innov@

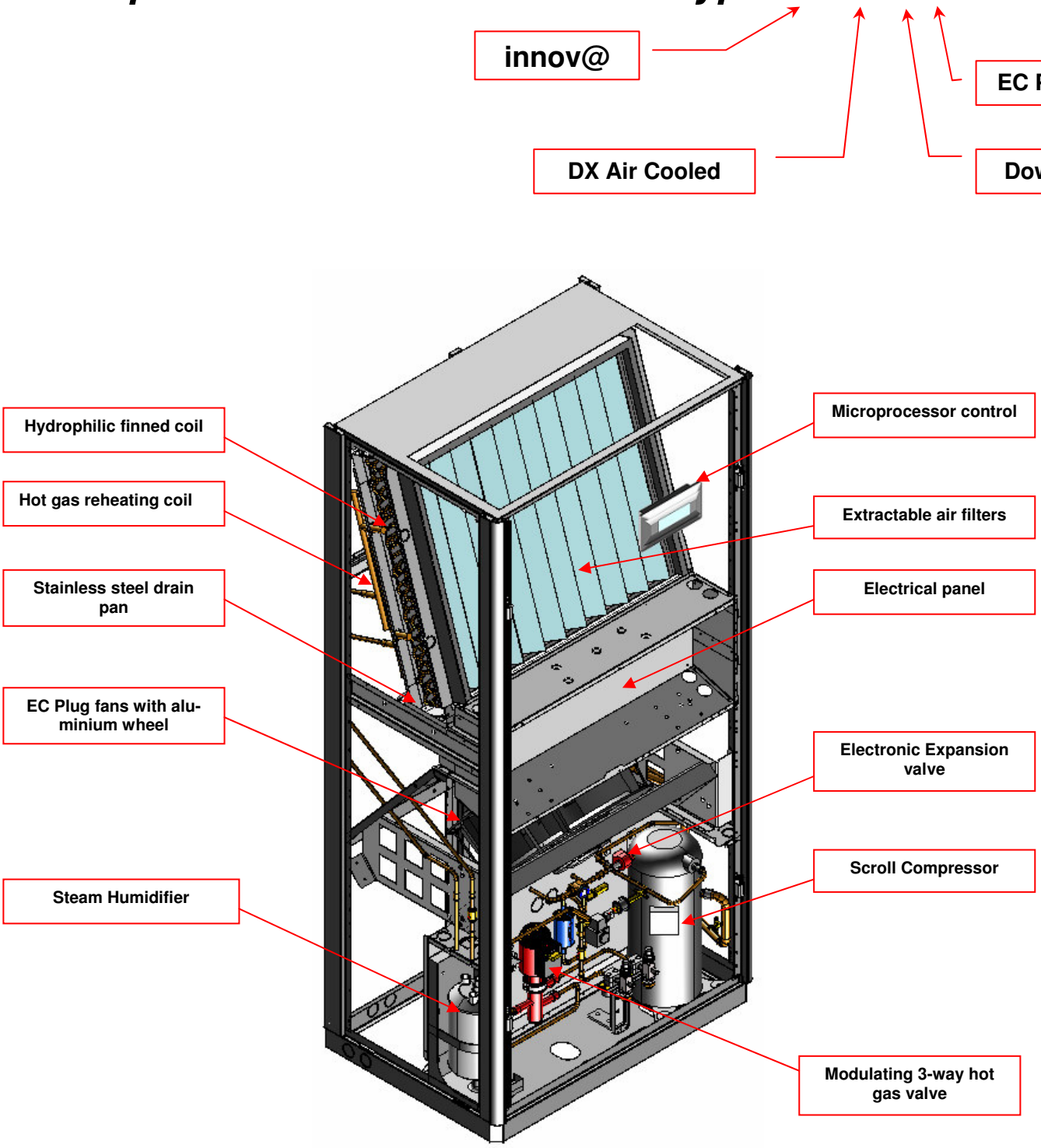
Close Control Units

“EC Direct Driven Plug fans”

APPLICATION GUIDE

Index

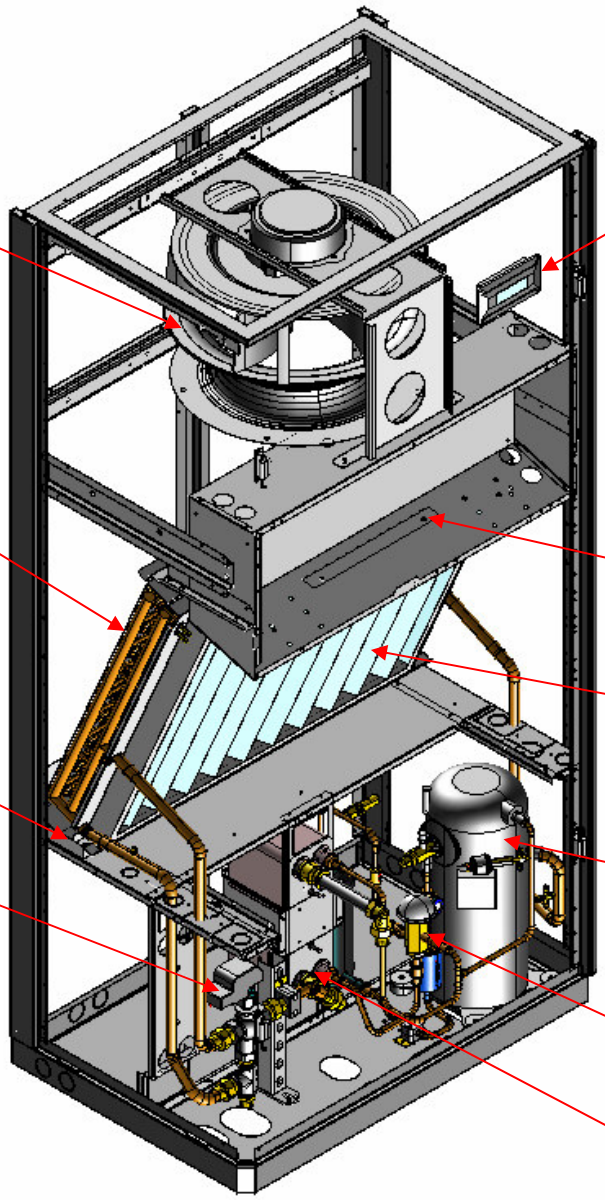
Example of a DX Air Cooled Unit Type: DHADR



Example of a DX Indirect Free-cooling Unit Type:

DHFUR

- innov@
- EC Plug Fan
- DX - Indirect FC
- Up Flow



- EC Plug fans with aluminium wheel
- Hydrophilic finned coil
- Stainless steel drain pan
- Modulating 3-way water valve
- Microprocessor control
- Electrical panel
- Extractable air filters
- Scroll Compressor
- Electronic Expansion valve
- Brazed plate condenser

Example of a CW Unit Type: DHCDR

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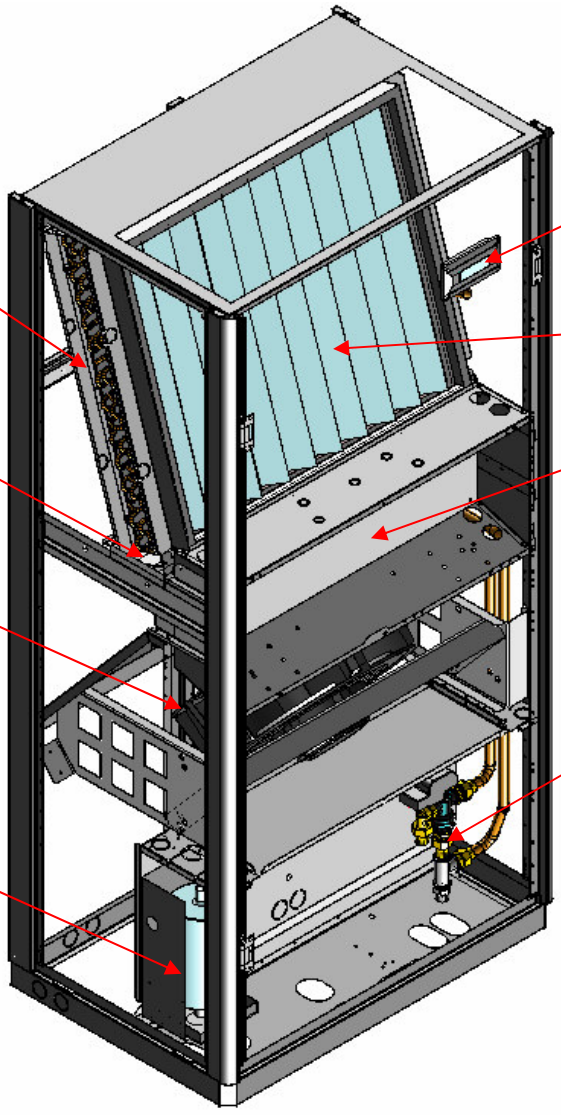
CW Chilled water unit

Plug Fan

Down Flow



Hydrophilic finned coil

Stainless steel drain pan

Plug fans with aluminium wheel

Steam Humidifier

Microprocessor control

Extractable air filters

Electrical panel

3 way valve

DIGIT Configuration

The **RADIAL INNOV@ DH..R** range consists of 13 models with a cooling capacity ranging between 5,9 and 22,2 kW. All units are available in different air-flow configurations and in DX or CW version, according to the DIGIT configuration shown below.

