Installation, operating and maintenance

INNOV@ - CENT & RADIAL FAN

• • • Providing indoor climate comfort

INNOV@-IOM-0907-E

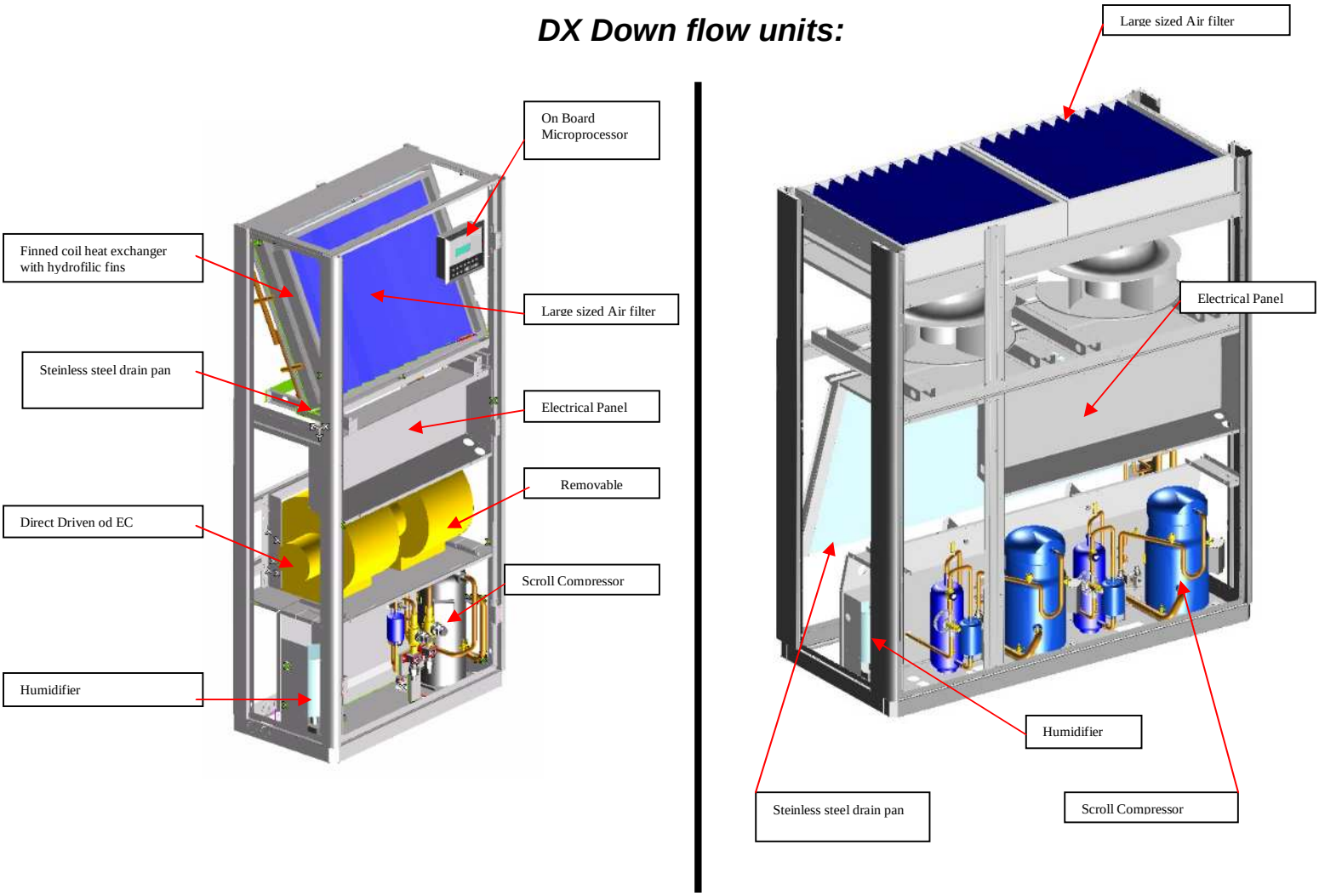
Index IOM INNV@

LENNOX have been providing environmental solutions since 1895, our range of INNV@ continues to meet the standards that have made LENNOX a household name. Flexible design solutions to meet YOUR needs and uncompromising attention to detail. Engineered to last, simple to maintain and Quality that comes as standard. Information on local contacts at www.lennoxeurope.com.

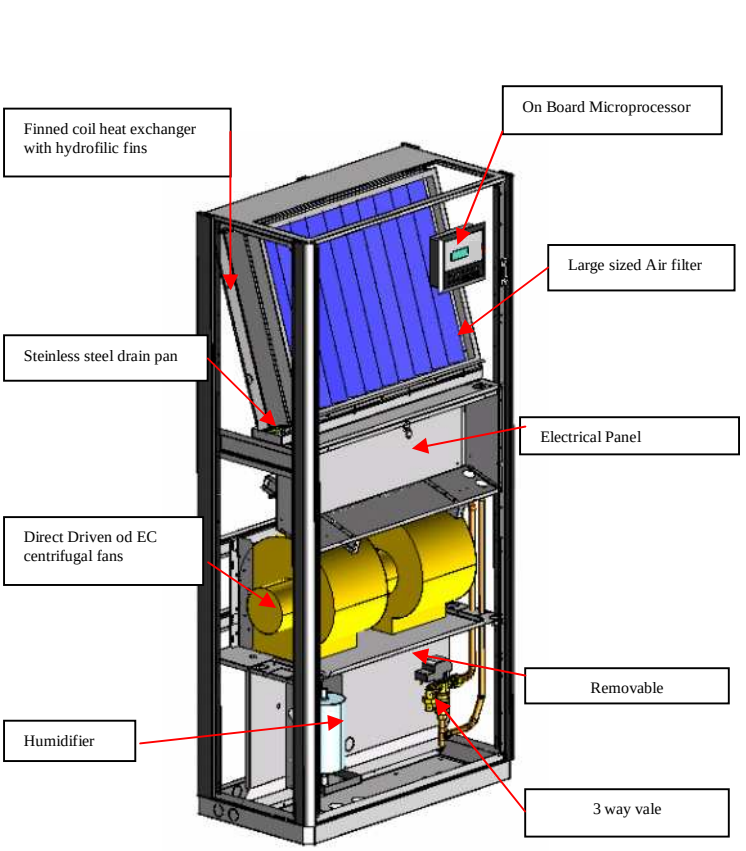
General Description

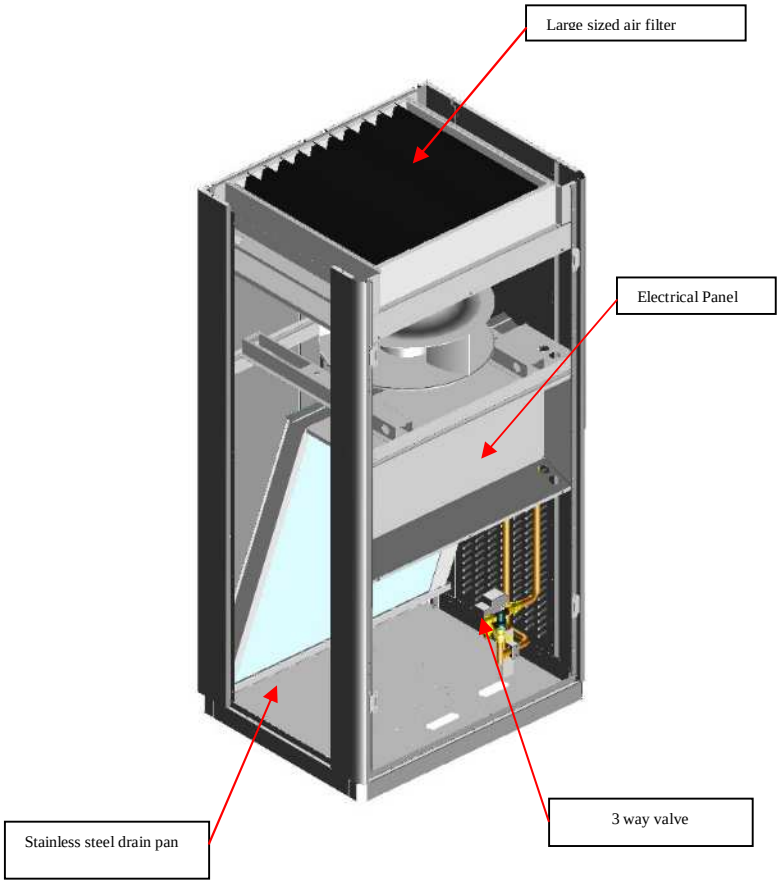
INNV@ CCAC self-contained units are specially designed for installation in technological environments such as Computer rooms, laboratories and in general where a high precision in climate control and a 24h/day operation are requested. INNV@ units represent the state of the art between technology and design as well as all HiRef S.p.A. products: thanks to their characteristics, INNV@ can be installed also in offices where people are working. The depth of 795 mm for all versions, allows the compatibility with standard electronic devices: furthermore the innovative design and the high tech selected colours make INNV@ units complementary to the last generation of IT devices. The internal design of the units in firstly made looking to efficiency and reliability but don't loosing accessibility: **all** components, including e-heaters, fans, compressors, valves, etc. can be maintained from the front and furthermore the door(s) are dismountable in few seconds thanks to an innovative hinge: this is very important when units are installed in small corridors. The exclusive use of primary brands components and a fully integrated development process (CAD+CAM, CAE) stands for highest possible quality level regarding efficiency, reliability, maintenance time, pre and after sales support. All DX units are available both in single circuit up to 41,2 kW and up to 76,2 kW in double circuit.

DX Down flow units:



CW Down flow units:





Structure

INNV@ units are designed with a self supporting frame and all components are produced using sophisticated computer driven machines and special tools. All sheet metals are galvanized and all external panels are powder coated RAL 7016 giving to the units the image and the quality like last generation of IT devices. Units are completely closed and only frontal access is requested. Anyway it is also possible to have side access in order to reach the steam piping and the drain pan, or simply to substitute a damaged side panel: all this problems are very rare, but with INNV@ units it is possible to solve them. The shape of the units is characterized with the curved edges with variable radium as for all HiRef products: this feature is obtained using special tools and gives both a good aesthetic and advantages against injuries. The compressor compartment is separated from the air flow and the special internal design allows the simple dismounting of the upper part of it ensuring an insuperable accessibility to all refrigerating components.
All fixing elements are made in stainless steel or in non corroding materials. The dray pan is made in stainless steel in order to ensure long time operation without damages.

All panels are thermally insulated with a polyurethane foam class 1 according UL 94 norms: this material, thanks to the open cells, gives good performances in sound absorption. As an option, sandwich panels are available: in this case mineral fibres are closed between the panel and a second sheet of metal giving the maximum in terms of internal cleaning. Double skin panels are classified between non flammable materials class A1 according DIN 4102 norms : the sound insulation is better than the standard solution, but the internal reflected sound power will increase the amount in delivery side (+2dB).

Power supply limits and Storage conditions for DX versions:

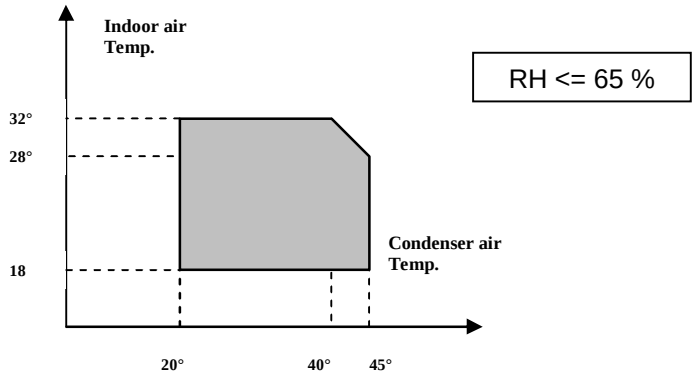
Model	DHA..C/R
Power supply	Nominal Value +/-10%
Storage conditions	-10 / 90 % r.h. + 55 / 90 % r.h.

