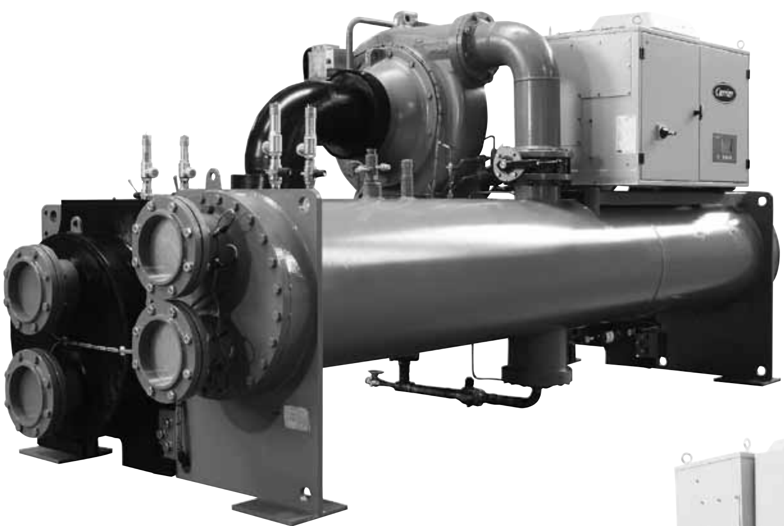
Carrier®

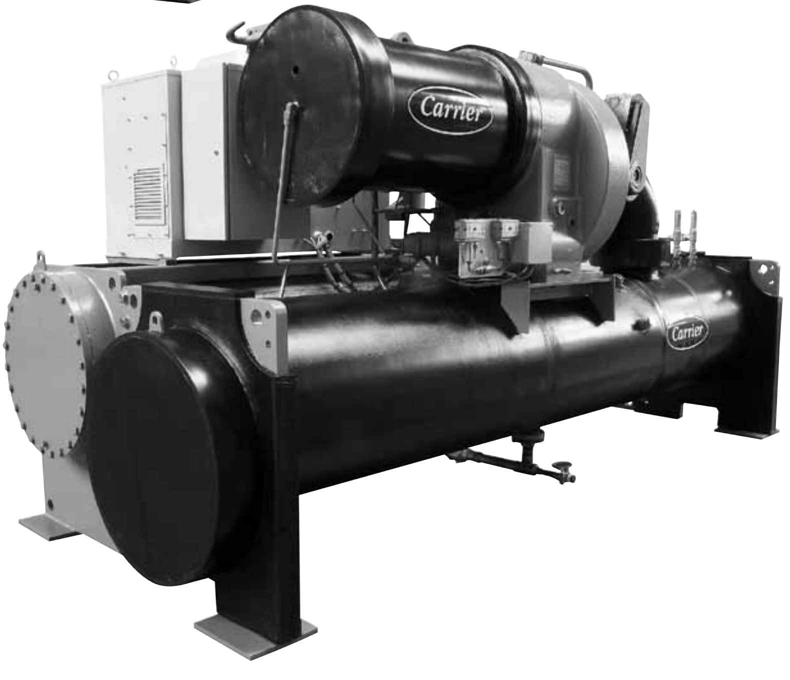
19XR PIC II/19XRV PIC III

Hermetic Centrifugal Liquid Chillers

Nominal cooling capacity 1000 - 5300 kW

50 Hz





Installation, operation and maintenance instructions

ISO9001 · ISO14001

Quality and Environment Management Systems Approval

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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:
1. Machine installation instructions 19XR Yes/No ________
2. Machine assembly, wiring and piping diagrams Yes/No ________
3. Starting equipment details and wiring diagrams Yes/No ________
4. Applicable design data (see above) Yes/No ________
5. Diagrams and instructions for special controls Yes/No ________

Initial machine pressure: ____________
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						
Polarization 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 pressurise 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 authorised 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-energised 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): 1300

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 authorised 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	**Minimum**	**Maximum**
Evaporator entering water temperature, °C	7	20
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

- 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.

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

Be aware of electrostatic discharge (static electricity) when handling or making contact with circuit boards or module connections. Always touch a chassis (grounded) part to dissipate body electrostatic charge before working inside control 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) 97/23/EC
- Machinery directive 98/37/EC, 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
CCW	Counterclockwise
CW	Clockwise
ECW	Entering Chilled Water
ECDW	Entering Condenser Water
EMS	Energy Management System
HGBP	Hot Gas Bypass
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 circuit

The ICVC software version number of your 19XR unit will be located on the ICVC 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 below the control box.

2.3.2 - System components

The components include the cooler and condenser heat exchangers in separate vessels, motor-compressor, lubrication package, control centre, and motor starter. 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 - Motor-compressor

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

2.3.2.4 - Control equipment

This includes circuits and automatic controls 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.
- 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 can be installed in a dedicated box or integrated in the starter cabinet.

2.3.2.5 - 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 control equipment and 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 control equipment and the protection and power transmission elements.

2.3.2.6 - 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.

Fig. 1 - Model number nomenclature
(unit reference given an an example)

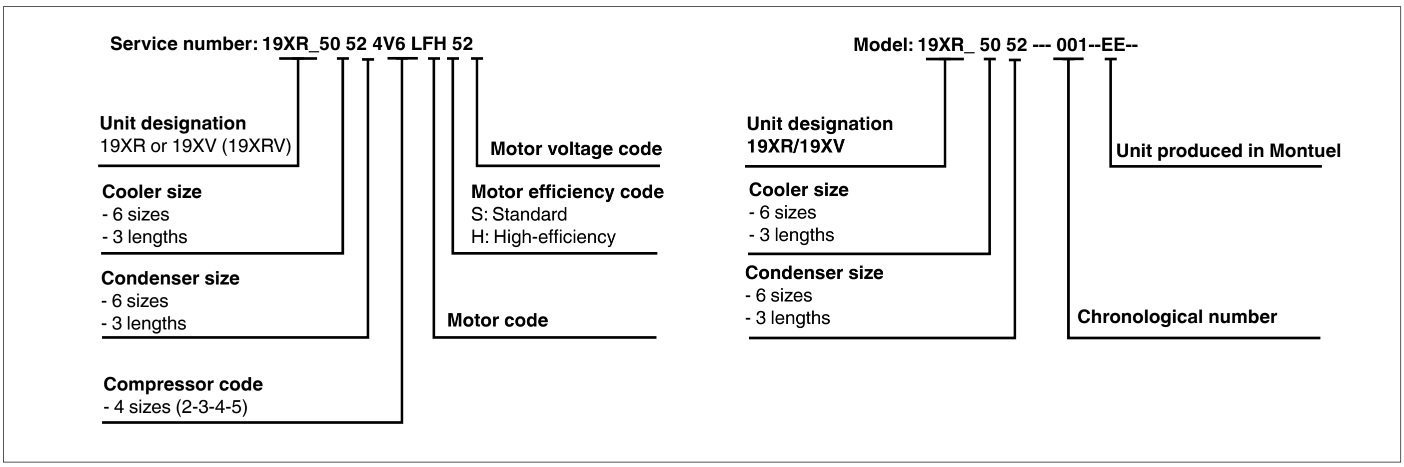
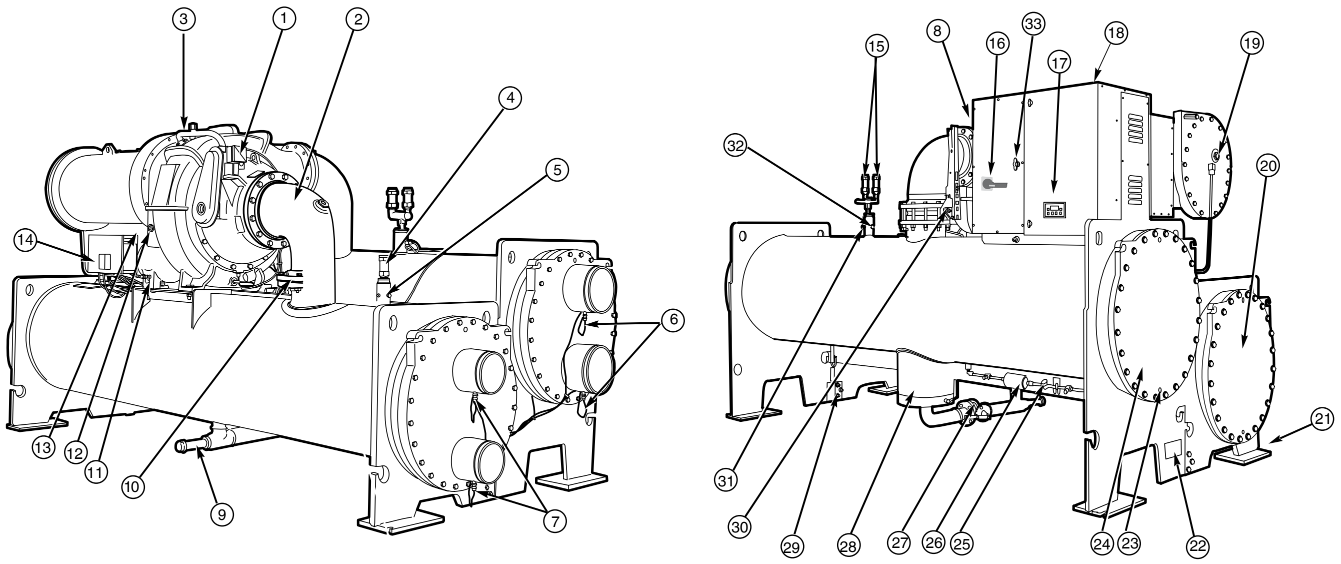


Fig. 2 - 19XR machine components



Front view

1. Guide vane actuator
2. Suction elbow
3. Compressor
4. Cooler valve*
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

* One relief valve is standard. The optional dual relief valves include change-over for each heat exchanger.

Rear view

15. Condenser auto reset relief valves*
16. Circuit breaker/disconnect switch
17. ICVC
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. Vessel take-apart connector
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.

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").

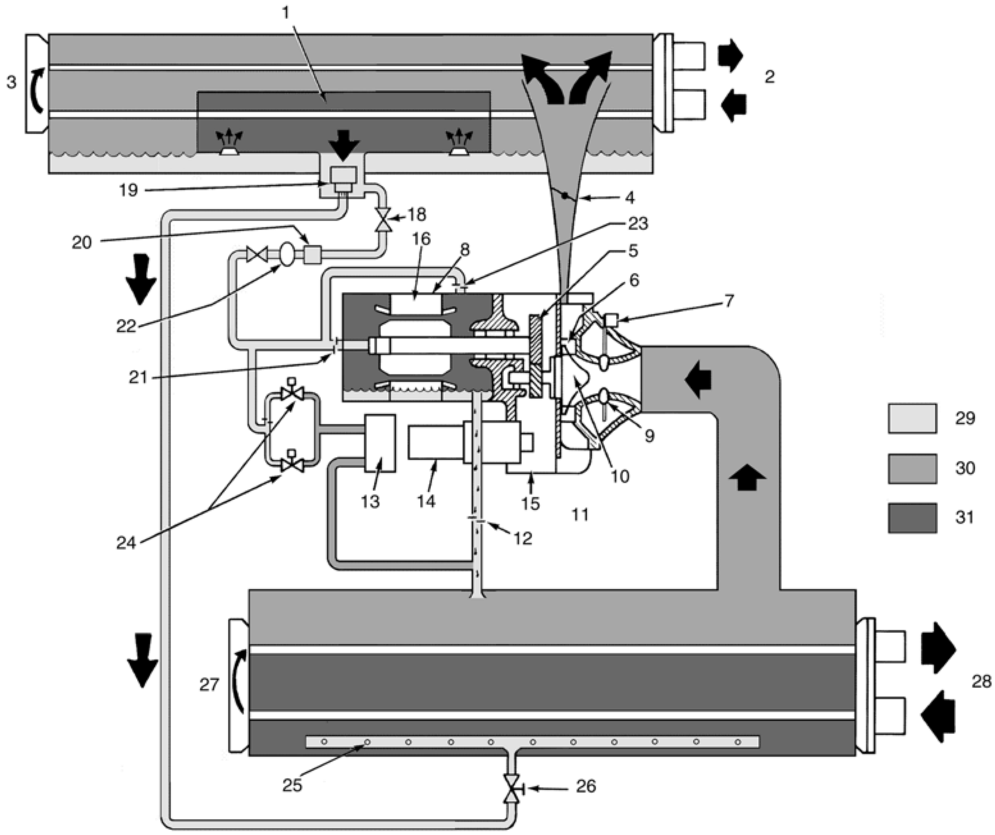
Since the FLASC chamber is at a lower pressure, part of the liquid refrigerant flashes to vapour, thereby cooling the remaining liquid.

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.

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.

Fig. 3 - Typical 19XR unit diagram
(for 19XRV particulars refer to Fig. 48)



1. FLASC chamber
2. Condenser water
3. Condenser
4. Condenser isolation valve
5. Transmission
6. Diffuser
7. Guide vane motor
8. Motor
9. Guide vanes
10. Impeller
11. Compressor
12. Back pressure orifice
13. Oil cooling
14. Oil filter
15. Oil pump
16. Stator
17. Rotor
18. Refrigerant cooling isolation valve
19. Float valve chamber
20. Filter drier
21. Orificed fitting
22. Moisture/flow indicator
23. Orificed fitting
24. Thermostatic expansion valves (TXV)
25. Distribution pipe
26. Cooler isolation valve
27. Evaporator
28. Chilled water
29. Refrigerant liquid
30. Refrigerant vapour
31. Refrigerant liquid/vapour

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.

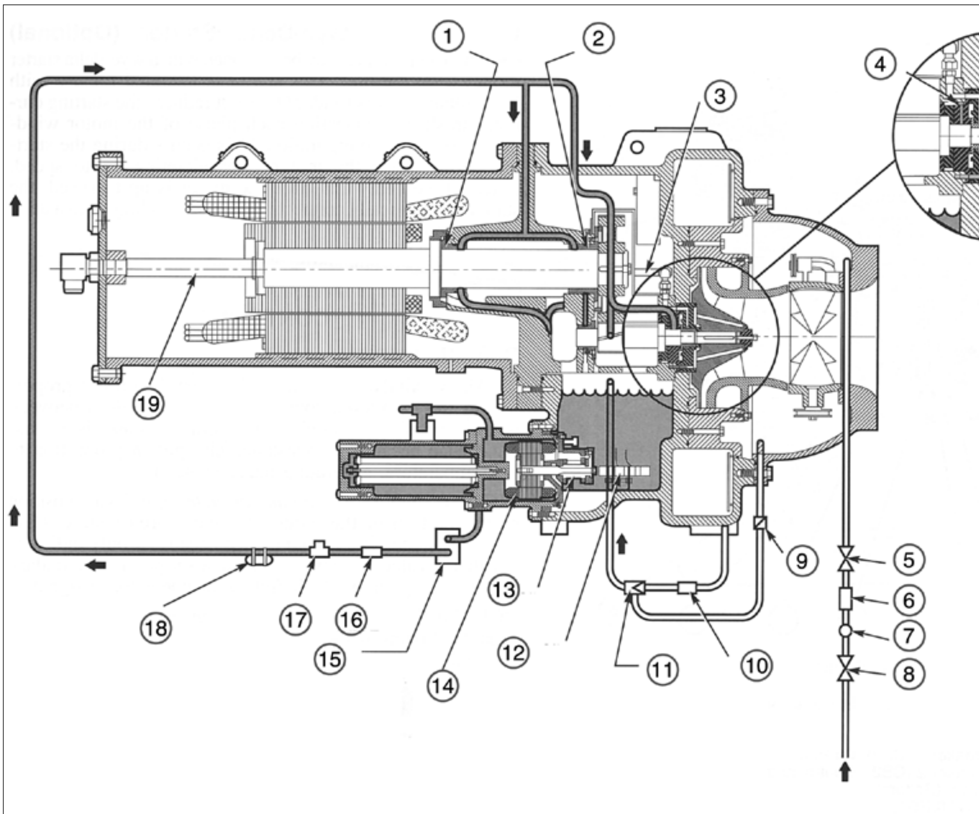
Flow to the motor flows through an orifice and into the motor. Once past the orifice, the refrigerant is directed over the motor by a spray nozzle. The refrigerant collects in the bottom of the motor casing and then is drained back into the cooler through the motor refrigerant drain line.

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.

Fig. 4 - Lubrication system



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. 4 - “Lubrication system”).

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 ICVC 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 ICVC 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 ICVC default screen.

During the chiller start-up, the PIC will energize the oil pump and provide 15 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 post-lubricate after the compressor shuts down. The oil pump can also be energized for testing purposes in the Control Test.

Ramp loading can slow the rate of guide vane opening to minimize 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.

After a power cut of over three hours to the PIC control the oil pump will be energized periodically when the power is restored. This helps to eliminate refrigerant that has migrated to the oil sump during the power failure. The controls will energize the pump for 60 seconds every 30 minutes until the chiller is started.

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.

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 cabinet. It ensures the operation of the PIC command and mainly includes:

- the built-in control circuit transformer
- the CCM module
- the ICVC control screen
- the electrical short-circuit protections.

2.3.7 - Power circuit equipment

The standard power circuit equipment for the power supply, protection and lubrication circuit command is integrated in the same cabinet as the control circuit equipment. It mainly includes:

- the pump and heater converter contactors.
- the electrical short-circuit protections.

The compressor control and protection module (ISM) is also supplied. 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 25a: compressor start-up via electronic starter***
- ***Option 25b: 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.

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 responsibilty of the contractor and/or customer.

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:
  1. Version number
  2. Model number
  3. CE marking
  4. Serial number
  5. Year of manufacture and test date
  6. Refrigerant used and refrigerant class
  7. Refrigerant charge per circuit
  8. Containment fluid to be used
  9. PS: Min./max. allowable pressure (high and low pressure side)
  10. TS: Min./max. allowable temperature (high and low pressure side)
  11. Globe valve cut-out pressure
  12. Pressure switch cut-out pressure
  13. Unit leak test pressure
  14. Voltage, frequency, number of phases
  15. Maximum current drawn
  16. Maximum power input
  17. Unit net weight

		High pressure		Low pressure	
		Min.	Max.	Min.	Max.
PS (see point 9 in the list above)	kPa	-90	1250	-90	1250
TS (see point 10 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

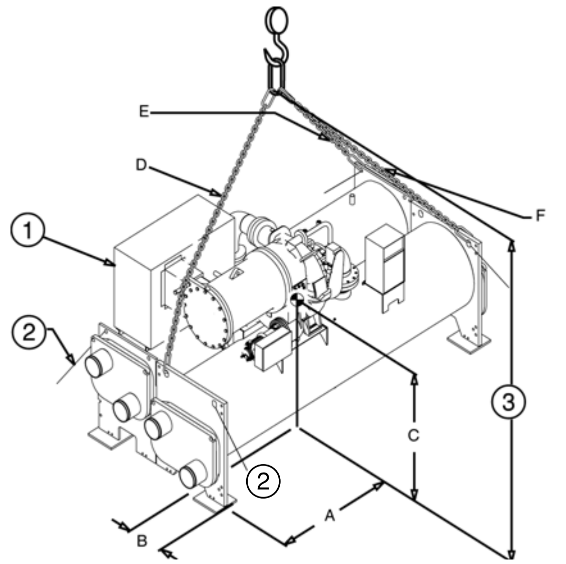
The 19XR machine can be rigged as an entire assembly. It also has flanged connections that allow the compressor, cooler, and condenser sections to be separated and rigged individually.