Direct Expansion Unit DX

DH	A	D	R		0	1	0	0		1	2	3	4	5	6	7	8	9	10	11

DH : Innov@ series

DX Direct expansion units

A: remote air condensed units
W: water condensed units
F: Indirect free cooling (“R” radial fan version only)
D: dual cooling (Water coil + DX coil remote condensed -for “R” only)
Q: dual cooling (Water coil + DX coil water condensed -for “R” only)
Z: city water condensed units (T inlet <=20°C)*

Air Flow

D: downstream
U: upstream
X: displacement (“R” only)

Fans

R: EC Radial fan with backward curved blades

Cooling capacity

KW / 10

(*)kindly suggested the pressostatic valve

	Configuration	
1	**Power supply**	
	400V / 3 ph + N / 50Hz	**3**
2	**Control**	
	Basic – Carel µAC	**0**
	Advanced (with local interface) – Carel pCO1	**B**
3	**Refrigerant**	
	R407C	**0**
	R407C with electronic expansion valve	**1**
	R22	**2**
	R22 with electronic expansion valve	**3**
4	**Fan**	
	Brushless *EC Technology* (Special)	**E**
5	**Humidifier**	
	No	**0**
	Dehumidification	**4**
	Dehumidification + Steam Humidifier	**5**
6	**Electrical heater**	
	No	**0**
	Yes - 3 steps	**F**
7	**Re-heating system**	
	No	**0**
	Hot gas coil modulating On/Off (Special)	**4**
	Hot gas coil modulating (with advanced control) (Special)	**8**
	Hot water coil with 0-10V signal activated valve (Special)	**7**
8	**Air filtration**	
	G3 (standard)	**0**
	G4	**H**
	F5 (Special)	**P**
	G3 + clogged filter sensor	**I**
	G4 + clogged filter sensor	**L**
	F5 + clogged filter sensor (Special)	**Q**
9	**Condensing control**	
	None	**0**
	Mod. fan speed control with MCB (advanced)	**5**
	Flooding technology refrigerant side with back pressure valve (in „F“ version = standard)	**7**
	2-way water pressostatic valve for watercooled „Z“ & „Q“ version	**9**
10	**Packaging**	
	Standard	**0**
	Wooden crate with cardboard	**M**
	Seaworthy	**N**
11	**Special**	
	Standard	**0**
	Special	**S**

Configuration DIGIT

Chilled water units: Example...

DH	C	D	R		0	0	8	0		1	2	3	4	5	6	7	8	9	10	11

DH : INNOV@ series

CW chilled water
C: base unit
S: slave unit without microprocessor

Air Flow
D: downstream
U: upstream
X: displacement (“R” only)

Fans
R: EC Radial fan with backward curved blades

Cooling capacity
KW / 10

	Configuration	
1	**Power supply**	
	400V / 3 ph + N / 50Hz	**3**
	Standard: 230V / 1 ph + N / 50Hz	**1**
2	**Control**	
	Basic – Carel µAC	**0**
	Advanced (with local interface) Carel pCO1	**B**
	Slave unit without micrprocessor (Special)	**C**
3	**Valve**	
	3 way valve with 3 point motor	**0**
	3 way valve with 0-10 V signal activated motor	**3**
4	**Fan**	
	Brushless *EC-Technology* (Special)	**E**
5	**Humidifier**	
	No	**0**
	Dehumidification	**4**
	Dehumidification + Humidifier	**5**
6	**Electrical heater**	
	No	**0**
	Yes - 3 steps	**F**
7	**Re-heating system**	
	No	**0**
	Hot water coil with 3 point activated valve (Special)	**5**
	Hot water coil with 0-10 V signal activated valve (Special)	**6**
8	**Air filtration**	
	G3 (standard)	**0**
	G4	**H**
	F5 (Special)	**P**
	G3 + clogged filter sensor	**I**
	G4 + clogged filter sensor	**L**
	F5 + clogged filter sensor (Special)	**Q**
9	**Condensing control**	
	No	**0**
10	**Packaging**	
	Standard	**0**
	Wooden crate with cardboard	**M**
	Seaworthy	**N**
11	**Special**	
	None	**0**
	Special	**S**

Main Characteristics

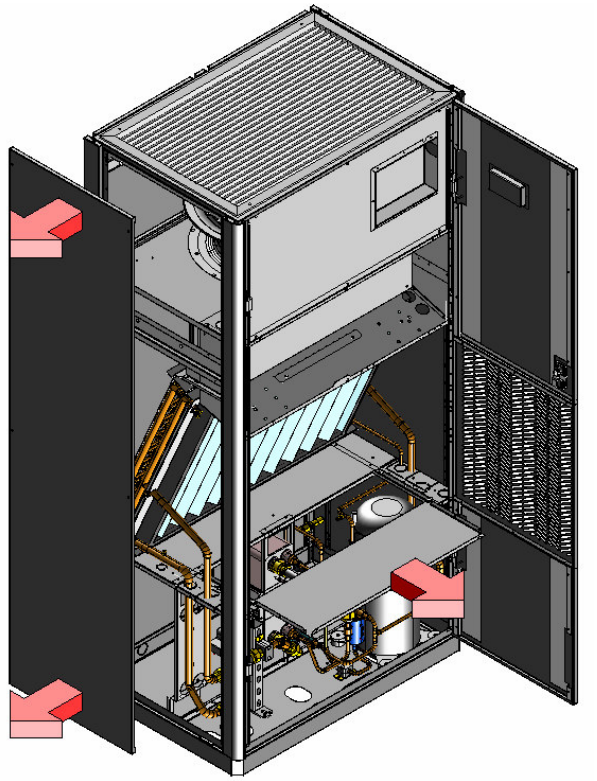
INNOV@ DH..R CCU Units

INNOV@ CCU self-contained units are specially designed to be installed in technological environments such as Computer rooms, laboratories and where a high precision in climate control and a 24h/day operation are requested. INNOV@ units represent the state of the art of technology and design as well as all **Lennox** products. Thanks to their characteristics, INNOV@ can be installed also in office environments where people are working in. A depth of 600 mm in "R" versions, allows the compatibility with standard cabinets for EDP environments. Furthermore, the innovative design and the high tech colours match the INNOV@ units to the last generation of IT devices. The internal design of the units is developed primary on the background of efficiency and reliability, but guaranteeing unhindered accessibility: **all** components, such as e-heaters, fans, compressors, valve, etc. can be easily maintained from the front of the unit. Moreover, the door/s are dismountable in just a few seconds thanks to an innovative hinge: this is a very important additional feature, specially developed to enable accessibility when units are installed in small corridors. The exclusive use of components of internationally well-known brands and a fully integrated development process (CAD+CAM, CAE) represents the highest possible quality level in efficiency, reliability, maintenance time, pre and after sales support. All DX units are available in single circuit version.

Frame

INNOV@ units are designed with a self-supporting frame and all components are made “in-house”, using sophisticated computer driven machines and special tools. All sheet metals are galvanized; the external panels moreover are powder coated RAL 7016 “anthracite grey” colour, or RAL 9002 “grey white”, giving the units an image and a look such as the last generation of IT devices. The units are completely closed, only frontal access is required. Nevertheless, a side access is also possible in order to reach the steam tube, the drain pan, or simply to replace a damaged side panel: all these problems are very unusual, but with INNOV@ units, it is possible to solve them, in spite of most other product on the market. The shape of the units is characterized by rounded edges of 26,5 mm radius, as it happens for all Lennox products. This special feature is produced using special tools and it gives a new aesthetic appearance together with advantages in injury prevention. The compressor compartment is separated from the air-flow. The special internal design allows a simple dismounting of the upper part of the compartment ensuring an insuperable accessibility to all refrigerating components.

All fixing elements are made either of stainless steel or of non-corroding materials. The drain pan is made of stainless steel in order to ensure long lifetime operations without damage.



All panels are thermally insulated with a polyurethane foam class 1, according to UL 94 norms: this material, thanks to the open cells, achieves good performances in sound absorption. Sandwich panels are available as an option. They are made of synthetic fibres, laid between the external panel and a second metal sheet, to get the highest value of internal smoothness. The sound insulation is better than in standard versions, but the level of the internal reflected sound-power will increase on airflow discharge side.

Refrigerating circuit

The entire refrigerating circuit is assembled in Lennox’s production, including all pipe work and using only primary brand for the components. The employees involved in the welding and pipe work processes are qualified by a third part according to the CEE 97/23 PED directive: this kind of qualification for workers is not a requirement, but Lennox’s policy is for the care of the product quality and of the customer’s satisfaction. All DX units are in single circuit execution and are precharged with dry nitrogen for “A”, “D” or with R407C refrigerant in “W”, “F”, “Q” versions. Units for different re-

frigerants such as R22, R134a, and R410A are available on request.

- Compressors: Only primary brand scroll compressors are installed in INNOV@ units (fig.1). The scroll compressor represents the best solution in terms of efficiency and reliability for CCU units. The internal compression ratio is very close to the typical operating condition of CCU applications, bearing the maximum in terms of COP. The perfectly balanced pressures during start-up phases are a great advantage for the electrical motor and its reliability, most of all in this field, where start-ups are very frequent.
  If more cooling capacity modulation is necessary, maintaining high values of the COP, the ENERGY units with inverter compressor are suggested. Further information about this technology is available on the product documentation of **ENERGY** units.