Power supply limits and Storage conditions for CW versions:

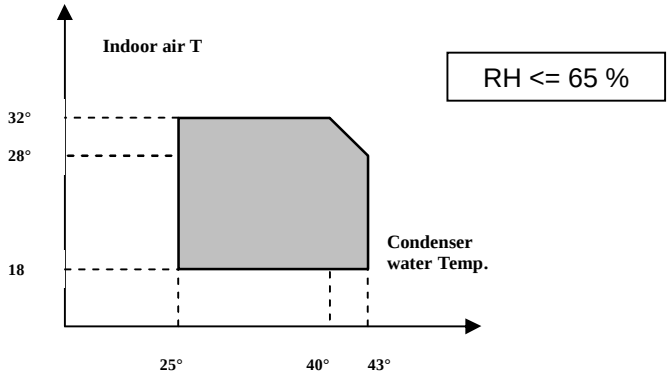
Model	DHC..C/R
Power supply	Nominal Value +/-10%
Storage conditions	-10 / 90 % r.h. + 60 / 90 % r.h.

Application limits

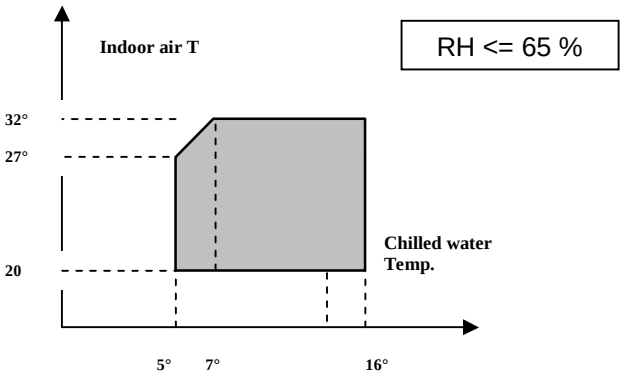
- DHA..C/R - Air condensed versions:.



- DHW..C/R - Water condensed versions:



- DHC..C/R - Chilled Water versions:



Cooling circuit

The entire refrigerating circuit is assembled in our warehouse including all pipe work and using only primary brand for components. The workers involved in the welding and pipe work process are qualified by a third part according CEE 97/23 PED directive: it is worth to be underlined that this qualification for workers were not request, but it is our own decision taking care of the quality and/or in general to the customer satisfaction. All DX unit ("A", "W", "F", "D", "Q" versions) are prechargerd with dry nitrogen for "A", "D" or with R407C refrigerant for "W", "F", "Q" versions. Other refrigerants, like R22, R134a, R410A are available on request and previous check for local rules.

- Compressors: on INNV@ units only primary brand scroll compressors are installed. Scroll compressor represent for CCAC units the best solution in terms of efficiency and reliability. The internal compression ratio is very close to the typical operating condition of CCAC giving the maximum in terms of COPs and the perfect balanced pressures at start up gives big advantages to the e_motor in terms of reliability, mainly in this filed where frequent start up may be possible. All motors are thermally protected with an internal sensors chain: in case of overload this sensor opens without giving contacts to the connection box.
- Cooling components:
  - Molecular mesh activated-alumina filter dryer
  - Flow indicator with humidity indicator. Indications are provided directly on the sight glass.
  - Thermostatic valve with external equalization and integrated MOP function.
  - High and low pressure switches
  - Schrader valves for checks and/or maintenance

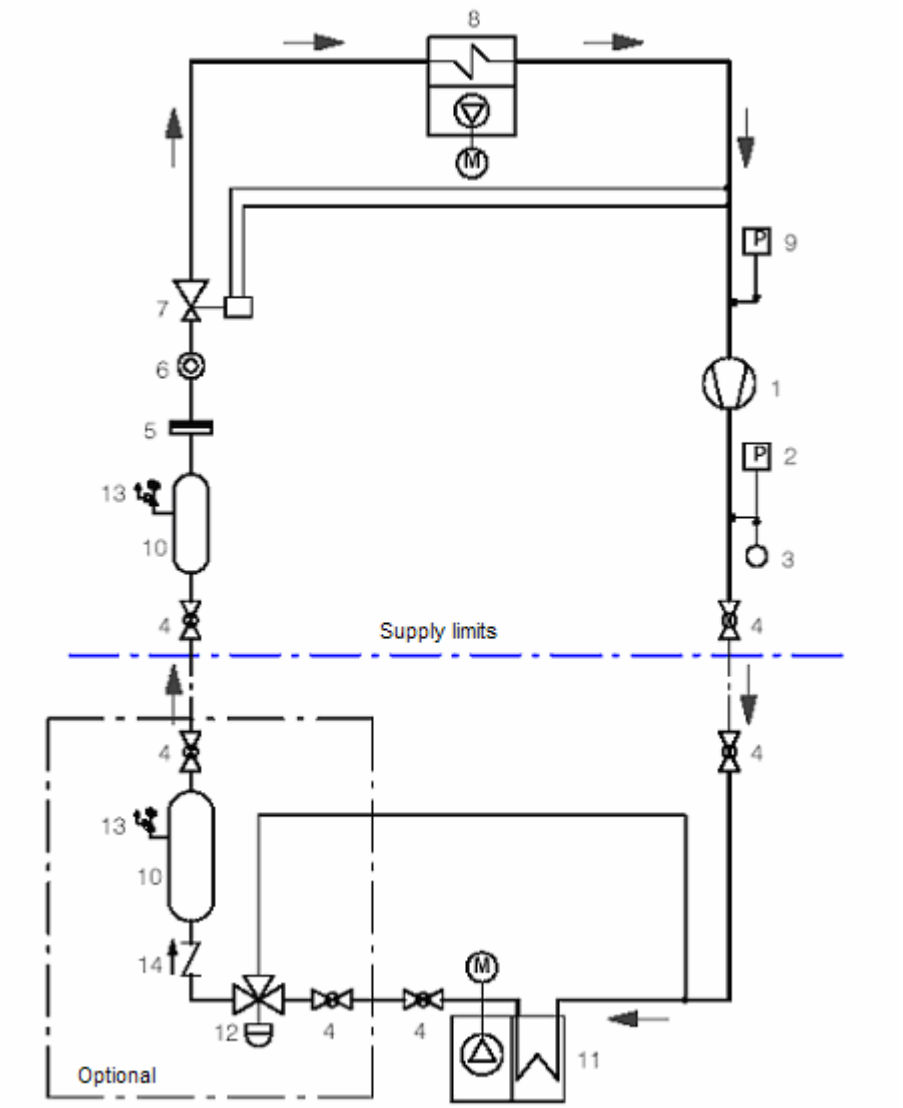
- Electric control board: The electric control board is constructed and wired in accordance with Directives 73/23/EEC and 89/336/EEC and related standards. The board may be accessed through a door after the main switch has been turned off. All the remote controls use 24 V

signals powered by an insulating transformer situated on the electric control board. **NOTE**: the mechanical safety devices such as the high pressure switch are of the kind that trigger directly; their efficiency will not be affected by any faults occurring in the microprocessor control circuit, in compliance with 97/23 PED.

- Control microprocessor: the microprocessor built into the unit allows the different operating parameters to be controlled from a set of pushbuttons situated on the electric control board;
  - Switching on/off of compressor(s) to maintain the temperature set point T inside the shelter
  - Alarm management
    - High / low pressure
    - Dirty filters alarm (optional)
    - Air flow alarm
  - Alarm signalling
  - Display of operating parameters
  - RS232, RS485 serial output management (optional)
  - Phase sequence error [Not displayed by the mP, but prevents the compressor from starting up]

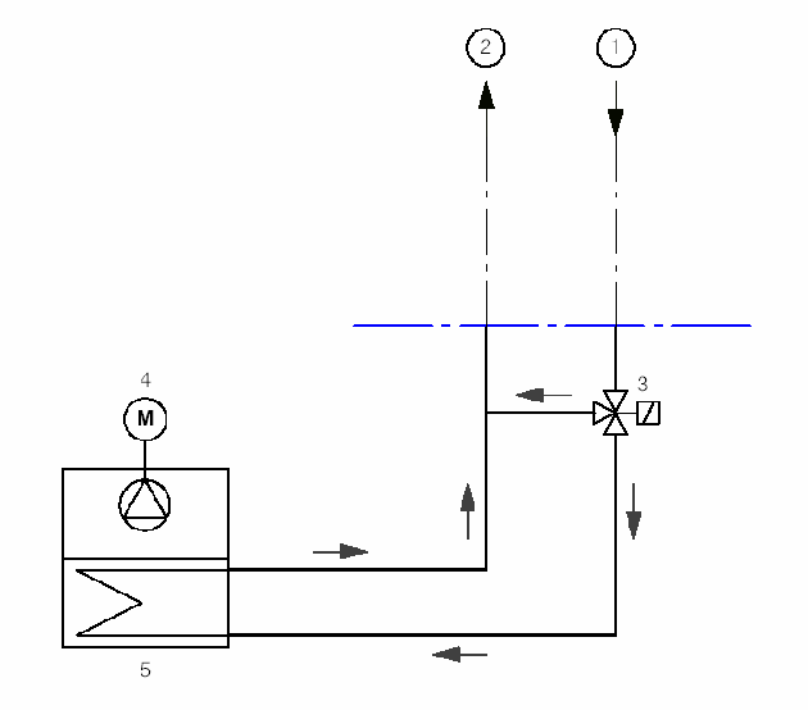
  [see microprocessor control manual for further details, also in relation to particular customer specifications]

BASIC COOLING CIRCUIT for DX versions (each circuit)



Ref.	Description	Ref.	Description
1	Compressor	8	Evaporating coil
2	HP Pressure switch	9	LP pressure switch
3	Pressure transmitter	10	Liquid receiver
4	Ball valve	11	Remote condenser
5	Refrigerant filter	12	Flooding valve
6	Sight glass	13	Safety valve
7	Thermostatic valve	14	Check valve

Basic cooling circuit for CW versions



Ref.	Description
1	Chilled water inlet
2	Chilled water outlet
3	3 way valve
4	Fan
5	Coil Heat exchanger

Installation warnings

General rules

- When installing or servicing the unit, you must strictly follow the rules provided in this manual, comply with the directions on the units themselves and take all such precautions as are necessary.

- The fluids under pressure in the cooling circuit and the presence of electrical components may cause hazardous situations during installation and maintenance work.

All work on the unit must be carried out by qualified personnel only, trained to do their job in accordance with current laws and regulations

- Failure to comply with the rules provided in this manual or any modification made to the unit without prior authorisation will result in the immediate invalidation of the warranty.

Warning: Before performing any kind of work on the unit, make sure it has been disconnected from the power supply.

Inspection/Transport/Positioning

Inspection on receipt

On receiving the unit, check that it is perfectly intact: the unit left the factory in perfect conditions; immediately report any signs of damage to the carrier and note them on the Delivery Slip before signing it.
HiRef S.p.A. or its agent must be promptly notified of the entity of the damage. The Customer must submit a written report describing every significant sign of damage.

Lifting and Transport

While the unit is being unloaded and positioned, utmost care must be taken to avoid abrupt or violent manoeuvres. The unit must be handled carefully and gently; avoid using machine components as anchorages or holds and **always keep it in an upright position**.
The unit should be lifted using the pallet it is packed on; a transpallet or similar conveyance means should be used.

Warning: In all lifting operations make sure that the unit is securely anchored in order to prevent accidental falling or overturning.