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. 5 for the machine weights.

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

Fig. 5 - Machine rigging guide



Dimensions in mm
1. Starter cabinet (option)
2. Docking
3. Minimum height above floor: 4570 ⩽ ③ ⩽ 6400

D Chain D (see note 2)
E Chain E (see note 2)
F Chain F (see note 2)

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 lengths shown are typical for 4570 mm lifting height. Some minor adjustment may be required.

Machine code	Compressor size	Maximum weight, kg	Length, ft (m)	Dimensions, mm			Chain length, mm		
				A	B	C	D	E	F
70-72	5	20684	14 (4.3)	1870	1060	1090	3500	3790	3900
75-77	5	22407	16 (4.9)	2115	1069	1070	3640	4030	4130
80-82	5	24900	14 (4.3)	1870	1060	1090	3500	3790	3900
85-87	5	26444	16 (4.9)	2115	1069	1070	3640	4030	4130
70-72	4	18330	14 (4.3)	1990	1021	1041	3500	3790	3900
75-77	4	20053	16 (4.9)	2250	1041	1041	3640	4030	4130

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 Figs. 7 to 10.

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 without power circuit equipment and without starter cabinet (19XR)

Compressor chassis No.	Heat exchanger reference	Without starter cabinet			
		A* kg	B* kg	C* kg	D* kg
3	**30-32**	2653	1338	2517	1701
	35-37	2789	1610	2653	1973
	40-42	3175	1973	3038	2336
	45-47	3356	2177	3220	2540
	50-52	3583	2358	3447	2721
	55-57	3788	2608	3651	2970
4	**40-42**	3583	1973	3447	2336
	45-47	3764	2177	3628	2540
	50-52	3991	2358	3855	2721
	55-57	4195	2608	4059	2970
	60-62	4354	2698	4218	3061
	65-67	4603	2971	4467	3333
	70-72	5715	4172	5578	4535
5	**70-72**	6395	4218	7256	4127
	75-77	6757	4626	7619	4535
	80-82	7483	4989	8345	4898
	85-87	7891	5420	8753	5329

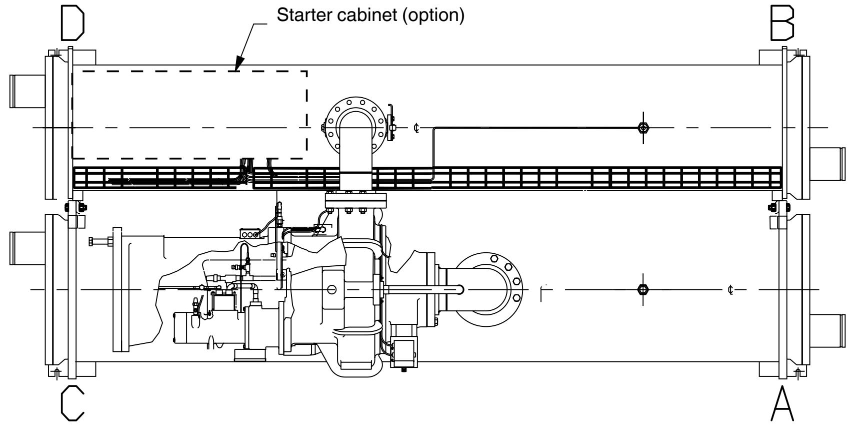
* See Fig. 6

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

NOTE: Weights are approximate and include the weight of the refrigerant, water, nozzle-in-head waterboxes and the thickest pipes.

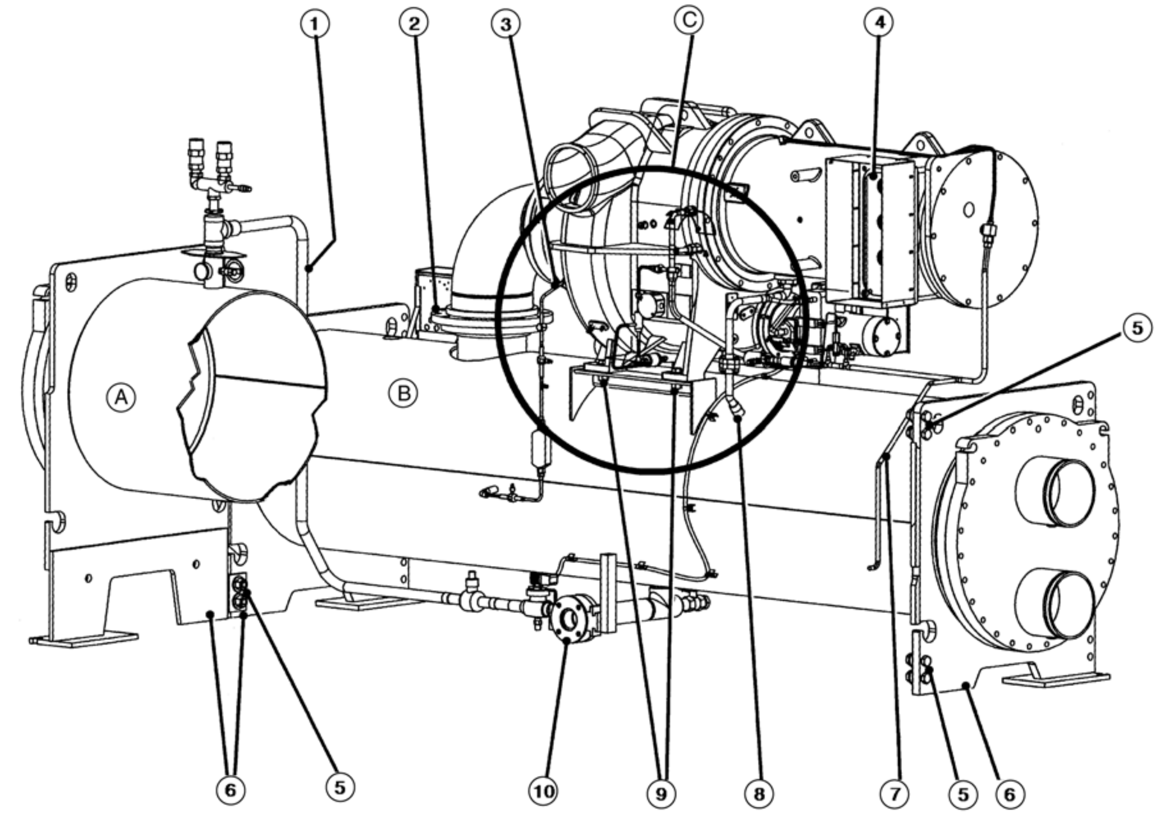
For the 19XRV machines the weight of the power equipment must be added to the net machine weights - please refer to chapter 17.3.

Fig. 6 . Reference diagram, machine operating weights (without starter equipment)



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

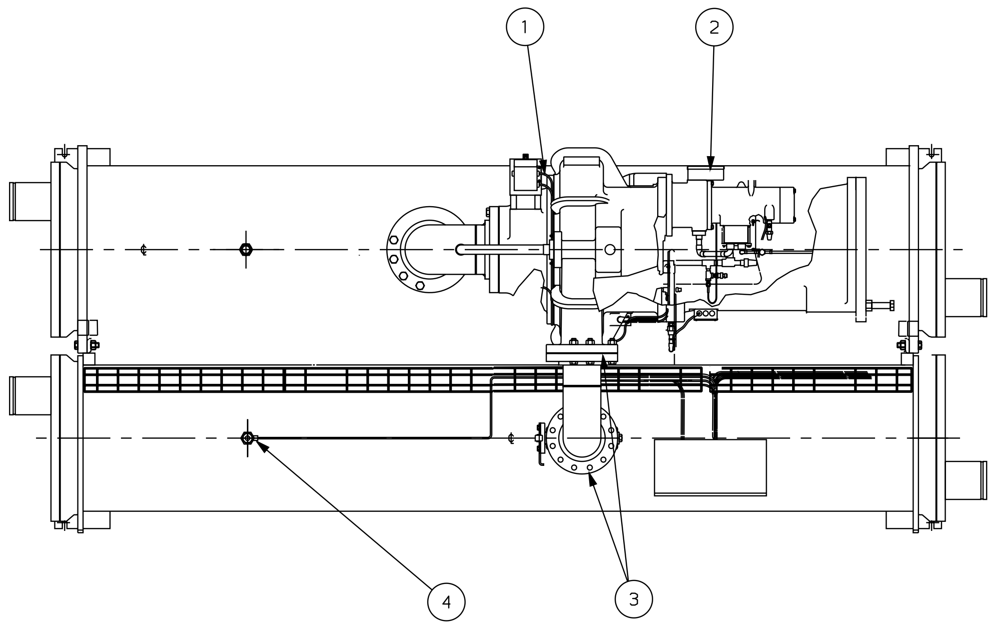
Fig. 7 - 19XR Cooler side view



1. Hot gas bypass (cut)
2. Compressor suction elbow (unbolt)
3. Oil reclaim line
4. Starter connector (unbolt)
5. Heat exchanger assembly (unbolt)
6. Tube sheet
7. Refrigerant motor cooling line (cut)
8. Motor drain
9. Compressor mounting (unbolt)
10. Cooler liquid feed line

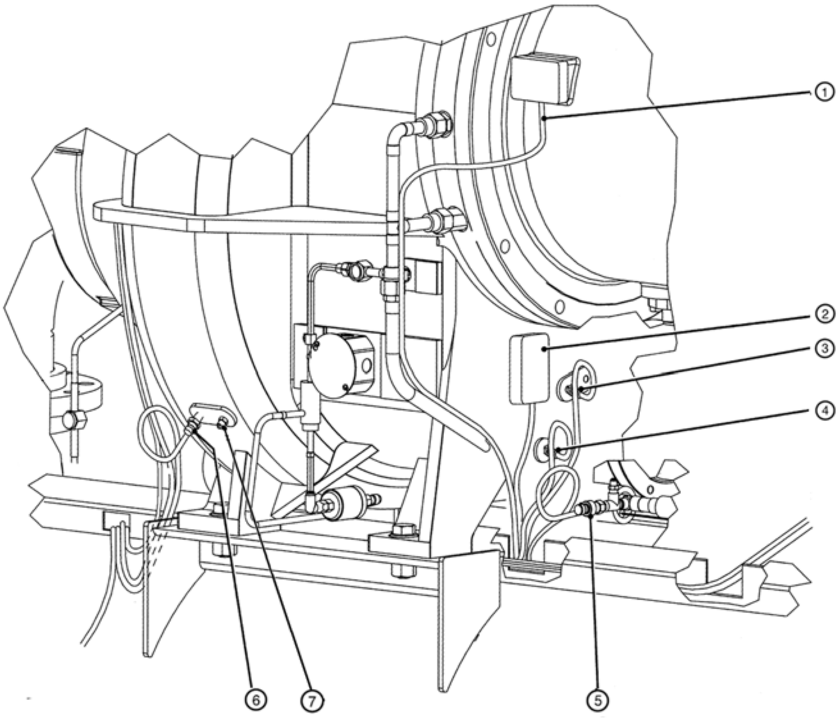
A Condenser
B Cooler
C Compressor

Fig. 8 - 19XR Chiller top view



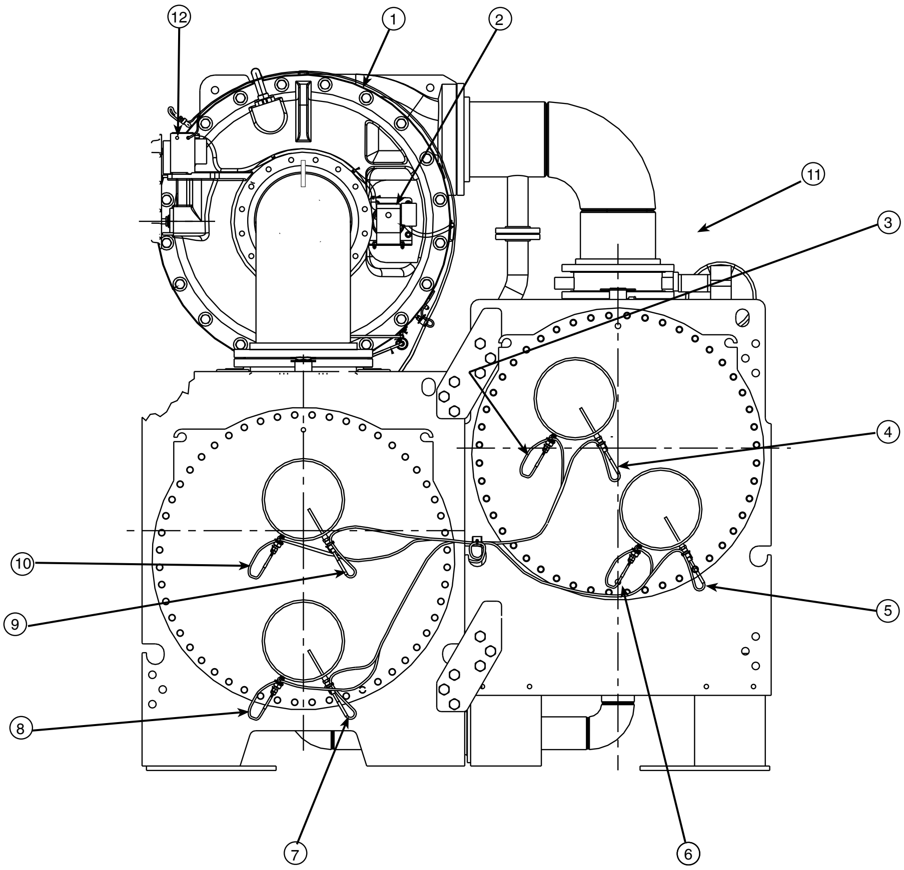
1. Guide vane motor
2. Branch circuit control box
3. Compressor discharge elbow joints
4. Condenser transducer cable

Fig. 9 - 19XR Compressor detail



1. Motor temperature sensor cable
2. Bearing temperature sensor cable connection (inside box)
3. Compressor oil sump pressure cable
4. Compressor oil sump temperature sensor cable
5. Compressor oil discharge pressure cable
6. Discharge temperature sensor cable
7. Connection for high pressurestat (DBK/SDBK)

Fig. 10 - 19XR Rear view



1. Guide vane motor cable
2. Diffuser motor (only XR5 compressor)
3. Condenser leaving water pressure cable
4. Condenser leaving water temperature cable
5. Condenser entering water temperature cable
6. Condenser entering water pressure cable
7. Evaporator entering water temperature cable
8. Evaporator entering water pressure cable
9. Evaporator leaving water temperature cable
10. Evaporator leaving water pressure cable
11. Chiller Visual Control (ICVC)
12. Guide vane motor

3.3.3.2 - Dimensions/clearances

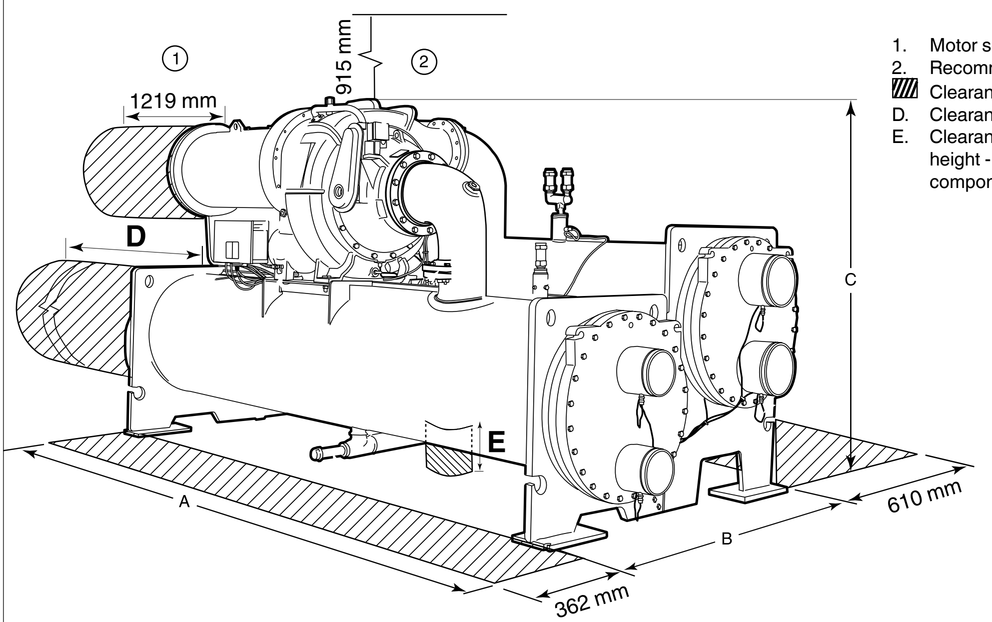
For units with marine waterboxes, please refer to the dimensional drawings supplied with the unit.

	Dimensions (±10 mm)					
Heat exchanger size 19XR	**A (Length with nozzle-in-head waterbox)**		**B (Width except 19XRV)**	**C (Height)*****	**D**	**E******
	2 passes*	**1 or 3 passes****				
30 to 32	4230	4380	1670	2127	3747	250
35 to 37	4754	4904	1670	2127	4278	250
40 to 42	4230	4380	1880	2294	3747	250
45 to 47	4754	4904	1880	2294	4278	250
50 to 52	4230	4380	2054	2781	3754	250
55 to 57	4754	4904	2054	2780	4278	250
60 to 62	4230	4380	2124	2879	3754	250
65 to 67	4754	4904	2124	2878	4280	250
70 to 72	4919	5104	2530	3276	4278	460
75 to 77	5525	5710	2530	3276	4884	460
80 to 82	4919	5104	2530	3343	4278	460
85 to 87	5525	5710	2530	3343	4884	460

19XRV machines: The width (B) and height (C) dimensions may be modified, if the variable frequency drive is used. Please refer to the relevant chapters.

* 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.
*** Size < 50-52: maximum height shown is for units with starter cabinet
Size ≥ 50-52: maximum height shown is for units with high-voltage terminal box
See dimensional drawings for each unit for more details
**** Clearance for float valve variable depending on the unit height - see Fig. 2 - "19XR Machine components", item No. 28.