- Plate heat exchangers: only AISI 304 BPHEs with low-carbon steel connections are used. The special design of the plates gives both the advantage of increasing the turbulence, reducing the fouling, and of increasing the efficiency, lowering the overall dimensions: this feature let the BPHE to be installed behind the compressor compartment, leaving more space for piping and other components.

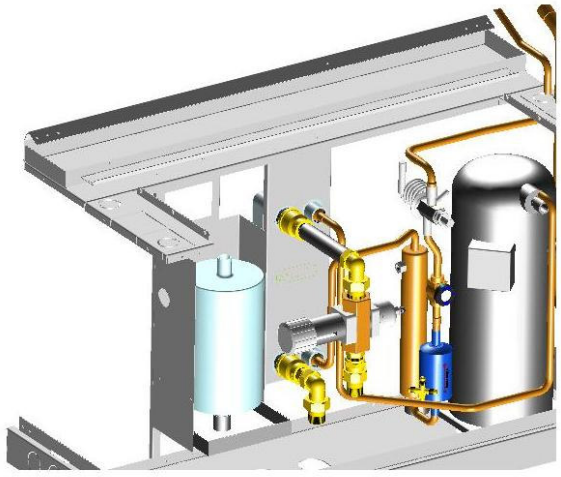


Fig.1

- Finned coil heat exchanger: All coils are made by using the 25 x 21,65 mm geometry, in combination with 9,52mm copper pipes and 0,10mm-thick aluminium fins. The expanding process, that guarantees a perfect contact between pipes and fins, is one of the most critical processes and it's 100% monitored in the whole production. The design criteria for our R&D department and our laboratories, can be summarized in 4 main points:
  - Reduction of pressure losses by using coils with a large front surface
  - Hydrophilic treatment on the fins to allow the film-condensation of the dehumidification water
  - Reduction of the vertical length to avoid big thickness of water film and, at the same time, to have the possibility to deal with high air volumes and high relative humidity with no water-detaching in down-flow units.
  - Special Corrugated Fins increase the heat transfer coefficient on air-side and consequently improve the SHR.

  A great care has been taken over the chilled-water units by checking the behaviour of the Reynolds number inside the pipes during the modulation of the three-way valve: a transition between laminar and turbulent flow may lead to a big benefit for the heat exchange efficiency, but with loss of accuracy in T control.
  In order to reduce the stocking of spare parts, as usual for all Lennox products, only one coil is used for both up- and down-flow units.

- Remote condenser: coils are made using the 25 x 21,65 mm geometry for the 9,52mm copper grooved pipes (5/16" for R410A refrigerant fluid) and 0,10mm-thick aluminium louvered fins. The combination of these technologies allows the maximum reduction of the internal volume and consequently a reduction of the refrigerant charge quantity. The adopted fans come only with external-rotor motor and in 4- or 6-pole execution, depending on the selected sound power level. There are already two available selections in the catalogue, but on special request, our R&D department can work further solutions out. Panels are made of galvanized precoated metal sheet and special brackets for horizontal installations are available for the whole range (as an option). For different climatic areas you can choose among three different type of condensing controls:

  - None
  - Modulating fan-speed control installed on-board of the CCU → down to -15°C
  - Flooding technology in addition to the fan-speed control for temperatures below -15°C and down to -30°C. This last option will be supplied as a kit (including a liquid receiver, a back pressure valve, a safety valve and a protection cabinet) and needs to be installed on-site just next to the condensing unit.

- Refrigerating components:
  - Filter with molecular sieve and activated alumina.
  - Sight glass with humidity indication.
  - Thermostatic valve with MOP function and external equalization.
  - Electronic expansion valve for insuperable performances in middle and winter season: the pay-back of the solution in North-Europe countries is less than one year.

- Liquid receiver according to the CEE 97/23 PED directive
- HP pressostat with manual reset according to cat. IV CEE 97/23 PED.
- LP pressostat with automatic reset and delayed time during start-ups.
- Schrader valves for maintenance and/or control.
- Long distance kit if needed.

Electrical panel & components

- Electrical panel: the electrical panel is fully integrated into the unit and is designed according to the CEE directives 72/23, 89/336 and related norms. An access to the electrical panel even with open doors is needed: with open doors the protection still remains IP 30 thanks to a transparent plastic sheet protection in front of the components. All remote signals are with low voltage 24 Vac, obtained by a safety transformer. The electrical panel has a circulation air system in order to manage the inside thermal dissipation when the unit is running. All connected loads are protected with automatic switches in addition to those, which are already provided within the compressors and fans. All 3-phase units are standard equipped with a phase sequence relay: this device checks the sequence of the phases, avoiding the start-up of the compressors in the wrong direction. With the electronic valve option (EEV), the microprocessor manages the evaporating temperature; therefore, SHR is under control also with constant air-flow.

- Microprocessor: two different types are available:
  - Basic – Carel µAC
  - Advanced – Carel serie pCO.

  The Lennox Software Development Team is always ready to customize the software for these controls, according to customer specifications.

  The main functions are summarized in:

  - Input of main parameters by means of the keyboard;
  - Display of operating conditions, alarms and devices status;
  - ON/OFF switching or modulating (three-way valve, humidifier) resources to keep the environment parameters constant;
  - Modulation of the three-way valve for hot water re-heating (option);
  - Activation / Deactivation of the solenoid valve for hot gas re-heating (option) in DX version only;
  - Modulation of the humidifier capacity;
  - Activation of the different steps in electrical heating (option);
  - Alarm management:
  - High / Low ambient temperature;
    - High / Low pressure refrigerant circuit
    - Air Flow;
    - Dirty filters;
    - Electrical heating;
    - Humidifier general alarm;
  - Management of maximum compressor starts;
  - LAN connection for stand-by rotation (only with Advanced pCO).

- Serial port / protocols

  1. Advanced:
  - RS485 / Carel o Modbus® ;
  - Modem GSM + RS 232 / sms (units status advice by sms in case of alarm);
  - LonWorks® FTT-10 card / LonWorks®
  - pCOweb Ethernet connection / BACnet™ o SNMP (TCP-IP)
  - pCOweb RS485 connector / BACnet™
  - TREND® serial card / TREND®

  2. Basic:
  - RS485 / Carel
  - External Modbus® gateway / Modbus®

- Display for advaced microprocessor

  - pGD0 basic display:

  - pGD3 Graphical Touch screen color display:

Aeraulic section

Fans of backward-curved blades type, Plug Fans, in combination with EC motors (standard). Fans are statically and dynamically balanced ensuring a drastic reduction for noise and vibrations. This technology allows reductions of energy consumptions mainly at partial loads and allows keeping an exact air-flow apart from external conditions. The air circuit is provided with an air-flow switch that continuously checks for a fan faulty situation.

Hydraulic Circuit

CW units are fully assembled and pressure tested in a factory final test. The three-way valves (Fig.2) are selected according to their characteristic Kvs and to the coil pressure drop, in order to give enough authority to the valve for a good water-flow control. The valve body is made of brass OT 58 and the shutter is plated in RILSAN for the maximum tightness: the Unit system is PN16. The external connections are standard supplied with 3-part quick connections to reduce the on-site working time.

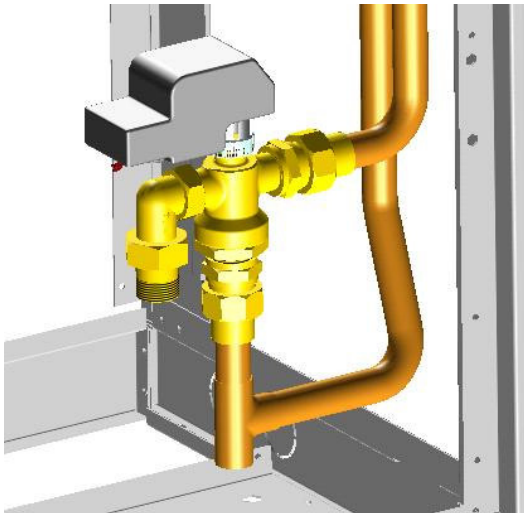
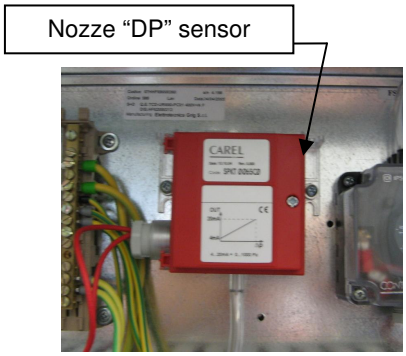


Fig. 2

Automatic air flow control option

Air differential pressure sensor

Inside of the electrical panel is installed an air differential pressure sensor, to measure **the nozzle pressure drop dP**.



Using this value is possible to calculate the air flow and to regulate the fan speed (0-10V) to obtain the desired air flow (Air flow setpoint).

