling, using the refrigerant in the machine.

ATTENTION: The typical diagram is not contractually binding: Refer to the machine PID.

Figure 69- Typical 19XRV unit diagram



9.6 - Flow detection by the saturated suction temperature sensor

A temperature sensor in the suction line is used by the PIC control to check that the flow rate in the heat exchanger is not zero.

If flow detection by measuring the pressure differential in the water circuit is active, the two verifications are carried out in parallel and cumulated.

9.7 - Electrical specifications

Assigned conditional short-circuit current	50 kA rms
Assigned operating current	According to the variable-frequency drive parameter set at the factory
Current draw at shutdown**	< 32 A
Power supply frequency	50/60 (± 2) Hz
Voltage range***	±10 %
Power factor (values at nominal capacity)****	> 0.97
Cosine phi	> 0.99
Harmonic distortion index (THDI)	< 5% at full motor capacity
Electromagnetic emission rate****	19xr-506---912: C3**** 19xr-506---922: C3**** 19xr-507---802: C3**** conducted emissions C4* radiated emissions* 19xr-507---812: C3**** conducted emissions C4* radiated emissions*
Installation altitude	< 1000 m
Cut-out frequency	
Default factory control	4 kHz
Other possible control	2 kHz
Operating frequency range***	65 to 100%
Maximum capacity dissipated by the variable-frequency drive	
19xr-506---912	6000 W
19xr-506---922	9000 W
19XR-507---802	12000 W
19XR-507---812	18000 W

* Emission level according to level C3+5 dB(μV/m)

** Continuous bus load

*** Around the nominal value

**** According to standard 61800-3; installation in an industrial environment

10 - 19XRV - INSTALLATION INSTRUCTIONS AND ELECTRICAL CONNECTION

10.1 - Introduction

19XRV machines are supplied with the electrical equipment integrated, wired, pre-configured and tested at the factory. The installation of the electrical equipment includes the connection of customer auxiliary and communication power supply cables, as well as configuration parameter adjustment specific to the installation site.

10.2 - Receiving the machine

During storage the machine must be protected against humidity and dust. Specifically, the machine must not be placed in an outside location, exposed to the weather.

10.3 - Physical data

10.3.1. Unit rigging

ATTENTION: The control box must not be used as a machine rigging point.

The 19XRV machine rigging points are the same as those for the standard machine without variable-frequency drive. Refer to the dimensional drawing supplied with the machine.

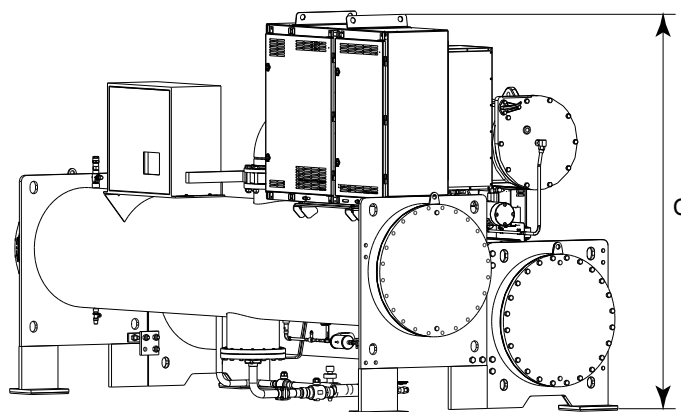
10.3.2 - Weights and dimensions

The data in this section is for information only. The contractual data is given on the dimensional drawing supplied with the machine. The weight of 19XRV machines is the same as that of standard machines plus weight of the control boxes

Control box, variable-frequency drive	Control box weight, kg
19xr-506---912	750
19xr-506---922	750
19xr-507---802	1300
19xr-507---812	1300

19XRV machine dimensions are the same as for standard machines; the height (only) is increased for machines equipped with VFD control boxes 19XR-506---912 and 19XR-506---922.

Figure 70 - Height of 19XRV with variable-frequency

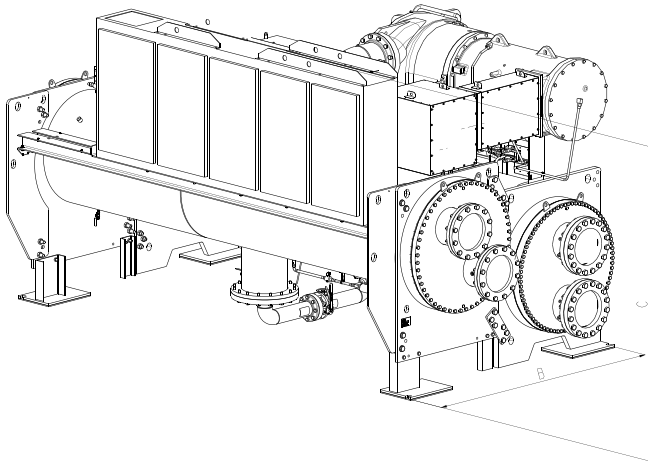


Dimensions, machines equipped with VFD control box	
Heat exchanger size	Height C, mm
3	2414
4	2501
5	2680
6	2721
7	N/A
8	N/A

N/A These configurations (machine size and VFD size combination) are not possible.

19XRV machine dimensions are the same as for standard machines; height and width are increased for machines equipped with VFD control boxes 19XR-506---802 and 19XR-506---81.

Figure 71 - Height of 19XRV with variable-frequency drive - 19XR-507---802 and 19XR-507---812



Dimensions, machines equipped with VFD control box		
Heat exchanger size	Height C, mm	Width B, mm
3	N/A	N/A
4	N/A	N/A
5	2908	2036
6	2959	2127
7**	3110	2920
8**	3161	3165

** For these machines, the VFD is supplied, but not installed on the machine. The dimensions given apply to the machine with the VFD installed.

N/A These configurations (machine size and VFD size combination) are not possible.

10.4 - Location of connection points and interfaces

Refer to the dimensional drawings supplied with the machine.

10.5 - Electrical connections

10.5.1 - Power connections

19XRV units have only one power connection point, located in the VFD control box.

Cable sizing is the responsibility of the installer and must comply with the characteristics and regulations specific to each installation site. The connections supplied as standard for the incoming customer power cables on the circuit breaker/main disconnect switch are designed to receive the number and type of wire sections defined in the table below.

VFD for 19XRV	Connectable wire sections		
	Quantity	Connection sections, mm ²	Torque, N-m
19XR-506---912	3	95 to 240	34
19XR-506---922	3	95 to 240	34
19XR-507---802	4	50 to 300	42
19XR-507---812	4	50 to 300	42

Note: The use of flexible multi-stranded conductors is possible, but care must be taken to ensure that strands are not caught in the screw threads. The ends of the conductors must be equipped with ferrules.

Before connecting the power cables (L1 - L2 - L3), ensure that the sequence is correct.

10.5.2 - Report and control connections on site

For the site control wiring of the following elements refer to the controls manual and the certified wiring diagram supplied with the unit:

On the CCM board in the PIC III control box:

- Remote set point reset (4-20 mA), J5-3/4 CCM
- Demand limiter, J5-1/2 CCM
- Operating capacity percentage, J8-1/2 CCM.

On the IOB board if PIC 5:

- Autowater temp reset (4-20 mA), IOB3 J15-5/11
- Autodemand limit (4-20 mA), IOB3 J15-3/9

On the terminal strip in the compressor VFD cabinet:

- Safety shutdown, TB1-20/21
- Ice storage contact, TB1-21/22
- Remote start/stop button, TB1-23/24
- Condenser pump control, TB2-1/2
- Evaporator pump control, TB2-3/4
- Alarm report, TB2-9/10.

10.6 - Equipment details

safety consideration reminder: Disconnect the power supply before working on the control box. The circuit breaker/ main disconnect switch allows isolation of the complete electrical equipment from its power supply with the exception of the power conductor connection terminals for the installation. Specifically, it disconnects the PIC control box.

IMPORTANT

- *Disconnecting the power equipment using the handle of disconnect switch QF101 also disconnects the control equipment and power supply to the oil pump. To prevent compressor lubrication problems, do not switch off the machine using the disconnect switch, if the compressor is still energized.*
- *An emergency shutdown to protect the capacitor coils can be initiated at any time by the control, while power is supplied to the variable-frequency drive. This shutdown acts on the circuit breaker/main disconnect switch.*

Never apply voltage to the variable-frequency drive that cannot be deenergised by the circuit breaker/main disconnect switch: Connection of 400 V voltage to the variable-frequency drive must be upstream of the circuit breaker/main disconnect switch. Specifically, do not:

- *Connect a power supply bypass circuit upstream of the secondary disconnect switch QF in the VFD control box.*
- *Connect a power supply bypass circuit upstream of the control box and the PIC control, if the disconnect switch QF is conducting.*

11 - 19XRV PIC III - BEFORE THE INITIAL START UP

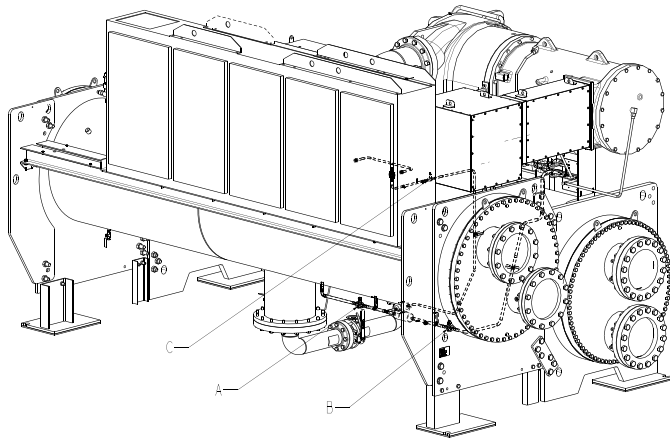
11.1 - Before energizing the unit

11.1.1 - Opening the VFD cooling line isolation valve

The three isolation valves installed on the VFD cooling pipes must be open:

- Valves A and B located under the condenser
- Valve C located behind the VFD control box.

Figure 72 - Location of the 19XRV isolation valves



11.1.2 - Wiring and installation inspection

For these checks the circuit breaker/disconnect switch of the VFD control box must be on the open position.

ATTENTION: Isolation using the main disconnect switch does not disconnect the voltage upstream to the power conductor connection terminals in the power supply to the machine.

Check the electrical connections: Tightening torques and connector tightening on the electronic boards.

Checking the variable-frequency drive in the application:

- The nominal current and capacity data for the variable-frequency drive must be in accordance with the data calculated for the machine in the application.
- Check that the voltage at the power connection terminals of the machine complies with that on the component name plates.

If documents are kept in the machine, they must be kept in the document holder on the door. Specifically there must not be any paper in the space below the power module, as there is a risk that it may obstruct the cooling fan of the power module.

11.2 - Start-up checks

ATTENTION: The warranty conditions for the variable frequency drive require that the first start-up is carried out by a Carrier-authorized technician.

Observe the safety and connection requirements in chapters 8 and 10 of this document.

11.2.1 - Energizing the PIC control circuits and the crankcase heater

The circuit breaker/disconnect switch QF101 and disconnect switch QF located in the VFD control box must be closed to carry out the following checks on these circuits. The checks are the same as those for the standard machine.

11.2.2 - Quick test of the status LEDs

The status LED on the internal communication gateway and the front face of the power module on each rectifier and the chopper control board permit a quick check of the operation.

The LEDs on the communication gateway must be on as follows:

- VFD status LED: Green continuous or green flashing
- Module status LED: Green continuous or green flashing
- NET A status LED: Green continuous or green flashing
- NET B status LED: Green continuous or green flashing.

Refer to chapter 13.3 “Gateway communication module status LEDs”.

On the front face of the power module the LEDs must be on as follows:

- Green LED: Continuous
- Yellow LED: Flashing.

Refer to chapter 13.4 “Power module status LEDs”.

11.3 - Control checks

11.3.1 - Variable-frequency drive application parameters

The variable-frequency drive parameters are set at the factory. The controls can be checked and adjusted on the HMI.

The PIC control permits configuration of the variable-frequency drive using the VFD_CONF table. A secret code is required to access the parameter setting of the variable-frequency drive. It is different from that defined for access to the other parameters of the PIC control.

With ICVC PIC III :

Menu > Service > Password (default 1111) > VFD CONFIG DATA > Password (default 4444) > CFD_CONF.

With PIC 5:



>> set password (default 4444) >> Menu configuration >> Factory parameters >> set VFD option for Rockwell (3) >> You have access to a new table for VFD unit mounted (UM VFD Configuration)

Specifically, the parameters below must be consistent with the application (Aquaedge selection outputs)

Parameter	Description
Motor Nameplate Voltage	Motor voltage at nominal speed (normally 400 V)
Compressor 100% Speed	Compressor speed at the nominal machine operating point (normally 50 Hz)
* Rated Line Voltage	Nominal line voltage (machine supply, normally 400 V)
* Rated Line Kilowatts	Line power input of the machine at its maximum operating point (see Chiller input KW selection @ full load)
* Motor Rated Load KW	Power input of the motor at the nominal machine operating point (Motor input power of selection)
* Motor Rated Load Amps	Current draw of the motor at the maximum machine operating point and nominal speed (RLA of selection)
Motor Nameplate Amps	Nominal motor current or max. RLA (selection)
Motor Nameplate RPM	Nominal motor speed (selection)
Motor Nameplate kW	Nominal motor capacity
Inverter PWM Frequency (0=4 k Hz, 1=2 k Hz)	0 (setting for VFD with PWM, active frond end technology)
Skip Frequency 1	102 (setting for VFD with PWM, active frond end technology)
Skip Frequency 2	102 (setting for VFD with PWM, active frond end technology)
Skip Frequency 3	102 (setting for VFD with PWM, active frond end technology)
Skip Frequency Band	0 (setting for VFD with PWM, active frond end technology)

Note: The other variable-frequency drive controls generally keep the default values.

The control parameters of the variable-frequency drive speed are accessible

With ICVC PIC III :

Menu >> Service >> Password (default 1111) >> SETUP2.