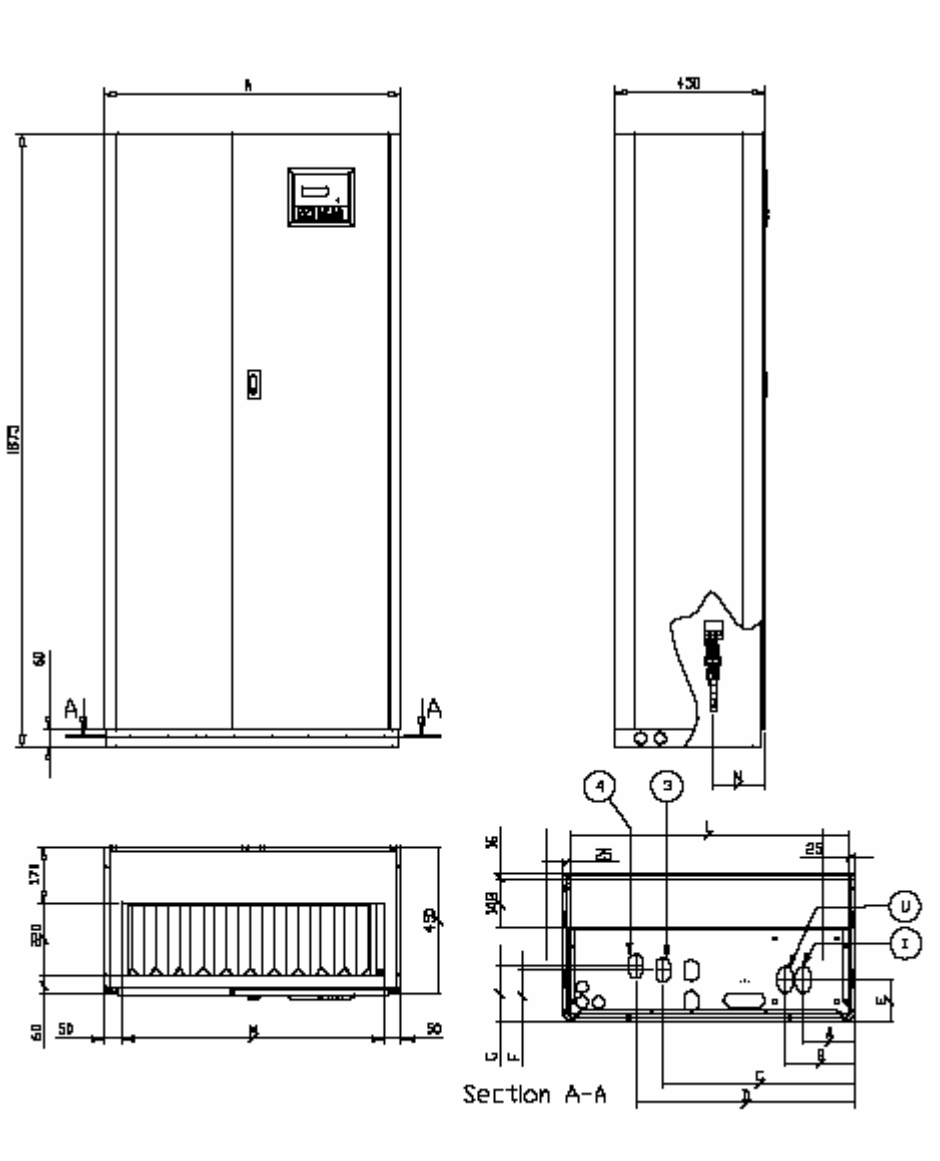
Unpacking

The packing must be carefully removed to avoid the risk of damaging the unit. Different packing materials are used: wood, cardboard, nylon etc.
It is recommended to keep them separately and deliver them to suitable waste disposal or recycling facilities in order to minimise their environmental impact.

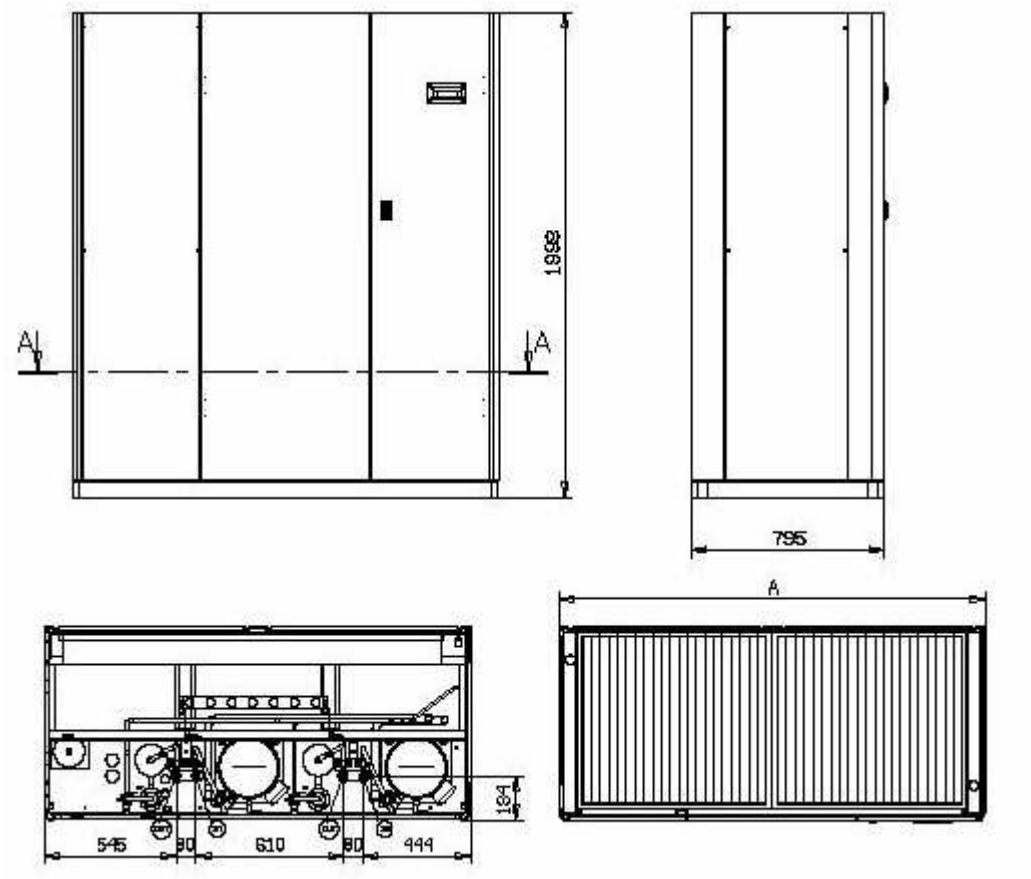
Positioning

Bear in mind the following aspects when choosing the best site for installing the unit and the relative connections:
- Positioning and dimensions of the coupling flanges;
- Location of power supply;
- Solidity of the supporting floor;

It is recommended to first prepare holes in the floor/wall for passing through the power cables and for the air outlet (down flow units).
The dimensions of the air outlet and the positions of the holes for the screw anchors and power cables are shown below:



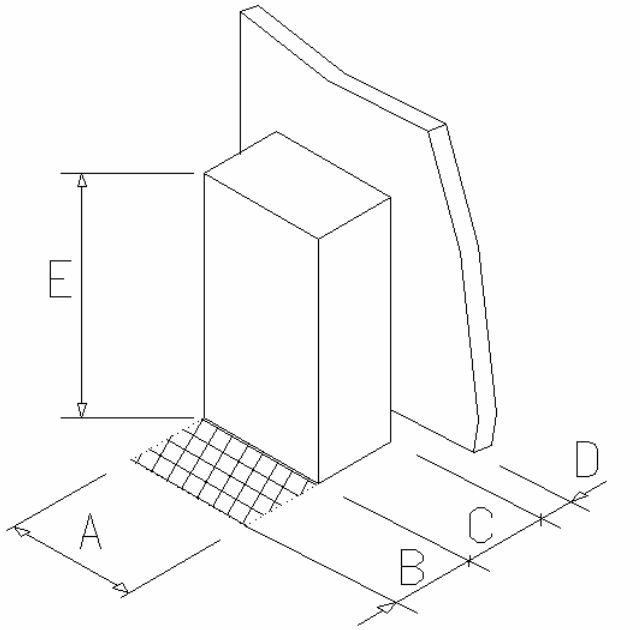
MODEL	A(mm)
DHCDC0080-DHCUC0080	1000
DHCDC0110-DHCUC0110	1750
DHCDC0140-DHCUC0140	1750
DHCDC0160-DHCUC0160	1750
DHCDC0200-DHCUC0200	2500
DHCDC0230-DHCUC0230	2500
DHADC0060-DHAUC0060	600
DHADC0080-DHAUC0080	600
DHADC0100-DHAUC0100	900
DHADC0110-DHAUC0110	900
DHADC0130-DHAUC0130	900
DHADC0160-DHAUC0160	1200
DHADC0190-DHAUC0190	1200
DHADC0205-DHAUC0205	1200



MODEL	A(mm)
DHCDR0300-DHCUR0300	1000
DHCDR0400-DHCUR0400	1750
DHCDR0500-DHCUR0500	1750
DHCDR0650-DHCUR0650	1750
DHCDR0900-DHCUR0900	2500
DHCDR1000-DHCUR1000	2500
DHADR0201-DHAUR0201	1000
DHADR0251-DHAUR0251	1000
DHADR0261-DHAUR0261	1000
DHADR0271-DHAUR0271	1750
DHADR0301-DHAUR0301	1750
DHADR0401-DHAUR0401	1750
DHADR0272-DHAUR0272	1750
DHADR0302-DHAUR0302	1750
DHADR0362-DHAUR0362	1750
DHADR0422-DHAUR0422	1750
DHADR0452-DHAUR0452	1750
DHADR0512-DHAUR0512	1750
DHADR0552-DHAUR0552	2500
DHADR0602-DHAUR0602	2500
DHADR0692-DHAUR0692	2500
DHADR0762-DHAUR0762	2500

INSTALLATION

The INNV@ air-conditioning unit is suitable for all environments except aggressive ones. Do not place any obstacles near the units and make sure that the air flow is not impeded by obstacles and/or situations causing back suction.



MODEL	A(mm)	B(mm)	C(mm)	D(mm)	E(mm)
DHCDC0080-DHCUC0080	600	650	449	30	1875
DHCDC0110-DHCUC0110	600	650	449	30	1875
DHCDC0140-DHCUC0140	900	650	449	30	1875
DHCDC0160-DHCUC0160	900	650	449	30	1875
DHCDC0180-DHCUC0200	1200	650	449	30	1875
DHCDC0200-DHCUC0200	1200	650	449	30	1875
DHCDC0230-DHCUC0230	1200	650	449	30	1875
DHCDR0300-DHCUR0300	1000	750	795	0	1998
DHCDR0400-DHCUR0400	1750	750	795	0	1998
DHCDR0500-DHCUR0500	1750	750	795	0	1998
DHCDR0650-DHCUR0650	1750	750	795	0	1998
DHCDR0900-DHCUR0900	2500	750	795	0	1998
DHCDR1000-DHCUR1000	2500	750	795	0	1998
DHADC0060-DHAUC0060	600	650	449	30	1875
DHADC0080-DHAUC0080	600	650	449	30	1875
DHADC0100-DHAUC0100	900	650	449	30	1875
DHADC0110-DHAUC0110	900	650	449	30	1875
DHADC0130-DHAUC0130	900	650	449	30	1875
DHADC0160-DHAUC0160	1200	650	449	30	1875
DHADC0190-DHAUC0190	1200	650	449	30	1875
DHADR0201-DHAUR0201	1000	750	795	0	1998
DHADR0251-DHAUR0251	1000	750	795	0	1998
DHADR0261-DHAUR0261	1000	750	795	0	1998
DHADR0271-DHAUR0271	1750	750	795	0	1998
DHADR0301-DHAUR0301	1750	750	795	0	1998
DHADR0401-DHAUR0401	1750	750	795	0	1998
DHADR0272-DHAUR0272	1750	750	795	0	1998
DHADR0302-DHAUR0302	1750	750	795	0	1998
DHADR0362-DHAUR0362	1750	750	795	0	1998
DHADR0422-DHAUR0422	1750	750	795	0	1998
DHADR0452-DHAUR0452	1750	750	795	0	1998
DHADR0512-DHAUR0512	1750	750	795	0	1998
DHADR0552-DHAUR0552	2500	750	795	0	1998
DHADR0602-DHAUR0602	2500	750	795	0	1998
DHADR0692-DHAUR0692	2500	750	795	0	1998
DHADR0762-DHAUR0762	2500	750	795	0	1998