Air flow setpoint setting

To configure the air flow setpoint is necessary to enter in the setpoint menu and press DOWN to reach the screen S2. Then press ENTER and UP or DOWN to change the value: only step of 250 m3/h are possible.

```
      m_select_air
+--------------------+
|Air flow          S2|
| setpoint: 7000 m3/h|
|                    |
|                    |
+--------------------+
```

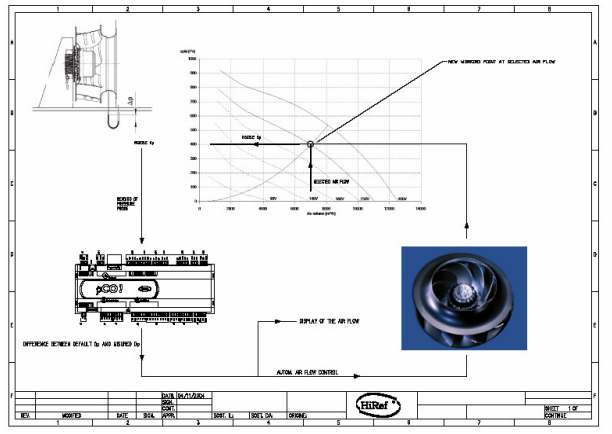
Operating air differential pressure and related air flow

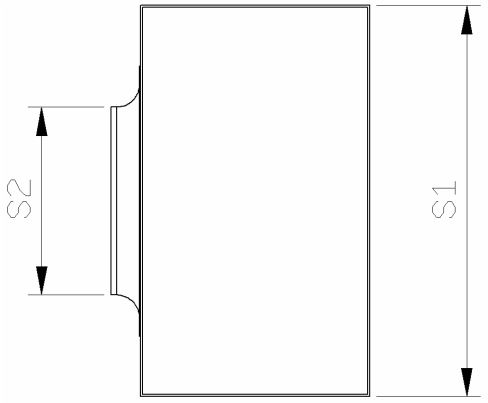
To see the actual air differential pressure (**Nozzle differential pressure**) and the actual air flow is necessary to enter in the Input/Output menu, and press DOWN to reach the screen .

```
      m_synoptic3b
+--------------------+
|Analog inputs:   I2a|
|Coil temp:   000.0°C|
|Diff.press.:000.0 Pa|
|Air flow: 00000 m3/h|
+--------------------+
```

Important note

The automatic flow control is made using a PI (proportional + integral) regulation. The regulation is set with parameter to grant the stability of the system. Please take in account that the mean time to reach the stable value is 5-10 minutes.





S2 = Nozzle restricted section
S1 = Unit's internal sec
P = Air Pressure
V = Air speed
ρ = Air density

Note: the following calculation doesn't consider the friction and the flow coefficient of the nozzel, which are instead considered into the formulae memorized into the mP

$$\frac{p_1}{\rho}+\frac{v_1^2}{2}=\frac{p_2}{\rho}+\frac{v_2^2}{2}$$ Bernoulli Principle ;

$$v_1 \times S_1 = v_2 \times S_2$$
(same air flow through the two sections)

for ENERGY units the ratio S2/S1 = 0.17 so that combining both the equations, the influence of the V1 is negligible

$$\frac{p_1-p_2}{\rho}=\frac{v_2^2}{2}\times\left(1-\left(\frac{S_2}{S_1}\right)^2\right) \Rightarrow$$

$$v_2 \cong \sqrt{\frac{2\times(p_1-p_2)}{\rho}} \Rightarrow$$ Air Flow = S_2 x V_2

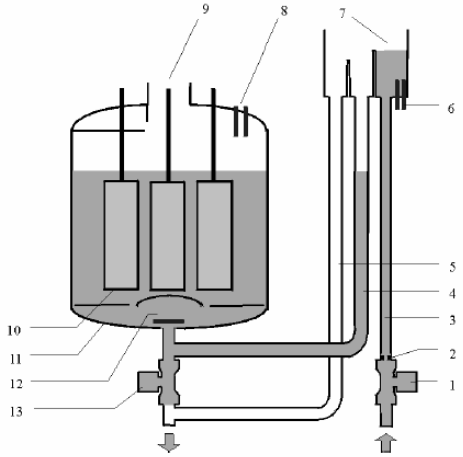
Air Filter

The filter is positioned on the suction side just before the coil and is made of synthetic material with metallic frame. Filtration efficiency is G4, according to the Eurovent 4/5 document. To reach the filter you just have to simply open the door/s, so you can remove it. As an option, in the same frame, it is possible to install filters up to F5 class but, due to the higher pressure drops, HP fans are needed. For better filtration efficiency up to F9, an external plenum can be provided. In this case, an G3 filter will be part of the option as a prefilter; for up-flow units the high filtration plenum is positioned on the delivery side.

Humidifier Section

The steam humidifier is fully controlled by the mP as well as all the operating parameters, like the water level, the water conductivity and the current through the electrodes. Fixing the tension, the current (and so the steam capacity) depends on the water conductivity and the water level: the algorithm that mixes all the parameters ensures the right steam production, avoiding at the same time foam grooving into the cylinder. After a certain period - depending on the water characteristics- the cylinder has to be replaced by a new one: an European average is 3 cylinders per year for a full time operation.

Description of Immersed Electrode Humidifiers:



N.	Description
1	Fill solenoid valve
2	Flow rate limiting device
3	Supply pipe
4	Fill pipe
5	Overflow pipe
6	Conductivity measuring Electrodes
7	Fill tank – overflow device
8	High level electrodes
9	Steam outlet
10	Electrodes
11	Cylinder casing
12	Bottom filter

13 Drain solenoid valve

Important water supply characteristic:

For these units there are three options:

- medium-low conductivity
- normal-high conductivity
- high conductivity

In the Appendix "A" are indicated the supply water limit values needed for the right choice among the three cylinder options.

Humidity control

INNOV@ units can be supplied with a humidity sensor (option). For an independent control between T and r.h. it is necessary to adopt one of the re-heating possibilities (options):

- Electrical re-heating.
- Hot Water with three-way modulating valve.
- Hot gas re-heating: this solution is for DX versions only with no additional energy consumption for the heating process. The coil design criteria allow to have a higher heating capacity than sensible cooling capacity and then to dehumidify even when there is no thermal load inside. The Hot gas re-heating can be:
  - ON / OFF
  - Modulating with a three-way valve for a precise control of the environment parameters

Water-condensed versions

"W", "Z", "Q" and "F" DX water condensed units are equipped with an AISI 304 brazed plate condenser. They are fully tested and charged with POE oil and refrigerant: during the final factory test procedure, all operating parameters are measured.
Depending on the water T, but normally mandatory for "Z" versions, it is possible/necessary to add a two-way condensing control valve (Fig.3). In case of impossibility of reducing the water-flow, flooding technology is the alternative: in this case, only a refrigerant side action occurs and the water-flow remains the same.

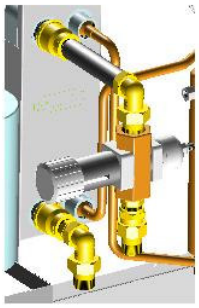


Fig. 3

The condenser is located behind the compressor compartment and is fully accessible from the front of the unit.

Fresh air kit

The fresh air kit consists in a flexible pipe and a cartridge G3 filter. Under normal conditions, it supplies about 100 m^3/h, no matter the unit size. In down-flow units, the filter is located in the fan sector. Before changing the filter, it is necessary to stop the unit and remove the sheet metal in front of the fan compartment. In up- flow units an additional booster fan is provided, to supply nearly 80 m^3/h for all models, and the relative filter is located just next to the main filter.

Plenum kit

A suction/delivery plenum (Fig. 4), 300mm or 500mm high, is available as an option. For down-flow units such plenums can be equipped with silencer cartridges, high efficiency filters, or, as a special option, a damper section with direct Free-Cooling configuration. In case of up-flow units, the discharge plenum can be delivered with aluminium grills for frontal air discharge.

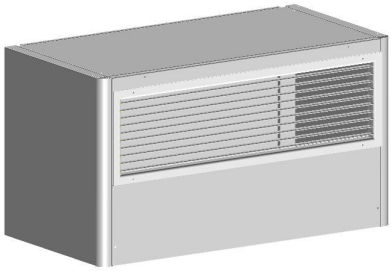


Fig.4

Base Frames / Floor stands

Made in galvanized steel, they are available in three different sizes (300 - 500 - 800 mm), with an excursion of +/- 25mm.

Electrical Heaters

Electrical heaters are realized for 3 steps operations and are made of aluminium with a large surface, in order to keep the lowest possible surface temperature (less than 130 °C), (Fig.5). Each heating element is provided with an independent safety thermostat. Despite the very small depth of the unit, the elements are mounted in a rail that allows their extraction from the front of all models, up and down-flow.

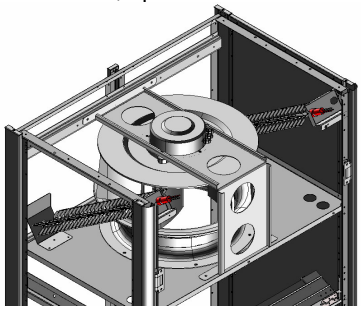


Fig. 5

Before any maintenance on the electrical heaters, disconnect the unit from the power supply and wait for 30 minutes, allowing the temperature to decrease

Application Field

INNOV@ units are designed for indoor installations in technological environments, but have been tested also under extreme conditions, typical e.g. of Far and Middle East markets. The indoor temperature limits are covered from 18°C and 32°C and the r.h. limit up to 75% for the whole range. Their reliable operation practically covers all indoor conditions.