Parameter	Description
VFD gain	Adjusts the response of the variable-frequency drive to a speed modification demand (0.75 per default)
VFD increase step	Parameter of Capacity control with VFD, step of speed (2 % per default)
VFD minimum speed	Parameter of Capacity control with VFD, minimum % of VFD speed, Lower limit of the authorized compressor speed range (70 % per default)
VFD maximum speed	Parameter of Capacity control with VFD, maximum % of VFD speed, Upper limit of the authorised compressor speed range (100 % per default)
VFD start speed	Parameter of Capacity control with VFD, set speed at compressor start, % of VFD speed (100 % per default)
VFD surge line gain	Parameter of Capacity / Surge control with VFD, (2 per default)
VFD encl temp correction	0% per default
VFD alarm reset	Enable per default

With PIC 5:



>> set password (default 4444) >> Menu configuration
>> General VFD Config

Parameter	Description
VFD gain	Adjusts the response of the variable-frequency drive to a speed modification demand (0.75 per default)
VFD maximum speed	Parameter of Capacity control with VFD, maximum % of VFD speed, Upper limit of the authorised compressor speed range (100 % per default)
VFD minimum speed	Parameter of Capacity control with VFD, minimum % of VFD speed, Lower limit of the authorized compressor speed range (70 % per default)
VFD start speed	Parameter of Capacity control with VFD, set speed at compressor start, % of VFD speed (100 % per default)
VFD current limit	Parameter of control with VFD, Max current output VFD (250 A per default)
VFD load current 20 mA	200 A per default
Comp frequency 100%	50 Hz per default
VFD load current input	Enable per default

12 - 19XRV PIC III - INITIAL START-UP

12.1 - Motor rotation check

The variable-frequency drive will not start the motor, if the phases connected upstream are reversed. The ICVC screen reports an alarm; two of the three incoming phases must be reversed.

The variable-frequency drive does not detect phase reversals between variable-frequency drive and motor. The verification procedure described for the standard machine must be used.

12.2 - Compressor start-up

At the start-up of the compressor, the variable-frequency drive applies a frequency ramp, until the set point defined by the parameter “VFD Start-up speed” is reached (default 100% of the value defined by “Compressor 100% Speed”).

The speed is reduced and the guide vanes open. The speed and the guide vane opening are controlled by the procedure described in chapter 9.4 of this document.

13 - 19XRV PIC - OPERATING MODE

13.1 - Shutdown controlled by the machine

If compressor shutdown is requested, the variable-frequency drive applies a decreasing voltage/frequency ramp until the motor shuts down. The guide vanes are closed, and then the oil pump shuts down. When the compressor shuts down, the oil pump ensures postlubrication.

Reminder: Do not stop the machine manually using the main disconnect switch or by any means that are likely to also disconnect the PIC control circuit and the power supply to the oil pump.

Only emergency stops initiated by the machine control must be used for this type of shutdown.

13.2 - Manual override commands

13.2.1 - Guide vane opening control

The opening of the guide vanes can be manually controlled as for the machine without variable-frequency drive, as described in the 19XR/19XRV controls manual.

13.2.2 - Compressor speed control

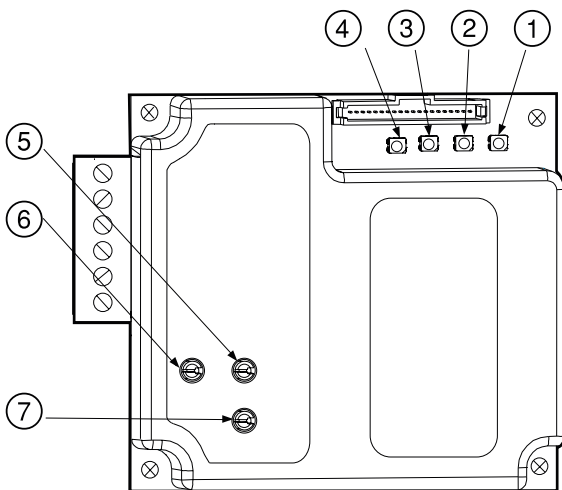
In the same way it is possible to manually control the motor speed: The parameter “Target VFD Speed” can be modified within the limits of the values defined by “VFD Minimum Speed” and “VFD Maximum Speed” on the COMPRESS screen of the HMI. In this case the machine capacity is controlled by the guide vanes.

13.3 - Gateway communication module status LEDs

13.3.1 - Gateway with PIC III :

The communication status between the ICVC and the variable-frequency drive can be quickly checked with the four status LEDs on the gateway. The potentiometer controls must not be modified.

Figure 73 - 19XRV PIC 3 Communication gateway



Item	Status indicator	Description
1	Variable-frequency drive	Connection status of the control interface board of the power module
2	Communication module	Connection status of the communication gateway module
3	NET A	Status of the serial communication
4	NET B	?
Item	Potentiometer control designation	
5	Address #1 = 0	
6	Communication speed = PGM	
7	Address #2 = 1	

Variable-frequency drive status indicator LED ①

Status	Cause	Corrective action
Off	The gateway has no supply or has a poor connection	- Check the connection of the gateway to the power module. - Energise the power module.
Red flashing	The gateway and the power module are no longer recognised.	- Check the connection of the gateway to the power module. - Re-initialise the supply to the power module.
Red continuous	The power module has refused a communication from the gateway	IMPORTANT: Re-initialise the power supply after having carried out the action below: Check that all control interface board cables of the power module are correctly connected.
Orange	There is a communication protocol incompatibility between the gateway and the power module.	- Check the bus cables. - Check that the connectors are well connected to the gateway.
Green flashing	The communication is being established or communication has stopped.	Operation is normal
Green continuous	The gateway is correctly connected and communicates with the power module.	As above

Gateway module status indicator LEDs ②

Status	Cause	Corrective action
Off	The gateway has no supply or has a poor connection.	- Check the connection of the gateway to the power module. - Energise the power module.
Red flashing	Resettable fault.	Re-initialise the supply to the power module. If there is no improvement it may be necessary to reload the firmware.
Red continuous	The module has stopped the material test.	- Re-initialise the supply to the power module. - Replace the gateway.
Green flashing	The gateway is operational. No communication in progress.	Operation is normal.
Green continuous	The gateway is operational and currently communicating.	As above

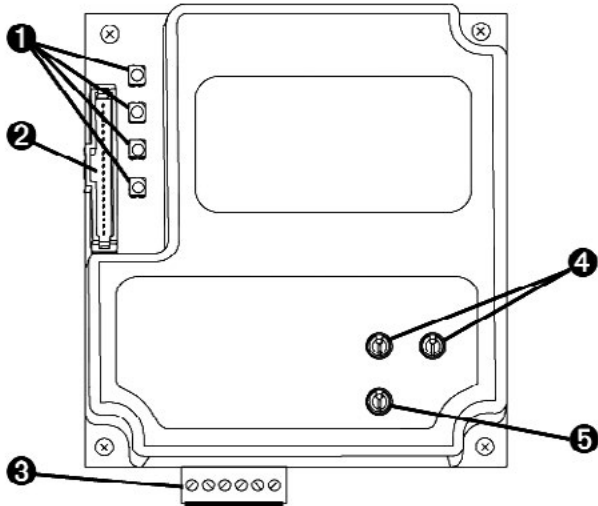
NET A and NET B communication status indicator LEDs ③ and ④

Status	Cause	Corrective action
Off	The gateway has no supply or has a poor connection.	- Check that the connectors are well connected to the gateway. - Energise the power module.
Red flashing	Communication error.	Re-initialise the supply to the power module.
Red continuous	The gateway has detected an error that makes any communication impossible.	- Check that the control potentiometers on the communication gateway are set to their original control. - Re-initialise the supply to the power module.
Green flashing	Network connected. No communication in progress.	Operation is normal.
Green continuous	Communication in progress.	As above.

13.3.2 - Gateway with PIC 5 :

The gateway module is different with ICVC PIC V. This is the 20-COMM-H. This board is factory installed into the VFD and factory configured.

Figure 74 - 19XRV PIC 5 Communication gateway



Item	Part	Description
1	Status indicators	Four LEDs indicate the status of the connected drive, adapter, and network. PORT : DPI Connection status MOD : Adapter status NET A : Serial Communication status NET B : Serial Communication Traffic Status
2	DPI Connector	A 20-pin, single-row shrouded male header. An Internal Interface cable connects to this connector and one on the drive.
3	Terminal Block	A 6-screw terminal block connects the adapter to the network
4	Node Address Switches	Two switches set the node address
5	Network Selector Switch	One switch selects the network protocol.

Flashing status of LEDs : refer to 13.3.1

13.4 - Power module status LEDs :

The operating status of the variable-frequency drive can be seen on the status LEDs on the front face of the power module on the control interface board. The LEDs are located on each rectifier and chopper control board.

The chopper status diagnostics are quickly carried out by checking the corresponding status LEDs:

Colour	Status	Description
Green	Flashing	12 V supply present. Ready to operate.
	Continuous	12 V supply present. Operating.
Yellow	Flashing	The variable-frequency drive is not ready to start, as PIC shutdown command is present.
	Continuous	An alarm is present: Check the return of the variable-frequency drive status on the ICVC.
Red	Flashing	A fault is present: Check the return of the variable-frequency drive status on the ICVC.
	Continuous	A fault is present that cannot be reset: Check the return of the variable-frequency drive status on the HMI
Chopper: Red Rectifier: Green	Continuous	The thyristor control circuit of the variable-frequency drives has opened after a safety pressure switch fault.

If there is a more general fault that affects the rectifier and the chopper, the status diagnostics are displayed as shown in the table below:

Colour	Status	Description
Red-green	Alternate flashing	The firmware may be corrupt. Contact Carrier Service.
Yellow/green/red	Flashing, Repeating, pattern	RAM fault or the firmware may be corrupt. Contact Carrier Service

13.5 - Safety shutdowns and cuts

13.5.1 - Safety shutdown

The controlled safety shutdowns initiate a decreasing voltage/frequency ramp until the motor shuts down.

In addition to shutdowns initiated as standard by the machine, certain specific component faults are likely to lead to a safety shutdown, if a variable-frequency drive as used:

- Variable-frequency drive power fault
- Variable-frequency drive overheating
- Condensation formation on the cooling plate of the variable-frequency drive.

The faults detected in the variable-frequency drive can be checked on the VFD_HIST screen of the HMI.

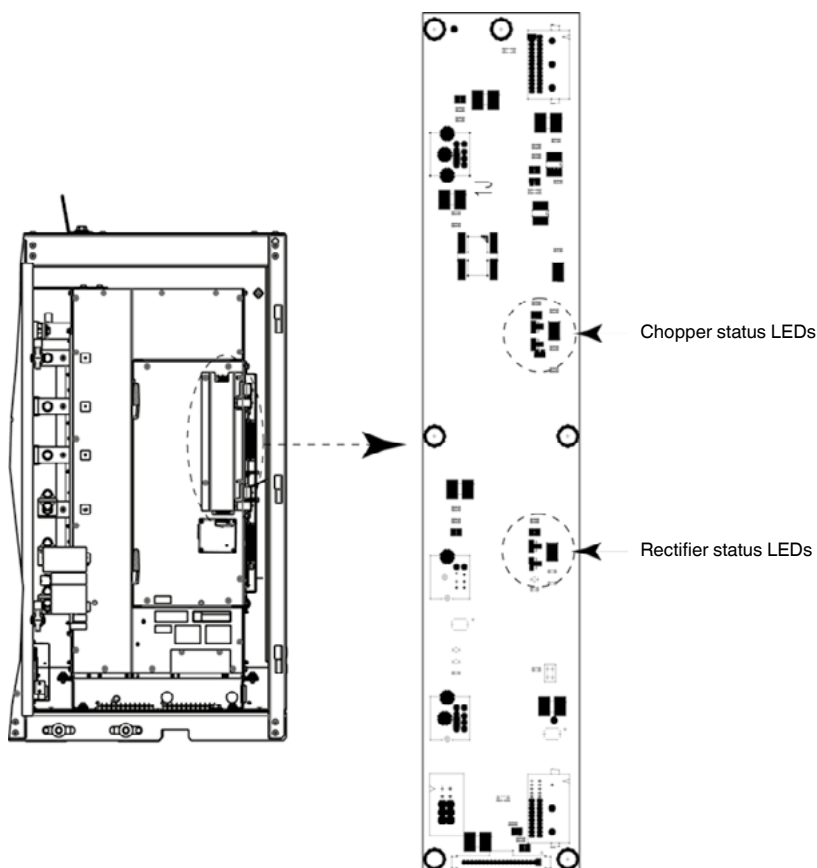
13.5.2 - Emergency stop by the circuit breaker/main disconnect switch

The emergency shutdown immediately opens the circuit breaker/main disconnect switch. It can be initiated by certain internal fault conditions at the variable-frequency drive. Overvoltage faults on the power bus and earth current leaks detected by the variable-frequency drive lead to an emergency shutdown.

13.5.3 - Safety pressure switch cut-out

The opening of the safety pressure switch leads to the disconnection of the 24 V power supply for the command gates of the IGBT of the variable-frequency drive (Gate Kill input on the power module): The motor shuts down immediately following the power supply fault.

Figure 75 - 19XRV Communication interface board
Location of the power module status LEDs for variable-frequency drives 19XR-506---912 and 19XR-506---922



14 - 19XRV PIC III – MAINTENANCE

Safety consideration reminder: For the access conditions to the variable-frequency drive control box refer to chapter 1 of this document.

14.1 - Special precautions during maintenance

14.1.1 - Isolation check

The voltages applied during tests with the unit energised (isolation and dielectric) can damage the variable-frequency drive.

When the motor isolation is checked, the power supply conductors between the motor and the variable-frequency drive must be disconnected.

14.1.2 - Disassembly and replacement of components in the variable-frequency drive cabinet

Disassembly and replacement operations of parts in the variable-frequency drive cabinet must be carried out by a Carrier technician officially authorised and qualified to do this work. This instruction must be observed to ensure that the warranty conditions for the variable-frequency drive are valid.