Fig. 11 - Dimensional drawing



1. Motor service space
2. Recommended clearance above the machine

▨ Clearances required

D. Clearance area for heat exchanger tubes
E. Clearance for float valve, variable depending on the unit height - see chapter 2.3, Fig. 2 "19XR Machine components" - item No. 28.

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*							
Model No.	**Reference**	**1 pass**		**2 passes**		**3 passes**		**Model No.**	**Reference**	**1 pass**		**2 passes**		**3 passes**	
		Min.	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**			**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**
3	**30**	38	154	19	77	13	51	**3**	**30**	41	163	20	81	14	54
	31	46	185	23	92	15	62		**31**	50	199	25	100	17	67
	32	54	215	27	108	18	72		**32**	59	235	29	118	20	79
	35	38	154	19	77	13	51		**35**	41	163	20	81	14	54
	36	46	185	23	92	15	62		**36**	50	199	25	100	17	67
	37	54	215	27	108	18	72		**37**	59	235	29	118	20	79
4	**40**	62	249	31	125	21	83	**4**	**40**	69	277	35	138	23	92
	41	70	281	35	140	23	93		**41**	78	312	39	156	26	104
	42	77	307	38	154	26	112		**42**	86	346	43	173	29	115
	45	62	249	31	125	21	93		**45**	69	277	35	138	23	92
	46	70	281	35	140	23	93		**46**	78	312	39	156	26	104
	47	77	307	38	154	26	112		**47**	86	346	43	173	29	115
5	**50**	83	332	42	166	28	111	**5**	**50**	95	380	48	190	32	127
	51	93	374	47	187	31	125		**51**	104	416	52	208	35	138
	52	100	400	50	200	33	133		**52**	112	450	56	225	37	150
	55	83	332	42	166	28	111		**55**	95	380	48	190	32	127
	56	93	374	47	187	31	125		**56**	104	416	52	208	35	138
	57	100	400	50	200	33	133		**57**	112	450	56	225	37	150
6	**60**	107	429	54	215	36	143	**6**	**60**	121	484	61	242	40	161
	61	115	462	58	231	38	154		**61**	130	519	65	260	43	173
	62	122	488	61	244	41	163		**62**	138	554	69	277	46	185
	65	107	429	54	215	36	143		**65**	121	484	61	242	40	161
	66	115	462	58	231	38	154		**66**	130	519	65	260	43	173
	67	122	488	61	244	41	163		**67**	138	554	69	277	46	185
7	**70**	124	496	62	248	41	165	**7**	**70**	146	583	73	291	49	194
	71	140	560	70	280	47	187		**71**	163	650	81	325	54	217
	72	152	609	76	305	51	203		**72**	178	713	89	356	59	238
	75	124	596	62	248	41	165		**75**	146	583	73	291	49	194
	76	140	560	70	280	47	187		**76**	163	650	81	325	54	217
	77	152	609	76	305	51	203		**77**	178	713	89	356	69	238
8	**80**	140	562	70	281	47	187	**8**	**80**	185	740	92	370	62	247
	81	174	695	87	347	58	232		**81**	202	807	101	404	67	269
	82	188	752	94	376	63	251		**82**	219	874	109	437	73	291
	85	160	639	80	320	53	213		**85**	185	740	92	370	62	247
	86	174	695	87	347	58	232		**86**	202	807	101	404	67	269
	87	188	752	94	376	63	251		**87**	219	874	109	437	73	291

* 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

Figs. 12 and 13 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 Figs. 14 and 15.

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, pre-mixed, 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.

Fig. 12 - Standard isolation

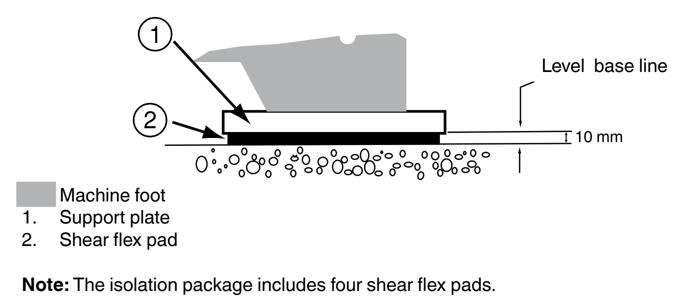
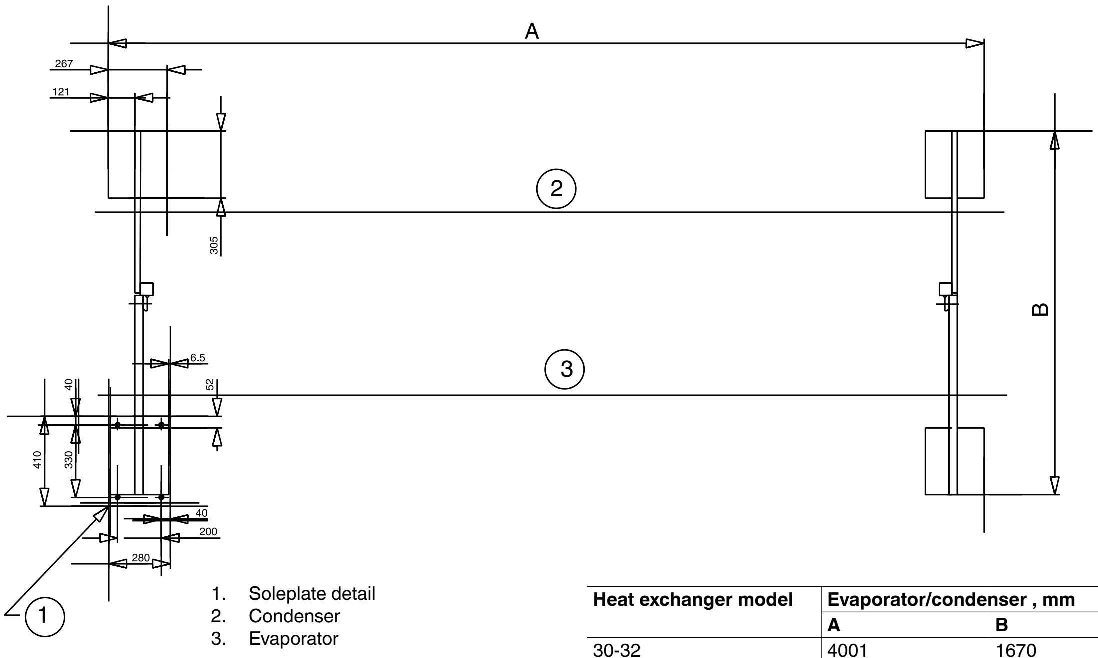


Fig. 13 - 19XR Chiller footprint



Heat exchanger model	Evaporator/condenser , mm	
	A	B
30-32	4001	1670
35-37	4525	1670
40-42	4001	1880
45-47	4525	1880
50-52	4001	1994
55-57	4525	1994
60-62	4001	2096
65-67	4525	2096
70-72	4620	2426
75-77	5229	2426
80-82	4620	2711
85-87	5229	2711

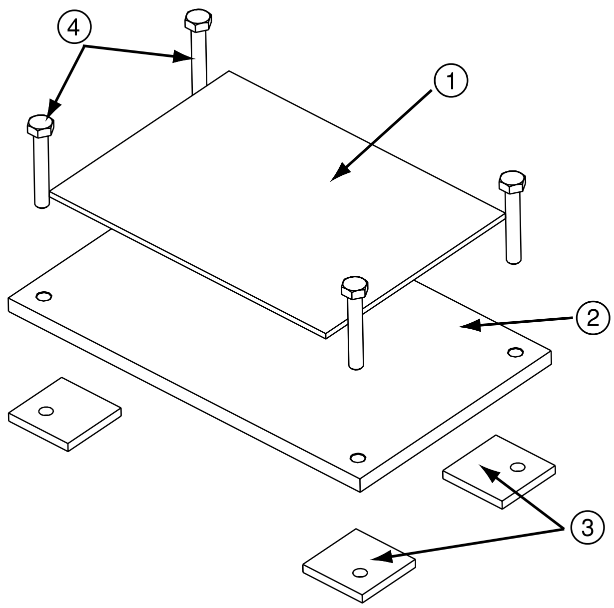
3.4.3 - Install spring isolation

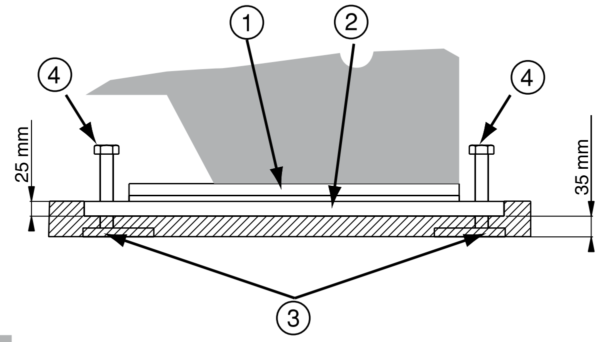
Spring isolation may be purchased as an accessory from Carrier for field installation. It may also be field supplied and installed.

Spring isolators may be placed directly under machine support plates or located under machine soleplates. See Fig. 15 - “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.

Fig. 14 - Levelling accessory for 19XR units





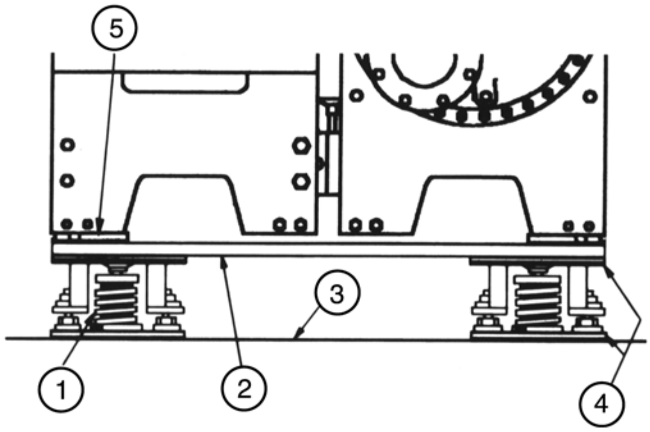
Machine foot (side view)
System base (concrete)

1. Anti-vibration platform
2. Soleplate
3. Adjusting pads
4. Adjusting screws

Note: Accessory (Carrier supplied, field-installed) soleplate package includes 4 anti-vibration platforms/soleplates, 16 adjusting screws and levelling pads.

Thickness of grout will vary, depending on the amount necessary to level chiller. Use only pre-mixed non-shrinking grout. Celcote HT-648 or Master Builders 636, 38 to 57 mm thick.

Fig. 15 - 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. 17 - “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 analysed 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. 16 - “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.

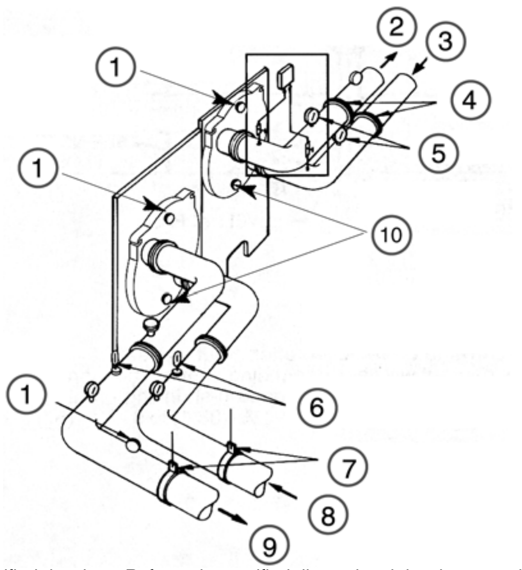
Remove chilled and condenser water sensors and probes before welding connecting piping to the connections. Refer to Fig. 10 - “19XR Rear view”. Replace sensors and probes after welding is complete.

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. 16.

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 Figs. 18 and 19.

Fig. 16 - Typical nozzle piping (not supplied by Carrier)



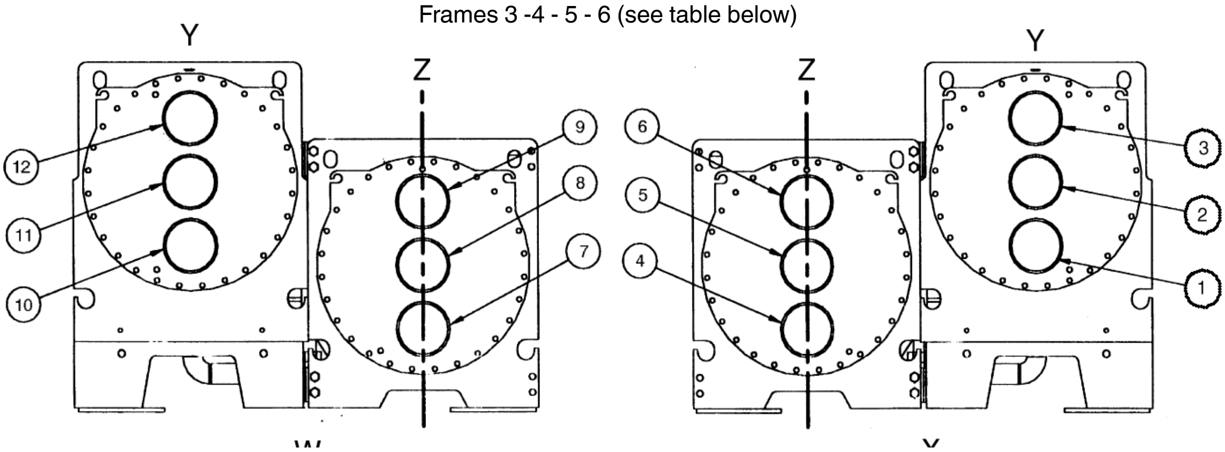
1. Air vent
2. Leaving condenser water
3. Entering condenser water
4. Isolation valve
5. Pressure gauges
6. Thermometer openings (optional)
7. Pipe hangers
8. Entering chilled water
9. Leaving chilled water
10. Water drain

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

Fig. 17 - Standard waterboxes and nozzle arrangements (19XR)

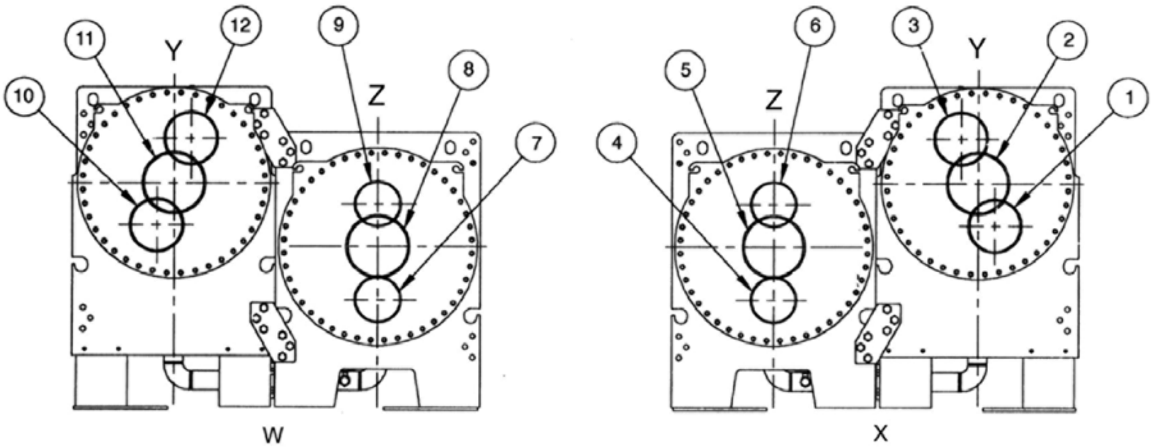
Nozzle arrangements - nozzle-in-head waterboxes (19XR)

Frames 3 -4 - 5 - 6 (see table below)



W Drive end
X Compressor end
Y Condenser
Z Evaporator

Frames 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.

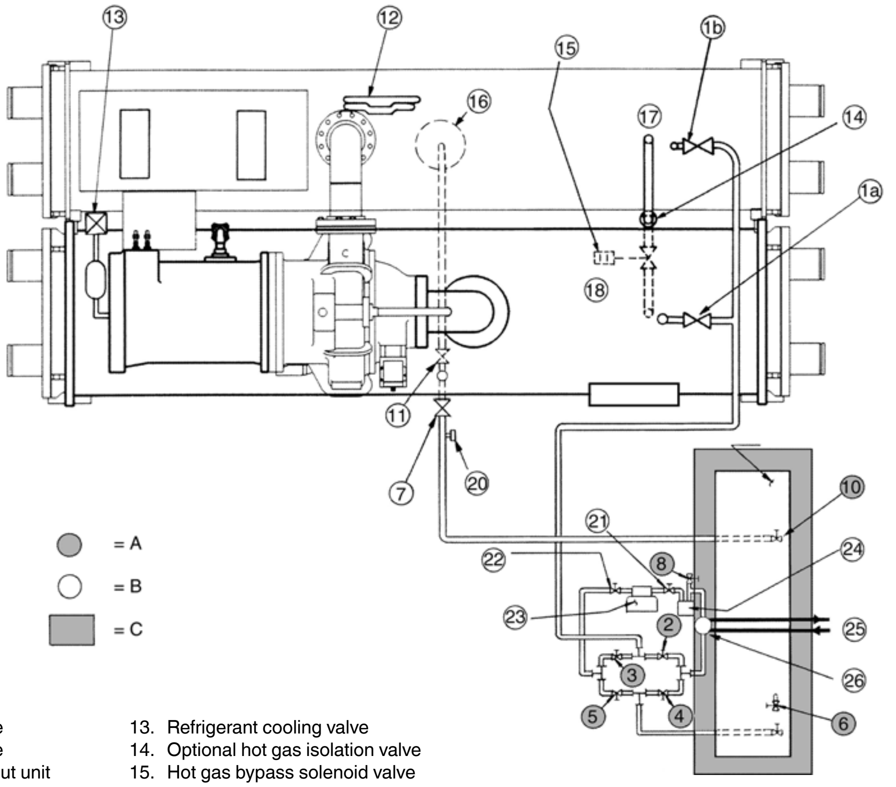
Nozzle arrangement codes for all standard nozzle-in-head waterboxes

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

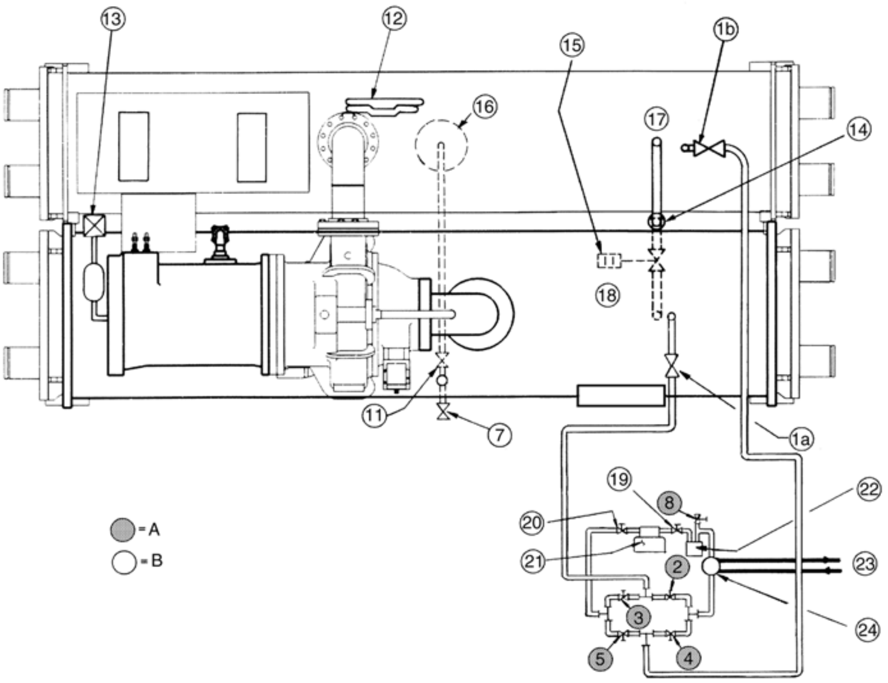
ATTENTION: For marine waterboxes, please refer to the dimensional drawings supplied with the machine.