The following diagram (Fig.6) shows the application of the water-cooled DX units.

- Water condensed:

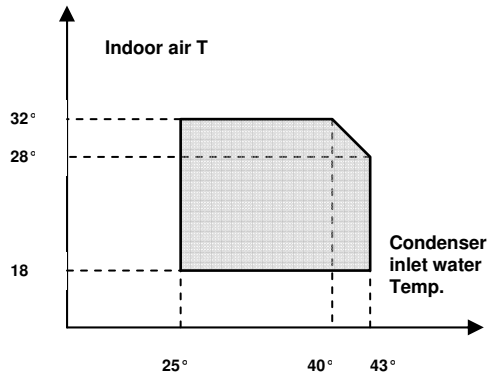


Fig. 6

Water temperatures below 25°C require a condensing control valve (option):

- ❑ Two-way modulating valve on water side: the valve is installed in the inlet piping to avoid large amounts of water flowing into the system in case of a broken pipe on refrigerant side.
- ❑ Flooding technology: this has no influence on the water flow, but a flooding of the heat exchanging surface by a constant back pressure valve and a large liquid receiver.

The next diagram (fig.7) shows the application of air-cooled DX units with Lennox condenser selection.

- Air condensed:

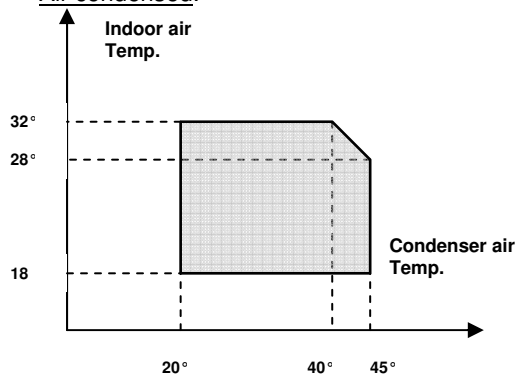


Fig. 7

If extended application ranges are needed, please contact Lennox's R&D department or your local Application. Applications with an external air temperature below 20°C, require a condensing control to ensure enough pressure drops through the expansion valve. Temperatures below -15° and down to -30°C require a flooding device (Fig.8) in order to flood the condenser internal surface and get the right condensing T, even in case of strong and cold winds. This device is added as a kit, consisting in a backpressure valve, a receiver, a safety valve and assembly instructions. The installation is very simple, just close to the condensing unit at the bottom side.

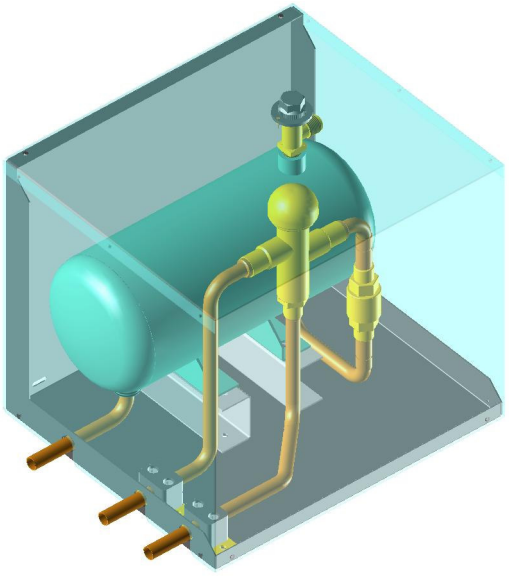


Fig.8

Compressors Oil Heaters

Fig.9 shows a specific property [Charles' law] of gasses: the higher the pressure, the more they get soluble in liquids; on the other hand, the lower the temperature, the less they become soluble: if the oil in the crankcase heater is kept at a constant pressure, an increase in temperature will significantly reduce the amount of refrigerant dissolved in it, thus ensuring that the desired function is maintained.
The problem of not enough lubrication occurs when the crankcase is not properly heated, most of all after a long time of standstill when, due to the suction effect of the compressor, there is an abrupt drop in pressure inside the crankcase, which results in a considerable evaporation of the refrigerant previously dissolved in the oil. With no heating elements, these circumstances would cause two problems:

- Dilution of the oil, hence insufficient lubrication
- Migration of the oil towards the cooling circuit, due to the dragging effect of the refrigerant.

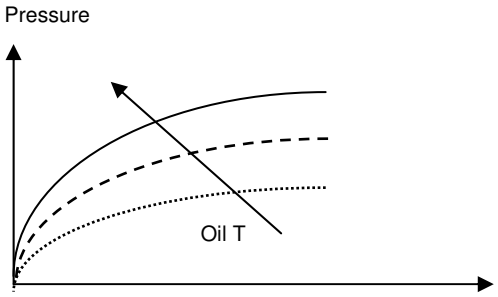


Fig. 9 % R407C in oil

Heating elements are very important, especially when starting up for the first time; in this case it is recommended to leave them switched on for at least 12 hours before starting the compressor.

Application limits short table

- operating fluid : water or e-glycol mixtures
- synthetic non dangerous and non flammable refrigerant HFC R407C
- PN water side: 16 bar
- Max P refrigerant cycle HP side = 28 bar-r
- Max piping T HP side = 125° C
- Max P refrigerant cycle LP side= 22.6 bar-r (*)
- Power supply: +/- 10% to the nominal value
- **Max storage T = + 50 °C**
- Minimum storage T = - 10 °C
- Max r.h. during storage = 85%

(*) This value influences the maximum storage T for the units that have a closed refrigerating circuit, like “W” water cooled, “F” free cooling or “Q” Dual cooling” units.

Technical Selection

Thermodynamics

Refrigerants

INNOV@ units are charged exclusively with HFC refrigerants, which do no harm, according to specifications of the EEC regulation 2037/00. Standard units are configured for the use of R407C, a ternary mixture of R32 (23%), R125 (25%) and R134a (52%). This mixture displays a typical phase change temperature called “GLIDE” [from GLIDER = which loses height as it travels]. The glide effect is due to the fact that the three constituents have very different phase change temperatures and this leads to a sort of fractional evaporation/condensation. This means that the heat exchangers must be designed very accurately and that a careful choice of the kind of flow which occurs in them, i.e. in the opposite or same direction, must be made. The diagram (Fig.10) illustrates this “temperature glide” as well as the beginning condensing T (dew point) and the saturated liquid/end of condensation process T (bubble point)

- Begin = DEW POINT
- End = BUBBLE POINT

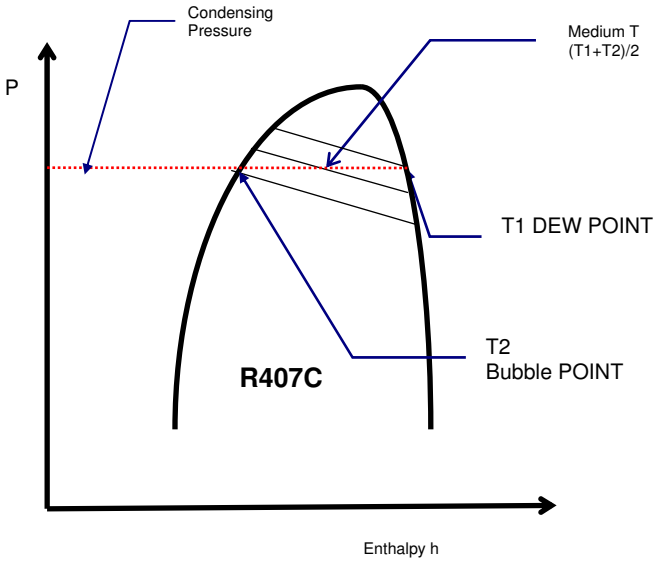


Fig. 10

Expansion Valves

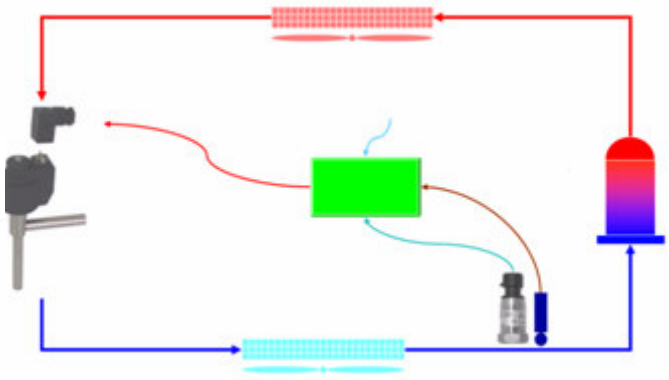
The expansion valve is just a mass-flow regulator that ensures the right flow by checking the superheating at the evaporator outlet. The mass-flow depends mainly

on the percentage of the opening and on the available Delta pressure through the valve. Mechanical valves have a very little modulating capacity and a significant Delta P through them has to be maintained to ensure the mass flow. On every Lennox product, it is possible to install innovative electronically controlled electric expansion valves (optional), which have a much bigger modulating capacity compared to traditional mechanical thermostatic valves. This makes it possible to operate below reduced pressure differentials during middle and winter seasons. The minimum condensing T allowed (Dew Point) is 28°C, due to the scroll compressor mechanical limits.