All connectors used on the electronic boards of the power module are equipped with locks. Disconnection must be easy by activating the unlocking mechanism.

14.2 - Periodic maintenance

14.2.1 - Standard maintenance

The normal maintenance operations for electrical equipment apply:

- Re-tightening of the electrical connections
- Elimination of dust
- Checking for signs of localised overheating.

14.2.2 - Variable-frequency drive cooling line

The variable-frequency drive cooling line includes a filter that must be replaced once a year.

14.2.3 - Protection devices

Faults that occur on the functional components of the variable-frequency drive cabinet are normally detected by the control. For each reported fault, the diagnosis, the possible causes and the corrective actions required are described in the PIC III controls manual.

It is however not possible to obtain a fault report for the destruction of the surge limiter (F) and the protection fuses for the capacitor coils of the inlet filter (FU4/5/6). Verification of these components is required at each periodic maintenance visit.

APPENDIX B: PARTICULARS OF CARRIER 19XRV PIC III MACHINES - EATON XVE DRIVES

15 - 19XRV PIC III - SAFETY CONSIDERATIONS FOR MAINTENANCE

15.1 - Electrical maintenance

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 authorised 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: EATON XVE drives 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 drive. Ensure that there is no power supply to any conducting parts of the power circuit that are accessible during the work.

15.2 - Mechanical maintenance

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

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

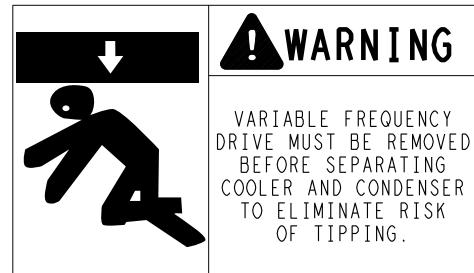
WARNING: Do not attempt to disconnect the flanges, if the chiller is under pressure. The chiller has not been purged, and this can cause injuries or damage to the machine.

ATTENTION: Before lifting the compressor, disconnect all cables entering the interface box.

15.2.1 - Removal of the VFD box

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

WARNING: For VFD box XVE 765 to 1530 do not disconnect the evaporator and condenser before VFD box has been disconnected and removed. This 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.

1. Close the two filter-drier shut-off valves and VFD cooling circuit shut-off valve. Purge the refrigerant from the VFD heat exchanger using the Schrader valve at the side of the filter (refer to Fig. 76 - "VFD cooling circuit view").
2. Remove all VFD power supply cables
3. Remove the middle part of the terminal boxes
4. Identify and disconnect the motor terminals. Note the position of the power wiring cable lugs and use the same position during the re-assembly.
5. Remove the earth connection from the motor. Note the earth connection position and use the same position during the re-assembly.
6. Identify and disconnect the power wiring cables and all communication and connection cables between the VFD box and the interface box.
7. Remove the access panels at the rear of the VFD and disconnect the cooling circuit lines. Plug all openings.

Figure 76 - VFD cooling circuit view

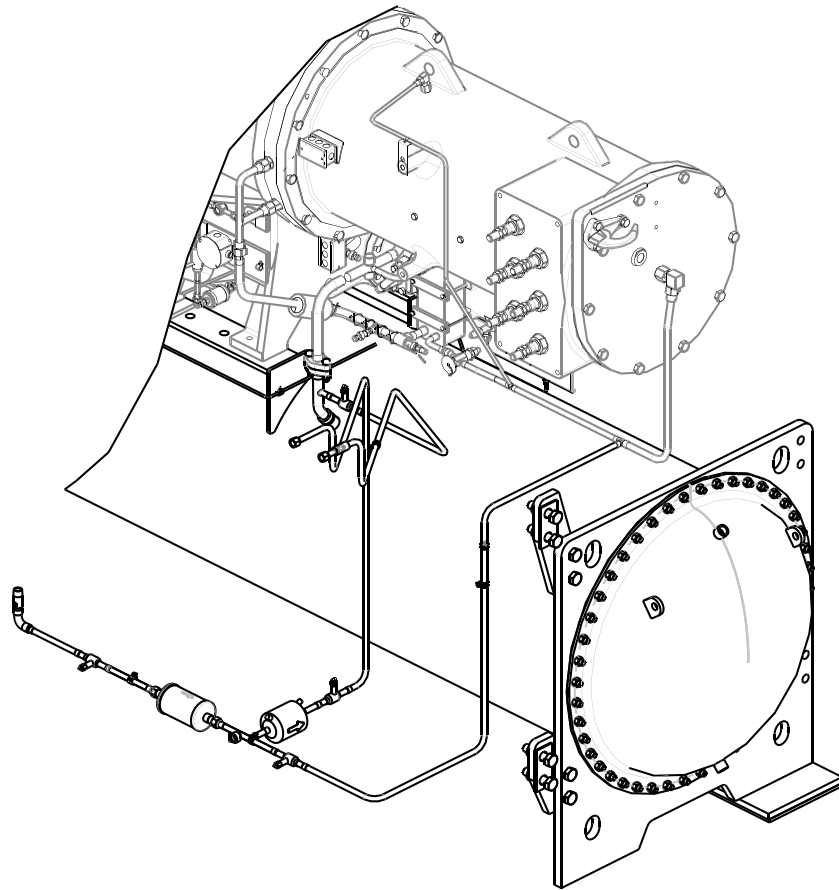
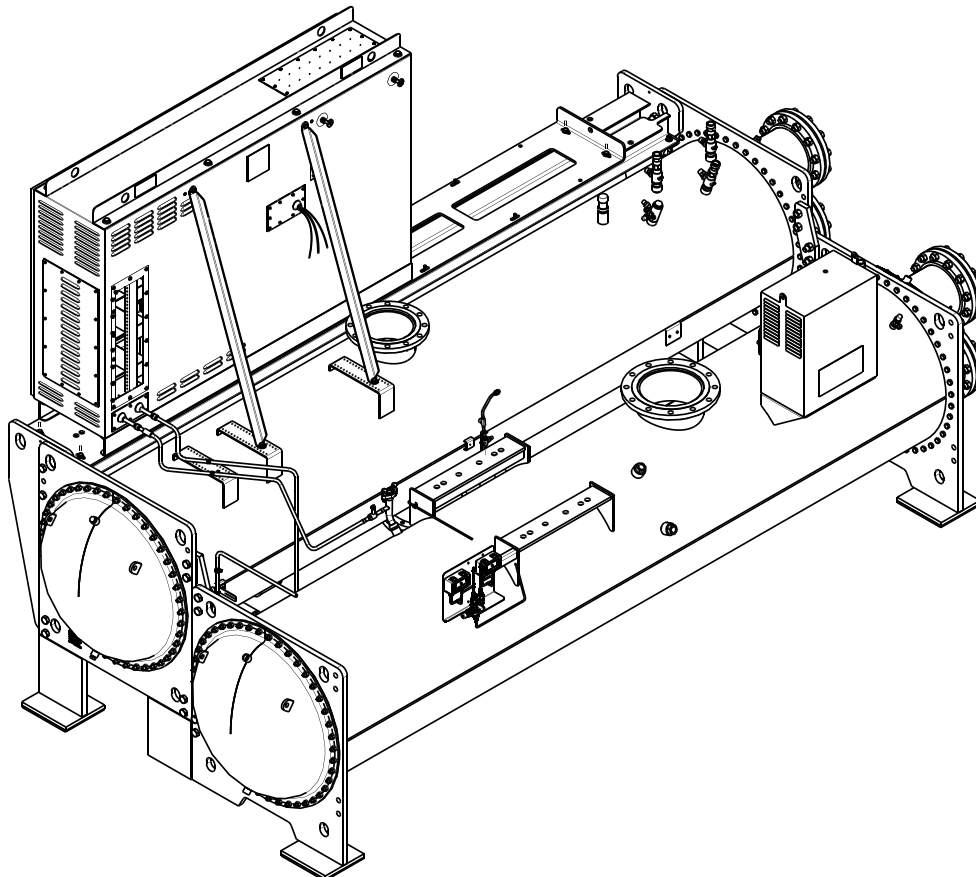


Figure 77 - VFD mounted view

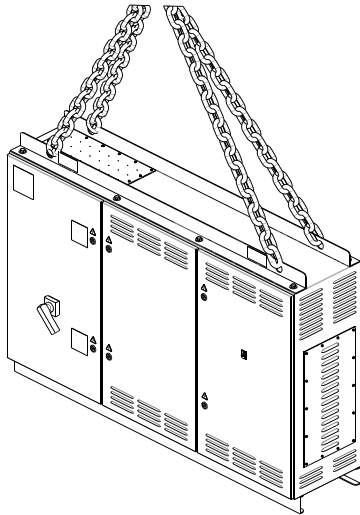


15.2.2 - Lifting of the VFD control box

Precautions must be taken to prevent any damage due to a fall or shock, if the VFD control box is removed. A fork-lift truck or a similar lifting and transport device can be used. Place chains on the VFD so that there is an equal load at the lifting points. Use a lifting beam, if the angle of the chains is less than 45° from the horizontal level. Avoid shocks when the VFD is lifted.

CAUTION: The lifting brackets on top of the electrical box permit attaching chains to the VFD control box. They must never be used to chain and lift the chiller.

Figure 78 - Lifting the VFD



Use the following procedure to lift the VFD :

- Attach a chain to each lifting hole provided at the lifting supports (these lifting supports are factory installed at the top of the VFD control box. Ensure that the chains do not form an angle of less than 45° to the horizontal level.
- Use an overhead or independent lifting bridge (nominal capacity of 2 tonnes minimum), attach a fall-arresting chain to each point to ensure safe lifting of the VFD.
- Lift to apply tension and remove the screws fixing the VFD control box to its support on the condenser.

NOTE: To re-assemble follow these instructions in reverse order. Connect the sensors and the cables after securing the installation of the main parts, to avoid the risk of damaging them.

15.2.3 - Separate the evaporator from the condenser

NOTE: If condenser and evaporator must be separated, the heat exchangers must be kept level by placing a support plate under the tube sheets. The support plate helps keeping the heat exchangers level and aligning them when they are re-assembled.

Remove all cables from the probes and sensors. Cut the cable paths required to separate the two heat exchangers.

ATTENTION: The evaporator must not be separated from the condenser without first disconnecting and removing the control box. The VFD control box type has a high-level centre of gravity and can tip over at the moment when the heat exchangers are separated, if the control box is not separated first. This can result in material damage and a serious injury risk for the personnel.

- Place a support plate under each tube sheet to keep the heat exchangers level.
- Cut the motor cooling line.
- Disconnect discharge elbow from the compressor.
- Disconnect liquid line flange from the float chamber,
- Plug all openings. Disconnect all cables that cross from one heat exchanger to the other
 - Probe and sensor cables of the water boxes.
 - Motor power wiring cables from the terminal box.
 - Communication and connecting cables between the VFD and the interface box.
- Remove the connecting plates from the tube sheets (see Fig. 64, item 5).
- Keep the disconnected heat exchangers separate.

15.2.4 - Separate the compressor from the evaporator

- Remove the suction and discharge bends
- Cut the motor cooling line
- Disconnect the motor cooling return line,
- Disconnect the following elements:
 - The cable from the compressor oil temperature sensor.
 - The cable from the compressor bearing temperature sensor
 - The cable from the motor temperature sensor
 - The communication and connection cables between the VFD control box and the interface box.
 - The discharge temperature sensor cable.
 - The compressor oil pressure sensor cable
 - The compressor oil discharge pressure sensor cable
 - The guide vane motor cable.
 - The diffuser motor cable (for compressor 02XR5 and 02XR4 with separate diffuser (SRD))
 - The diffuser pressure sensor cable (for compressor 02XR5 and 02XR4 with separate diffuser (SRD))
- Disconnect the oil recovery line connections
- Plug all openings.
- Disconnect the power wiring cables from the VFD control box.
- Remove the screws mounting the compressor on the evaporator support.
- Lift the compressor.

15.2.5 - Case of unit shipped with dismantled VFD cabinet:

WARNING: If the unit is shipped with dismantled VFD cabinet, please follow the below instructions:

- VFD drive refrigeration circuit is Nitrogen loaded for transport, depressurise the VFD cooling circuit by escaping the Nitrogen,
- Be sure the service valve are closed
- Connect the VFD inlet/outlet to the chiller copper piping free of refrigerant load
- Charge with 4 bars He and do a leaking detection test on connections
- Do the vacuum and stop when 1mbar.
- Wait for 5 min and check if pressure goes up.
- If OK then, open the service valves in order to fill the VFD cooling circuit with refrigerant R134a.

WARNING: Risk of piping freezing due to quick expansion, don't touch the parts when opening the valves.

16 - 19XRV PIC III - EQUIPMENT PRESENTATION

16.1 - Environmental conditions

The operating and storage conditions are as those described for the standard machine.

The machines must be installed inside the building. Control boxes are protected against water projections to IP33 in accordance with standard IEC60529-1: They are protected against accidental and exceptional, vertical water projections and up to an angle of 60° relative to the vertical.

16.2 - CE marking

The 19XRV electrical equipment is designed to ensure machine conformity with all applicable European directives:

- Machinery directive 2006/42/EC modified and low-voltage directive 2006/95/EC:

The electrical equipment is designed in accordance with the recommendations of the harmonised European standard EN60204-1 that recommends the use of components that comply with the relevant IEC standards

The variable-frequency drive cabinet is certified in accordance with standard EN50178. Its integration in the machine complies with the directives of standard EN60204-1.

- European directive 2004/108/EEC (Electromagnetic compatibility):

Conformity is assured by application of the product standard EN61800-3 that applies to variable-speed power drives.