The following steps should be carried out to ensure proper installation:

- Apply a anti-vibration rubber lining between the unit and the bottom
- Position the unit on the floor / floorstand (base frame)

The recommended sizes for the power cables and emergency line are shown in the table below:

INNV@ CW

	Fans	
Unit model	**Main power supply**	**Cable type**
	Plug Fan	
DHCDR0080-DHCUR0080	230V/1Ph/50Hz	4X6 mmq + T 6mmq
DHCDR0110-DHCUR0110		4X6 mmq + T 6mmq
DHCDR0140-DHCUR0140		4X6 mmq + T 6mmq
DHCDR0160-DHCUR0160		4X10 mmq + T 6mmq
DHCDR0200-DHCUR0200		4X10 mmq + T 6mmq
DHCDR0230-DHCUR0230		4X10 mmq + T 6mmq
	Centrifugal Fan	
DHCDC0080-DHCUC0080	230V/1Ph/50Hz	4X6 mmq + T 6mmq
DHCDC0110-DHCUC0110		4X6 mmq + T 6mmq
DHCDC0140-DHCUC0140		4X10 mmq + T 6mmq
DHCDC0160-DHCUC0160		4X10 mmq + T 6mmq
DHCDC0200-DHCUC0200		4X10 mmq + T 6mmq
DHCDC0230-DHCUC0230		4X10 mmq + T 6mmq
	Plug Fan	
DHCDR0300-DHCUR0300	400V/3Ph+N/50Hz	4X10 mmq + T 6mmq
DHCDR0400-DHCUR0400		4X10 mmq + T 6mmq
DHCDR0500-DHCUR0500		4X10 mmq + T 6mmq
DHCDR0650-DHCUR0650		4X10 mmq + T 6mmq
DHCDR0900-DHCUR9300		4X10 mmq + T 6mmq
DHCDR1000-DHCUR1000		4X10 mmq + T 6mmq

INNV@ DX

	Fans	
Unit model	**Main power supply**	**Cable type**
	Plug Fan	
DHADR0060-DHAUR0060	400V/3Ph+N/50Hz	4X6 mmq + T 6mmq
DHADR0080-DHAUR0080		4X6 mmq + T 6mmq
DHADR0100-DHAUR0100		4X10 mmq + T 6mmq
DHADR0110-DHAUR0110		4X10 mmq + T 6mmq
DHADR0130-DHAUR0130		4X10 mmq + T 6mmq
DHADR0160-DHAUR0160		4X10 mmq + T 6mmq
DHADR0190-DHAUR0190		4X10 mmq + T 6mmq
DHADR0205-DHAUR0205		4X10 mmq + T 6mmq
	Centrifugal Fan	
DHADC0060-DHAUC0060	400V/3Ph+N/50Hz	4X6 mmq + T 6mmq
DHADC0080-DHAUC0080		4X6 mmq + T 6mmq
DHADC0100-DHAUC0100		4X10 mmq + T 6mmq
DHADC0110-DHAUC0110		4X10 mmq + T 6mmq
DHADC0130-DHAUC0130		4X10 mmq + T 6mmq
DHADC0160-DHAUC0160		4X10 mmq + T 6mmq
DHADC0190-DHAUC0190		4X10 mmq + T 6mmq
DHADC0205-DHAUC0205		4X10 mmq + T 6mmq
	Plug Fan	
DHADR0201-DHAUR0201	400V/3Ph+N/50Hz	4X10 mmq + T 6mmq
DHADR0251-DHAUR0251		4X10 mmq + T 6mmq
DHADR0261-DHAUR0261		4X10 mmq + T 6mmq
DHADR0271-DHAUR0271		4X10 mmq + T 6mmq
DHADR0301-DHAUR0301		4X10 mmq + T 6mmq
DHADR0401-DHAUR0401		4X10 mmq + T 6mmq
DHADR0272-DHAUR0272		4X16 mmq + T 6mmq
DHADR0302-DHAUR0302		4X16 mmq + T 6mmq
DHADR0362-DHAUR0362		4X16 mmq + T 6mmq
DHADR0422-DHAUR0422		4X16 mmq + T 6mmq
DHADR0452-DHAUR0452		4X16 mmq + T 6mmq
DHADR0512-DHAUR0512		4X16 mmq + T 6mmq
DHADR0552-DHAUR0552		-
DHADR0602-DHAUR0602		-
DHADR0692-DHAUR0692		-
DHADR0762-DHAUR0762		-

Vacuum and charging operations for DX-type units

This type of work must be carried out by qualified personnel only trained to do their job in accordance with current laws and regulations

1. Introduction:

The contemporaneous presence of liquid and vapour requires for both to be in a state of saturation [Gibb's law], as shown in **fig. 1**. In thermal equilibrated conditions, the pressure in the tank corresponds to the ambient temperature. Withdrawal of refrigerant from the tank has following effects:

- withdrawal of refrigerant charge	⇨ pressure drop inside the tank
- pressure drop inside the tank	⇨ T drop & change of status
- T drop & change of status	⇨ evaporation of part of the liquid, causing a cooling down of the liquid
- cooling of liquid	⇨ thermal exchange with ambient air, further evaporation of remaining liquid; the original pressure in the tank will be restored after a certain period of time

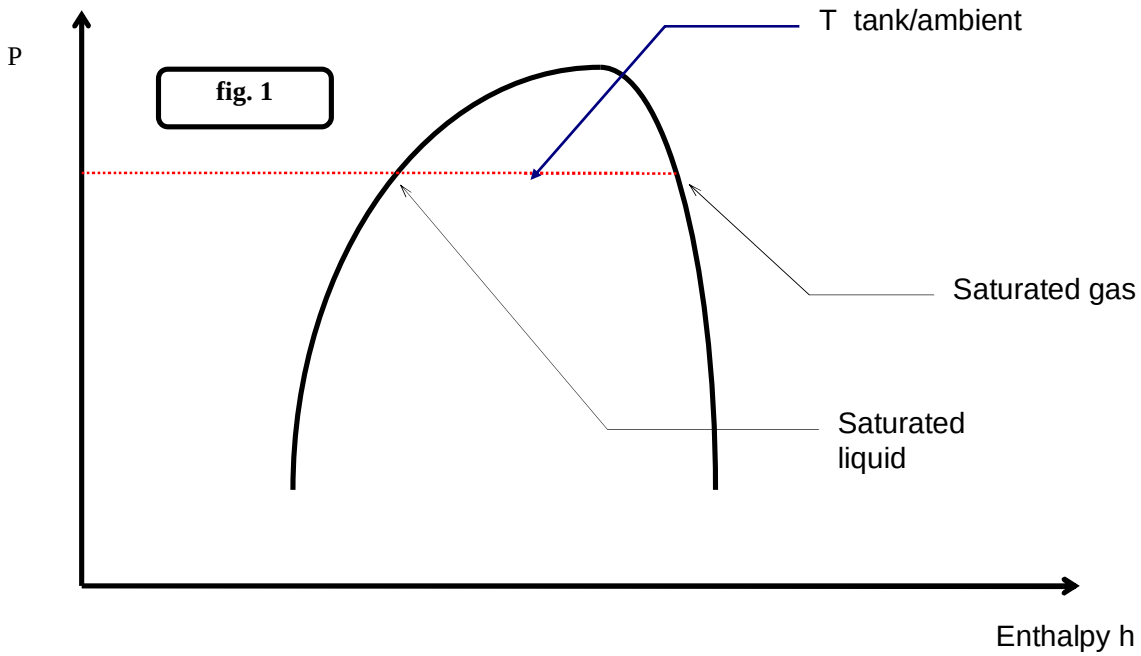


fig. 1

2. Full vacuum and charge of the unit

3. Vacuum cycle

In general it is better to apply a “long” rather than a “hard” vacuum: reaching a low pressure too abruptly may in fact cause that any remaining humidity evaporates instantaneously, thus freezing part of it.

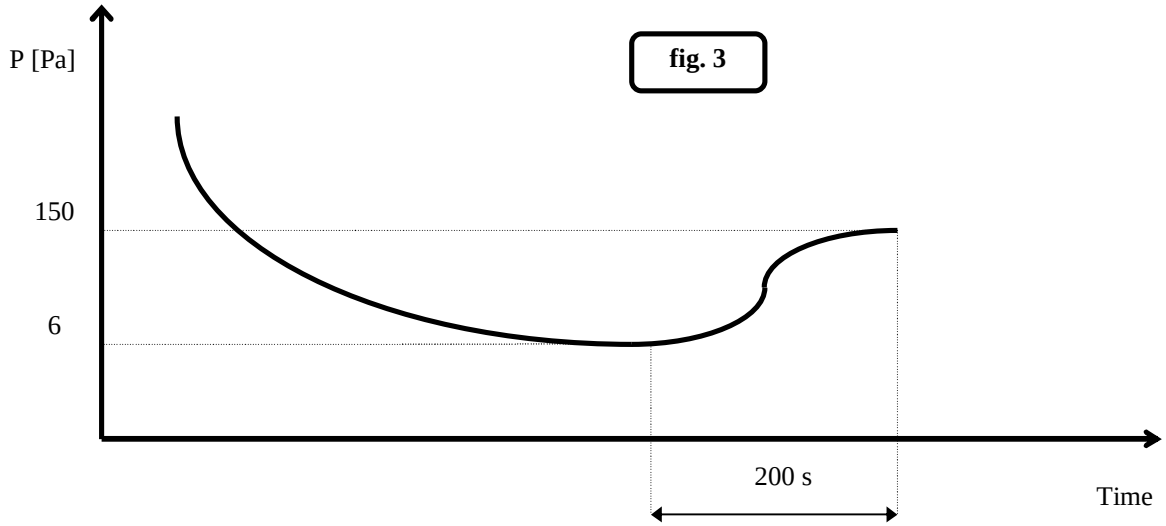


fig. 3

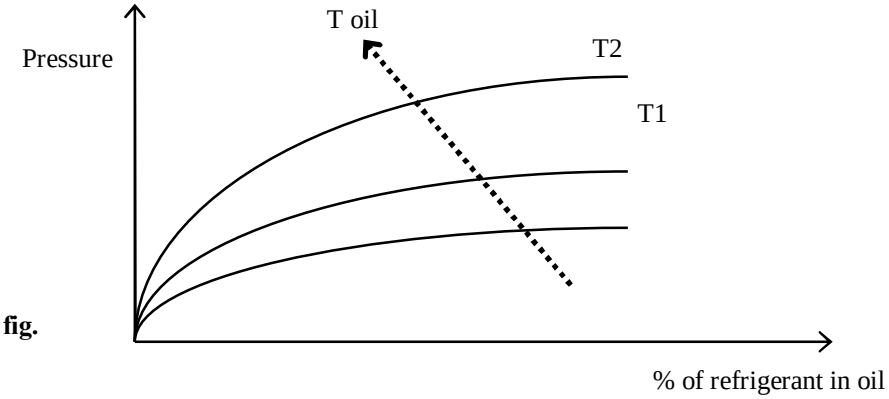
The figure **fig.3** represents a vacuum cycle and an optimal subsequent pressure rise for the refrigeration devices we manufacture.

Generally in bigger refrigeration systems or if there is a suspicion of an extensive quantity of humidity in the refrigeration circuit, the vacuum needs to be “broken” by using anhydrous nitrogen. Then the steps of evacuation need to be repeated as described before. This operation facilitates the removal of remaining and/or frozen humidity during the evacuation process.