In this period it is possible to cut the energy consumptions even to 51 %, since the compression process occurs between two levels that are very close to each other; the limit is represented only by the intrinsic fixed compression ratio of scroll compressors. Return of investments can thus be achieved in shorter time. Lennox can support you with calculations for a different specific thermal load and outside T profiles.

The simple scheme shows how the valve is managed: a pressure transmitter reads the evaporating pressure and a T sensor measures the Refrigerant T. The mP calculates the superheating and, using special algorithms, one of which is patented by Lennox S.p.A. (pat. nr. BO2002A000785 ITA) drives the valve to open/close by means of a stepper motor. Only two valves cover the INNOV@ Range, giving important advantages for eventual res. A similar technology is used to modulate hot gas bypass in units.

ETV scheme

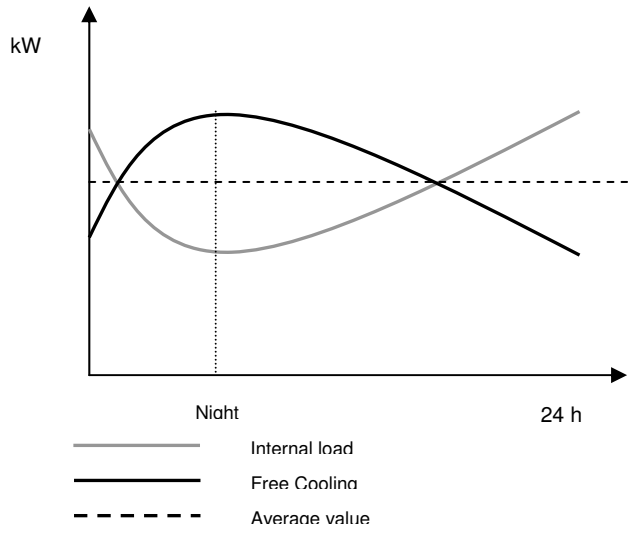


ETV picture

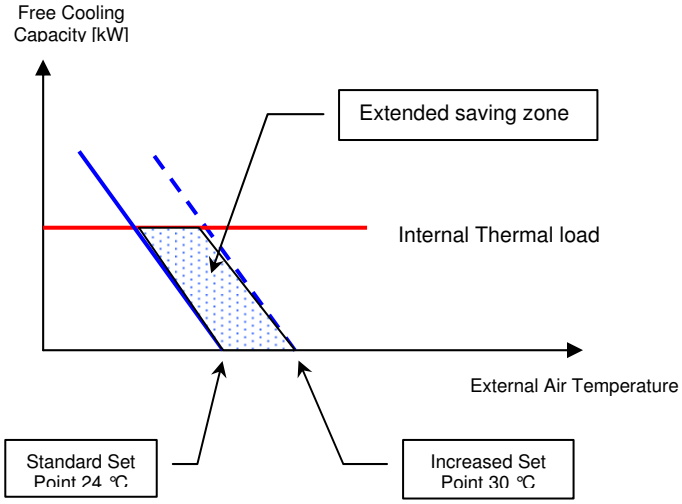
Free Cooling

Direct FREE COOLING

When the outdoor conditions allow it, the free cooling is the best solution to save energy. It should be considered that the external air, mixing with the internal air, will be heated without adding humidity: the lowest acceptable indoor conditions in terms of T and r.h., identifies the minimum outdoor condition at which is still possible to have free cooling.
The internal thermal load is not constant but increases during the day, and, at the same time, the external air T also raises up reducing the capacity of the free cooling. To have the maximum performance in energy saving, the peaks in cooling demands have to be phased with the peaks in free cooling capacity: the way to get this is to use the thermal inertia of appliances and structures to accumulate cool as much as possible i.e. during the night time. This is possible allowing the set-point to shift down to the limit fixed by the ETSI norms; for example, during the night, when the thermal load is low and the FC capacity is maximum, the CRAC will cool down the room(s) to the minimum allowed T (15°C) and humidity (15%). All this accumulated cool energy will help during the day, when the free cooling capacity could be lower than the internal generated load.
During the day, allowing the set point to raise up to the ETSI limits (30° in T and 70% in r.h), it is possible to avoid using the compressors as much as possible. The free cooling capacity depends directly on the T difference between the indoor environment and the external air: by allowing the Room Temperature to rise up, it is possible to extend the Freecooling operating field extending the saving period



This "floating" set-point is made according parameters (T and r.h) fixed by the ETSI norms and in any case it is possible to modify this values using the "service pass-word" for the microprocessor, or set the conventional modality with a fixed set point.



Plenum for direct free-cooling version

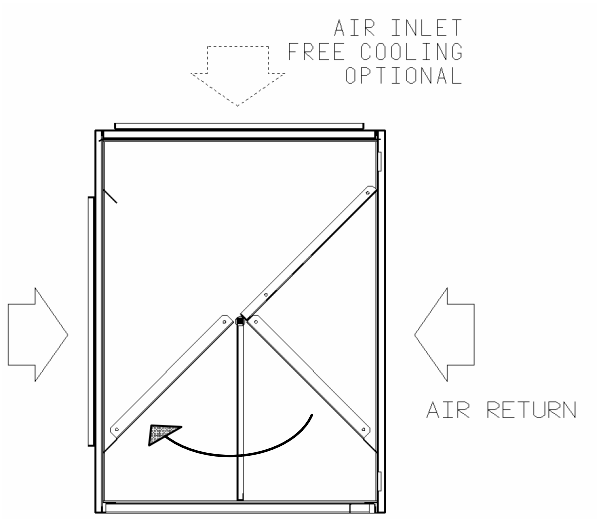


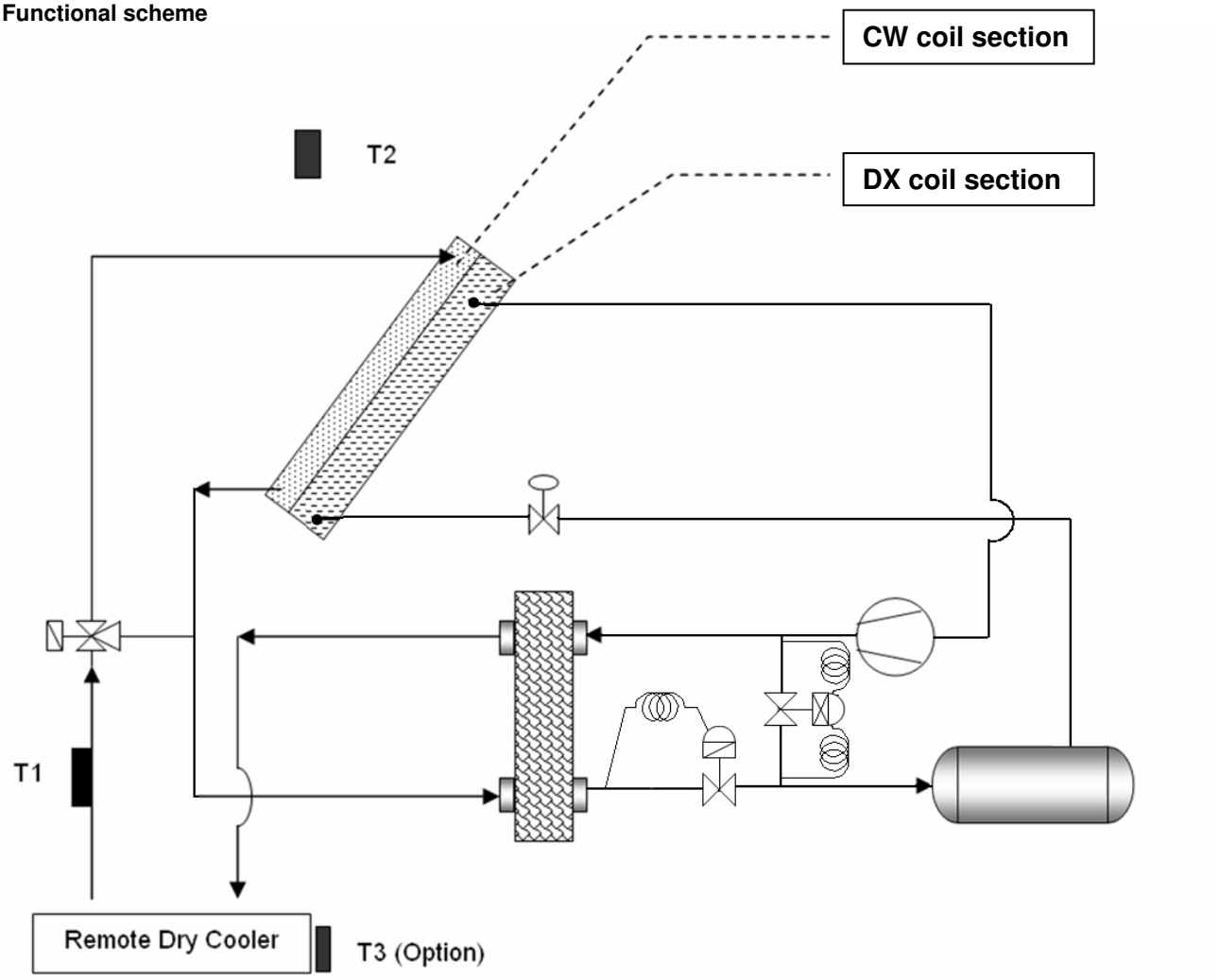
Fig. 11

In Fig. 11 is showed the scheme of the plenum installed in the direct free-cooling version. The microprocessor manages the position of the dumper, allowing the external air-flow when the free-cooling conditions are reached.