16.3 - Description of electrical equipment elements

The electrical equipment of 19XRV machines is included in two separate control boxes:

- The PIC III control box. The dimensions and components of the control boxes are the same for the full range of proposed drive.
- The variable-frequency drive control box is available in several versions in the range up to 1530A

Part number	VFD model	Standard model	EMC C3 level (RFI filter) (Special order)	Nominal voltage, V	Maximum current draw, A	Maximum current output, A
19XR-512---682--E 19XR-513---672--E	19XVE0485	X	X	380 > 400 V 380 > 400 V	485	485
19XR-512---702--E 19XR-513---682--E	19XVE0550	X	X	380 > 400 V 380 > 400 V	550	550
19XR-512---722--E 19XR-513---692--E	19XVE0605	X	X	380 > 400 V 380 > 400 V	605	605
19XR-512---742--E 19XR-513---702--E	19XVE0680	X	X	380 > 400 V 380 > 400 V	680	680
19XR-512---762--E 19XR-513---712--E	19XVE0765	X	X	380 > 400 V 380 > 400 V	765	765
19XR-512---782--E 19XR-513---722--E	19XVE0855	X	X	380 > 400 V 380 > 400 V	855	855
19XR-512---802--E 19XR-513---732--E	19XVE0960	X	X	380 > 400 V 380 > 400 V	960	960
19XR-512---822--E 19XR-513---742--E	19XVE1070	X	X	380 > 400 V 380 > 400 V	1070	1070
19XR-512---842--E 19XR-513---752--E	19XVE1275	X	X	380 > 400 V 380 > 400 V	1275	1275
19XR-512---862--E 19XR-513---762--E	19XVE1530	X	X	380 > 400 V 380 > 400 V	1530	1530

For details and the component location in the control box refer to the wiring diagram supplied with the machine.

16.3.1 - The PIC control box

The PIC control equipment mainly includes (identified in accordance with the references on the wiring diagram):

- The internal control circuit transformer (TC1) and the heater power supply transformer (TC2),
- The CCM control module (A1), if PIC III
- The IOBs boards if PIC 5
- The control screen of the HMI interface (A2). This is the machine interface. Specifically it permits consultation and configuration of the VFD, HMI can be ICVC PIC III or HMI Touchscreen PIC 5.
- The UPC board (gateway from HMI Pic 5 to VFD) if PIC 5
- The pump (KM81) and heater (KM66) change-over contactors,

- The overcurrent circuit breakers (QF11 protects the control circuit, QF4 protects the oil pump, QF66 protects the heater and QF1 the general protection of the box),
- The terminal blocks (XR).

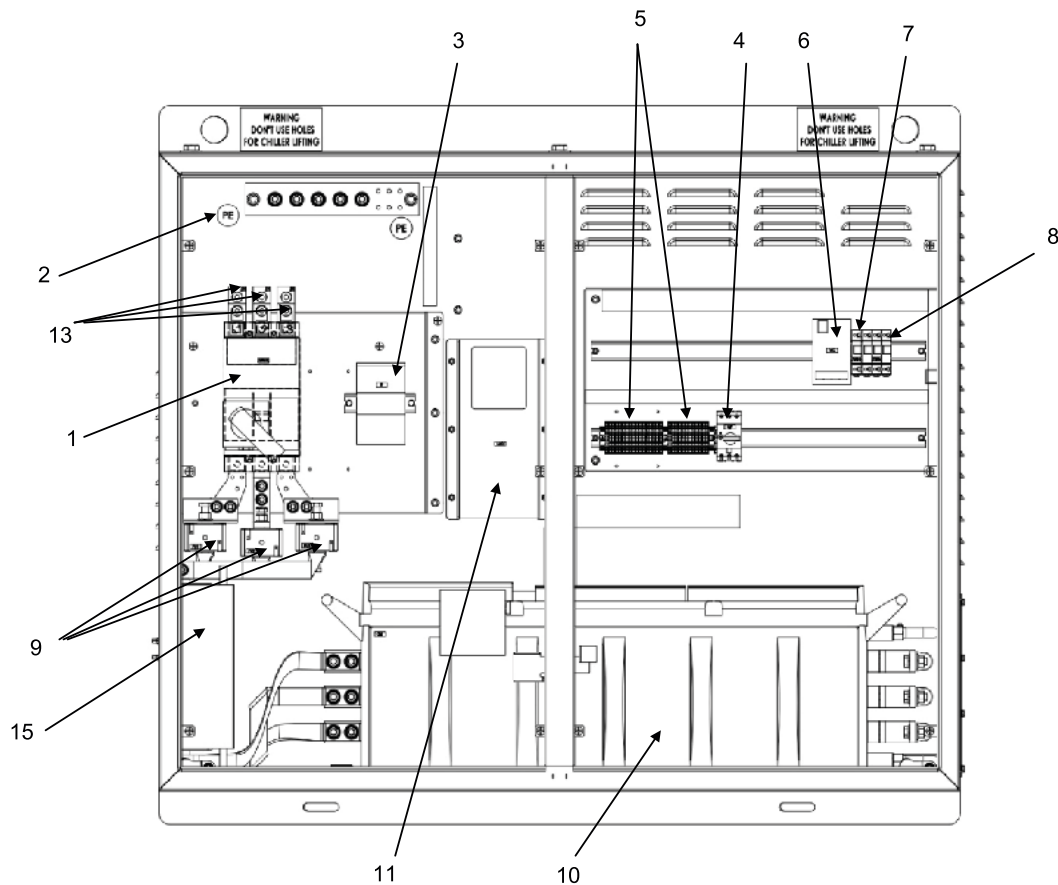
(refer to wiring diagram supplied with chiller)

16.3.2 - The compressor power variable-frequency drive

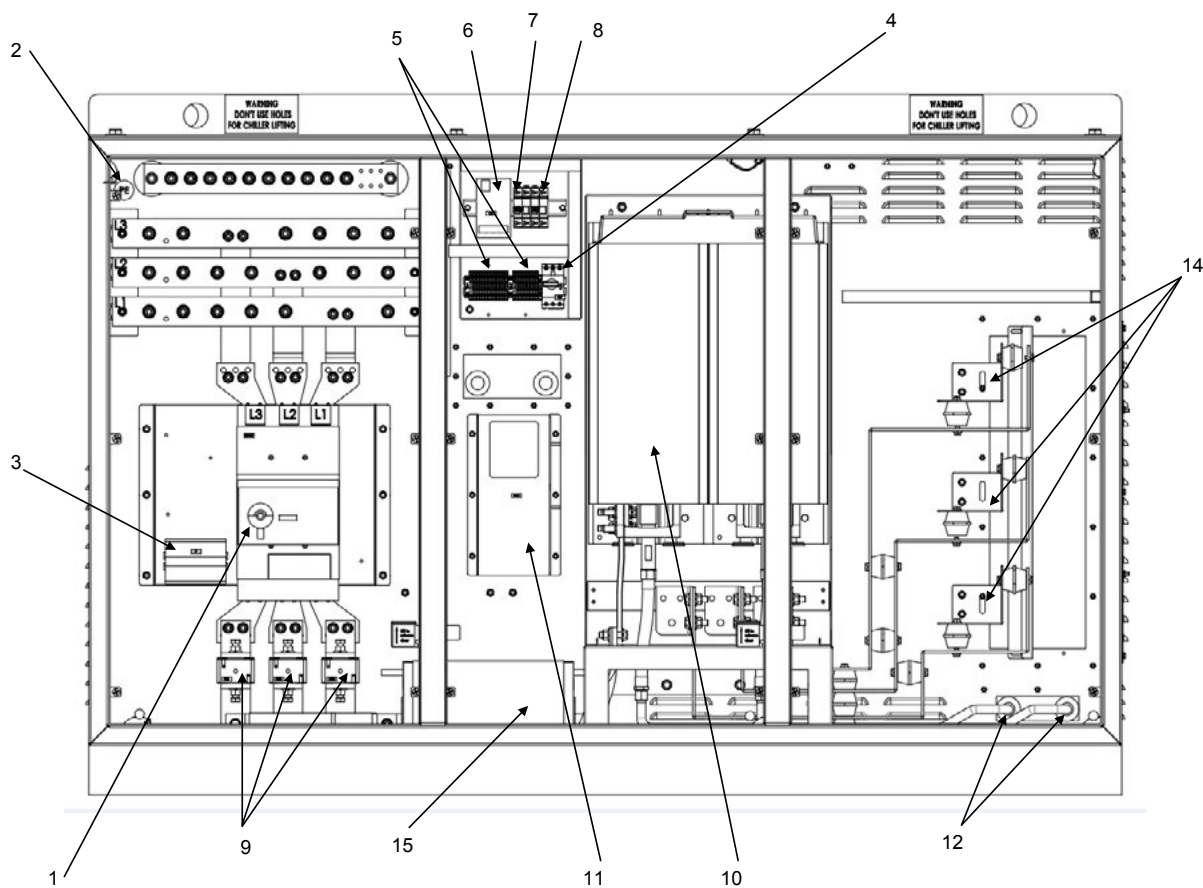
The compressor power variable-frequency drive cabinet includes the following functional components (identified in accordance with the references on the wiring diagram and the following arrangement):

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. Ground (PE).
3. Surge limiter (F).
4. Power supply circuit protection disconnect switch for the PIC control box (QF).
5. Terminal blocks TB1 and TB2.
6. The transformer rectifier (VC) converts 400VAC to 24VDC to supply the drive control circuit.
7. The fuse (FU11) downstream of the rectifier (VC) for the protection of the internal control circuit of the drive.
8. The fuses (FU10) upstream of the rectifier (VC) for the protection of the internal control circuit of the drive.
9. The rapid fuses (FU1, FU2, FU3) protect the power module (GS)
10. Power module (GS) for the following functions:
 - Compressor start-up and shut-down 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
 - Electrical protection against over/under-voltage, ground fault, overcurrent, over/under-load, motor stall, unit's over temperature and short-circuit.
 - Input/output phase supervision
 - All devices to protect against internal faults of the variable-frequency drive as well as pressure safety switch cut-out
 - Report of variable-frequency drive status parameters and internal faults to the PIC control
11. The keypad module (A3) is the drive interface. It allows you to parameter the power module, read the received data and transmit controls commands.
12. These connections allow the circulation of coolant provides the internal cooling of the power module (GS).
13. Power supply connection.
14. Motor supply connection.
15. RFI filter for EMC noise limitation. (special order).

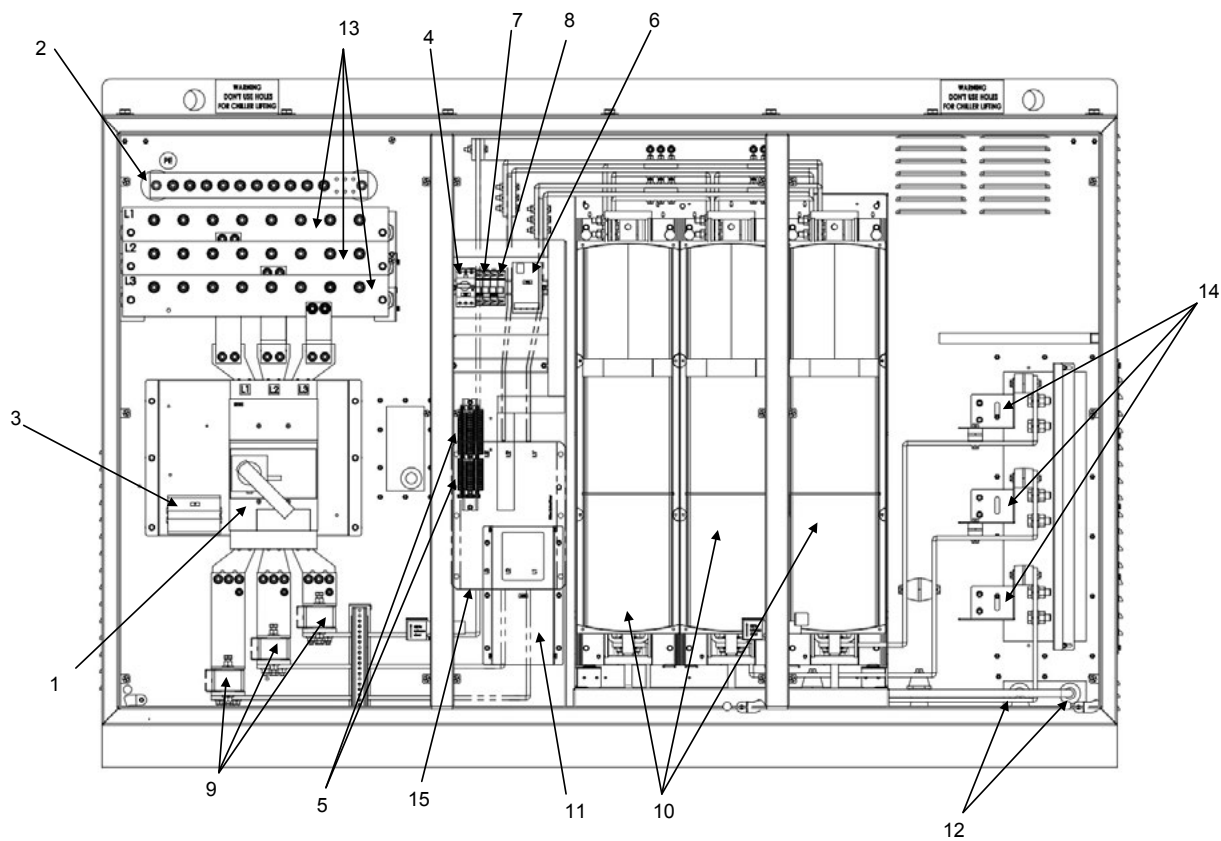
Figure 79 - Variable-frequency drive cabinet for machines with maximum nominal current up to 680A (19XVE0485, 19XVE0550, 19XVE0605 and 19XVE0680)



**Figure 80 - Variable-frequency drive cabinet for machines with maximum nominal current up to 1070A
(19XVE0765, 19XVE0855, 19XVE0960 and 19XVE1070)**



**Figure 81 - Variable-frequency drive cabinet for machines with maximum nominal current up to 1530A
(19XVE1275 and 19XVE1530)**



16.4 - General compressor speed control principles

The compressor speed is regulated by the control of the voltage/frequency values applied to the motor. The voltage applied, generated by pulse width modulation (PWM), is proportional to the frequency.