Fig. 18 - Optional pumpout system piping schematic with storage tank



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

Fig. 19 - Pumpout system piping schematic without storage tank



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

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

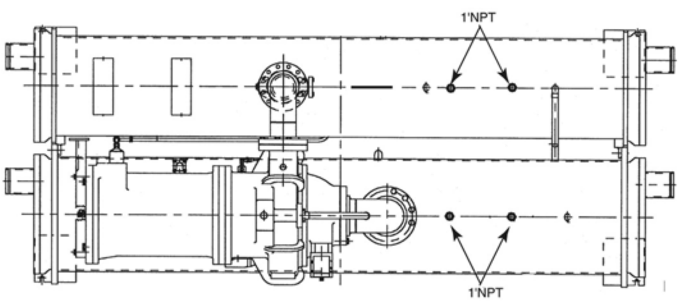
If a safety valve is replaced, do not leave the machine without safety valves. Only remove the safety valve, if the risk of fire is completely controlled and under the responsibility of the user. Only one safety valve at a time must be removed and replaced so that fire protection is maintained during 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.***

Fig. 20 - 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.

Connect control inputs. For details about the remote control wiring refer to the chapter for the relevant starter type used.

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 drice (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/($\sqrt{3}$ 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 (optional), 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.

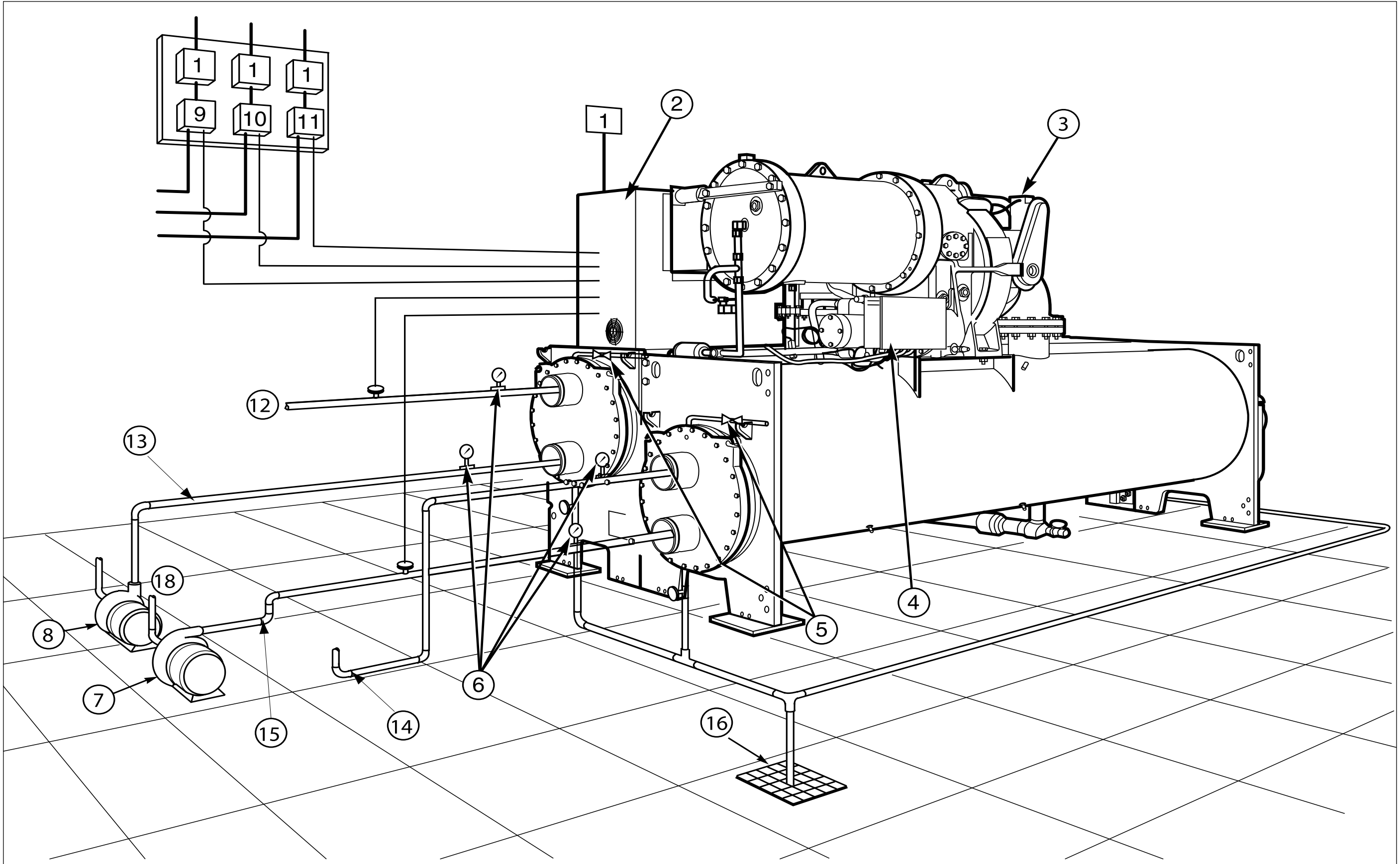
1. The operating environment for the 19XR units is specified below:
   Environment* Environment as classified in IEC 60364 § 3:
   - ambient temperature range: +5°C to +40°C, class AA4*
   - humidity range (non-condensing)*:
     50% relative humidity at 40°C
     90% relative humidity at 20°C
   - altitude: ≤ 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.

Fig. 21 - 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

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:

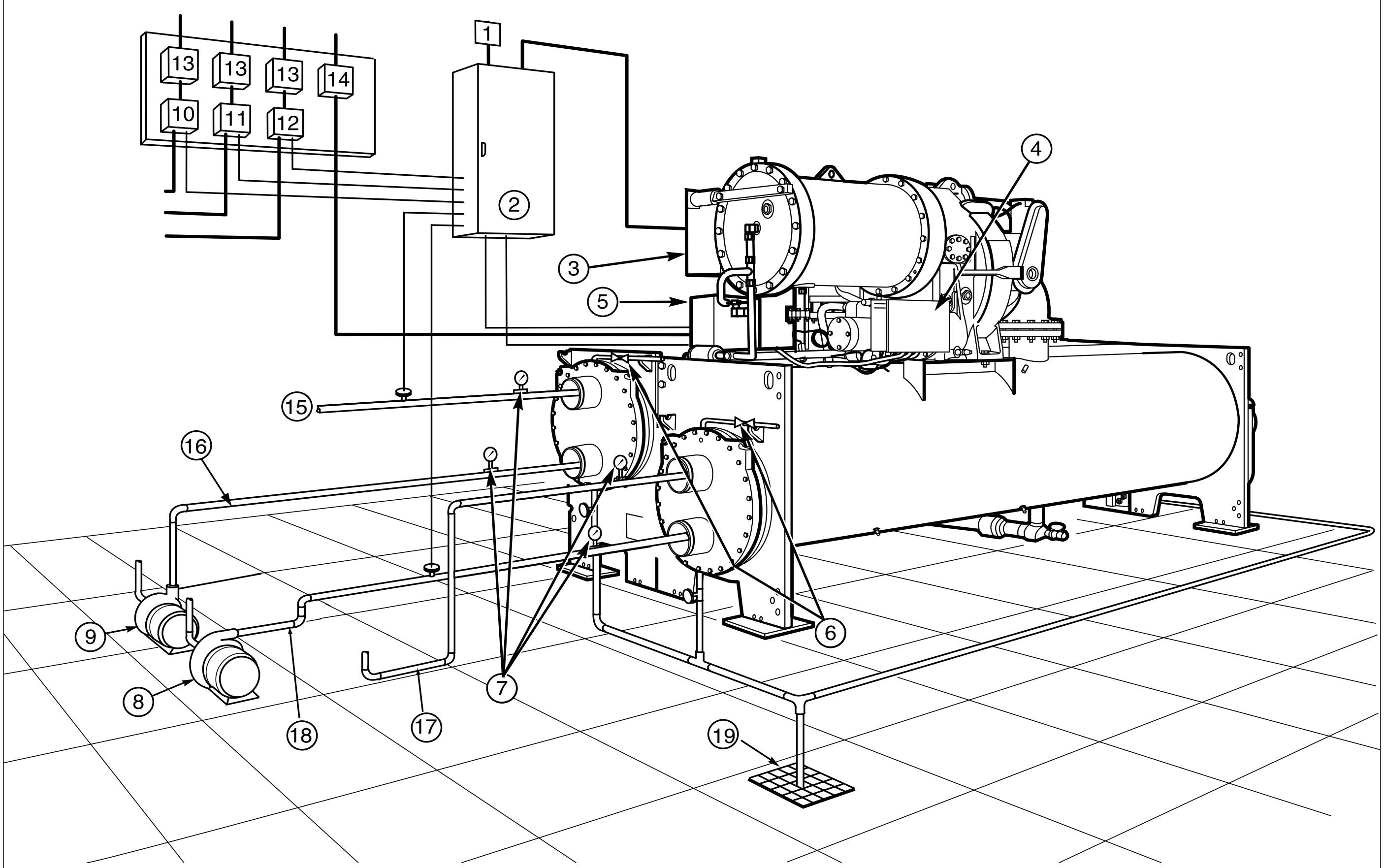
1. ***Wiring and piping shown are for general point-of-connection only and are not intended to show details for a specific installation. Certified field wiring and dimensional diagrams are available on request.***
2. ***All wiring must comply with applicable codes.***
3. ***Refer to Carrier System Design 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***

3.6.6.2 - Freestanding, field-installed starter

The starters must be designed and manufactured in accordance with applicable regulations. Fig. 22 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).

Fig. 22 - Unit with separate starter/variable-frequency drive



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

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, (independent 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. 23 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. 22).

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.

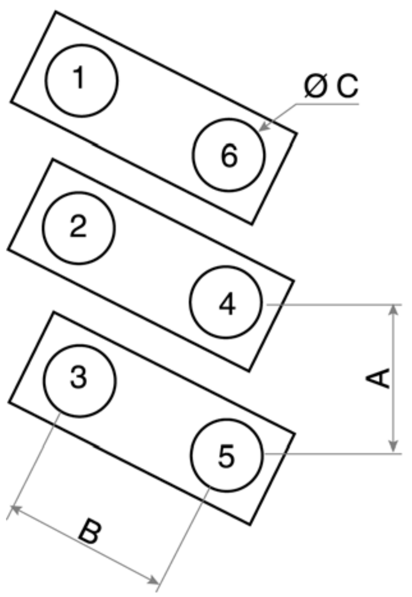
When connecting the CCN communication bus to a system element, a colour code system for the entire network is recommended to simplify installation and checkout. The following colour code is recommended:

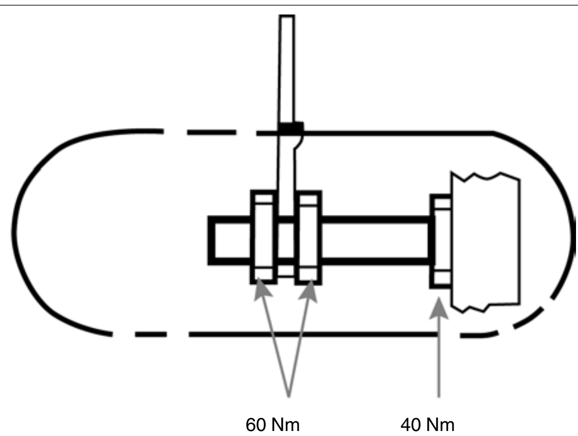
Signal type*	ICVC connector	CCN Bus conductor insulation colour
+	1	Red
Ground	2	White
-	3	Black

* 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.

Fig. 23 - 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 lightning 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 (refer to Fig. 24):

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

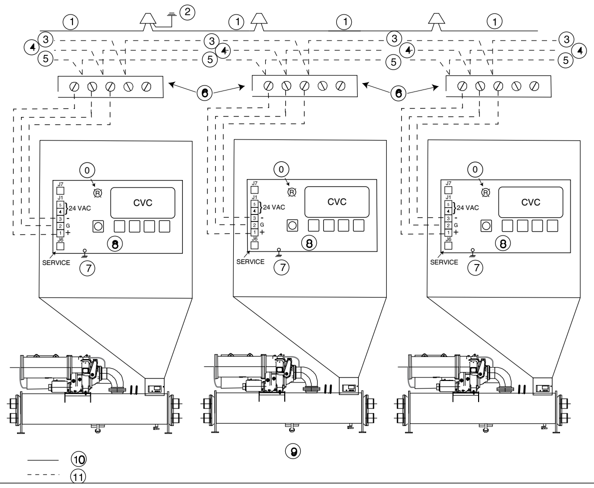
See Fig. 25 - "Machine isolation".

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:

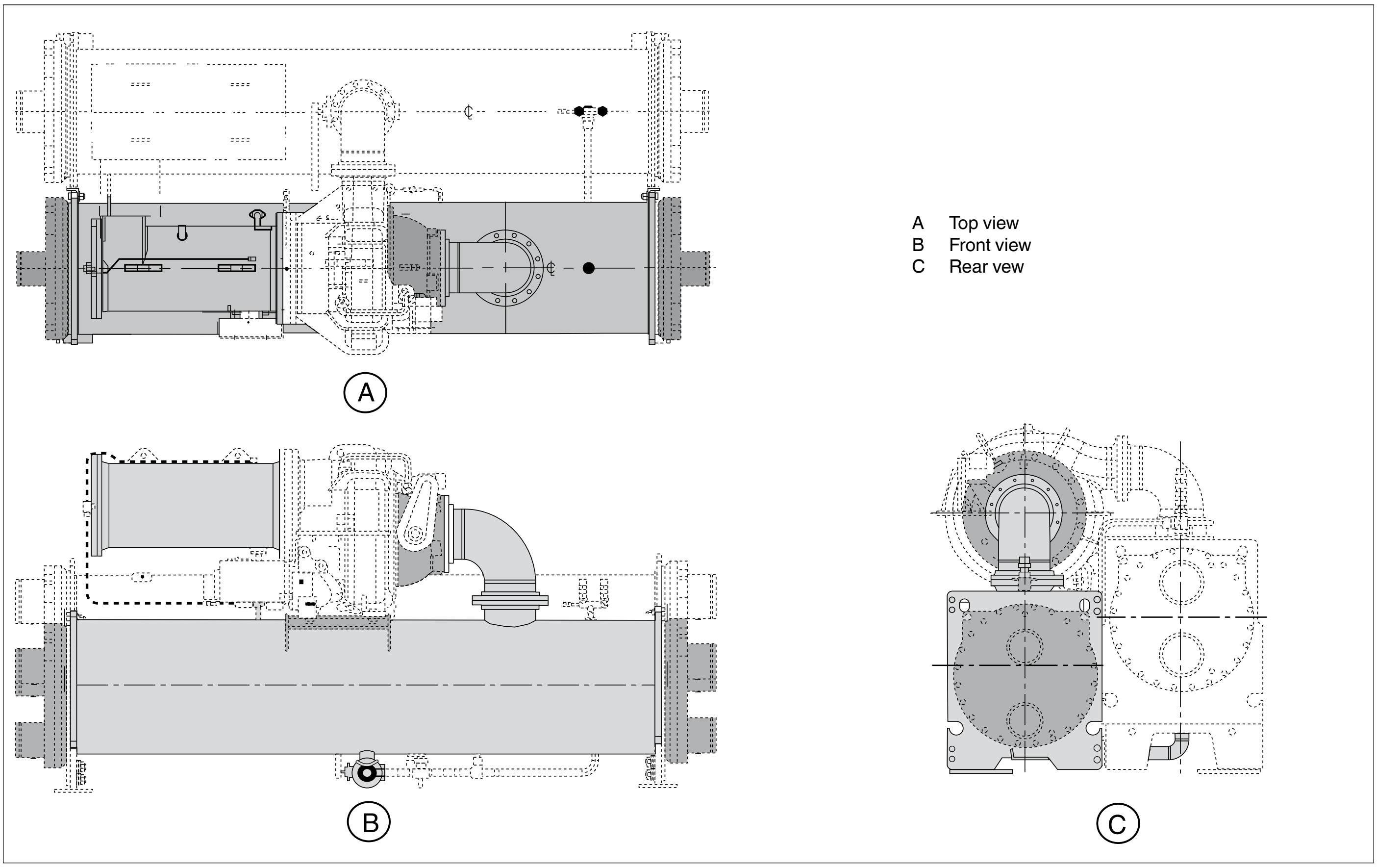
- compressor motor
- cooler shell
- cooler tube sheets
- suction elbow
- motor cooling drain
- oil reclaim piping
- plate heat exchanger refrigerant side tubing
- refrigerant liquid line to cooler
- suction chamber waterbox covers

Fig. 24 - COMM1 CCN communication wiring for multiple 19XR chillers (typical)



0. Alarm
1. Ground wire
2. Ground
3. Black
4. White
5. Red
6. Terminal strip
7. Chassis ground
8. Chiller Visual Control ICVC
9. 19XR chillers
10. Factory-wiring
11. Field-wiring

Fig. 25 - 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. 26), that is conncted to a sensor located between the two heat exchangers at the middle point of the unit (see Fig. 27). This sensor is encased and attached to a fixing bracket mounted between the oil balancing line and its fixing support (see Fig. 28).