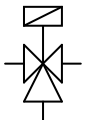
Note: the direct free-cooling option could be select for all INNOV@ models only with down-flow version.
With this solution an overpressure damper, installed on a room's wall, is necessary.

Indirect FREE COOLING

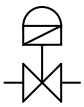
Functional scheme



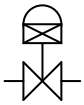
Legenda:



3 Way water valve



Flooding valve re-frigerant side



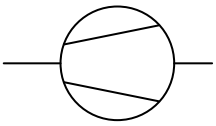
By-pass valve

Expansion valve

Solenoid valve

Sensor

Liquid receiver



Compressor

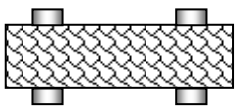


Plate heat exchanger

Check valve

Functionality

Indirect free-cooling begins when the external dry cooler outlet temperature (T1) is lower than the room air temperature (T2) of a preset ΔT (3° as default).
In this condition, the three-ways valve (see fig.12) let the cooled water flow through the CW section of the coil. If the free-cooling capacity is not enough, the compressor starts. Both circuits can work simultaneously thanks to the flooding valve system: this allows to reduce the condenser area by moving the refrigerant from the liquid receiver to the condenser, so the condensing pressure remains the same even when the water temperature is very low.

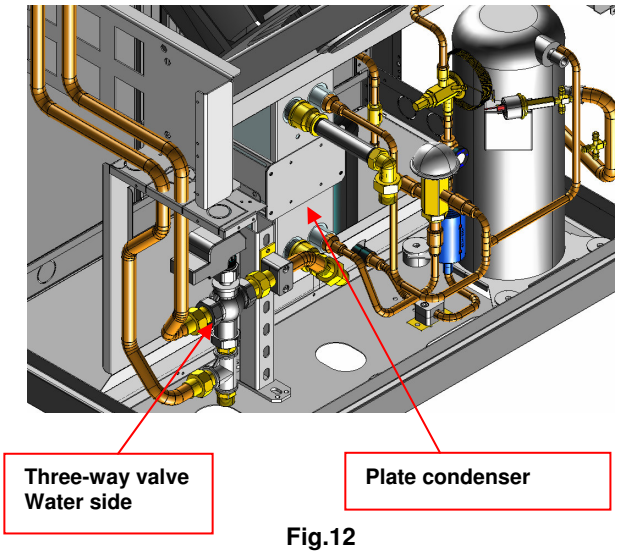


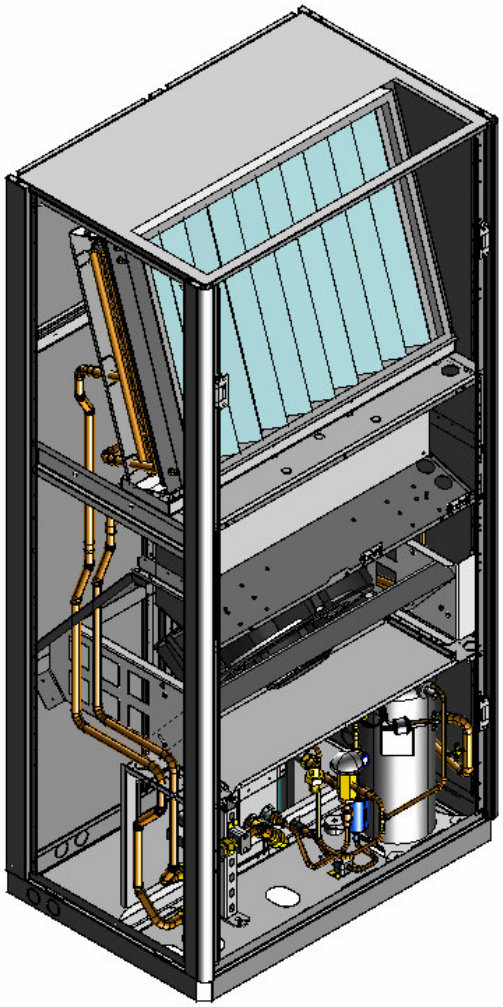
Fig.12

The T3 sensor (optional) allows the control the dry cooler fan speed:

- If the external temperature goes below (T2 – 10°), than the fans are speeded up to the max rpm, in order to have the largest help from the free-cooling action.
- If the external air temperature is higher than (T2 – 10°) the fan speed is modulated to have an addictional condensing control, and to reduce the noise level.

The T3 sensor has to be installed on site, on the dry cooler suction side and sheltered from sunshine.

Drawing



FREE COOLING: direct Vs indirect

Comparing these two free-cooling solutions leads to the following remarks.

Thermodynamic point of view:
With the indirect free-cooling it's possible to avoid some thermodynamic losses, which are due to the air-to-water exchange in the dry cooler and in the cooling coil, even made worse by using glycol. This means that the direct free-cooling allows more cooling capacity, at the same external air temperature, and a higher FFT (full free-cooling temperature).

Economic point of view:
Direct free-cooling is to prefer even under economic aspect. The starting investment costs, due to the structural complexity, and the working cost, due to the thermodynamic efficiency, represent a penalty in the indirect free-cooling. In this surplus cost, also the power consumptions of the water circulation pump have to be considered in indirect solution.

Air quality point of view:
Indirect free-cooling is the only way of air-conditioning when the room has to be insulated from the external air, when hard-filtering is requested (as white rooms) or if is not possible to link the unit to the external environment. Using the direct free-cooling, the specific humidity will be the same as in the outside and, for this reason, the r.h. can drop down below 20% (fig.12). For avoid this, an humidifier is needed and the related cost should be considered.

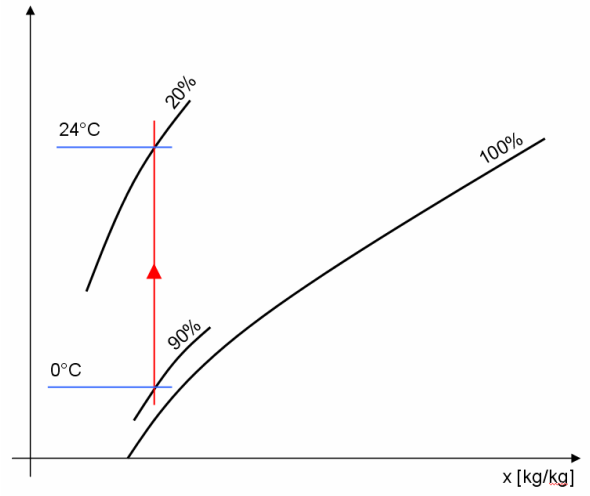
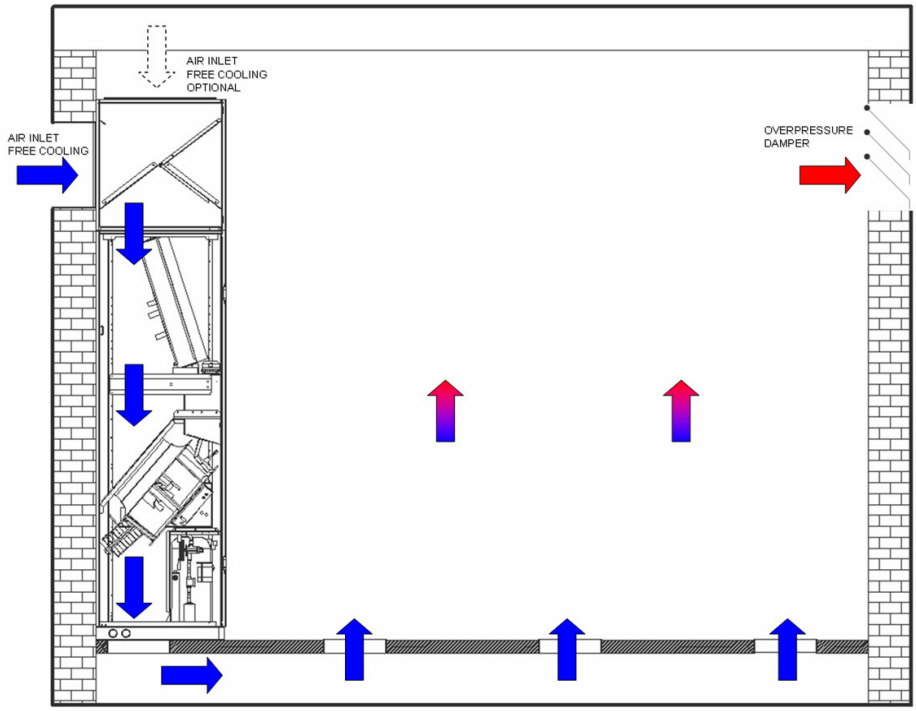


Fig.12

Overpressure damper:

When direct free-cooling, there has to be an overpressure damper to let the free-cooled air flow outside. This device will be installed on a wall and has to be designed for a ΔP of 30 Pa in the nominal air-flow conditions.