Decreasing the compressor speed makes the machine more susceptible to surging; the prevention and protection algorithms against this phenomenon interact with the control of the speed-vane couple.

Deviation of the water temperature parameters measured, from the assigned "Control point" value and the "Chilled water deadband" parameter is calculated in the "Guide Vane Delta" parameter. This parameter leads to an adjustment of the machine capacity by a simultaneous and coordinated action on the guide vane opening and the compressor speed ("Target VFD Speed").

"Normal" operating mode: The capacity is primarily controlled by the variation of the compressor speed within the limits defined by the "VFD Minimum Speed" and "VFD Maximum Speed" parameters (default settings 70 and 100%). If the capacity reduction objective permits, the guide vane opening is maintained at 100%. If the "VFD Minimum

Speed" is reached, capacity reduction is obtained by reducing the guide vane opening.

Operating mode to prevent surging: If the PIC detects a surge risk, the prevention logic requests an increase of the compressor speed up to the risk zone outlet defined in the dP-dT diagram. The capacity reduction is controlled by reducing the guide vane opening.

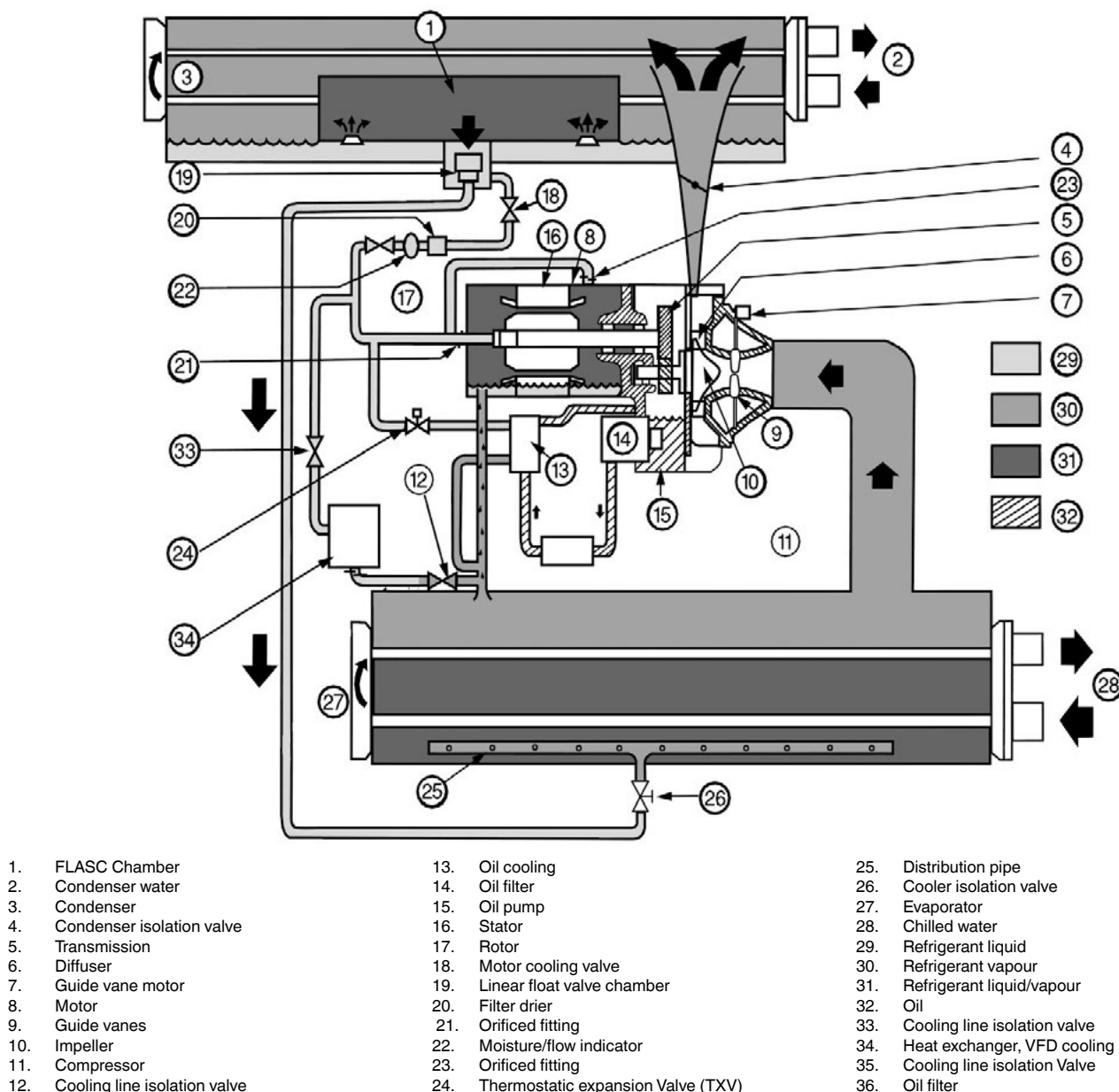
Operating mode to protect against surging: Effective surging is detected by the compressor motor current fluctuations. In these conditions the compressor speed is increased. The logic that requests the compressor safety shutdown in case of prolonged surging is the same as the one for a standard machine without variable-frequency drive. Please also refer to the controls manual.

16.5 - Variable-frequency drive cooling

The power module of the variable-frequency drive is equipped with a heat exchanger to provide cooling, using the refrigerant in the machine.

ATTENTION: The typical diagram is not contractually binding; refer to the PID diag. of the unit.

Figure 82 - Typical 19XRV unit diagram



16.6 - Flow detection by the saturated suction temperature sensor

A temperature sensor in the suction line is used by the PIC control to check that the flow rate in the heat exchanger is not zero.

If flow detection by measuring the pressure differential in the water circuit is active, the two verifications are carried out in parallel and cumulated.

Please refer to the controls manual.

16.7 - Electrical specifications

Assigned conditional short-circuit current	50 kA – eff
Assigned operating current	According to the variable frequency drive parameter set at the factory
Current draw at shutdown*	Drive CH72: 0.33 A Drive CH63: 0.45 A Drive CH74: 0.70 A
Power supply frequency	45/66 Hz
Voltage range**	-10% to +10%
Power factor (values at nominal capacity) ***	>97%
Cosine phi	>0.83
Harmonic distortion index (THDI)	≥30% (full motor capacity)
Electromagnetic emission rate***	EMC level C4 (C3with RFI filter) as special order)
Installation altitude	100% load capacity (no derating) up to 1000 m. If the altitude is higher than 1000 m, derating 1% per level of 100 m required
Cut-out frequency (480 V)	3.6 kHz
Default factory control	1-12 kHz
Other possible control	
Operating frequency range**	65% to 100%
Maximum capacity dissipated by the variable frequency drive	
19xve0485	8100 Watts
19xve0550	9700 Watts
19xve0605	10700 Watts
19xve0680	12800 Watts
19xve0765	13300 Watts
19xve0855	15300 Watts
19xve0960	17500 Watts
19xve1070	19700 Watts
19xve1275	20200 Watts
19xve1530	25400 Watts

* Continuous bus load

** Around the nominal value

*** According to standard 61800-3: Installation in an industrial environment

WARNING : This VFD is not equipped with built-in harmonic filter. The acceptance of level of THDI delivered is the responsibility of the local electrical contractor. Sizing and selection of the filtering device is out of Carrier scope.

19XRV PIC III - INSTALLATION INSTRUCTION AND ELECTRICAL CONNECTION

16.8 - Introduction

19XRV machines are supplied with the electrical equipment integrated, wired, pre-configured and tested at the factory. The installation of the electrical equipment includes the connection of customer auxiliary and communication power supply cables, as well as configuration parameter adjustment specific to the installation site.

16.9 - Receiving the machine

During storage the machine must be protected against humidity and dust. Specifically, the machine must not be placed in an outside location, exposed to the weather.

16.10 - Physical data

16.10.1 - Unit rigging

ATTENTION: The control box must not be used as a machine rigging point.

The 19XRV machine rigging points are the same as those for the standard machine without variable-frequency drive. Refer to the dimensional drawing supplied with the machine.

16.10.2 - Weights and dimensions

The data in this section is for information only. The contractual data is given on the dimensional drawing supplied with the machine. The weight of 19XRV machines is the same as that of standard machines plus weight of the control boxes.

Control box, variable-frequency drive	Control box max weight, kg
19xve0485	390
19xve0550	390
19xve0605	400
19xve0680	400
19xve0765	640
19xve0855	640
19xve0960	650
19xve1070	650
19xve1275	890
19xve1530	960

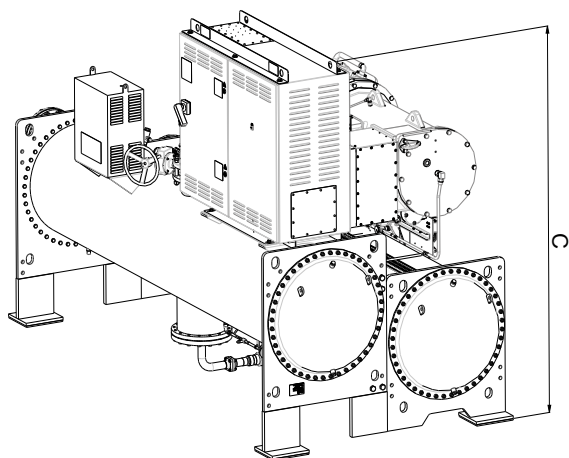
For exact values please always refer to dimensional drawings supplied with the unit.

- | | | |
|----------------------------------|--|----------------------------------|
| 1. FLASC Chamber | 13. Oil cooling | 25. Distribution pipe |
| 2. Condenser water | 14. Oil filter | 26. Cooler isolation valve |
| 3. Condenser | 15. Oil pump | 27. Evaporator |
| 4. Condenser isolation valve | 16. Stator | 28. Chilled water |
| 5. Transmission | 17. Rotor | 29. Refrigerant liquid |
| 6. Diffuser | 18. Motor cooling valve | 30. Refrigerant vapour |
| 7. Guide vane motor | 19. Linear float valve chamber | 31. Refrigerant liquid/vapour |
| 8. Motor | 20. Filter drier | 32. Oil |
| 9. Guide vanes | 21. Orificed fitting | 33. Cooling line isolation valve |
| 10. Impeller | 22. Moisture/flow indicator | 34. Heat exchanger, VFD cooling |
| 11. Compressor | 23. Orificed fitting | 35. Cooling line isolation Valve |
| 12. Cooling line isolation valve | 24. Thermostatic expansion Valve (TXV) | 36. Oil filter |

For units with VFD XVE485 to 680:

19XRV machine dimensions are the same as for standard machines; the height (only) is increased for machines equipped with VFD control boxes 19XVE0485, 19XVE0550, 19XVE0605 and 19XVE0680.

**Figure 83 - Height of 19XRV with variable-frequency drive
– 19XVE0485, 19XVE0550, 19XVE0605 and 19XVE0680**



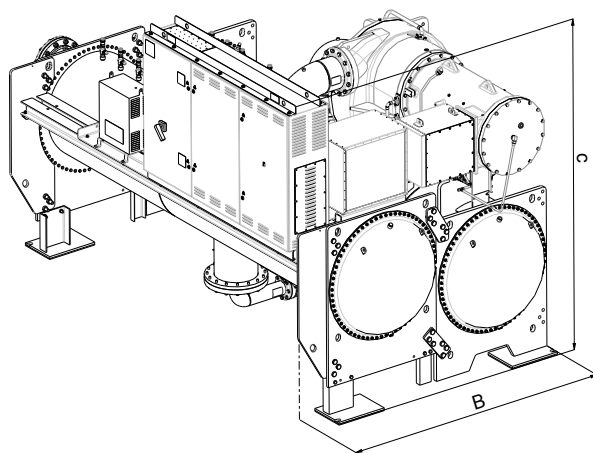
Dimensions, machines equipped with VFD control box

Heat exchanger size	Height (C - mm)
19XR3	2460
19XR4	2565
19XR5	2750
19XR6	2810

For units with VFD XVE765 to 1070:

19XRV machine dimensions are the same as for standard machines; height and width are increased for machines equipped with VFD control boxes 19XVE0765, 19XVE0855, 19XVE0960 and 19XVE1070.

**Figure 84 - Height of 19XRV with variable-frequency drive
– 19XVE0765, 19XVE0855, 19XVE0960 and 19XVE1070**



Dimensions, machines equipped with VFD control box

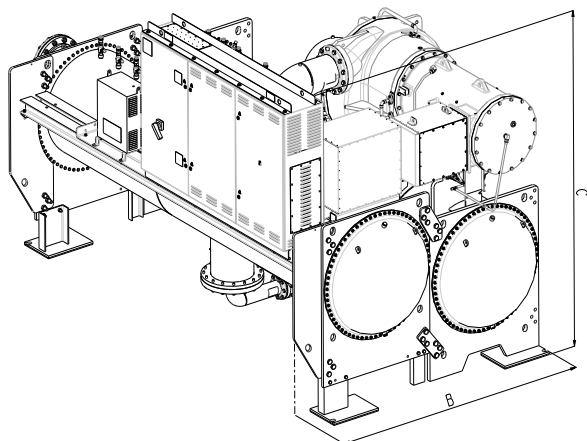
Heat exchanger size	Height (C - mm)	Width (B - mm)
19XR5	2860	2480
19XR6	2925	2480
19XR7	3075	2960

For exact values please always refer to dimensional drawings supplied with the unit.

For units with VFD XVE1275 to 1530:

19XRV machine dimensions are the same as for standard machines; height and width are increased for machines equipped with VFD control boxes 19XVE1275 and 19XVE1530.

Figure 85 - Height of 19XRV with variable-frequency drive – 19XVE1275, 19XVE1530



Dimensions, machines equipped with VFD control box

Heat exchanger size	Height (C - mm)	Width (B - mm)
19XR7	3275	2960
19XR8	3325	3165

For exact values please always refer to dimensional drawings supplied with the unit.

16.11 - Location of connection points and interfaces

Refer to the dimensional drawings supplied with the machine.