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 ICVC. The access is via MENU/SERVICE/EQUIPMENT SERVICE/SELECT/OPTIONS. The default value is 20 mA, regulated at 6 mA.

If the sensor detects refrigerant in the air, the refrigerant leak detection alarm (No. 250) is relayed and displayed on the ICVC. 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. 29).

3.8.3 - Adding the module to an installed chiller

Carrier offers a referigerant 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.

The kit consists of the following parts:

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

Fig. 26 - View of module in the control box

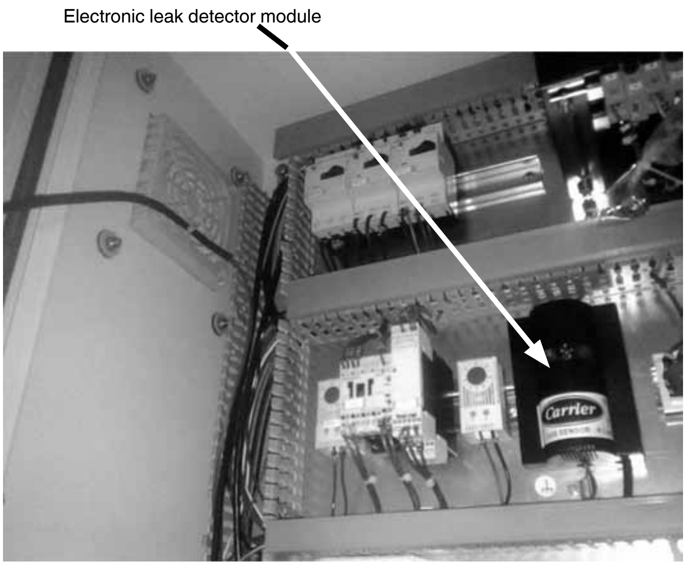


Fig. 27 - Detector support fixing

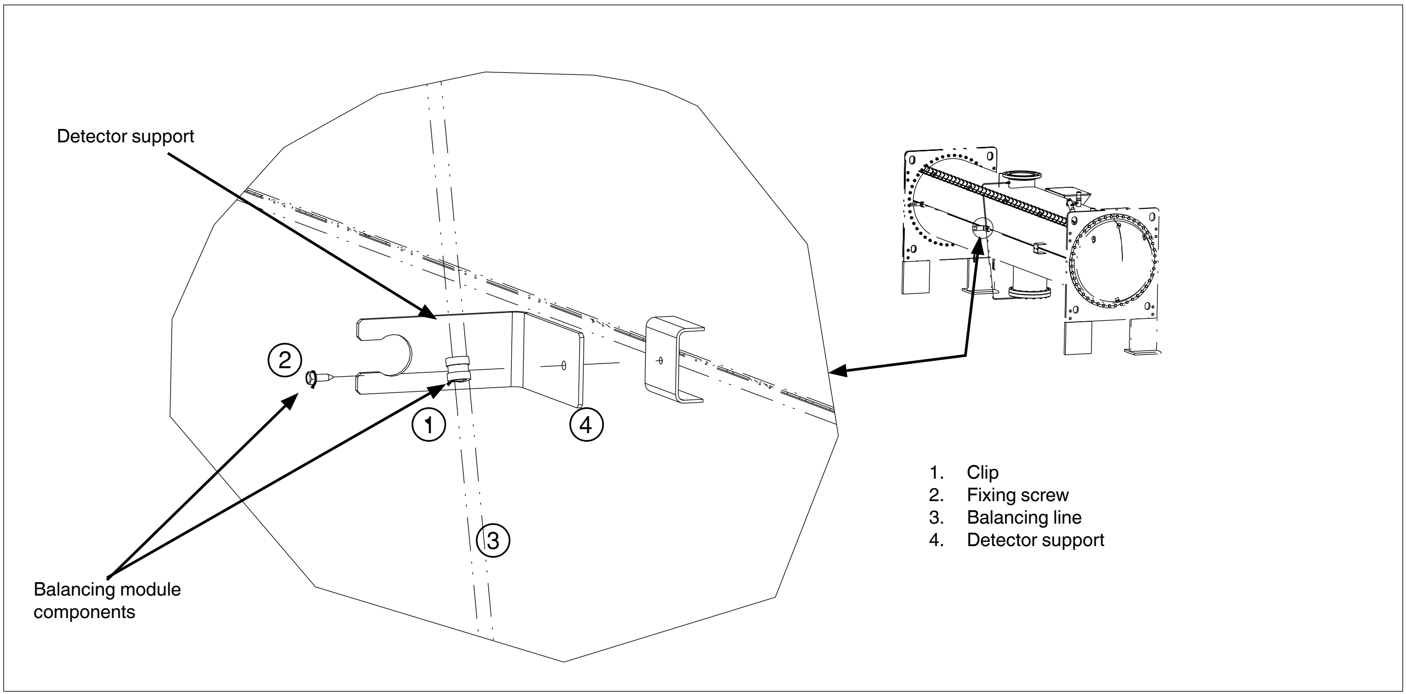


Fig. 28 - Detector fixing

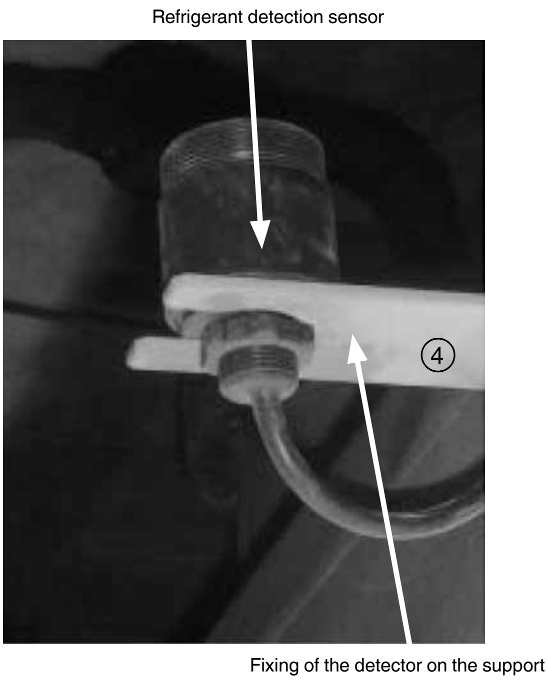
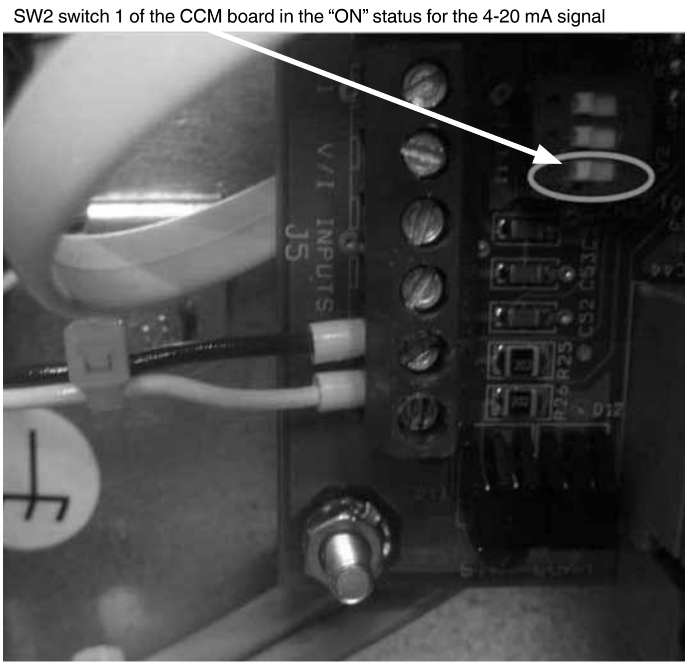


Fig. 29 - Changing SW2 switch 1



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 detailled 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. 4 - "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.

Do not introduce any significant static or dynamic pressure into the heat exchange circuit (with regard to the design operating pressures).

Before any start-up verify that the heat exchange fluid is compatible with the materials and the water circuit coating.

In case additives or other fluids than those recommended by Carrier are used, ensure that the fluids are not considered as a gas, and that they belong to class 2, as defined in directive 97/23/EC.

Carrier recommendations on heat exchange fluids:
- No NH^{4+} ammonium ions in the water, they are very detrimental for copper. This is one of the most important factors for the operating life of copper piping. A content of several tenths of mg/l will badly corrode the copper over time.
- Cl^- Chloride ions are detrimental for copper with a risk of perforations by corrosion by puncture. If possible keep below 10 mg/l.
- SO_4^{2-} sulphate ions can cause perforating corrosion, if their content is above 30 mg/l.
- No fluoride ions (<0.1 mg/l).
- No Fe^{2+} and Fe^{3+} ions with non negligible levels of dissolved oxygen must be present. Dissolved iron < 5 mg/l with dissolved oxygen < 5 mg/l.
- Dissolved silicon: silicon 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 Figs. 18 and 19.

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. 31.

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 pressurized. 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 pressurize 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 4.12 "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 outlined 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.
   b. If the leakage rate exceeds 0.17 kPa in 24 hours, repressurize the vessel and test for leaks. If refrigerant is available in the other vessel, pressurize 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.

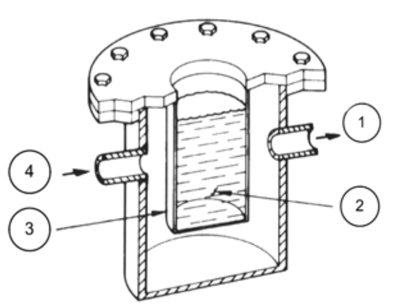
WARNING: Do not start or megohm-test the compressor motor or oil pump motor, even for a rotation check, if the chiller is under dehydration vacuum. Insulation breakdown and severe damage may result.

Dehydration is readily accomplished at room temperatures. Use of a cold trap (see Fig. 30 - "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:

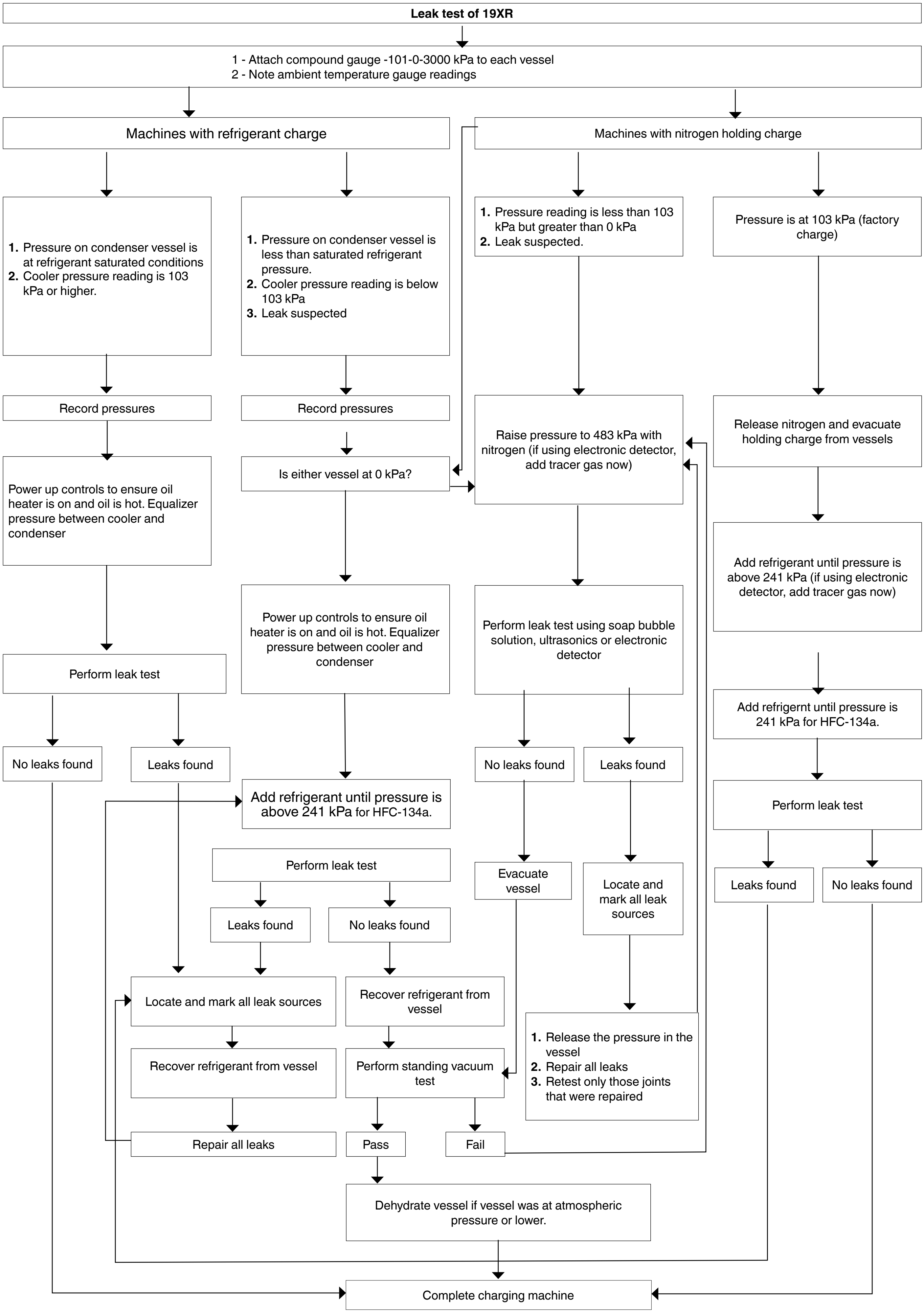
1. Connect a high-capacity dehydration pump (0.002 m^3/s or larger is recommended) to the refrigerant charging valve. Tubing from the pump to the chiller should be as short and as large a diameter as possible to provide least resistance to gas flow.
2. Use an absolute pressure manometer or a wet bulb 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 equalization 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 (sublimination) 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.

Fig. 30 - Dehydration cold trap



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

Fig. 31 - 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 CCM modules.
6. The bus cable between the CCM 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 19XR compressor holds approximately 30 l of oil for frame 3 compressors; 38 l of oil for frame 4 compressors and 67.8 l for frame 5 compressors. 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 - "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 energizing controls. A circuit breaker in the starter energizes the oil heater and the control circuit. When first powered, the ICVC should display the default screen within a short period of time.

The oil heater is energized by powering the control circuit. This should be done several hours before start-up to minimize 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 Status02 table on the ICVC. Oil sump temperature can be viewed on the ICVC default screen.

4.8 - 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 holddown 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 4.11 “Chiller equalization without pumpout unit” and 4.12 “Chiller equalization with pumpout unit”.

4.9 - High altitude locations

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

4.10 - 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.

4.11 - 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 19XL chiller, use the TERMNATE 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.

4.12 - 19XR Chiller equalization with pumpout unit

The following procedure describes how to equalize refrigerant pressure on an isolated 19XR chiller using the pumpout 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 Figs. 18 and 19). Progressively open valve 2 on the pumpout unit to equalize the pressure. This process will take approximately 15 minutes.
- Once the pressures have equalized, 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 Figs. 18 and 19) 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.

4.13 - 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.

Refrigerant charge by evaporator size selected*

Size	kg	Size	kg
30	277	**60**	616
31	308	**61**	635
32	340	**62**	653
35	322	**65**	694
36	359	**66**	712
37	391	**67**	725
40	381	**70**	907
41	413	**71**	962
42	440	**72**	1007
45	440	**75**	1039
46	477	**76**	1103
47	508	**77**	1157
50	520	**80**	1007
51	560	**81**	1062
52	589	**82**	1112
55	617	**85**	1156
56	648	**86**	1215
57	667	**87**	1270

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

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 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 52°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.
   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.

   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 initialisation 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 ICVC: 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 pressurizes 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. If the ICVC shows a fault, the order of phases connected to the starter must specifically be checked.

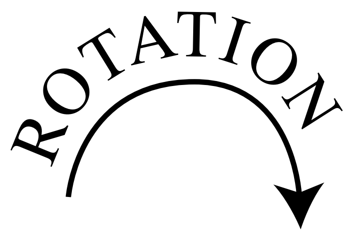
   On the 19XRV machines this verification may be duplicated by the starter/variable frequency drive. Please refer to the appendix starting with chapter 8.
2. After the default screen Status message states "Ready for Start" press the LOCAL softkey. The PIC control now initialises the start-up procedure.
3. When the starter is energized and the motor begins to turn, immediately at the start-up check for clockwise rotation (see Fig. 32 - "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 equalization of vessel pressures.

Fig. 32 - Rotation diagram



5.4 - Check oil pressure and compressor stop

- When the motor is up to full speed, note the differential oil pressure reading on the ICVC 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

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.

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 chamber, 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 - Control system
CCN and ICVC start, reset, menu, softkey functions, ICVC operation, occupancy schedule, set points, safety controls, and auxiliary and optional controls.

5.7.6 - Auxiliary equipment
Starters and disconnects, pumps, and cooling tower.

5.7.7 - Describe chiller cycles
Refrigerant, motor cooling, lubrication, and oil reclaim.

5.7.8 - 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.

5.7.9 - Safety devices and procedures
Electrical disconnects, relief device inspection, and handling refrigerant.

5.7.10 - 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

Become familiar with refrigeration chiller and related equipment before operating the chiller.

1. Prepare the system for start-up, start and stop the chiller, and place the system in a shutdown condition.
2. Maintain a log of operating conditions and document any abnormal readings.
3. Inspect the equipment, make routine adjustments, and perform a Control Test. Maintain the proper oil and refrigerant levels.
4. Protect the system from damage during shutdown periods.
5. 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. 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”.

6.3 - Check the running system

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

1. The oil reservoir temperature should be above 49°C during shutdown, and above 52°C during compressor operation.
2. The bearing oil temperature accessed on the 'COMPRESS' status screen should be 49 to 74°C. 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 ICVC default screen.
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 temperature range will be 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 to 8°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’.

IMPORTANT: Power equipment fault reports should be checked on the ICVC 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 shutdown 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.

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 ICVC 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 equalization without pumpout unit” and 4.12 “Chiller equalization 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).

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 Fig. 33 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.

Fig. 33 - Refrigeration log

Date...

Installation site .... **Model No.** .... **Serial No.** .... **Refrigerant type** ....

	Evaporator				**Condenser**				**Compressor**				**Operator initials**	**Notes**
Date/Time	**Refrigerant**		**Water**		**Refrigerant**		**Water**		**Bearing temperature**					
									Oil			**Motor**		
	Pressure	Temperature	Pressure (inlet/outlet, l/s)	Temperature (inlet/outlet)	Pressure	Temperature	Pressure (inlet/outlet, l/s)	Temperature (inlet/outlet)	Pressure change	Temperature (tank)	Level	**(FLA - current*)**		

* or angle of guide vanes

Notes: Indicate shutdowns on safety controls, repairs made, oil or refrigerant added or removed, air exhausted and water drained from dehydrator. Include amounts.