4. Evacuating a circuit “contaminated” with refrigerant

The first step is to remove the refrigerant from the circuit. To do this a specific machine is necessary with a drying compressor in order to recover the refrigerant.

Refrigerants all tend to dissolve in oil [compressor sump]. The "**Oil**" figure illustrates a specific property [Charles’ Law] of gases, which are more soluble in liquids as the pressure increases but less soluble as the temperature increases.



“Oil” fig.

If the oil in the sump is held at a constant pressure, an increase in temperature will significantly reduce the amount of refrigerant dissolved in it, thus ensuring that the lubricating function desired is maintained. The problem of inadequate lubrication occurs if the crankcase is not duly heated, above all after seasonal interruptions when, due to the suction effect of the compressor, there is an abrupt drop in pressure inside

the sump, which results in considerable evaporation of the refrigerant previously dissolved in the oil. If heating elements were not installed, this phenomenon would cause two problems:

The release of refrigerant from the cooling circuit tends to cool down the oil and thus actually creates the opposite effect by keeping more refrigerant dissolved in the oil: for this reason, it is advisable to switch on –if available- the crankcase heater during the evacuation process.

If a high % of refrigerant gets in contact with the Pirani gauge (vacuum sensor), it may "mislead" this sensitive sensor and misinterpret the value for a certain period of time. For this reason -if no machine for recovering refrigerant is available- it is nonetheless advisable to switch on the crankcase heater and to avoid full vacuum before the circuit has been adequately purged of refrigerant. The refrigerant may in fact dissolve in the oil of the vacuum pump, reducing its performance for a long time (hours).

5. Charging positions [single point]

The best position to charge the unit is the section between the thermostatic valve and the evaporator. Take care to avoid the fixing of the thermostat bulb until the operation is completed. It is important to ensure that the valve orifice remains open in order to allow the passage of refrigerant also towards the condenser / liquid receiver.

If possible, avoid the charge of refrigerant into the suction line of the compressor as this may cause excessive dilution of the lubricant.
In any case verify first the necessary volume of the crankcase and compare it with the required charge volumes.

ELECTRICAL CONNECTIONS

GENERALITIES

Before carrying out any job on electrical parts, make sure the power supply is disconnected.

Check that the mains electricity supply is compatible with the specifications (voltage, number of phases, frequency) shown on the unit rating plate.
The power connection for single-phase loads is to be made with a three-pole cable and "N" wire at the centre of the star [optional: power supply w/o neutral]

The size of the cable and line protections must conform to the specifications provided in the wiring diagram.

The supply voltage may not undergo fluctuations exceeding ±5% and the unbalance between phases must always be below 2%.

The above operating conditions must always be complied with: failure to ensure said conditions will result in the immediate invalidation of the warranty.

The electrical connections must be made in accordance with the information shown in the wiring diagram provided with the unit and with current and local regulations.
An earth connection is **mandatory**. The installer must connect the earthing wire using the earthing terminal situated on the electric control board (yellow and green wire).
The power supply to the control circuit is taken from the power line through an insulating transformer situated on the electric control board.

The control circuit is protected by suitable fuses or automatic breakers depending on the unit size.

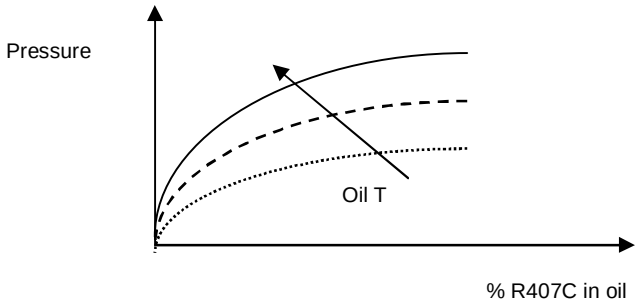
STARTING UP

Preliminary checks

- Check that the electrical connections have been made properly and that all the terminals **are securely tightened**. This check should also be included in a periodic six-month inspection.
- Check that the voltage at the RST terminals is 400 V ± 5% and **make sure** the yellow indicator light of the phase sequence relay is on. The phase sequence relay is positioned on the electric control board; if the sequence is not duly observed, it will not enable the machine to start.
- Make sure there are no refrigerant leakage that may have been caused by accidental impacts during transport and/or installation.
- Check the power supply to the crankcase heater, where present.

The heating elements must be turned on at least 12 hours before the unit is started. They are automatically activated when the main switch is put on. Their function is to raise the T of the oil in the sump and limit the quantity of refrigerant dissolved in it.

To verify whether the heating elements are working properly, check the lower part of the compressors: it should be warm or in any case at a temperature 10 - 15 °C higher than the ambient temperature.



The diagram above illustrates a specific property of gases [Charles' Law], which are more soluble in liquids as the pressure increases but less soluble as the temperature increases: if the oil in the sump is held at a constant pressure, an increase in temperature will significantly reduce the amount of refrigerant dissolved in it, thus ensuring that the desired lubricating function is maintained.

SETTING OPERATING PARAMETERS

GENERALITIES

All the control devices are set and tested in the factory before the unit is dispatched. However, after the unit has been in service for a reasonable period of time you can perform a check on the operating and safety devices. The settings are shown in Tables II and III.

All servicing of the equipment is to be considered extraordinary maintenance and may be carried out BY QUALIFIED TECHNICIANS ONLY: incorrect settings may cause serious damage to the unit and injuries to persons.

The operating parameters and control system settings configurable by means of the microprocessor control are password protected if they have a potential impact on the integrity of the unit.

TABLE II - SETTING OF CONTROL DEVICES

CONTROL DEVICE		SET POINT	DIFFERENTIAL
Differential air pressure switch (air flow)	Pa	50	30
Differential air pressure switch (dirty filter)	Pa	70	20

CONTROL DEVICE		ACTIVATION	DIFFERENTIAL	RESETTING
Maximum pressure switch	Bar-g	28.0	4	Manual
Minimum pressure switch	Bar-g	2	1.5	Automatic
Modulating condensation control devices (DX versions)	Bar-g	14	7	
Time lapse between two compressor starts	s	480	-	-

MAXIMUM PRESSURE SWITCH

The high pressure switch stops the compressor when the outlet pressure exceeds the set value.

Warning: do not attempt to change the setting of the maximum pressure switch: Should the latter fail to trip in the event of a pressure increase, the pressure relief valve will open.

The high pressure switch must be **manually** reset; this is possible only when the pressure falls below the set differential (see Table III).

MINIMUM PRESSURE SWITCH

The low pressure switch stops the compressor when the inlet pressure falls below the set value for more than 180 seconds.

The switch is automatically reset when the pressure rises above the set differential (see Table II);

ROUTINE MAINTENANCE AND CHECKS

The only operations to be performed by the user are to switch the unit on and off.
All other operations are to be considered maintenance work and must thus be carried out by qualified personnel trained to do their job in accordance with current laws and regulations.

WARNINGS

All the operations described in this chapter MUST ALWAYS BE PERFORMED BY QUALIFIED PERSONNEL ONLY.

Before carrying out any work on the unit or accessing internal parts, make sure you have disconnected it from the mains electricity supply.

The upper part and the outlet pipe of the compressor reach high temperatures. Be especially careful when working in the surrounding area with the panels off.

Be especially careful when working in proximity to finned coils since the 0.11 mm-thick aluminium fins can cause superficial injuries due to cuts.

After completing maintenance jobs, always replace the panels enclosing the units and secure them with the fastening screws provided.

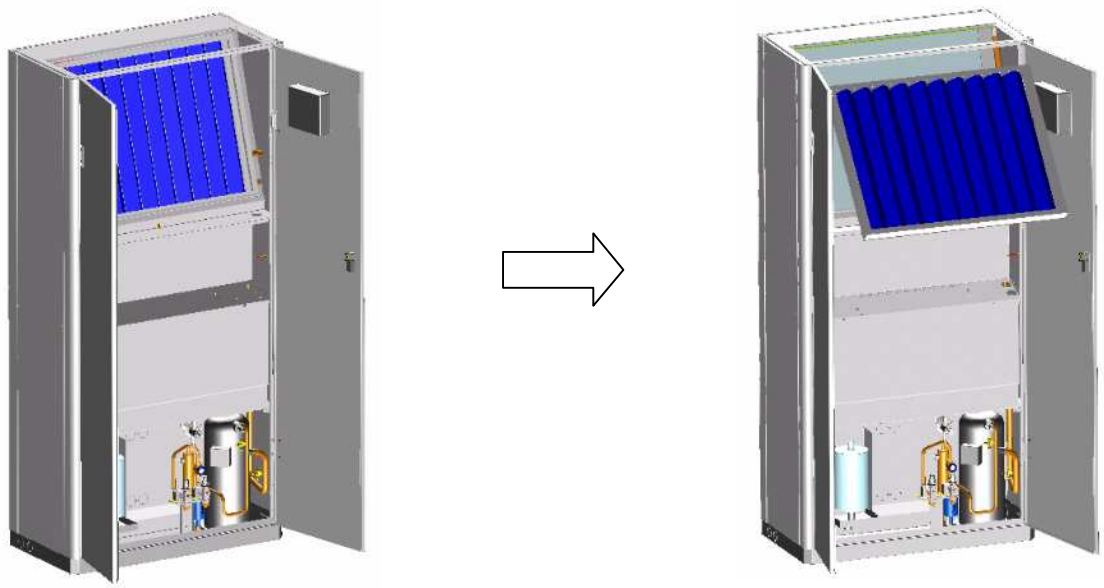
GENERALITES

To guarantee a constantly satisfactory performance over time, it is advisable to carry out routine maintenance and checks as described below. The indications below are related to standard tear and wear.

Operation	Frequency
• Check the efficiency of all the control and safety devices	Once a year
• Check the terminals on the electric control board and compressor terminal boards to ensure that they are securely tightened. The movable and fixed contacts of the circuit breakers must be periodically cleaned and replaced whenever they show signs of deterioration.	Once a year
• Check the refrigerant level by means of the liquid level indicator	Every 6 months (DX)
• Check the efficiency of the differential air pressure switch and dirty filter differential pressure switch	Every 6 months
• Check the condition of the air filter and replace it if necessary	Every 6 months
• Check the humidity indicator (green=dry, yellow=humid) on the liquid level indicator; if the indicator is not green as shown on the indicator sticker, replace the filter	Every 6 months (DX)