16.12 - Electrical connections

16.12.1 - Power connections

19XRV units have only one power connection point, located in the VFD control box.

The data in this section is for information only. Cable sizing is the responsibility of the installer and must comply with the characteristics and regulations specific to each installation site. The connections supplied as standard for the incoming customer power cables on the circuit breaker/main disconnect switch are designed to receive the number and type of wire sections defined in the table below.

VFD for 19XRV	Maximum connectable wire sections			
	Quantity	Connection sections (mm ²)	Torque (N.m.)	Lug dimensions
19XVE0485	2	240	/	/
19XVE0550	2	240	/	/
19XVE0605	4	300	50	10
19XVE0680	4	300	50	10
19XVE0765	6	300	60	12
19XVE0855	6	300	60	12
19XVE0960	8	300	60	12
19XVE1070	8	300	60	12
19XVE1275	8	300	60	12
19XVE1530	8	300	60	12

For the 19XVE0485 and 19XVE0550 sizes, the supply connections are done with tips directly on the breaker. The connections of the other sizes are provided by pod on the bus bar.

Before connecting the power cables (L1 - L2 - L3), ensure that the sequence is correct.

16.12.2 - Report and control connections on site

For the site control wiring of the following elements refer to the controls manual and the certified wiring diagram supplied with the unit:

On the CCM board in the PIC III control box:

- Remote set point reset (4-20 mA), J5-3/4 CCM
- Demand limiter, J5-1/2 CCM

Operating capacity percentage, J8-1/2 CCM.

On the IOB board if PIC 5:

- Autowater temp reset (4-20 mA), IOB3 J15-5/11
- Autodemand limit (4-20 mA), IOB3 J15-3/9

On the terminal strip in the compressor VFD cabinet:

- Safety shutdown, TB1-19/20
- Ice storage contact, TB1-21/22
- Remote start/stop button, TB1-23/24
- Condenser pump control, TB2-1/2
- Evaporator pump control, TB2-3/4
- Alarm report, TB2-9/10.

16.13 - Equipment details

Safety consideration reminder: Disconnect the power supply before working on the control box.

The circuit breaker/ main disconnect switch allows isolation of the complete electrical equipment from its power supply with the exception of the power conductor connection terminals for the installation. Specifically, it disconnects the PIC control box.

IMPORTANT:

- **Disconnecting the power equipment using the handle of disconnect switch QF101 also disconnects the control equipment and power supply to the oil pump.**

To prevent compressor lubrication problems, do not switch off the machine using the disconnect switch, if the compressor is still energised.

- An emergency shutdown to protect the capacitor coils can be initiated at any time by the control, while power is supplied to the variable-frequency drive. This shutdown acts on the circuit breaker/main disconnect switch.

Never apply voltage to the variable-frequency drive that cannot be de-energized by the circuit breaker/main disconnect switch: connection of 400 V voltage to the variable-frequency drive must be upstream of the circuit breaker/main disconnect switch. Specifically, do not:

- Connect a power supply bypass circuit upstream of the secondary disconnect switch **QF** in the VFD control box.
- Connect a power supply bypass circuit upstream of the control box and the **PIC III** control, if the disconnect switch **QF** is conducting.

ATTENTION: Internal components and circuit boards of the drive are live when the drive is connected to incoming power potential. Coming into contact with this voltage is extremely dangerous and will result in severe personal injury or death. The motor terminals U, V, W and the DC-link/brake resistor terminals B+/R+, R- are live when the drive is connected to incoming power, even if the motor is not running.

Do not make any connections when the drive is connected to the incoming power. After having disconnected the drive, wait until the indicators on the keypad go out (if no keypad is attached see the indicator through the keypad base). Wait 5 more minutes before doing any work on drive connections. Do not even open the cover before this time has expired.. Before connecting the drive to incoming power, make sure that the switchgear enclosure door is closed.

ATTENTION: The control I/O-terminals are isolated from the incoming power potential. However, the relay outputs and other I/O terminals may have a dangerous control voltage present even when the drive is disconnected from incoming power. Coming into contact with this voltage could result in severe personal injury.

CAUTION: If other than refrigerant cooling is used, before connecting the drive to incoming power, make sure that the coolant is circulating and has no leaks.

17 - 19XRV PIC III - BEFORE THE INITIAL START-UP

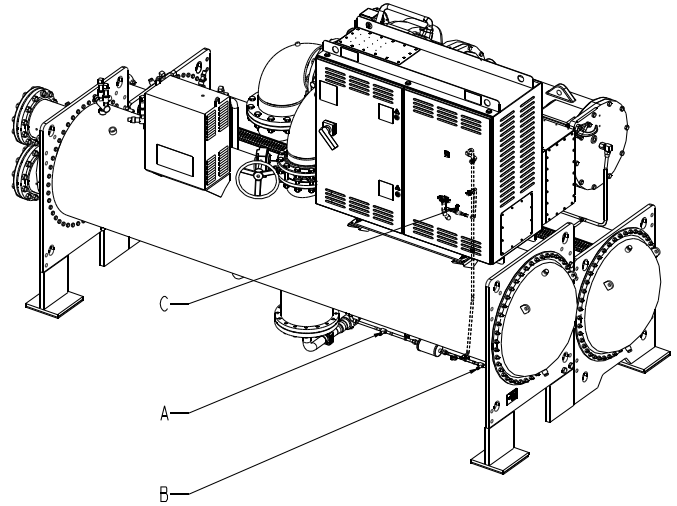
17.1 - Before energizing the unit

17.1.1 - Opening the VFD cooling line isolation valve

The three isolation valves installed on the VFD cooling pipes must be open:

- Valves A and B located under the condenser
- Valve C located behind the VFD control box.

Figure 86 - Location of the 19XRV isolation valves



17.1.2 - Wiring and installation inspection

For these checks the circuit breaker/disconnect switch of the VFD control box must be on the open position.

ATTENTION: Isolation using the main disconnect switch does not disconnect the voltage upstream to the power conductor connection terminals in the power supply to the machine.

Check Configuration Jumpers - Check if the X1, X2, X3 and X6 jumpers are well configured and if it match with configuration jumpers are as shown in Fig. 88 below.

All LCX9000 Units "SPX" version Control **Module 5** Card Slots for are available for interfacing with Control Board.

Slots are designated A-E

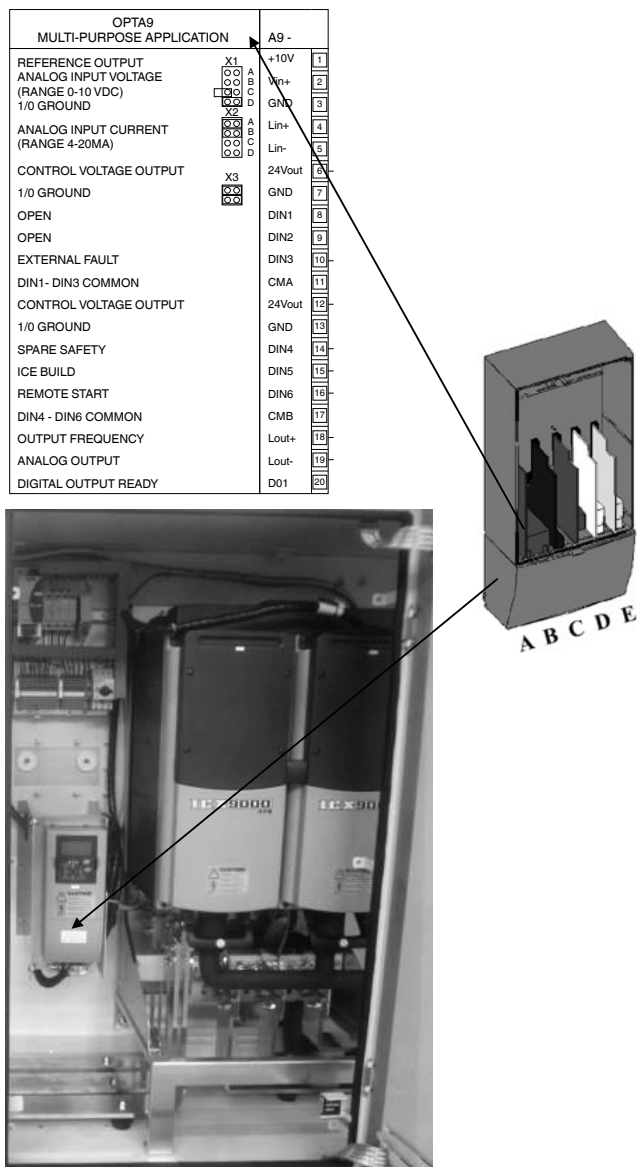
Slot A = Basic I/O (OPTA9)

Slot B = Two form C relays (OPTA2)

Slot C & D = Three N/O Relays each PCB (OPTB5)

Slot E = Communication PCB (OPTC2)

Figure 87 - Jumpers configuration of OPTA9 card and card emplacement



With PIC 5:



>> set password (default 4444) >> Menu configuration
>> Factory parameters >> set VFD option for Rockwell (3)
>> You have access to a new table for VFD unit mounted (UM VFD Configuration)

Specifically, the parameters below must be consistent with the application (Aquaedge selection outputs)

Parameter	Description
Motor Nameplate Voltage	Motor voltage at nominal speed (normally 400 V)
Compressor 100% Speed	Compressor speed at the nominal machine operating point (normally 50 Hz)
* Rated Line Voltage	Nominal line voltage (machine supply, normally 400 V)
* Rated Line Kilowatts	Line power input of the machine at its maximum operating point (see Chiller input KW selection @ full load)
* Motor Rated Load KW	Power input of the motor at the nominal machine operating point (Motor input power of selection)
* Motor Rated Load Amps	Current draw of the motor at the maximum machine operating point and nominal speed (RLA of selection)
Motor Nameplate Amps	Nominal motor current or max. RLA (selection)
Motor Nameplate RPM	Nominal motor speed (selection)
Motor Nameplate kW	Nominal motor capacity
Inverter PWM Frequency (0=4 k Hz, 1=2 k Hz)	0 (setting for VFD with PWM, active frond end technology)
Skip Frequency 1	0 (setting for VFD with 6 pulse technology)
Skip Frequency 2	0 (setting for VFD with 6 pulse technology)
Skip Frequency 3	0 (setting for VFD with 6 pulse technology)
Skip Frequency Band	0 (setting for VFD with PWM, active frond end technology)

Note: The other variable-frequency drive controls generally keep the default values.

The control parameters of the variable-frequency drive speed are accessible

With ICVC PIC III :

Menu >> Service >> Password (default 1111) >> SETUP2.

Parameter	Description
VFD gain	Adjusts the response of the variable-frequency drive to a speed modification demand (0.75 per default)
VFD increase step	Parameter of Capacity control with VFD, step of speed (2 % per default)
VFD minimum speed	Parameter of Capacity control with VFD, minimum % of VFD speed, Lower limit of the authorized compressor speed range (70 % per default)
VFD maximum speed	Parameter of Capacity control with VFD, maximum % of VFD speed, Upper limit of the authorised compressor speed range (100 % per default)
VFD start speed	Parameter of Capacity control with VFD, set speed at compressor start, % of VFD speed (100 % per default)
VFD surge line gain	Parameter of Capacity / Surge control with VFD, (2 per default)
VFD encl temp correction	0% per default
VFD alarm reset	Enable per default

Check VFD configuration - All configurations required by the VFD are supplied by the HMI through the VFD Gateway. Any configuration changes necessary and possible are made on the HMI screens. A complete set of configurations is transmitted to the VFD each time the controls are powered up.

The variable-frequency drive parameters are set at the factory. The controls can be checked and adjusted on the HMI.

The PIC control permits configuration of the variable-frequency drive using the VFD_CONF table. A secret code is required to access the parameter setting of the variable-frequency drive. It is different from that defined for access to the other parameters of the PIC control.

With ICVC PIC III :

Menu > Service > Password (default 1111) > VFD CONFIG DATA > Password (default 4444) > CFD_CONF.

With PIC 5:



>> set password (default 4444) >> Menu configuration
>> General VFD Config

Parameter	Description
VFD gain	Adjusts the response of the variable-frequency drive to a speed modification demand (0.75 per default)
VFD maximum speed	Parameter of Capacity control with VFD, maximum % of VFD speed, Upper limit of the authorised compressor speed range (100 % per default)
VFD minimum speed	Parameter of Capacity control with VFD, minimum % of VFD speed, Lower limit of the authorized compressor speed range (70 % per default)
VFD start speed	Parameter of Capacity control with VFD, set speed at compressor start, % of VFD speed (100 % per default)
VFD current limit	Parameter of control with VFD, Max current output VFD (250 A per default)
VFD load current 20 mA	200 A per default
Comp frequency 100%	50 Hz per default
VFD load current input	Enable per default

NOTE: The other variable-frequency drive controls generally keep the default values.

Eaton drive shall be loaded with:

1. Main SW VCN SPX00032V0XX.VCN
2. Carrier Application file SVCH0083V0XX.vcn
3. Option card file (gateway) OPTC2 CARPRV019B.VCN

Parameter P1.7.1.7 has to set to 0. Default value is 3.

This check can only be done by using the Eaton Service tool 9000X Drive and by connecting a serial port behind Drive interface.

XX : last software version

17.1.3 - Commissioning the Unit

The commission procedure is as follows:

1. If the chiller has been stored outdoors, allow at least 24 hours room temperature stabilisation prior to commissioning. Ensure any condensation that occurs as a result of the ambient temperature is allowed to evaporate.
2. Enter parameters in the VFD_CONF screen.
3. Install surge suppression devices if required.
4. Review the power wiring and grounding to ensure that it has been properly connected.
5. Visually examine the inside of the drive enclosure to:
 - a. Look for signs of corrosion or moisture residue.
 - b. Remove any dirt or debris.
 - c. Make sure all vents are clear.
6. Apply power to the drive and take thermal measurements of the power connections. Do this again before start-up.
7. Measure and record the incoming line voltages Vab, Vbc, Vca.

$$V_{avg} = (V_{ab} + V_{bc} + V_{ca}) / 3$$
 Pick the line voltage of the greatest difference from the average voltage. Subtract the smaller from the larger to get Vdiff.

$$(V_{diff} \times 100) / V_{avg} = \% \text{ voltage imbalance}$$
 Voltage imbalance must be 2% or less.