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 378-2.

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 pressurized 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.

All refrigerant removal and draining operations must be carried out by a qualified technician and with the correct material for the unit. Any inappropriate handling can lead to uncontrolled fluid or pressure leaks.

7.1.3 - Adding refrigerant
Follow the procedures described in chapter 4.10 “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 4.12) 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 4.13 “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 isued 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 pressured 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 pressurized for leak testing. In general, this refrigerant should not be present with high concentrations of air or oxygen above atmospheric pressures, because the mixture can undergo combustion.

Another method of leak testing is to pressurize 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 pressurizing 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 pressurizing 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. 34 - “Guide vane actuator linkage”.

If slack develops in the drive chain, backlash can be eliminated as follows:

1. With the chiller shut down and the actuator fully closed, remove the chain guard and loosen the actuator bracket holddown bolts.
2. Loosen guide vane sprocket adjusting bolts.
3. Pry bracket upwards to remove slack, then retighten the bracket holddown bolts.
4. Retighten the guide vane sprocket adjusting bolts. Make sure that the guide vane shaft is rotated fully in the clockwise direction in order for it to be fully closed.

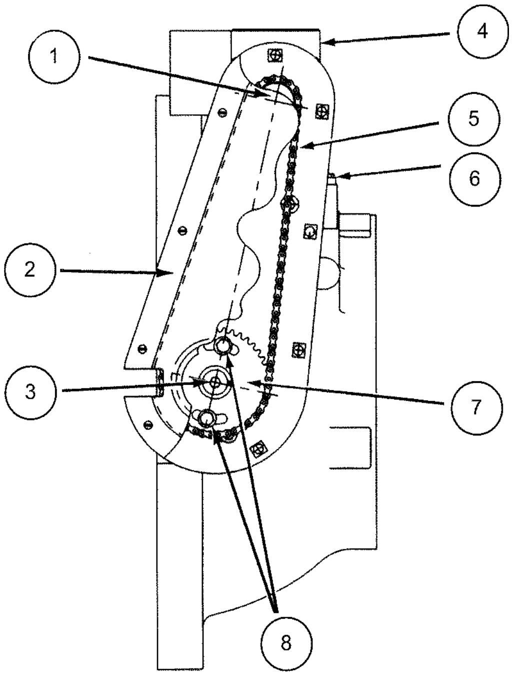
7.1.9 - Trim refrigerant charge

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 4.11 “Chiller equalization without pumpout unit” and 4.12 “Chiller equalization with pumpout unit”) or directly into the chiller as described in chapter 4.10 “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).

Fig. 34 - Guide vane actuator linkage



1. Actuator sprocket
2. Chain guard
3. Guide vane shaft
4. Electronic vane actuator
5. Drive chain
6. Actuator bracket hold-down bolts
7. Guide vane sprocket
8. Guide vane sprocket adjusting bolts

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. 4 - “Lubrication system”). A pump is required to complete the oil charge against refrigerant pressure. The oil charge is approximately:

Compressor size	Oil charge, l
2	19
3	30
4	38
5	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. The Status02 screen of the ICVC displays whether the heater is energized or not. If the PIC shows that the heater is energized, 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 ontime
The ICVC will display a *SERVICE ONTIME* value on the 'MAINSTAT' status screen. 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 Trouble-shooting 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. 4 - “Lubribation 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 thecompressor 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.

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 - “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 19XR uses approximately 30/38 l (compressor size 3/compressor size 4), so that the oil level is visible in the upper sight glass (refer to Fig. 2 - “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. 3 - “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.

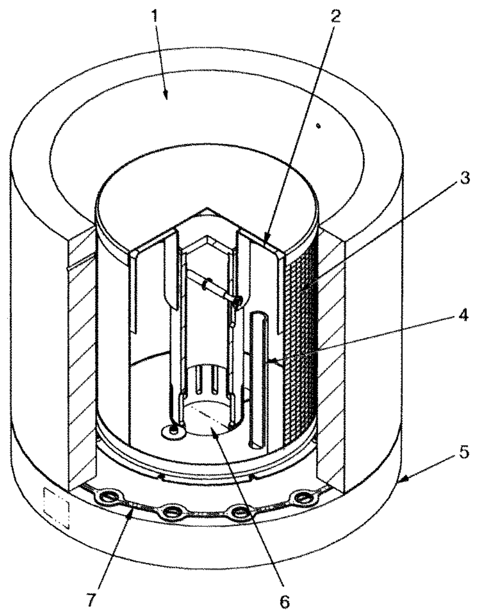
7.3.7 - Oil reclaim filter

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 scavanging 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. 4 - "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 of 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. 35 - "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.

Fig. 35 - 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

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 - Verification of the 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.

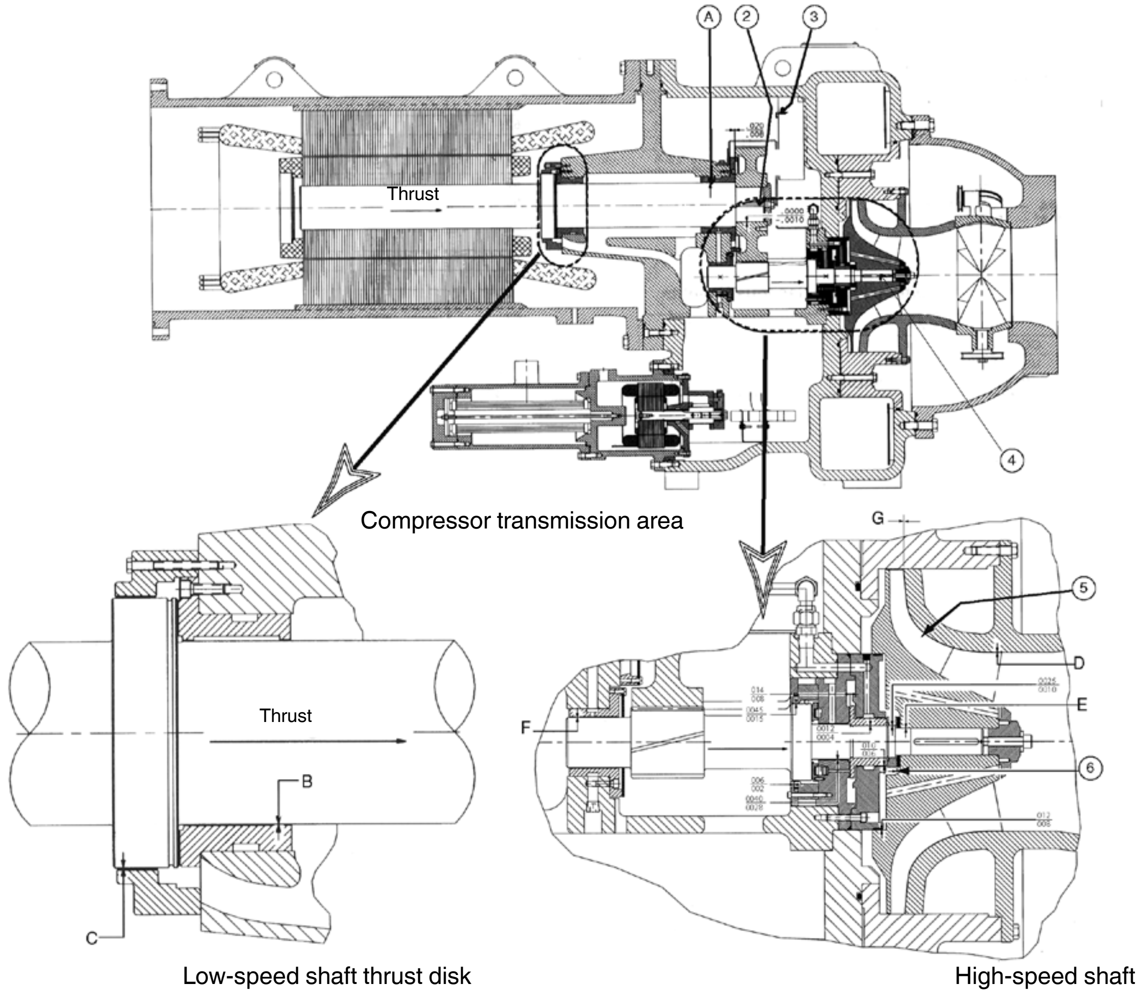
7.3.11 - Compressor bearing and gear maintenance

To ensure good bearing and gear maintenance proper lubrication is imperative. Use the proper grade of oil, maintained at recommended level, temperature, and pressure. Inspect the lubrication system regularly and thoroughly.

To inspect the bearings, a complete compressor teardown is required. Only a trained service technician should remove and examine the bearings. The cover plate on older compressor bases was used for factory-test purposes and is not usable for bearing or gear inspection. The bearings and gears should be examined for signs of wear.

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. Excessive bearing wear can sometimes be detected through increased vibration or increased bearing temperature. If either symptom appears, contact an experienced and responsible service organization for assistance.

Fig. 36 - Compressor fits and clearances



Legend

2 - 3 - 4 See table below
5 Impeller clearance to shroud: allows 15.48 mm (0.024 in) forward movement from thrust position for Frame 3 compressors; 19.35 mm (0.030 in) for Frame 4 compressors.
6 Impeller shimming to be determined at assembly

A-B-C-D-E-F-G = Max./min. installation clearances in mm (see table below):

Compressor types	A	B	C	D	E	F	G
221-299	0.1270 0.1016	0.1270 0.1016	0.2921 0.1016	4.8260 0.1016	0.0508 0.0127	0.1270 0.1016	3.9878 0.6528
321-389	0.1270 0.1016	0.1270 0.1016	0.2921 0.2032	0.5588 0.3048	0.0508 0.0127	0.1270 0.1016	3.9878 0.6528
421-489	0.1397 0.1092	0.1346 0.1092	0.2540 0.1270	0.6858 0.4318	0.0737 0.0356	0.1219 0.0965	0.8636 0.6096
521-599	0.1753 0.1499	0.1651 0.1397	0.0254 0.1524	8.8900 6.3500	0.0787 0.0432	0.1575 0.1321	1.3462 1.0922

Compressor assembly torques

Item	Description	Torque N-m
2	Bull gear retaining bolt	08-115
3	Demister bolts	20-26
4	Impeller retaining bolt	60-62
*	Oil heater grommet nut	14
*	Guide vane shaft seal nut	34
*	Motor terminals	60
*	Motor terminals (high voltage)	-
	Insulator	2.7 - 5.4
	Packing nut	6.8
	Brass jam nut	13.6

* Not shown

Notes
- All clearances for cylindrical surfaces are diametrical.
- Dimensions are with rotor in thrust position.
- Dimensions shown are in mm.

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 - “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 corro-sion, 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 19XRV 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 four 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).

Note the evaporator and condenser pressure readings on the ICVC 'HEAT-EX' 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 Troubleshooting Guide in the controls manual. 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: PARTICULARS OF 19XRV PIC III MACHINES

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

8 - 19XRV PIC III - 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 authorized for the work and familiar with the equipment and the installation, as well as the instructions and safety measures described in this document.

Never work on a unit that is energized.

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

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

ATTENTION: 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.

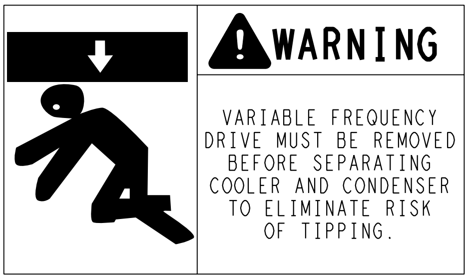
WARNING: Do not attempt to disconnect the flanges, if the chiller is under pressure. The chiller has not been purged, and this can cause injuries or damage to the machine.

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 minimises the number of sensors and cables that need to be disconnected.

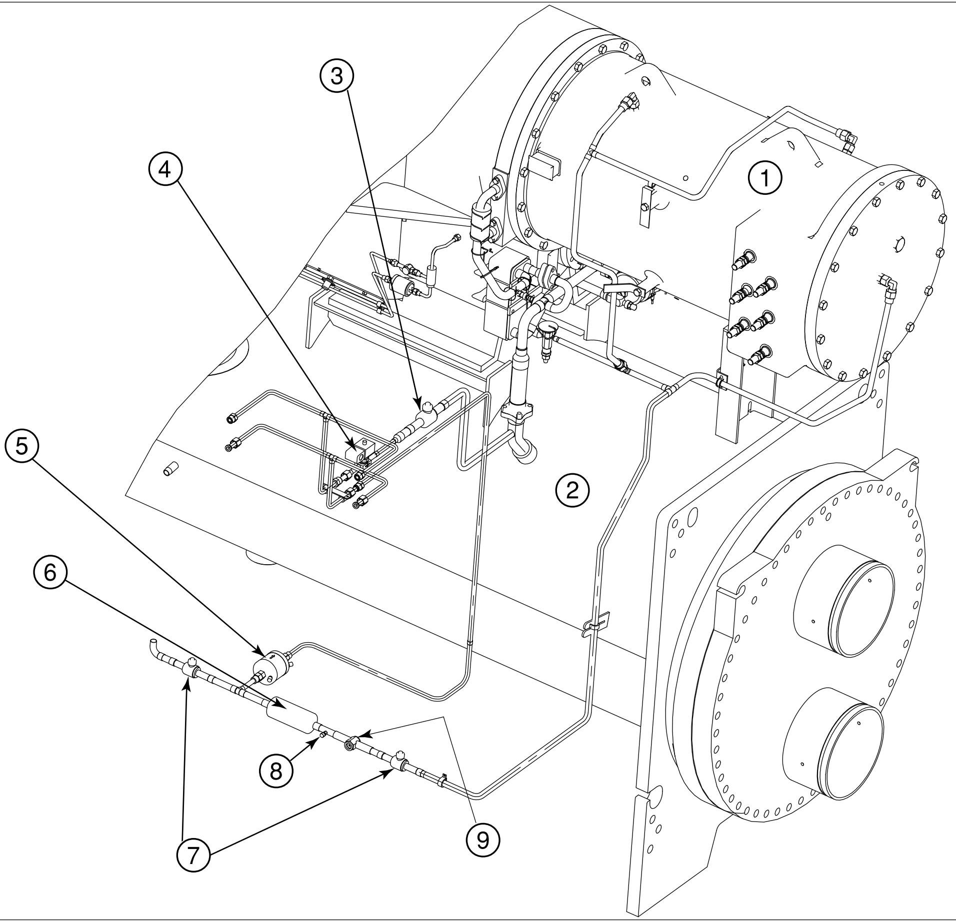
WARNING: For VFD box VFD 900-1169A do not disconnect the evaporator and condenser before VFD box 900-1169A has been disconnected and removed. This VFD box has a high-level centre of gravity and can tip over when the heat exchangers are disconnected, which can lead to material damage and/or serious injuries 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.

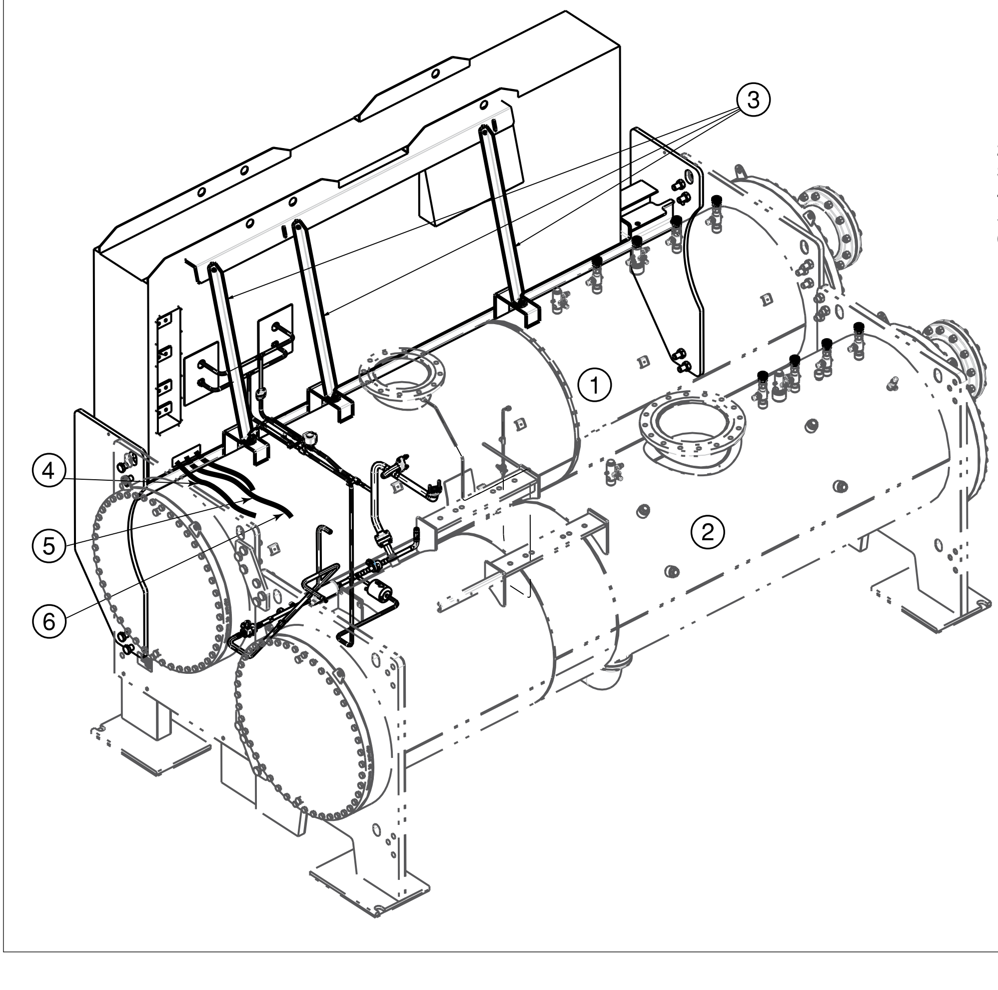
1. Close the two filter-drier shut-off valves and VFD cooling circuit shut-off valve. Purge the refrigerant from the VFD heat exchanger using the Schrader valve at the side of the filter (refer to Fig. 37 - "VFD cooling circuit".
2. Remove all VFD power supply cables (see Fig. 38 "VFD box installation (rear view)".
3. Remove the middle part of the terminal boxes (see Fig. 39 -"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. 38 - "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.