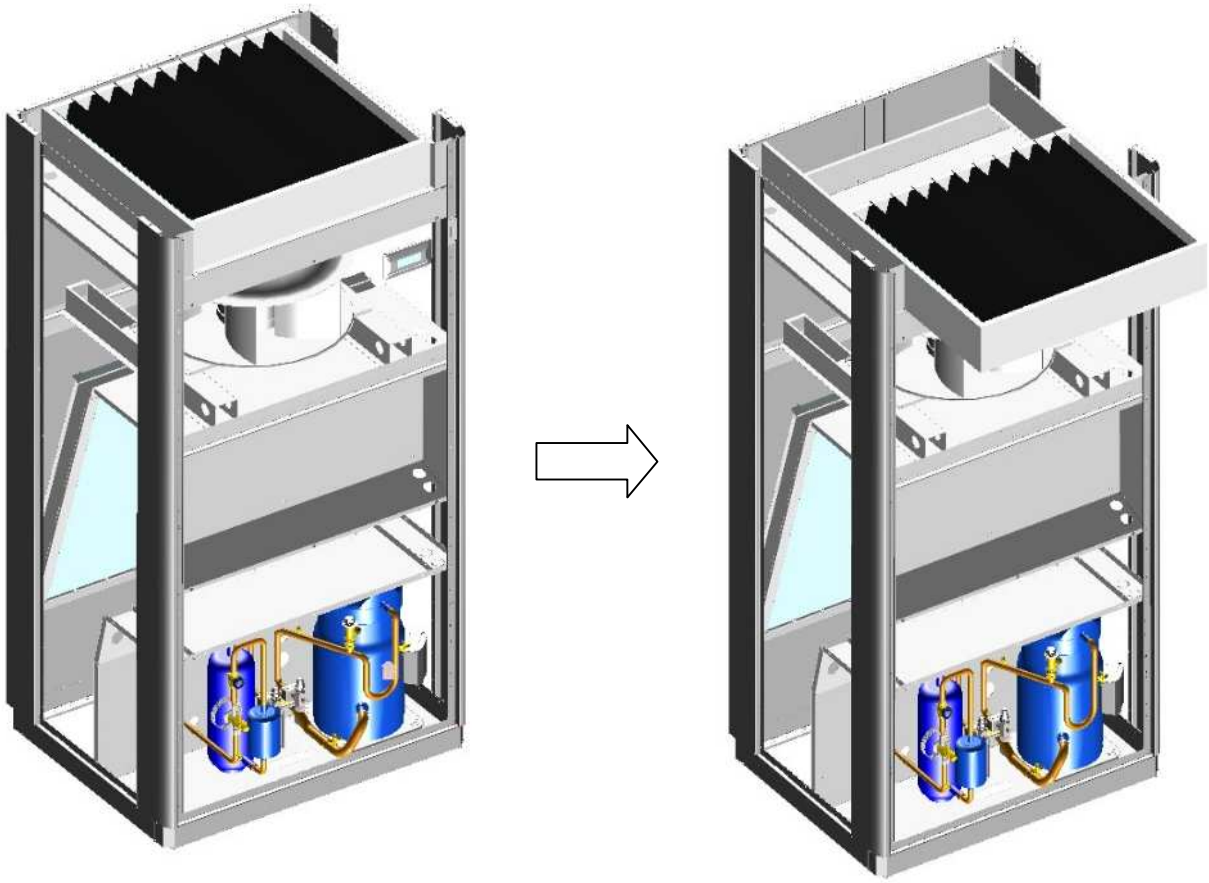
Inspecting the air filter DH*DC (DOWNFLOW CW and DX version)

- Remove the panel above the evaporator fan to access the damper and air filter compartment.
- Pull out the air filter.
- Check the condition of the filter and replace it if necessary



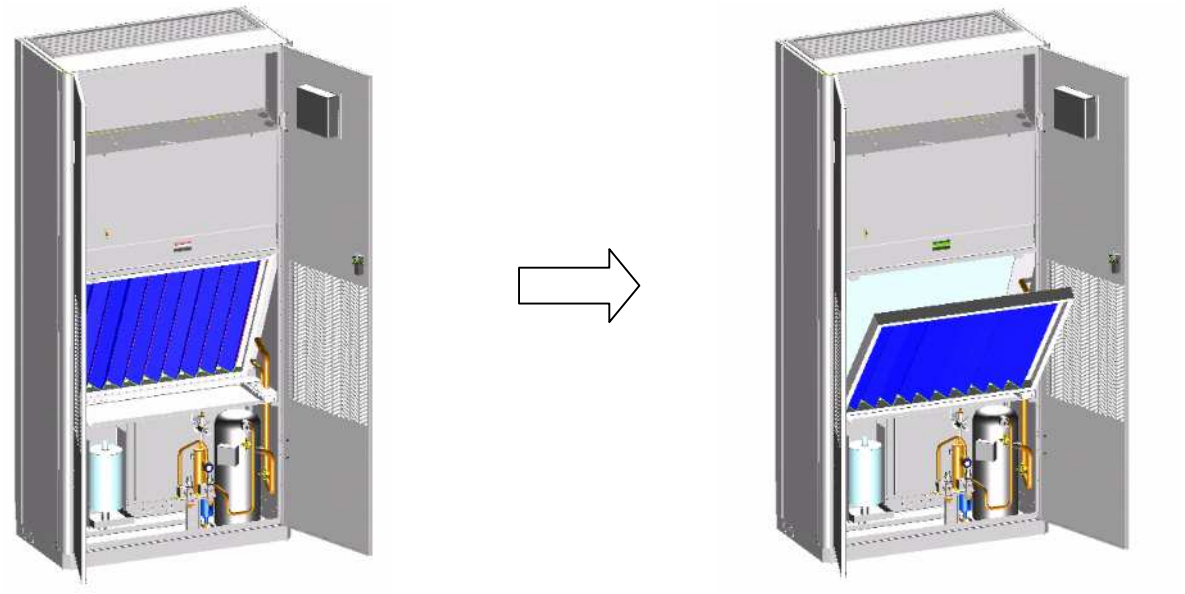
Inspecting the air filter DH*DR (DOWNFLOW CW and DX version)

- Open the front panels to access the air filter compartment.
- Pull out the air filter.
- Check the condition of the filter and replace it if necessary



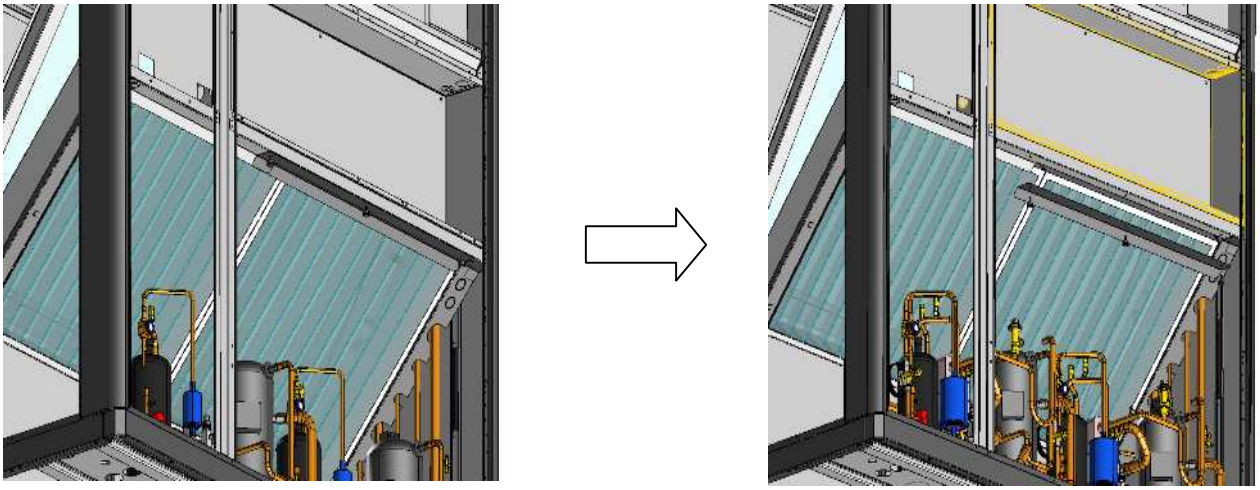
Inspecting the air filter DH*UC (UPFLOW CW and DX version)

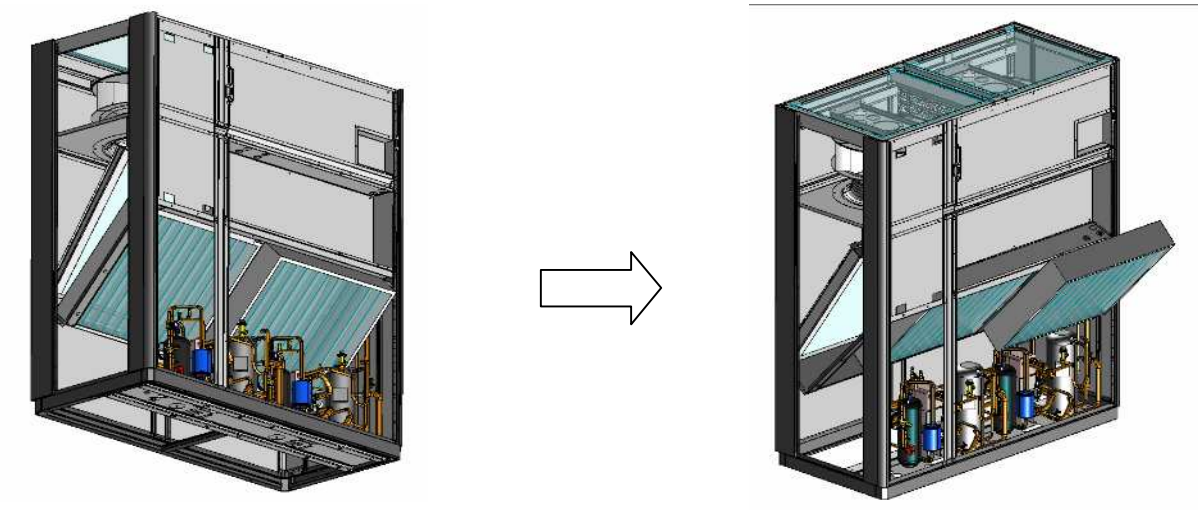
- Remove the panel above the evaporator fan to access the damper and air filter compartment.
- Pull out the air filter.
- Check the condition of the filter and replace it if necessary



Inspecting the air filter DH*UR (UPFLOW CW and DX version)

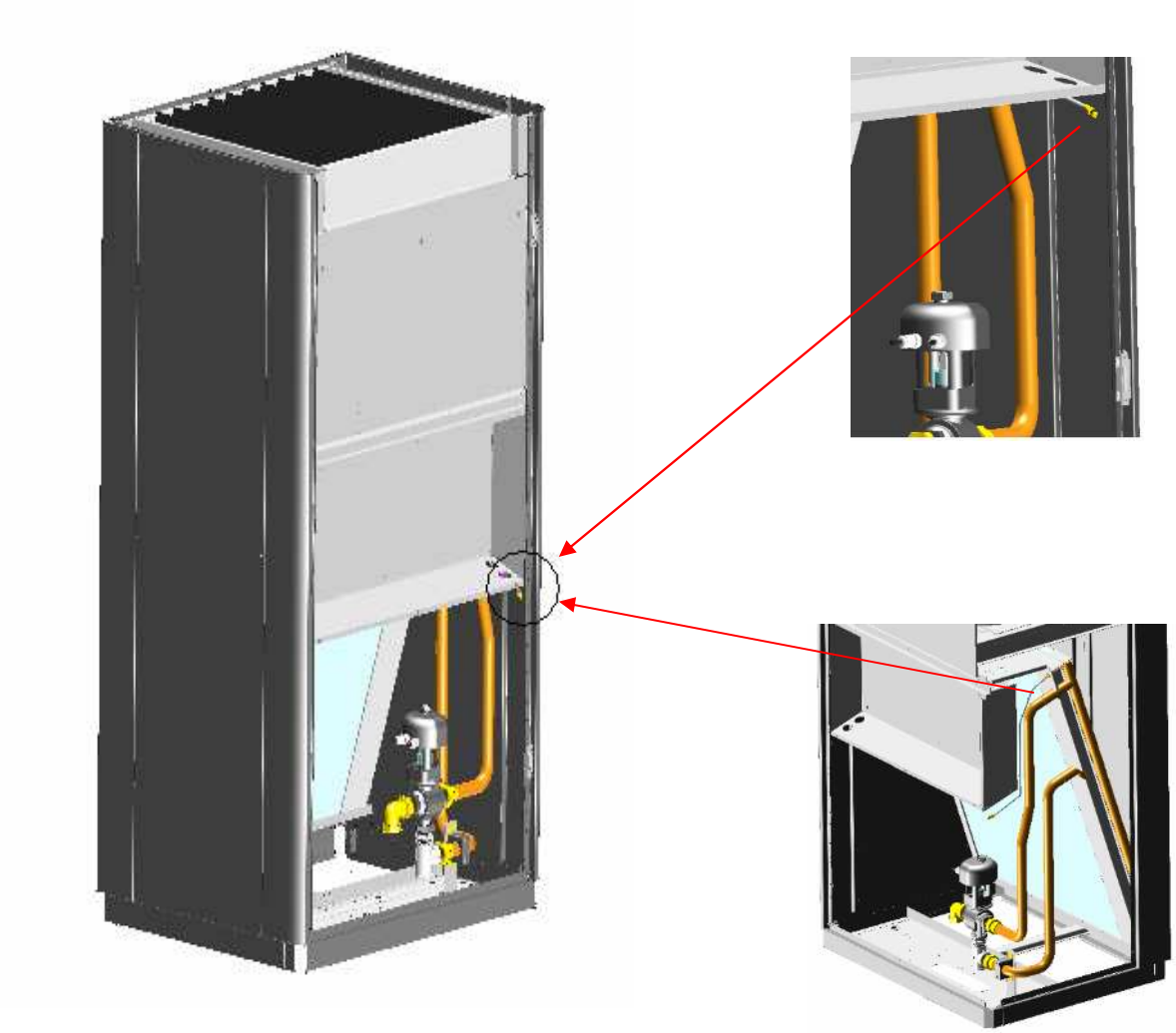
- Open the front panels to access the air filter compartment.
- Remove the screws(*) and the metallic support [(*) no need for tools]
- Extract the filter on the right.
- Pull on the right side the second filter and then extract it.