8. Take a final thermal measurement of the termination after finalising the installation to ensure all connections are good.
9. If a ground fault occurs, then do the following:
 - a. Turn off and lock out input power. Wait five minutes.
 - b. Check for a ground in the motor or motor wiring.
 - c. Check for damage to wiring insulation and that wiring is dry.
 - d. Verify the motor wiring is separated from ground and there is no connection between phases.
 - e. Check for failed IGBTs.
10. If an Overcurrent fault occurs, then do the following:
 - a. Turn off and lock out input power. Wait five minutes.
 - b. Check for excessive load and verify load limit settings on the HMI.
 - c. Check motor and wiring insulation.
 - d. Check parameter settings on VFD_CONF screen in the HMI.

Check the electrical connections: tightening torques and connector tightening on the electronic boards.

Checking the variable-frequency drive in the application:

- The nominal current and capacity data for the variable frequency drive must be in accordance with the data calculated for the machine in the application.
- Check that the voltage at the power connection terminals of the machine complies with that on the component name plates.

ATTENTION: Optical wires from VFD interface to VFD drive modules, are very sensitive and fragile.

If documents are kept in the machine, they must be kept in the document holder on the door.

17.2 - Start-up checks

ATTENTION: The warranty conditions for the variable frequency drive require that the first start-up is carried out by a Carrier-authorized technician.

17.2.1 - Energising the PIC control circuits and the crankcase heater

The circuit breaker/disconnect switch QF101 and disconnect switch QF located in the VFD control box must be closed to carry out the following checks on these circuits. The checks are the same as those for the standard machine.

17.2.2 - Quick test of the status LEDs

The status LED on the communication gateway and the front face of the keypad module permits a quick check of the operation.

The LEDs on the communication gateway must be on as follows:

- Fieldbus status LED: green continuous or green flashing
- Communication board status LED: yellow continuous or yellow flashing.

Refer to chapter “Gateway communication module status LEDs”.

On the front face of the keypad module the LEDs must be on as follows:

- Green LED Ready: Lights up with the supply connected to the drive
- Green LED Run: Lights up when the drive is running
- Red LED Fault: Indicates one or more active fault. Refer to chapter “Power module status LEDs”.

18 - 19XRV PIC III - INITIAL START-UP

18.1 - Motor rotation check

The variable frequency drive does not detect if the phases connected upstream are reversed. The variable-frequency drive does not detect phase reversals between variable-frequency drive and motor. In these two cases, the verification procedure described for the standard machine must be used.

18.2 - Compressor start-up

At the start-up of the compressor, the variable-frequency drive applies a frequency ramp, until the set point defined by the parameter “VFD Start speed” is reached (default 100% of the value defined by “Compressor 100% Speed”). The speed is reduced and the guide vanes open. The speed and the guide vane opening are controlled by the procedure described in chapter 9.4 of this document.

19 - 19XRV PIC III - OPERATING MODE

19.1 - Shutdown controlled by the machine

If compressor shutdown is requested, the variable-frequency drive applies a decreasing voltage/frequency ramp until the motor shuts down. The guide vanes are closed, and then the oil pump shuts down.

When the compressor shuts down, the oil pump ensures post-lubrication.

REMINDER: Do not stop the machine manually using the main disconnect switch or by any means that are likely to also disconnect the PIC control circuit and the power supply to the oil pump.

Only emergency stops initiated by the machine control must be used for this type of shutdown.

19.2 - Manual override commands

19.2.1 - Guide vane opening control

The opening of the guide vanes can be manually controlled as for the machine without variable-frequency drive, as described in the 19XR/19XRV controls manual.

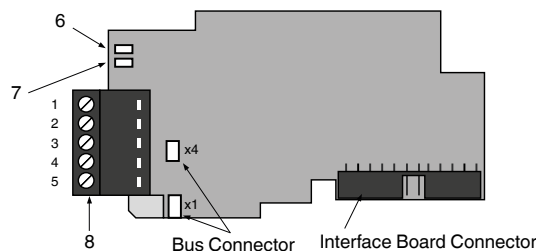
19.2.2 - Compressor speed control

In the same way it is possible to manually control the motor speed: the parameter “Target VFD Speed” can be modified within the limits of the values defined by “VFD Minimum Speed” and “VFD Maximum Speed” on the COMPRESS screen of the ICVC. In this case the machine capacity is controlled by the guide vanes.

19.3 - Gateway communication module status LEDs

The communication status between the ICVC and the variable-frequency drive can be quickly checked with the two status LEDs on the gateway.

Figure 88 - 19XRV Communication gateway



Item	Connections	Description
1	NC	No connection
2	VP	Supply voltage – plus (5 V)
3	RxD/TxD-N	Receive/Transmit data – minus (A)
4	RxD/TxD-P	Receive/Transmit data – plus (A)
5	DGND	Data ground (reference potential for VP)
6	-	Communication board status LED
7	-	Fieldbus status LED
8	-	Jumpers

Communication board status LED (6): Yellow

Status	Description
OFF	Option board not activated.
ON	Option board in initialisation state waiting for activation command from the Adjustable Frequency Drive (AFD)
Blinking fast (once/sec)	Option board is activated and in RUN state. Option board is ready for external communication.
Blinking slow (once/5secs)	Option board is activated and in FAULT state. Internal fault of option board.

Fieldbus status LED (7): Green

Status	Description
OFF	Fieldbus module is waiting for parameters from the AFD No external communication
ON	Fieldbus module is activated Parameters received and module activated Module is waiting for messages from the bus
Blinking fast (once/sec)	Module is activated and receiving messages from the bus
Blinking slow (once/5secs)	Module is in FAULT state No messages from Master within the watchdog time Bus broken, cable loose or Master offline

Jumpers (8):

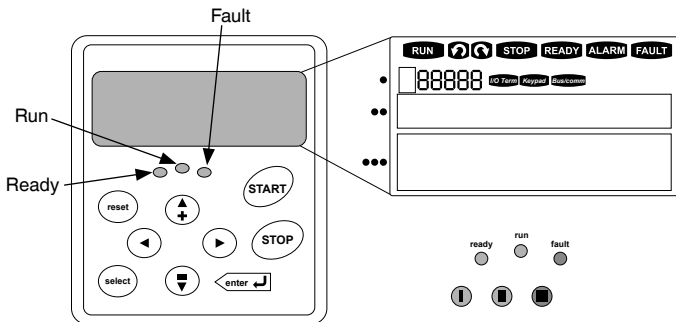
Item	Description
X1	Used to change the current/tension analog inputs.
X2	Used to change the current/tension analog inputs.
X3	Used to change the CMA and CMB grounding.
X4	ON, Terminated: This is the last device on network. OFF, Not Terminated: At least one other network device is connected past this device.
X6	Used to change the current/tension analog outputs.

19.4 - Keypad module status Indicator

The operating status of the variable-frequency drive can be seen on the status LEDs on the front face of the keypad module and status indicators on the screen.

The potentiometer controls must not be modified.

Figure 89 - 19XRV Communication interface board
Location of the keypad module status LEDs and indicator for variable-frequency drives



The drive and keypad module status diagnostics are quickly carried out by checking the corresponding status LEDs:

Color	Status	Description
Green - Ready	Continuous	Lights up with the AC power connected to the drive. Simultaneously, the drive status indicator READY is lit up.
Green - Run	Flashing	Blinks when the STOP button has been pushed and the drive is ramping down.
	Continuous	Lights up when the drive is running.
Red - Fault	Continuous	Lights up when unsafe operating conditions were encountered due to which the drive was stopped (Fault Trip). Simultaneously, the drive status indicator FAULT blinks on the display and the fault description can be seen.

The drive and keypad module status diagnostics can also be made by checking of the following status Indicators:

Indicator	Status	Description
	Flashing	The stop command has been given but the frequency is still ramping down.
	Continuous	Motor is running
	Continuous	Indicates the direction of motor rotation.
	Continuous	Indicates that the drive is not running.
	Continuous	Lights up when AC power is on. In case of a trip, the symbol will not light up.
	Continuous	Indicates that the drive is running outside a certain limit and a warning is given.
	Continuous	Indicates that unsafe operating conditions were encountered due to which the drive was stopped.

In case of fault, the keypad module displays its number, name and type. There are four type of fault defined in the table below:

Type of fault	Description
A (Alarm)	This type of fault is a sign of an unusual operating condition. It does not cause the drive to stop, nor does it require any special actions. The "A fault" remains in the display for about 30 seconds.
F (Fault)	An "F fault" makes the drive stop. Actions need to be taken to restart the drive.
AR (Fault Autoreset)	If an "AR fault" occurs the drive will stop immediately. The fault is reset automatically and the drive tries to restart the motor. Finally, if the restart is not successful, a fault trip (FT, see below) occurs.
FT (Fault Trip)	If the drive is unable to restart the motor after an AR fault an FT fault occurs. The "FT fault" has basically the same effect as the F fault: the drive is stopped.

19.5 - Safety shutdowns and cuts

19.5.1 - Safety shutdown

The controlled safety shutdowns initiate a decreasing voltage/frequency ramp until the motor shuts down.

In addition to shutdowns initiated as standard by the machine, certain specific component faults are likely to lead to a safety shutdown, if a variable-frequency drive as used:

- Variable-frequency drive power fault
- Variable-frequency drive overheating.

The faults detected in the variable-frequency drive can be checked on the VFD_HIST screen of the ICVC.

19.5.2 - Emergency stop by the circuit breaker/main disconnect switch

The emergency shutdown immediately opens the circuit breaker/main disconnect switch. It can be initiated by certain internal fault conditions at the variable-frequency drive. Overvoltage faults on the power bus and earth current leaks detected by the variable-frequency drive lead to an emergency shutdown.

19.5.3 - Safety pressure switch cut-out

The opening of the safety pressure switch leads to the appearance of an "External fault", the drive and the motor shuts down immediately.

20 - 19XRV PIC III - MAINTENANCE

Safety consideration reminder: For the access conditions to the variable-frequency drive control box refer to chapter 1 of this document.

20.1 - Special precautions during maintenance

20.1.1 - Isolation check

The voltages applied during tests with the unit energised (isolation and dielectric) can damage the variable-frequency drive.

When the motor isolation is checked, the power supply conductors between the motor and the variable-frequency drive must be disconnected.

20.1.2 - Disassembly and replacement of components in the variable-frequency drive cabinet

Disassembly and replacement operations of parts in the variable-frequency drive cabinet must be carried out by a Carrier technician officially authorised and qualified to do this work. This instruction must be observed to ensure that the warranty conditions for the variable-frequency drive are valid.

All connectors used on the electronic boards of the power module are equipped with locks. Disconnection must be easy by activating the unlocking mechanism.

20.2 - Periodic maintenance

20.2.1 - Standard maintenance

The normal maintenance operations for electrical equipment apply:

- Re-tightening of the electrical connections
- Elimination of dust
- Checking for signs of localised overheating.

20.2.2 - Variable-frequency drive cooling line

The variable-frequency drive cooling line includes a filter that must be replaced once a year. This frequency can be increased depending on the condition of the filter. Replacement is carried out after closing the isolation valves of the cooling line.

20.2.3 - Protection devices

Faults that occur on the functional components of the variable-frequency drive cabinet are normally detected by the control. For each reported fault, the diagnosis, the possible causes and the corrective actions required are described in the controls manual.

It is however not possible to obtain a fault report for the destruction of the surge limiter (F). Verification of this component is required at each periodic maintenance visit.

APPENDIX C: PARTICULARS OF 19XR UNITS WITH INTEGRATED PROGRESSIVE ELECTRONIC STARTER

21 - 19XR UNIT MOUNTED SOFTSTARTER: MAINTENANCE SAFETY CONSIDERATIONS

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 authorised 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: *The electronic starters that are used for the 19XR control boxes normally have a delta connection (square root of three installation). Depending on the wiring, voltage is present at all motor terminals if the main disconnect switch for the control box is in the ON position.*

22 - EQUIPMENT PRESENTATION

22.1 - Environmental conditions

The operating and storage conditions are as those described for the standard machine.

The machines must be installed inside the building. Control boxes are protected against water projections to IP44 in accordance with standard IEC60529-1: They are protected against accidental and exceptional water projections from any direction, without pressure.

22.2 - CE marking

The 19XRV electrical equipment is designed to ensure machine conformity with all applicable European directives:

- Machinery directive 98/37/EC modified and low-voltage directive 2006/90/EC:

The electrical equipment is designed and integrated in accordance with the recommendations of European standard EN60204-1

- European directive 2004/108/EEC (Electromagnetic compatibility):

Conformity is assured by application of generic standards 61000-6-2 and 61000-6-4 that apply to industrial applications.

22.3 - Description of electrical equipment elements

The standard components in the PIC control box and the optional equipment present to ensure compressor start-up and supply are located in a single control box.

The PIC control equipment includes (identified in accordance with the references on the wiring diagram):

- The internal control circuit transformer (TC1) and the oil heater (TC2) transformer
- The CCM control module (A3) or IOB board if PIC 5
- The interface control screen HMI (A2).
- The compressor control and protection module ISM (A1): It controls compressor start and stop, as well as electrical and non-electrical protection devices:
 - Monitoring of the current drawn: overcharge, imbalance, leak current.
 - Voltage monitoring: phase order, imbalance, over-/undervoltage, micro cut-outs, etc.
 - It also ensures fault information reporting to the PIC control: Starter, safety pressure switch, oil pump operation.
- The oil pump (KM81) and heater (KM66) changeover contactors.
- The short-circuit protection breakers (QF).