Fig. 37 - VFD cooling circuit



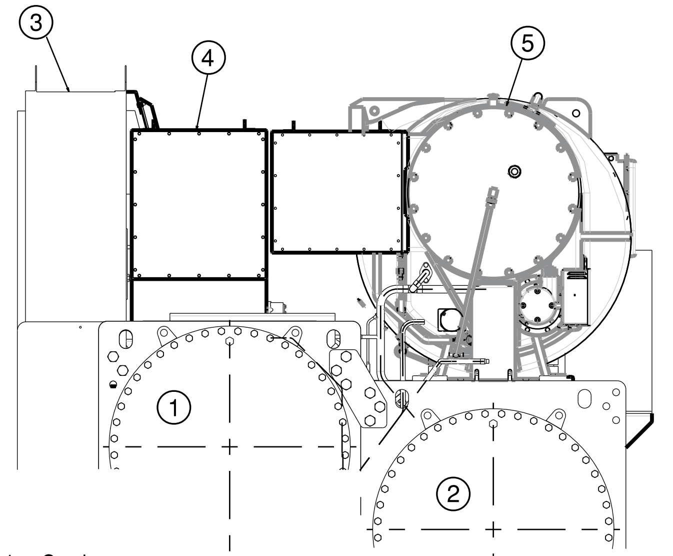
1. Condenser
2. Evaporator
3. VFD cooling circuit shut-off valve
4. VFD cooling soleniod valve
5. VFD cooling filter
6. Filter-drier
7. Filter-drier shut-off valves
8. Schrader connection
9. Motor cooling line sight-glass

Fig. 38 - VFD box installation (rear view)



1. Condenser
2. Evaporator
3. VFD support bars
4. Communication cable
5. Oil heater power wiring cable
6. Oil pump power wiring cable

Fig. 39 - VFD tunnel-side view



1. Condenser
2. Evaporator
3. VFD box
4. Motor terminal box (middle part)
5. Compressor motor

8.2.2 - Lifting of the VFD control box

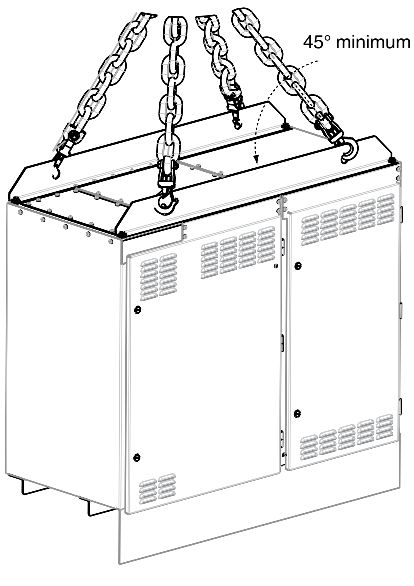
Precautions must be taken to prevent any damage due to a fall or shock, if the VFD control box is removed. A fork-lift truck or a similar lifting and transport device can be used. Place chains on the VFD so that there is an equal load at the lifting points. Use a lifting beam, if the angle of the chains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

Fig. 40 - 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. 41 - "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. 41, item 8.
- Plug all openings. Disconnect all cables that cross from one heat exchanger to the other (see Fig. 42 - "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. 41, 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. 41, items 1 and 10).
- Cut the motor cooling line at the point shown in Fig. 41, item 2.
- Disconnect the motor cooling return line, as shown in Fig. 41, item 2.

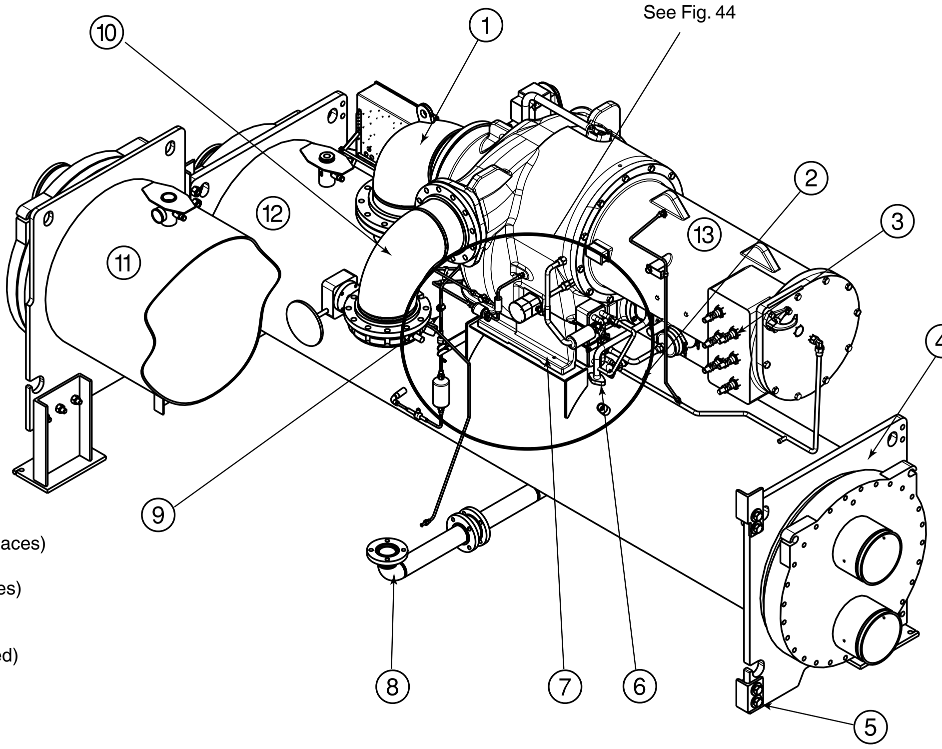
- Disconnect the following elements:
  - The cable from the compressor oil temperature sensor. See Fig. 44 - "Compressor details", item 4.
  - The cable from the compressor bearing temperature sensor - see Fig. 44, item 2.
  - The cable from the motor temperature sensor - see Fig. 44, item 1.
  - The communication and connection cables between the VFD control box and the interface box.
  - The discharge temperature sensor cable.
  - The compressor oil pressure sensor cable - see Fig. 44, item 3.
  - The compressor oil discharge pressure sensor cable - see Fig. 44, item 5.
  - The guide vane motor cable.
  - The diffuser motor cable (for compressor 02XR5 and 02XR4 with separate diffuser (SRD) - see Fig. 42 - "Unit rear/side view", item 2.
  - The diffuser pressure sensor cable (for compressor 02XR5 and 02XR4 with separate diffuser (SRD) - see Fig. 44, item 8.
- Disconnect the oil recovery line connections - see Fig. 41 - "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.***

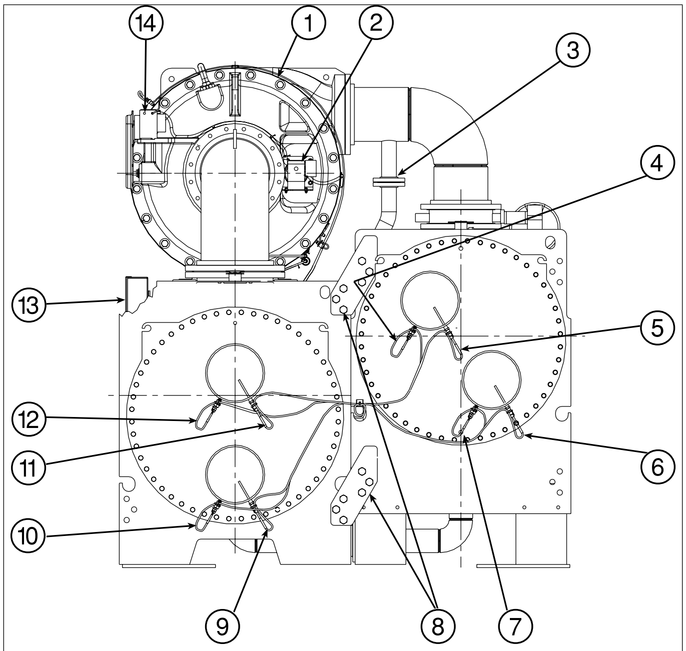
NOTE 2
- ***Each time the O-ring is replaced, use an O-ring lubrifier.***
- ***For all new O-rings, use a joint sealer.***
- ***The heat exchangers must be lifted vertically. Lifting must be done at the four corners of the tube sheets, provided for this purpose.***

Fig. 41 - Detailed perspective view of the unit



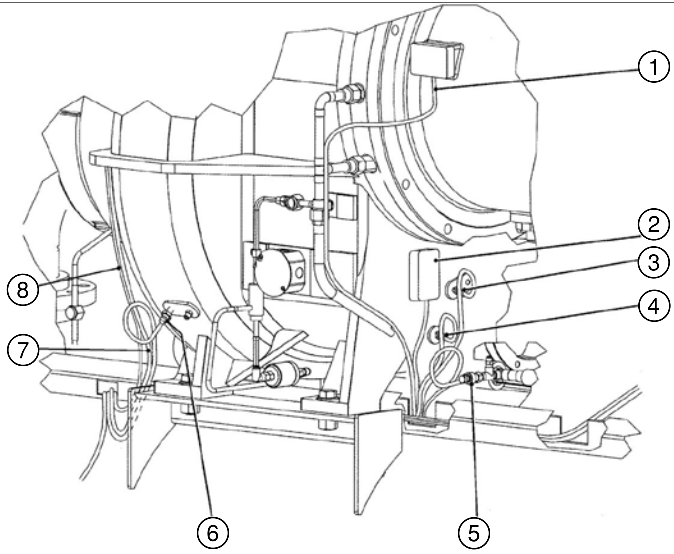
1. Compressor suction elbow (screws removed)
2. Motor cooling line (cut)
3. Motor terminal box (screws removed)
4. Tube sheet
5. Tube sheet fixing plate (screws removed - 4 places)
6. Motor cooling outlet line (screws removed)
7. Compressor fixings (screws removed - 4 places)
8. Liquid line (screws removed)
9. Oil return line (screws removed)
10. Compressor discharge elbow (screws removed)
11. Condenser
12. Evaporator
13. Compressor

Fig. 42 - Unit rear/side view



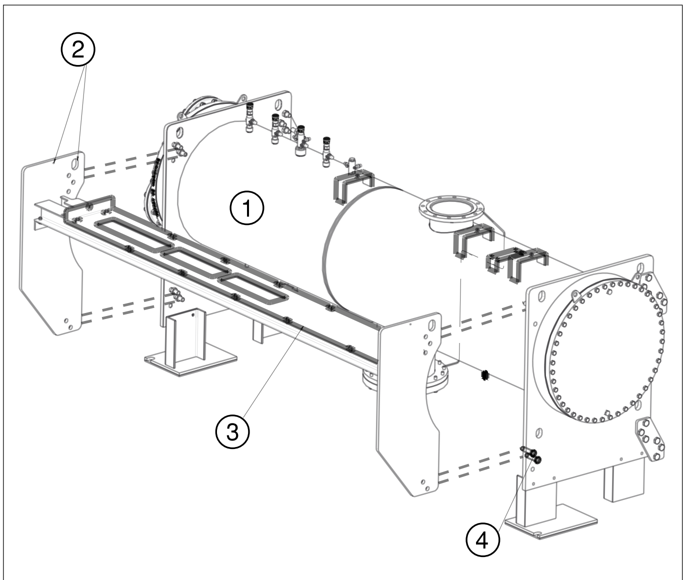
1. Guide vane motor cables
2. Diffuser motor (compressor size 5, and as an option on size 4)
3. Hot gas bypass circuit (option)
4. Condenser leaving water pressure sensor cable
5. Condenser leaving water temperature sensor cable
6. Condenser entering water temperature sensor cable
7. Condenser entering water pressure sensor cable
8. Heat exchanger fixing
9. Evaporator entering water temperature sensor cable
10. Evaporator entering water pressure sensor cable
11. Evaporator leaving water temperature sensor cabler
12. Evaporator leaving water pressure sensor cable
13. Control interface (ICVC)
14. Guide vane motor

Fig. 44 - Compressor details



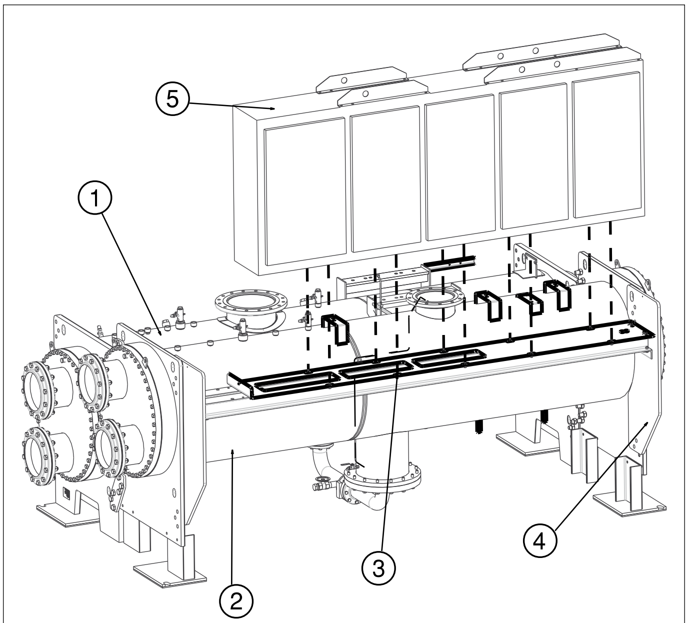
1. Motor temperature sensor cable
2. Bearing temperature sensor connection (inside box)
3. Compressor oil pressure sensor cable
4. Compressor oil temperature sensor cable
5. Compressor oil discharge pressure sensor cable
6. Discharge temperature sensor cable
7. Guide vane motor cables
8. Diffuser motor (compressor size 5, and as an option on size 4)

Fig. 43 - VFD box support installation



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

Fig. 45 - 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 PIC III - 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. Control boxes are protected against water projections to IP*1 in accordance with standard IEC60529-1: they are protected against accidental and exceptional vertical water projections.

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 III control box. The dimensions and components of the control boxes are the same for the full range up to 608 A.
- The variable-frequency drive control box is available in four versions in the range up to 608 A:

Version	Nominal voltage, V	Maximum current draw, A	Maximum current output, A
19XR-506---912	380 to 400	440	440
19XR-506---922	380 to 400	608	608
19XR-506---802	380 to 400	900	900
19XR-506---812	380 to 400	1169	1169

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

9.3.1 - The PIC III control box

The PIC III 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),
- The control screen of the ICVC interface (A2). This is the unique machine interface. Specifically it permits consultation and configuration of the VFD,
- The pump (KM81) and heater (KM66) change-over contactors,
- The overcurrent circuit breakers (QF--).

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):

Fig. 46 - Variable-frequency drive cabinet for machines with maximum nominal current up to 608 A
(19XR -506---912 and 19XR-506---922)

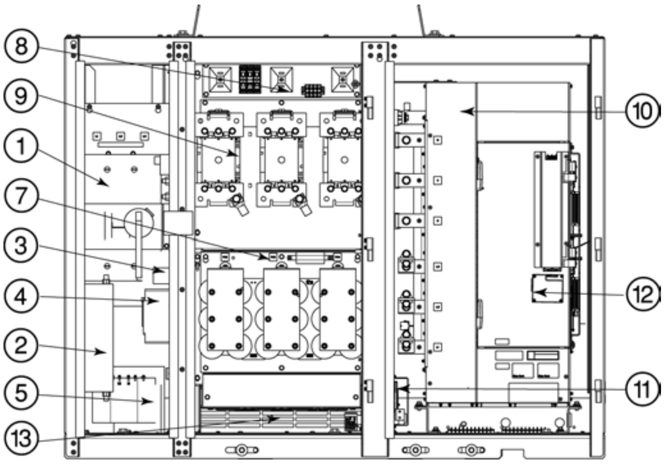
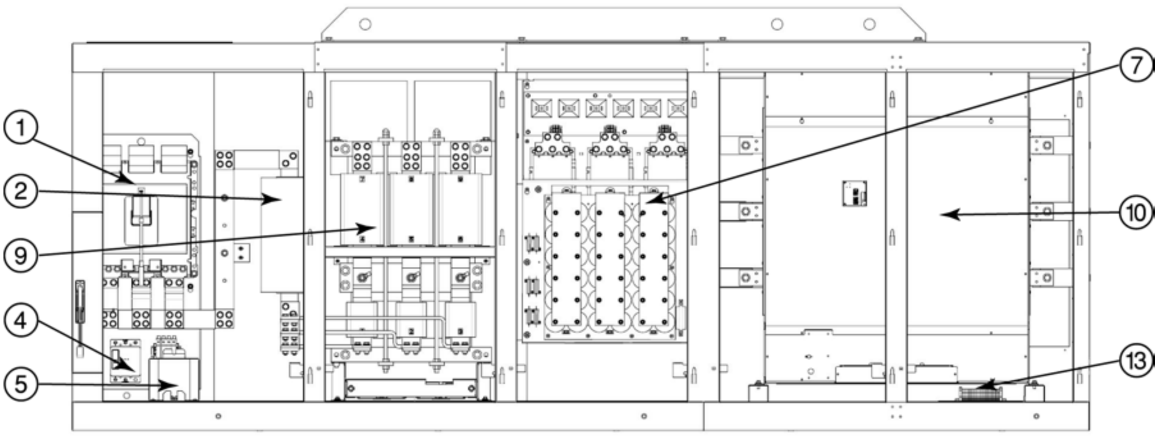


Fig. 47 - Variable-frequency drive cabinet for machines with maximum nominal current above 608 A
(19XR-506---802 and 19XR-506---812)



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 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
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:
    - compressor start-up and shutdown by voltage/frequency ramping to permit limitating 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 III 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 III 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 coordonated 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 III 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 III controls manual.