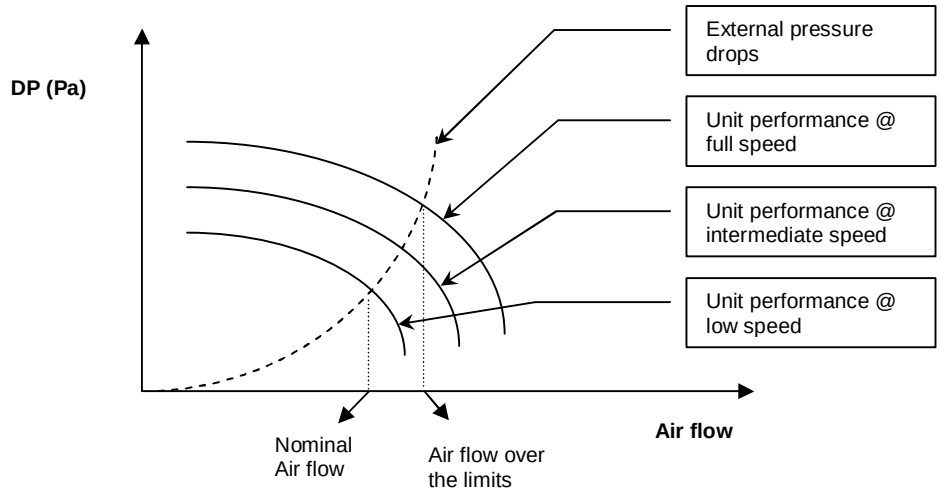
Purging the air out of the water coil (CW version)

- The relief valve is accessible in the units from front of the machines.
- In INNOV@ units there is a flexible pipe connecting the upper part of the coil to the front of the unit for an easier accessibility



Set the right fan speed

- The adopted fans are of the backward curved blades type in combination with a 4 poles e-motor. This kind of fan has very high performances so that it's speed has to be reduced in order to match to the nominal air flow with the real external pressure drops: in case of wrong selection, the air flow may exceed the limits with possible water dragging out from the coils (down flow units).



- The fan speed has to be selected according to the enclosed table by using the manual switch installed in the E-Panel and/or by changing the wire connections of the autotransformer for different selection than the four already available on the manual switch.

  - o Position 0 = fan OFF
  - o Position 1 = 30 Pa available @ nominal air volume [190 V]
  - o Position 2 = 100 Pa available @ nominal air volume [230 V]
  - o Position 3 = max Pa available @ nominal air volume [400 V]

  Other settings can be selected during the order process

- In the EC fans the rotation speeds are selected with different values of the control tension (0 – 10V). If in the unit is present the advanced control the right value of the control tension is set by the keyboard present in the advanced control. With the basic control the control tension is set with a manual potential installed in the E-Panel. To know the tension set with the potential it is necessary to use an external tool (Voltmeter).

AESP(Pa) with the different supply tensions for the plug fan(s)

DHADR 201/251	190 V	205 V	215 V	230 V	250 V	290 V	330 V	360 V	400 V
Base + Filter	..	..	..	28	91	163	258	327	396
Base + Filter + Heater	..	..	..	..	54	126	221	290	359
Base + Filter + Add Coil	..	..	..	..	62	134	229	298	367
Free Cooling + Filter	..	..	..	..	53	125	220	289	358
Free Cooling + Filter + Heater	..	..	..	..	1	71	166	235	304
Free Cooling + Filter + Add coil	..	..	..	..	14	86	181	250	319

DHADR 261	190 V	205 V	215 V	230 V	250 V	290 V	330 V	360 V	400 V
Base + Filter	..	..	..	9	72	144	239	308	377
Base + Filter + Heater	..	..	..	..	19	91	186	255	324
Base + Filter + Add Coil	..	..	..	..	34	106	201	270	339
Free Cooling + Filter	..	..	..	..	53	125	220	289	358
Free Cooling + Filter + Heater	..	..	..	..	..	71	166	235	304
Free Cooling + Filter + Add coil	..	..	..	..	14	86	181	250	319

DHADR 271/301/272/302/362	190 V	205 V	215 V	230 V	250 V	290 V	330 V	360 V	400 V
Base + Filter	..	42	79	116	173	240	331	406	481
Base + Filter + Heater	..	9	46	83	140	207	298	373	448
Base + Filter + Add Coil	..	18	55	92	149	216	307	382	457
Free Cooling + Filter	..	2	36,4	73,4	130,4	197,4	288	363	438
Free Cooling + Filter + Heater	..	..	2	35	92	159	250	325	400
Free Cooling + Filter + Add coil	..	..	12	49	106	173	264	339	414

DHADR 401/422/452/512	190 V	205 V	215 V	230 V	250 V	290 V	330 V	360 V	400 V
Base + Filter	..	22	59	96	153	220	311	386	461
Base + Filter + Heater	..	..	21	58	115	182	273	348	423
Base + Filter + Add Coil	..	..	34	71	128	195	286	361	436
Free Cooling + Filter	..	1	36,4	73,4	130,4	197,4	288	363	438
Free Cooling + Filter + Heater	..	..	1	35	92	159	250	325	400
Free Cooling + Filter + Add coil	..	..	12	49	106	173	264	339	414

DHADR 552	190 V	205 V	215 V	230 V	250 V	290 V	330 V	360 V	400 V
Base + Filter	..	47	84	121	178	245	336	411	486
Base + Filter + Heater	..	8	45	82	139	206	297	372	447
Base + Filter + Add Coil	..	24	61	98	155	222	313	388	463
Free Cooling + Filter	..	..	5	42	99	166	257	332	407
Free Cooling + Filter + Heater	..	..	..	4	61	128	219	294	369
Free Cooling + Filter + Add coil	..	..	..	19	76	143	234	309	384

DHADR 602 / 692 / 762	190 V	205 V	215 V	230 V	250 V	290 V	330 V	360 V	400 V
Base + Filter	..	16	53	90	147	214	305	380	455
Base + Filter + Heater	..	..	14,3	51,3	108,3	175,3	266	341	416
Base + Filter + Add Coil	..	..	30	67	124	191	282	357	432
Free Cooling + Filter	..	..	5	42	99	166	257	332	407
Free Cooling + Filter + Heater	..	..	..	4	61	128	219	294	369
Free Cooling + Filter + Add coil	..	..	..	19	76	143	234	309	384

AESP (Pa) with the different control tensions (0 – 10 V) for the EC fan(s)

DHADR 201 / 251	1 V	2 V	3 V	4 V	5 V	6 V	7 V	8 V	9 V	10 V
Base + Filter	..	..	..	..	11,5	92,5	173,5	254,5	335,5	416,5
Base +Filter + Heater	..	..	..	..	..	49,6	130,6	211,6	292,6	373,6
Base + Filter + Add Coil	..	..	..	..	..	64,4	145,4	226,4	307,4	388,4
Free Cooling + Filter	..	..	..	..	..	47,3	128,3	209,3	290,3	371,3
Free Cooling + Filter + Heater	..	..	..	..	..	4,3	85,3	166,3	247,3	328,3
Free Cooling + Filter + Add coil	..	..	..	..	..	19,1	100,1	181,1	262,1	343,1

DHADR 261	1 V	2 V	3 V	4 V	5 V	6 V	7 V	8 V	9 V	10 V
Base + Filter	..	..	..	..	..	66,5	147,5	228,5	309,5	390,5
Base +Filter + Heater	..	..	..	..	..	23,5	104,5	185,5	266,5	347,5
Base + Filter + Add Coil	..	..	..	..	..	38,3	119,3	200,3	281,3	362,3
Free Cooling + Filter	..	..	..	..	..	47,3	128,3	209,3	290,3	371,3
Free Cooling + Filter + Heater	..	..	..	..	..	4,3	85,3	166,3	247,3	328,3
Free Cooling + Filter + Add coil	..	..	..	..	..	19,1	100,1	181,1	262,1	343,1

DHADR 271 / 301 /272 / 302 / 362	1 V	2 V	3 V	4 V	5 V	6 V	7 V	8 V	9 V	10 V
Base + Filter	..	..	..	..	36,0	117,0	198,0	279,0	360,0	441,0
Base +Filter + Heater	..	..	..	..	..	78,8	159,8	240,8	321,8	402,8
Base + Filter + Add Coil	..	..	..	..	..	92,5	173,5	254,5	335,5	416,5
Free Cooling + Filter	..	..	..	..	..	76,5	157,5	238,5	319,5	400,5
Free Cooling + Filter + Heater	..	..	..	..	..	38,3	119,3	200,3	281,3	362,3
Free Cooling + Filter + Add coil	..	..	..	..	..	52,0	133,0	214,0	295,0	376,0

DHADR 401 / 422 / 452 / 512	1 V	2 V	3 V	4 V	5 V	6 V	7 V	8 V	9 V	10 V
Base + Filter	..	..	..	..	15,9	96,9	177,9	258,9	339,9	420,9
Base +Filter + Heater	..	..	..	..	..	58,7	139,7	220,7	301,7	382,7
Base + Filter + Add Coil	..	..	..	..	..	72,4	153,4	234,4	315,4	396,4
Free Cooling + Filter	..	..	..	..	..	76,5	157,5	238,5	319,5	400,5
Free Cooling + Filter + Heater	..	..	..	..	..	38,3	119,3	200,3	281,3	362,3
Free Cooling + Filter + Add coil	..	..	..	..	..	52,0	133,0	214,0	295,0	376,0

DHADR 552	1 V	2 V	3 V	4 V	5 V	6 V	7 V	8 V	9 V	10 V
Base + Filter	..	..	..	..	40,4	121,4	202,4	283,4	364,4	445,4
Base +Filter + Heater	..	..	..	..	2,2	83,2	164,2	245,2	326,2	407,2
Base + Filter + Add Coil	..	..	..	..	17,6	98,6	179,6	260,6	341,6	422,6
Free Cooling + Filter	..	..	..	..	..	43,1	124,1	205,1	286,1	367,1
Free Cooling + Filter + Heater	..	..	..	..	..	4,9	85,9	166,9	247,9	328,9
Free Cooling + Filter + Add coil	..	..	..	..	..	20,0	101,0	182,0	263,0	344,0

DHADR 602 / 692 / 762	1 V	2 V	3 V	4 V	5 V	6 V	7 V	8 V	9 V	10 V
Base + Filter	..	..	..	..	10,0	91,0	172,0	253,0	334,0	415,0
Base +Filter + Heater	..	..	..	..	..	52,8	133,8	214,8	295,8	376,8
Base + Filter + Add Coil	..	..	..	..	..	68,2	149,2	230,2	311,2	392,2
Free Cooling + Filter	..	..	..	..	..	43,1	124,1	205,1	286,1	367,1
Free Cooling + Filter + Heater	..	..	..	..	..	4,9	85,9	166,9	247,9	328,9
Free Cooling + Filter + Add coil	..	..	..	..	..	20,0	101,0	182,0	263,0	344,0

REPAIRING THE COOLING CIRCUIT

Warning: while performing repairs on the cooling circuit or maintenance work on the compressors, make sure the circuit is left open for as less time as possible. Even if briefly exposed to air, ester oils tend to absorb large amounts of humidity, which results in the formation of weak acids.