The power equipment includes the following operational elements:

- The circuit breaker/main disconnect switch QF101 for the following functions:
 - Short-circuit protection at the main circuit
 - Isolation and shut-down of the machine, using the handle on the outside of the control box
 - Emergency stop initiated by the PIC control.
- The electronic Siemens starter 3RW44 (GS1) that ensures functions, such as:
 - Compressor start and stop using voltage/frequency ramping, permitting limitation of torque and current draw at start-up
 - Overheat or overcharge auto-protection
 - Status report via dry contacts: ON/OFF, fault.
- The interface relay between the PIC power and control equipment: start-up (K1), emergency cut-out (TRIP), fault reporting (K4 ; K2).
- The emergency cut-out circuit transformer (TC4).
- The emergency cut-out relay (CTRL) in case of 115 V power supply failure at the ISM board.
- The cooling fans of the control box (EV) regulated by thermostat ST91.

For details and the component location in the control box refer to the wiring diagram supplied with the machine.

22.4 - Soft starter operation

Compressor start and stop are controlled by the ISM (1CR 24.3.1 - Unit rigging output).

When the start-up command is received, the starter controls the power thyristors to initiate the power supply to the motor. The voltage reduction obtained by chopping is controlled by the starter to maintain the current at the value configured in the starter.

ATTENTION: *If the limited current is configured at a value that is too low, the mechanical torque supplied by the motor does not allow it to start. It remains in the locked rotor condition: the compressor does not start and the PIC control generates an alarm.*

At the end of the start-up process, an internal bypass contactor at the starter is closed: The thyristors no longer have power supply; the power supply to the motor is at full voltage.

When shutting down, thyristors are again used to reduce the motor voltage, until the motor is stopped.

22.5 - Control box cooling

The control box includes fans to keep the temperature inside below a value of 50 °C, that is used for the selection of the electrical components. The fans are controlled by an internal thermostat.

22.6 - Electrical specifications

Assigned conditional short-circuit current	Max. machine RLA*
Start-up current	330% of max. motor RLA by default**
Power supply frequency	50 Hz (± 2 Hz)
Voltage variation range around the nominal value in continuous operation	-10% to +10%
Maximum voltage drop during starting i.e. 85% of the nominal voltage set	15% over 2 seconds
Electromagnetic emission rate (installation in an industrial environment)	61000-6-4
Electromagnetic immunity rate (installation in an industrial environment)	61000-6-2

* RLA value set at the machine PIC control and corresponding to the RLA of the unit selection fiche.

** or taken from the operating current values "Ie" and the current limitation "xIe" set in the starter.

23 - INSTALLATION INSTRUCTIONS AND ELECTRICAL CONNECTION

23.1 - Introduction

The electrical equipment is integrated, wired, pre-configured and tested at the factory. On-site installation includes the connection of customer auxiliary and communication power supply cables, as well as configuration parameter adjustment specific to the installation site.

23.2 - Receiving the machine

During storage the machine must be protected against humidity and dust. Specifically, the machine must not be placed outside, exposed to the weather.

23.3 - Physical data

23.3.1 - Unit rigging

ATTENTION: *The control box must not be used as a machine rigging point.*

The 19XR/19XRV machine rigging points on units with a starter are the same as those for the standard machine.

23.3.2 - weight and dimensions

The weight of 19XR/19XRV machines with a starter is the same as that of standard machines plus the weight of the additional material to ensure the progressive start-up function:

Additional machine weight (add to the weight of the standard machine)				
Max motor RLA range, A	< 440	440 < < 630	630 < < 1350	1350 <
Compressor sizes	2 and 3	3 and 4	4 and 5	5
Control box weight, kg	200	220	290	330

The height of 19XR/19XRV machines with a starter is increased compared to the standard machine without a starter:

Modified machine dimensions for the electrical equipment	
Heat exchanger size	Height C, mm
Size 3	2130
Size 4	2300
Size 5	2480
Size 6	2580
Size 7	2980
Size 8	3020

23.4 - Location of connection points and interfaces

Refer to the dimensional drawings supplied with the machine.

23.5 - Electrical connections

23.5.1 - Power wiring connections

The units have only one power connection point.

Cable sizing is the responsibility of the installer and must comply with the characteristics and regulations specific to each installation site. The connections supplied as standard for the incoming customer power cables on the circuit breaker/main disconnect switch are designed to receive the number of conductors defined in the table below.

Max. motor RLA range, A	Connectable number of connectors by phase
<250	X1
250< <450	X2
450< < 800	X3
1350<	X4

The connections are made on power rails drilled with holes to take connectors with diameters M8, M10 or M12, depending on the machine capacity.

Before connecting the power cables (L1 - L2 - L3), ensure that the sequence is correct.

23.5.2 - Control wiring connections on site

For the site control wiring of the following elements refer to the controls manual and the certified wiring diagram supplied with the unit:

On the CCM board:

- Remote set point reset (4-20 mA), J5-3/4 CCM
- Demand limiter, J5-1/2 CCM.

On the IOB board if PIC 5:

- Autowater temp reset (4-20 mA), IOB3 J15-5/11
- Autodemand limit (4-20 mA), IOB3 J15-3/9

On the ISM board:

- Alarm report, J9-16/15
- Machine power consumption, J8-1/2
- Ice storage contact, J2-3/4
- Safety shut-down, J2-1/2
- Chilled-water temperature reset, J5-3/4
- Evaporator hydronic pump control (obligatory), J9-7/8
- Condenser hydronic pump control, J9-9/10.
- On the terminal strip:
- Remote start/stop button, 31/32
- Operation report, 130/131
- High-pressure control valve control and supply, 1A/1B; 1C/1D
- Remote control, 31/32.

23.6 - Equipment details 24.6.1 - Isolation

SAFETY CONSIDERATION REMINDER: Disconnect the power supply before working on the control box.

The circuit breaker/main disconnect switch allows isolation of the complete electrical equipment from its power supply with the exception of the power conductor connection terminals for the installation.

IMPORTANT: Disconnecting the power equipment using the handle of disconnect switch QF101 also disconnects the control equipment and power supply to the oil pump.

To prevent compressor lubrication problems, do not switch off the machine using the disconnect switch, if the compressor is still energised.

23.6.1 - “Square root of three” installation and access to the motor terminals

In 400 V applications the starter is normally installed in a delta branch of the compressor power supply circuit. This configuration allows reducing the value of the current that passes through the starter by a factor of $\sqrt{3}$.

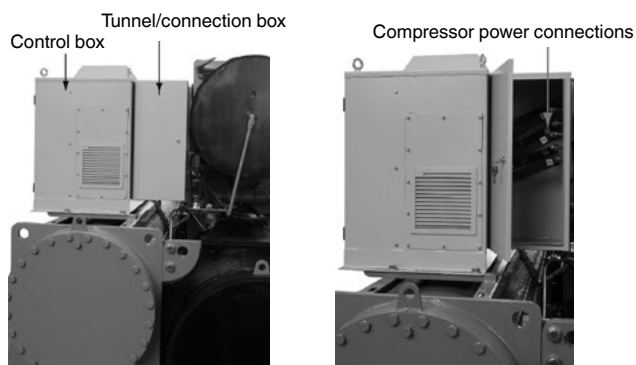
With this type of wiring, if the power supply is not disconnected and the motor is de-energised, there is always voltage present at the electrical motor terminals.

To warn and prevent people from working on the unit, a locking system with a captive key is used to access the motor terminals.

Access to the compressor terminals:

The control box element between the main control box and the compressor is locked by a key. The key becomes captive in the door, when this is open. Once the door is closed again, the key must be put back in its place on the door with the handle to operate the main machine switch. The control box door cannot be closed and the disconnect switch is again locked when the key has been put back in its place.

Figure 90 - Access to the motor terminals



Example of the internal safety system



24 - BEFORE THE INITIAL START-UP

24.1 - Wiring and installation inspection

For these checks the circuit breaker/disconnect switch of the VFD control box must be in the open position.

ATTENTION: Isolation using the main disconnect switch does not disconnect the voltage to the power conductor connection terminals in the power supply to the machine.

Check the electrical connections: tightening torques and connector tightening on the electronic boards.

Checking the starter in the installation:

- The nominal current and capacity data for the starter must be in accordance with the data calculated for the machine in the application. If the starter is installed in a delta branch of the motor (square root of three installation), verification is done by a comparison with the operating current of the starter multiplied by $\sqrt{3}$.
- Check that the voltage at the power connection terminals of the machine complies with that on the component name plates.

24.2 - Start-up checks

24.2.1 - energising the PIC control circuits and the crankcase heater

The circuit breaker/disconnect switch QF101 and disconnect switch QF1 must be closed to carry out the following checks on these circuits. The checks are the same as those for the standard machine.

25.2.2 - Check the starter configuration

The starter configuration is set at the factory. It can be checked and modified on the starter interface using the four navigation keys:

OK	To select the menu, modify the value or register the parameters.
▲▼	To navigate in the menu or modify the values.
ESC	To exit the current menu and pass to the next higher menu.

The control procedure is described below with the default parameter settings from the factory.

BEFORE ANY INTERVENTION: Authorise and lock access to the advanced parameters:

Setting 1 - Display language

RW44/MENU/SETTING/SELECT/DISPLAY SETTING/CHANGE/ENGLISH + CONFIRM OK

Setting 2 - Enter the motor parameters

RW44/MENU/SETTINGS/PAR. SET 1/MOTOR 1

Setting	To be set to
Enter user code	1000 or 1001

* RLA set at the machine PIC control and corresponding to the RLA of the machine selection card.

Setting 3 – Start-up

RW44/MENU/SETTINGS/PAR.SET 1/STARTING SETTINGS

Setting	To be set to
Starting mode	Voltage ramp + current limiting
Start voltage	50%
Starting time	5 seconds
Maximum starting time	10 seconds
Current limite value	330 x RLA max/le*
Breakaway voltage	80%
Breakaway time	0 ms

* RLA max is the value on the compressor name plate, "le" is the value defined for setting 2.

Setting 4 – Inputs

RW44/MENU/SETTINGS/INPUTS

Setting	To be set to
Input 1 - Action	Motor right PS1
Input 2 – Action	No action
Input 3 – Action	No action
Input 4 – Action	Trip reset

Setting 4 – Outputs

RW44/MENU/SETTINGS/OUTPUTS

Setting	To be set to
Output 1 - Action	On time motor
Output 2 – Action	Operation/bypass
Output 3 – Action	Group warning

Setting 6 – Motor protection

RW44/MENU/SETTINGS/MOTOR PROTECTION

Setting	To be set to
Tripping class	CLASS 10
Current asymmetry limit value	50%
Prewarning limit tripping reserve	0 ms
Prewarning limit motor heat build-up	95%
Idle time	Deactivated
Pre-charge time	60 s
Protection against voltage failure	Yes
Temperature sensor	Deactivated
Accept	Yes

Setting 9 – Control save settings

RW44/MENU/SETTINGS/SAVING OPTIONS

Setting	To be set to
Save settings	OK
Accept	Yes

Notes about the control values

- The parameter for the start-up current limitation can be slightly adjusted, if required: Refer to chapter 26.2.
- The starter is equipped with motor protection functions that are not used: motor protection is controlled by the PIC control. The starter parameter controls are adjusted to ensure that the PIC control has priority for the motor protection.

24.3 - PIC control checks

24.3.1 - Parameter setting

The standard machine parameter setting applies. For the list of all parameters and their default values please refer to the PIC III Controls IOM.

24.3.2 - Function test (quick test)

The standard machine tests apply.

25 - INITIAL START-UP

25.1 - Motor rotation check

The verification procedure for the standard machine must be used. If the phases are reversed it is possible that the starter detects the fault before the PIC control. In this case an alarm indicating a rotation fault will appear on the starter and not on the PIC control. The order of the phases connected to the starter needs to be reversed.

25.2 - Compressor start-up and starter control adjustment

When the compressor is started up, the starter controls the voltage applied to maintain the configured current (see chapters 23.4 and 25.2.2).

The current limitation value set as the default is selected to ensure certain motor starting. This value can be reduced during the first start-up by adjusting the current limitation value parameter configured in the starter:

- It is recommended not to reduce the parameter to a value that corresponds to less than 45% of the LRDA motor current.

- Motor start-up must be immediate, without any howling noise that indicates that motor rotation was not initiated.
- Measuring the start-up current must confirm that the effective start-up time is not more than five seconds.

26 - OPERATION

26.1 - Machine shut-down

Machine shut-down is controlled in the same way as for the standard machine.

When the compressor shuts down, the oil pump ensures post lubrication.

Do not manually shut down the machine using the main disconnect switch or by any method that is likely to also result in shutting down the PIC control circuit and the oil pump power supply.

Only emergency shut-downs initiated by the machine control must be used to carry out this type of shut-down.

26.2 - Fault diagnosis

If the factory-set parameters are kept, the starter is not likely to generate motor protection alarms. These are generated by and can be checked on the PIC control.

Internal starter fault and faults relating to its power supply and control circuit are however generated at starter level. In this case a fault information is reported to the PIC control.

A “STARTER FAULT” indicates the problem on the PIC display. The diagnosis must now be made by consulting the messages displayed on the starter screen. Refer to the manual for starter 3RW44.

NOTE: An emergency shut-down initiated by the PIC control will automatically generate a starter fault, indicating voltage loss at the main power circuit.

26.3 - Reset after a fault

Starter input 4 (reset) is connected in parallel with input 1 (start command). In this way the starter faults must be re-initialized at each start-up demand. If this automatic reset does not work, it may be necessary to carry out a manual reset:

1. Disconnect inputs IN1 and IN4 at the starter.
2. Install a jumper between terminals L+ and IN4 of the soft starter.
3. Apply power and check on the display that the alarm has disappeared.
4. Disconnect the jumper installed in step 2 - then reconnect inputs IN1 and IN4 at the starter.

27 - MAINTENANCE

27.1 - Isolation check

The voltages applied during tests with the unit energised (isolation and dielectric) can damage the starter.

When the motor isolation is checked, the power supply conductors between the motor and the starter must be disconnected.

27.2 - Periodic maintenance

The normal maintenance operations for electrical equipment apply:

- Re-tightening of the electrical connections
- Elimination of dust

Checking for signs of localised overheating



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