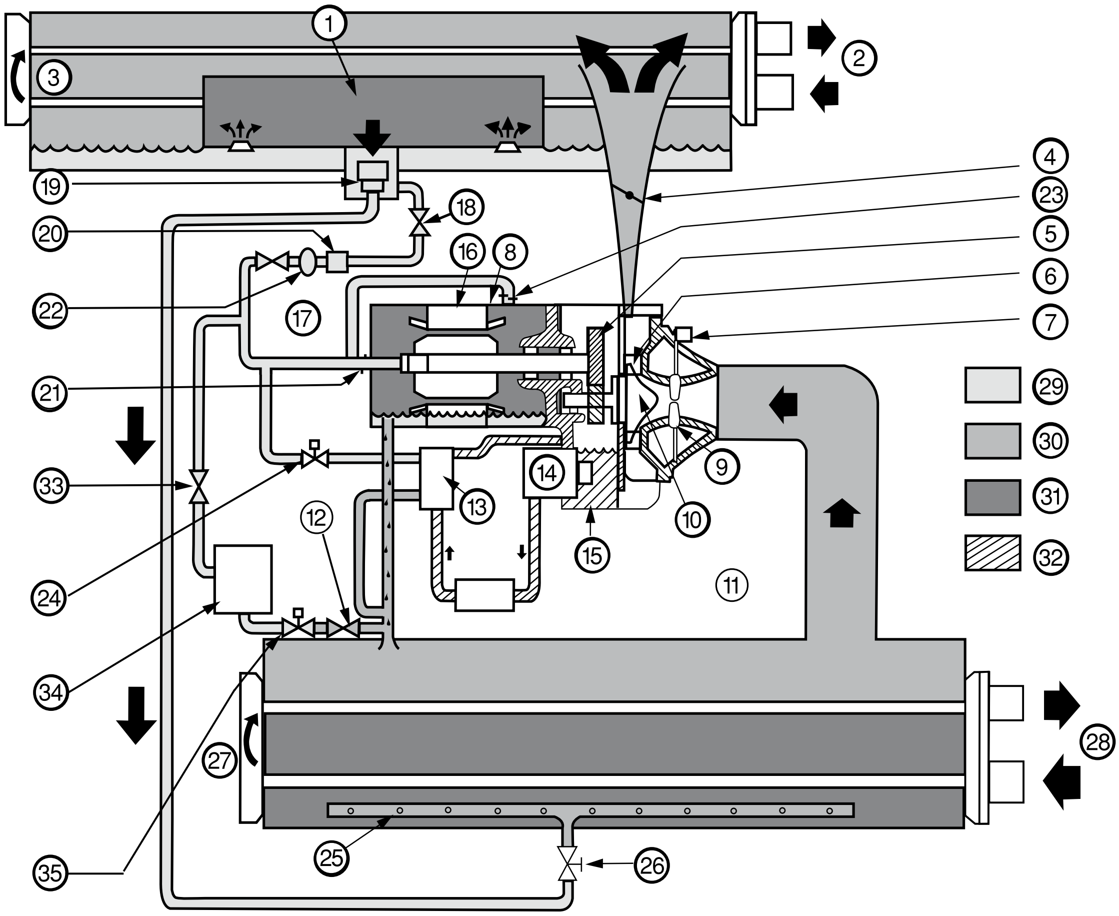
9.5 - Variable-frequency drive cooling

The power module of the variable-frequency drive is equipped with a heat exchanger to provide cooling, using the refrigerant in the machine. The PIC III control regulates the temperature by ON/OFF change-over of the valve (35) on the cooling pipes.

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

The reading reported by the relative humidity sensor is interpreted by the PIC III in order to maintain the temperature set point at a value that prevents condensation formation in the power module.

Fig. 48 - Typical 19XRV unit diagram



1. FLASC chamber
2. Condenser water
3. Condenser
4. Condenser isolation valve
5. Transmission
6. Diffuser
7. Guide vane motor
8. Motor
9. Guide vanes
10. Impeller
11. Compressor
12. Cooling line isolation valve
13. Oil cooling
14. Oil filter
15. Oil pump
16. Stator
17. Rotor
18. Motor cooling valve
19. Linear float valve chamber
20. Filter drier
21. Orificed fitting
22. Moisture/flow indicator
23. Orificed fitting
24. Thermostatic expansion valve (TXV)
25. Distribution pipe
26. Cooler isolation valve
27. Evaporator
28. Chilled water
29. Refrigerant liquid
30. Refrigerant vapour
31. Refrigerant liquid/vapour
32. Oil
33. Cooling line isolation valve
34. Heat exchanger, VFD cooling
35. Solenoid valve, VFD cooling control

9.6 - Flow detection by the saturated suction temperature sensor

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

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

Please refer to the 19XR PIC III controls manual.

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%
Electromagnetic emission rate****	19xr-506---912: C3**** 19xr-506---922: C3**** 19xr-506---802: C3**** conducted emissions C4* radiated emissions* 19xr-506---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-506---802	12000 W
19XR-506---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 PIC III - 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.

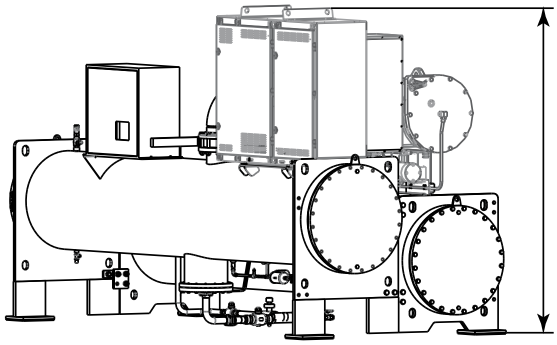
10.3.2 - Weights and dimensions

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-506---802	1300
19xr-506---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.

Fig. 49 - Height of 19XRV with variable-frequency drive - 19XR-506---912 and 19XR-506---922

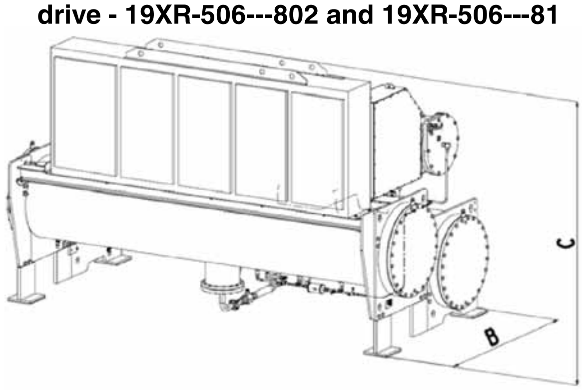


Dimensions, machines equipped with VFD control box	
Heat exchanger size	**Height C, mm**
3	2414
4	2501
5	2680
6	2721
7	N/A
8	N/A

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.

Fig. 50 - Height of 19XRV with variable-frequency drive - 19XR-506---802 and 19XR-506---81



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-506---802	4	50 to 300	42
19XR-506---812	4	50 to 300	42

Note: The use of flexible multi-standed 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 19XR PIC III 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 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 III 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 deenergized 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.***

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

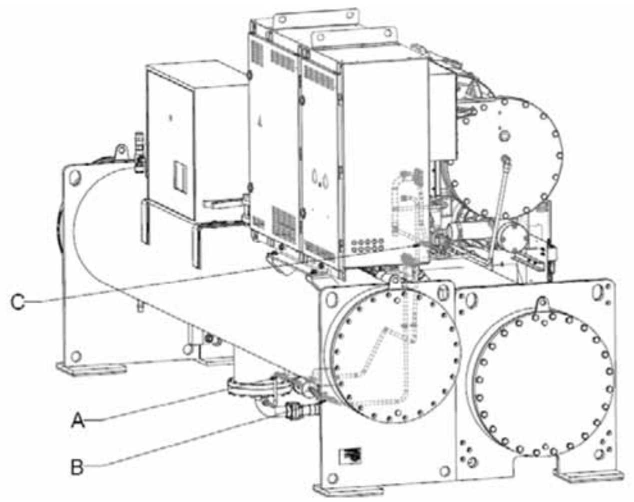
11.1 - Before energizing the unit

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.

Fig. 51 - 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 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 A 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 parameter tables for the 19XRV machine are given in the appendix of this document.

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

The PIC III 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 III control.
Menu ► Service ► Password (default 1111) ► VFD CONFIG DATA ► Password (default 4444) ► CFD_CONF.
Specifically, the parameters below must be consistent with the application.

Parameter	Value
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 Amps	Line current draw of the machine at its maximum operating point
Rated Line Kilowatts	Line power input of the machine at its maximum operating point
Motor Rated load kW	Power input of the motor at the nominal machine operating point
Motor Rated Load Amps	Current draw of the motor at the maximum machine operating point and nominal speed
Motor Nameplate Amps	Nominal motor current or max. RLA
Motor Nameplate RPM	Nominal motor speed
Motor Nameplate kW	Nominal motor capacity

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

The control parameters of the variable-frequency drive speed by the PIC III control are accessible from the SETUP2 table: Menu ► Service ► Password (default 1111) ► SETUP2.

The parameters for the variable-frequency drive application must be added to the parameters configured for the standard machine equipped with PIC II control:

Parameter	Value
VFD Speed control	
VFD Gain	Adjusts the response of the variable-frequency drive to a speed modification demand
VFD Minimum speed	Lower limit of the authorised compressor speed range
VFD Maximum Speed	Upper limit of the authorised compressor speed range

11.3.2 - Function test (quick test)

The following tests are added to the standard tests carried out on the machine equipped with PIC II control:

- Relative humidity, in the CCM Pressure Transducer menu: a humidity of 100% indicates a defective or disconnected sensor.
- VFD cooling valve, in the Discrete Outputs menu.

Refer to the 19XR PIC III controls manual.

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 III - 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 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.

13.2 - Manual override commands

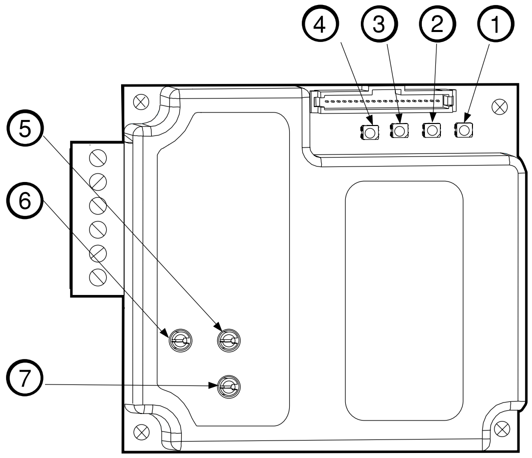
13.2.1 - Guide vane opening control
The opening of the guide vanes can be manually controlled as for the machine without variable-frequency drive, as described in the 19XR/19XRV controls manual.

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 ICVC. In this case the machine capacity is controlled by the guide vanes.

13.3 - Gateway communication module status LEDs

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.

Fig. 52 - 19XRV 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. - Energize 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. - Energize 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. - Energize 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 potentio-meters 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.

13.4 - 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 ICVC.
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 ICVC.

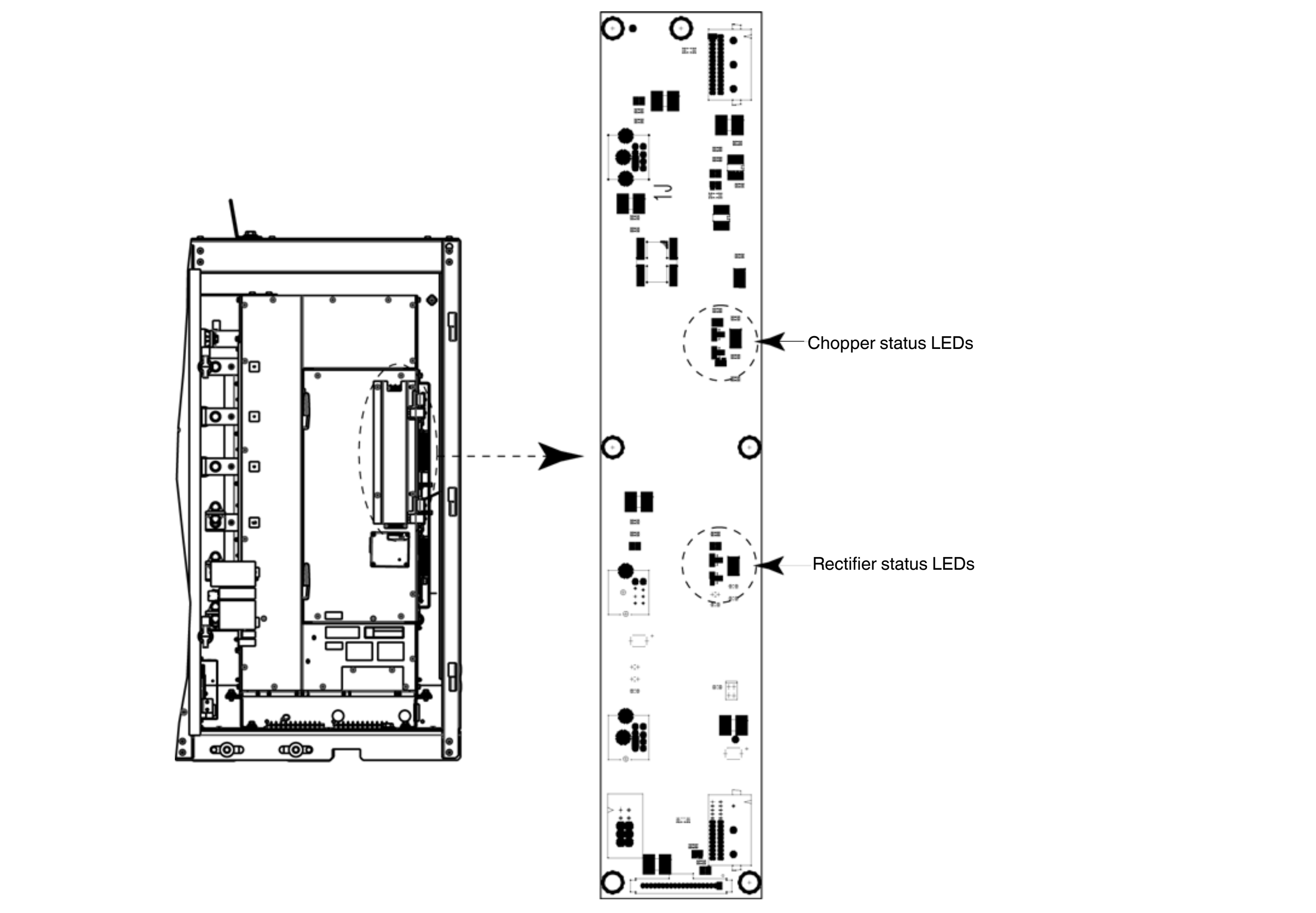
13.5.2 - Emergency stop by the circuit breaker/main disconnect switch

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.

Fig. 53 - 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 authorized 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: PARTICULARS OF 19XR PIC II UNITS WITH INTEGRATED PROGRESSIVE ELECTRONIC STARTER

15 - 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 authorized for the work and familiar with the equipment and the installation, as well as the instructions and safety measures described in this document.

Never work on a unit that is energized.

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

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

ATTENTION: 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.

16 - 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 IP44 in accordance with standard IEC60529-1: they are protected against accidental and exceptional water projections from any direction, without pressure.

16.2 - 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.

16.3 - 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),
- The interface control screen ICVC (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 II 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.

16.4 - Soft starter operation

Compressor start and stop are controlled by the ISM (1CR 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.

16.5 - 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.

16.6 - 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. See chapter 15.4.2.2.

17 - INSTALLATION INSTRUCTIONS AND ELECTRICAL CONNECTION

17.1 - 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.

17.2 - 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.

17.3 - Physical data

17.3.1 - 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.

17.3.2 - 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 excanger size	**Height C, mm**
Size 3	2130
Size 4	2300
Size 5	2480
Size 6	2580
Size 7	2980
Size 8	3020

17.4 - Location of connection points and interfaces

Refer to the dimensional drawings supplied with the machine.

17.5 - Electrical connections

17.5.1 - 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	x 1
250 < < 450	x 2
450 < < 800	x 3
1350<	x 4

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.

17.5.2 - Control wiring connections on site

For the site control wiring of the following elements refer to the 19XR PIC 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 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

17.6 - Equipment details

17.6.1 - 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.

17.6.2 - "Square root of three" installation and access to the motor terminals

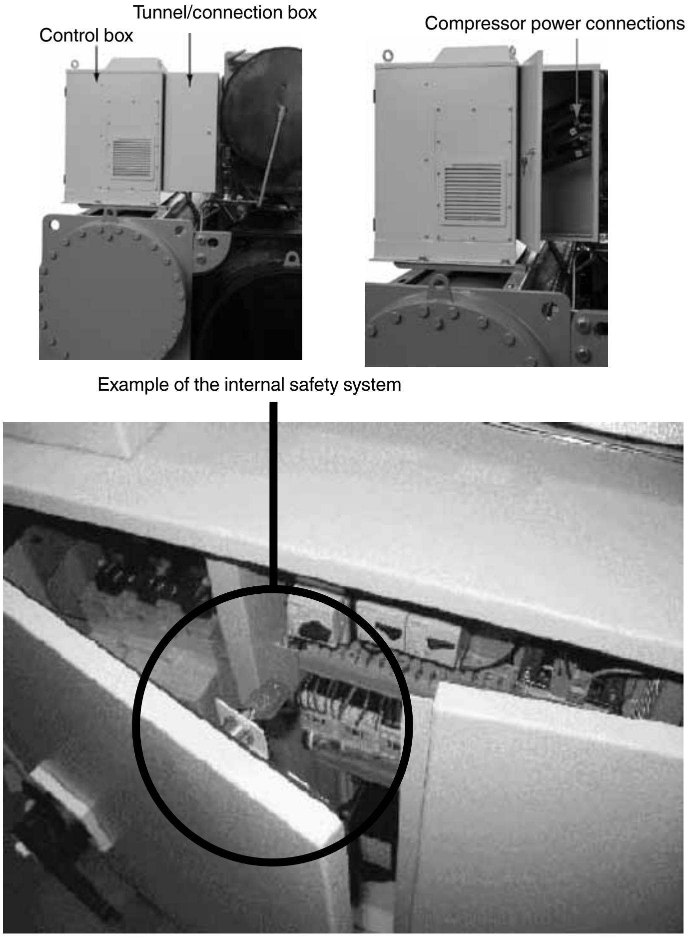
In 400 V applications the starter is normally installed in a delta branch of the compressor power supply circuit. This configuration allows reducing the value of the current that passes through the starter by a factor of $\sqrt{3}$.

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.

Fig. 54 - Access to the motor terminals



18 - BEFORE THE INITIAL START-UP

18.1 - 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.

18.2 - Start-up checks

18.2.1 - 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.

18.2.2 - 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:

RW44/MENU/SAFETY

Setting	To be set to
Enter user code	1000 or 1001

Selecting code 1000 gives access to the modification and reading of all parameters. Selecting code 1001 gives limited access to the modification and reading of the 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
Rated operating current	Machine RLA*

* RLA set at the machine PIC control and corresponding to the RLA of the machine selection card.

Setting 3 - Start-up

RW44/MENU/SETTINGS/PARAMETER 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 limiting value	330 x RLA max/Ie*
Breakaway voltage	80%
Breakaway time	0 ms

* RLA max is the value on the compressor name plate, "Ie" 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 5 - 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/SETTING/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 19.2.
- 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.

18.3 - PIC control checks

18.3.1 - 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.

18.3.2 - Function test (quick test)

The standard machine tests apply.

19 - INITIAL START-UP

19.1 - 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.

19.2 - 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 16.4 and 18.2.2).

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.

20 - OPERATION

20.1 - 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.

20.2 - 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 reporteed 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.

20.3 - 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-initialised 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.

21 - MAINTENANCE

21.1 - 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.

21.2 - 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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