If the cooling circuit has undergone any repairs, the following operations must be carried out:

- tightness test;
- evacuation and drying of the cooling circuit;
- charging with refrigerant.

If the system has to be drained, always recover the refrigerant present in the circuit using suitable equipment; the refrigerant should be handled exclusively in the liquid phase.

Tightness test

Fill the circuit with anhydrous nitrogen supplied from a tank with a pressure-reducing valve until the pressure rises to 22 bars.

During the pressurisation phase, do not exceed a pressure of 22 bars on the compressor low pressure side

The presence of any leaks must be determined using special leak detectors. Should any leaks be detected during the test, empty out the circuit before repairing the leaks with suitable alloys.

Do not use oxygen in the place of nitrogen as a test agent, since this would cause a risk of explosion.

Hard Vacuum and Drying of Cooling Circuit

To achieve a hard vacuum in the cooling circuit it is necessary to use a pump capable of generating a high degree of vacuum, i.e. 150 Pa of absolute pressure with a capacity of approximately 10 m^3/h. If such a pump is available, one evacuation will normally suffice to achieve an absolute pressure of 150 Pa.
If there is no such vacuum pump available, or whenever the circuit has remained open for long periods of time, you are strongly recommended to adopt the triple evacuation method. This method is also recommended when there is a presence of humidity within the circuit.
The vacuum pump should be connected to the inlets.
The procedure to be carried out is as follows:

- Evacuate the circuit until you reach an absolute pressure of at least 350 Pa: at this point inject nitrogen into the circuit until you reach a relative pressure of about 1 bar.

- Repeat the step described above.

- Carry out the step described above for the third time, but in this case attempting to reach the hardest vacuum possible.

Using this procedure you can easily remove up to 99% of pollutants.

Recharging with refrigerant R407C

- Connect the tank of refrigerant gas to the male 1/4 SAE inlet situated on the liquid line after discharging a little gas to eliminate air in the connection pipe.

- **Fill with refrigerant in liquid form** until you reach 75% of the total charge.

- Then connect to the inlet on the pipe between the thermostatic valve and evaporator and complete the charging process with the refrigerant **in liquid form** until no more bubbles can be seen on the liquid level indicator and the operating parameters specified in section 4.4 have been reached.

Since R407C is a ternary mixture, charging must take place exclusively with liquid refrigerant to ensure the correct percentages of the three constituents.
Introduce refrigerant through the inlet in the liquid line.

A unit that was originally charged with R407C in the factory must not be charged with R22 or other refrigerants without the written authorisation of HiRef S.p.A.

Environmental protection

The law implementing the regulations [reg. EEC 2037/00] which govern the use of ozone-depleting substances and greenhouse gases bans the dispersal of refrigerant gases in the environment and requires whoever is in their possession to recover them and, at the end of their useful life, either to return them to the dealer or take them to a suitable waste disposal facility.
The refrigerant HFC R407C is not harmful to the ozone layer but is included among the substances responsible for the greenhouse effect and thus falls within the scope of the aforesaid regulations.

Therefore, special care should be taken when carrying out maintenance work to minimise refrigerant leaks.

STARTING UP FOR THE FIRST TIME

STARTING OPERATION

Before starting the unit, turn the main switch on, select the operating mode desired from the control panel and press the "ON" button on the control panel.

If the unit fails to start up, check if the service thermostat has been set according to the nominal values provided

You should not disconnect the unit from the power supply during periods when it is inoperative but only when it is to be taken out of service for a prolonged period (e.g. at the end of the season).

CHECKS DURING OPERATION

- Check the phase sequence relay on the control board to verify whether the phases occur in the correct sequence: if they do not, disconnect the unit from power supply and invert two phases of the incoming three-pole cable. **Never** attempt to modify internal electrical connections: any undue modifications will immediately invalidate the warranty.

CHECKING THE REFRIGERANT LEVEL (DX Versions)

- After a few hours of operation, check whether the liquid level indicator has a green ring: a yellow colour indicates the presence of humidity in the circuit. In such a case the circuit must be dehumidified by qualified personnel.

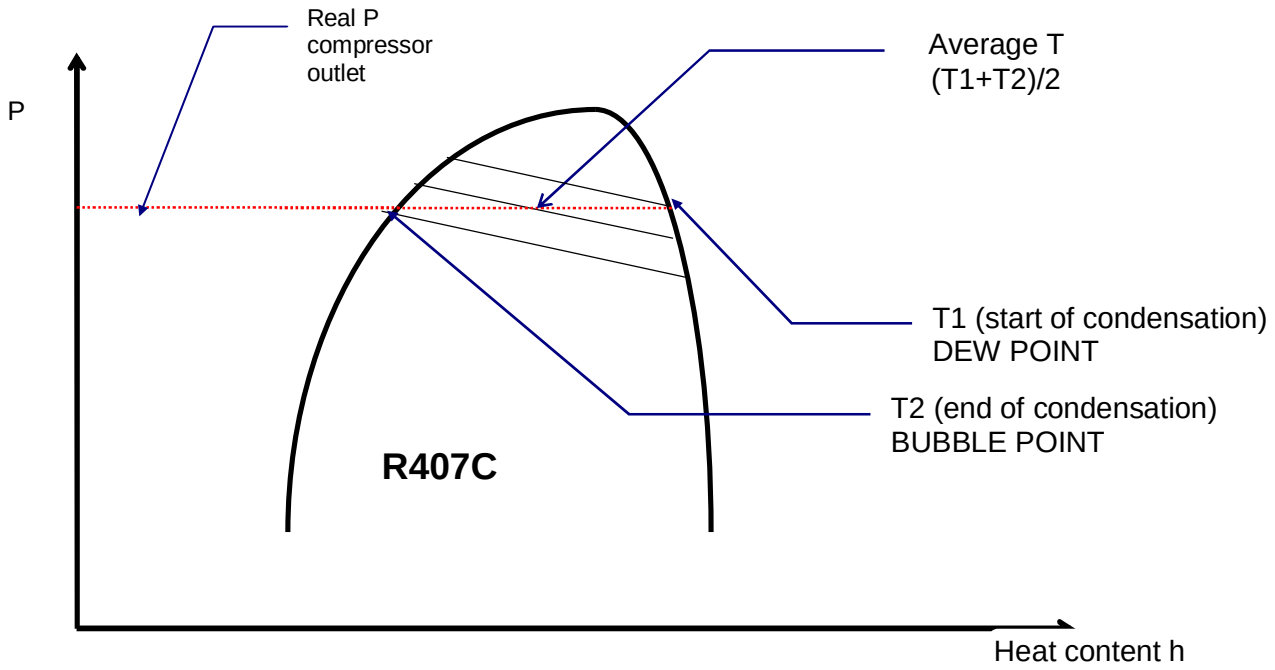
  -Large quantities of bubbles should not appear through the liquid level indicator. A constant passage of numerous bubbles may indicate that the refrigerant level is low and needs to be topped up. The presence of a few bubbles is however allowed, especially in the case of high-glide ternary mixtures such as HFC R407C

- Make sure the overheating of the cooling fluid is limited to between 5 and 8 °C: to this end:
  1) read the temperature indicated by a contact thermometer placed on the compressor intake pipe;
  2) read the temperature indicated on the scale of a pressure gauge likewise connected to the intake side; refer to the pressure gauge scale for the refrigerant R407C, marked with the initials D.P. (Dew Point). The degree of overheating is given by the difference between the temperatures thus determined.

- Make sure that the Sub-cooling of the cooling fluid is limited to between 3 and 5°C: to this end:
  1) read the temperature indicated by a contact thermometer placed on the condenser outlet pipe;
  2) read the temperature indicated on the scale of a pressure gauge connected to the liquid inlet at the condenser outlet; refer to the pressure gauge scale for the refrigerant R407C, marked with the initials B.P. (Bubble Point).
     The degree of Sub-cooling is given by the difference between the temperatures thus determined.

Warning: all INNV@ units are charged with dry nitrogen. Any top-ups must be made using the same type of refrigerant. This operation is to be considered extraordinary maintenance work and must be performed by qualified personnel only.

Warning: the refrigerant R407C requires “POE” polyolester oil of the type and viscosity indicated on the compressor rating plate.
For no reason should oil of a different type be introduced into the oil circuit.



- The difference between the Dew Point and Bubble Point is known as “GLIDE” and this is a characteristic property of refrigerant mixtures. If pure fluids are used, the phase change occurs at a constant T and thus the glide is equal to zero.

TROUBLESHOOTING

On the next pages you will find a list of the most common reasons that may cause the package unit to fail or any malfunction. This causes are broken down according to easily identifiable symptoms.

You should be extremely careful when attempting to implement any of the possible remedies suggested: overconfidence can result in injuries, even serious ones, to inexpert individuals. Therefore, once the cause has been identified, you are advised to contact the manufacturer or a qualified technician for help.

FAULT	Possible causes	Corrective actions
The unit does not start	No power supply	Check if power is being supplied both to the primary and auxiliary circuits.
	The electronic card is cut off from the power supply	Check the fuses
	Alarms have been released	Check whether any alarms are signalled on the microprocessor control panel, eliminate the causes and restart the unit.
	The phase sequence is wrong	Invert two phases in the primary power line after disconnecting them upstream from the unit
The compressor is noisy	The compressor is rotating in the wrong direction	Check the phase sequence relay. Invert the phases on the terminal board after disconnecting the unit and contact the manufacturer.
Presence of abnormally high pressure	Insufficient airflow through the condenser	Check for the presence of obstructions in the condenser section ventilation circuit Check whether the condenser coil surface is obstructed Check the condensation control device [optional]
	Presence of air in the refrigerant circuit, as revealed by the presence of bubbles in the flow indicator also with sub-cooling values exceeding 5 °C	Drain and pressurise the circuit and check for leaks. Evacuate slowly [for more than 3 hours] until reaching a pressure of 0.1 Pa and then recharge in the liquid phase

FAULT	Possible causes	Corrective actions
Presence of abnormally high pressure	Unit overcharged, as revealed by a Sub-cooling of more than 8 °C	Drain the circuit
	Thermostatic valve and/or filter obstructed. These symptoms may also occur in the presence of an abnormally low pressure.	Check the temperatures upstream and downstream from the valve and filter and replace them if necessary.
Low condensation pressure	Transducer fault	Check the efficiency of the condensation control device [optional]
Low evaporation pressure	Malfunctioning of thermostatic valve	Warming the bulb with your hand, check whether the valve opens and adjust it if necessary. If it does not respond, replace it.
	Filter dryer clogged	Pressure drops upstream and downstream from the filter should not exceed 2°C. If they do, replace the filter.
	Low condensation T	Check the efficiency of the condensation control device [where present]
	Low level of refrigerant	Check the refrigerant level by measuring the degree of Sub-cooling; if it is below 2°C replenish the charge
	The internal thermal protection device has tripped	In the case of compressors equipped with a protection module, check the thermal contact. Identify the causes after restarting.
The compressor does not start	The circuit breakers or line fuses have been tripped by a short circuit	Pinpoint the cause by measuring the resistance of the individual windings and the insulation from the casing before restoring power.
	One of the high or low pressure switches has tripped	Check on the microprocessor, eliminate the causes.
	The phases have been inverted in the distribution compartment	Check the phase sequence relay.
Water out from the unit	The drain pan hole is closed	Open the front panels, remove the sheet metal just below the e-panel (Down Flow units) and clean it
Water out from the unit	The siphon is missing	Check for the presence and provide for a new one.
Water out from the unit	The Air flow is too high	Reduce the fan speed up to reaching the nominal air flow.

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