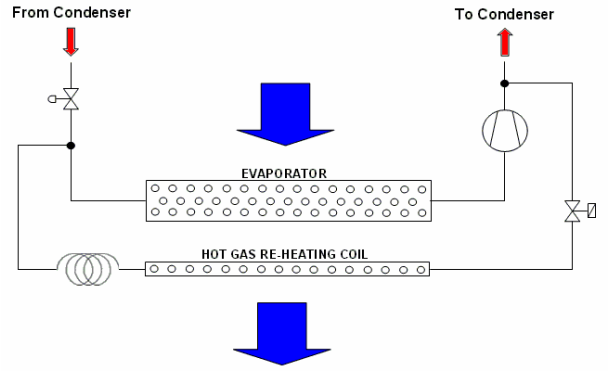
The direct free-cooling option is available only for the down-flow configuration.



Re-heating Systems and Capacity Control

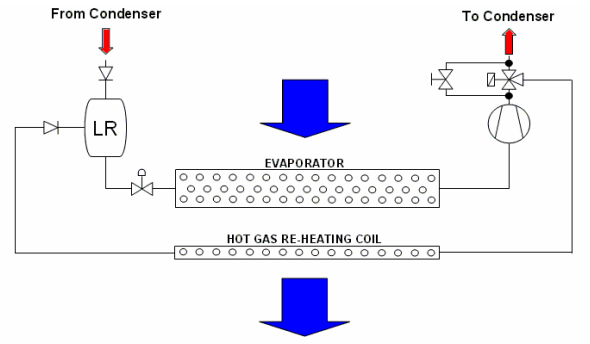
INNOV@ units different options can be chosen in order to control temperature and humidity. Below functionality schemes and function of different options:

Hot Gas Re-heating Coil ON/OFF



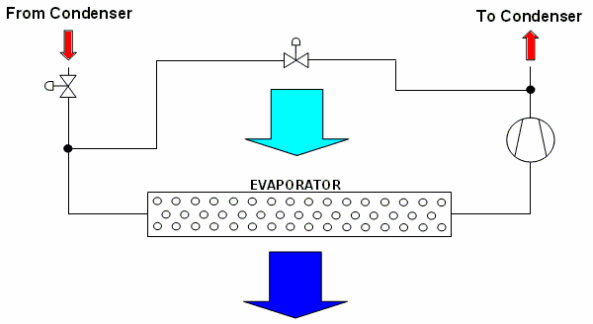
In the hot gas re-heating coil ON/OFF option a 2-way valve with no modulation (ON/OFF) is used. The function is reheating in dehumidification, but there can be no temperature close control and additional heating. The hot gas re-heating coil is designed to kill up to 90% of the total sensible cooling capacity provided by the refrigerating circuit.

Hot Gas Re-heating Coil PRECISE



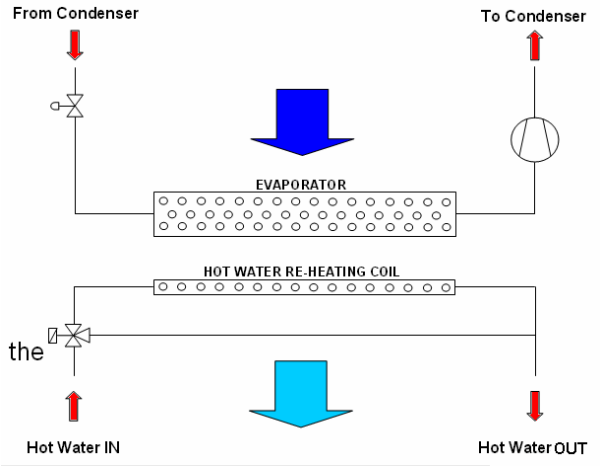
In the hot gas re-heating coil PRECISE option a 3-way valve modulates the hot gas flow through the re-heating coil. The 3-way valve cannot completely by-pass the whole hot-gas mass flow into the re-heating coil; this to avoid HP alarms to switch on. The functions are re-heating in dehumidification, precise temperature control, but not additional heating. The hot gas re-heating coil is designed to kill up to 90% of the total sensible cooling capacity provided by the refrigerating circuit.

Hot Gas BY-PASS



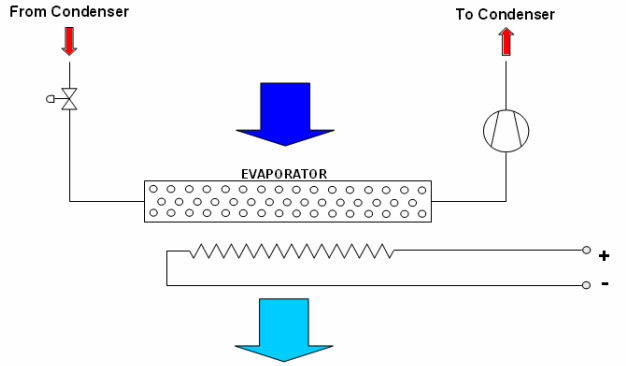
the hot gas BY-PASS option a modulating valve manages the hot gas flow into the evaporating coil. The aim is to control the cooling capacity from 30% to 100%.

Hot Water Re-heating Coil

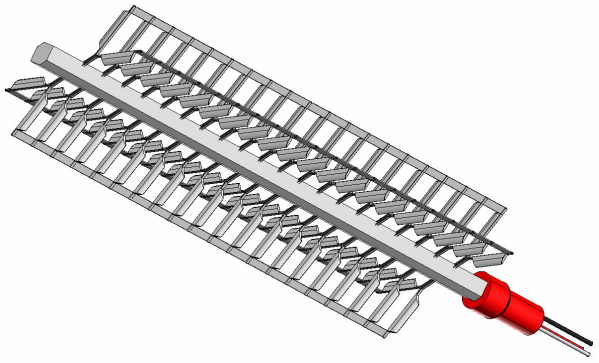


With this option, a hot water connection is needed. In the hot water re-heating coil option, a 3-way valve modulates the hot water flow through the re-heating coil. The function is reheating in dehumidification, but not temperature close control. Together with the next solution (electrical heaters), this is the only way of heating while the compressor is kept off. The heating capacity of the hot water re-heating coil depends on the inlet water conditions available.

Electrical heaters



The function of the electrical heaters is reheating in dehumidification and heating while the compressor is off, but there can be no temperature close control. The heating capacity of the electrical heaters is 1.6 kW: only one module can be installed in Frame1 units and two in Frame2. The electrical heaters heating elements are in aluminium, with a wide surface that allow low temperature during heating phases.



Technical data DX unit, air cooled

		DHADR0060 DHAUR0060	DHADR0080 DHAUR0080	DHADR0100 DHAUR0100	DHADR0110 DHAUR0110	DHADR0130 DHAUR0130	DHADR0160 DHAUR0160	DHADR0190 DHAUR0190	DHADR0205 DHAUR0205
Power supply	[V/Ph/Hz]	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50
Air Flow	[m3/h]	1.785	2.150	3.530	3.530	3.700	5.100	5.100	5.100
Frame									
H	[mm]	1.875	1.875	1.875	1.875	1.875	1.875	1.875	1.875
L	[mm]	600	600	900	900	900	900	900	900
D	[mm]	600	600	600	600	600	600	600	600
Compressor									
Type		Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Cooling Capacity @ 24°C 50% UR – Condensing temperature 45°C (Dew point)	[kW]	**6,0**	**8,0**	**9,9**	**11,0**	**13,0**	**17,2**	**19,9**	**22,0**
Cooling Capacity @ 24°C 50% UR – external air temperature 35°C *	[kW]	**5,9**	**7,7**	**9,3**	**10,6**	**12,7**	**15,8**	**18,4**	**20,5**
Power consumption	[kW]	1,5	1,9	2,3	2,6	3,2	4,2	4,9	5,5
Nominal current	[A]	2,8	3,6	4,4	5,1	6,2	8,0	8,7	10,5
FLA	[A]	5	6	6	7	10	13	13	15
LRA	[A]	24	32	40	46	50	66	74	101
Oil charge	[l]	1	1	1,1	1,1	1,36	1,65	1,65	1,65
Finned Coil Evaporator									
Front surface	[m2]	0,27	0,27	0,45	0,45	0,45	0,53	0,53	0,53
Geometry		25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65
Rows	[-]	3	4	3	3	4	4	5	5
Type of fins	[-]	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic
Fin pitch	[mm]	1,8	1,8	1,8	1,8	1,8	1,8	1,8	1,8
SHR	[-]	1,00	0,96	1,00	1,00	0,98	0,99	0,94	0,92
Indoor Fan									
Type		Radial -EC	Radial -EC	Radial -EC	Radial -EC	Radial -EC	Radial -EC	Radial -EC	Radial -EC
Power supply	[V/Ph/Hz]	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50
Number of fan		1	1	1	1	1	1	1	1
Nominal current	[A]	0,24	0,33	0,51	0,51	0,47	1,05	1,19	1,19
Power consumption	[W]	151	203	315	315	291	652	743	743
AESP	[Pa]	30	30	30	30	30	30	30	30
AESP @ max fan speed	[Pa]	557	505	477	477	453	174	144	144
Air Filter									
Filtration		G3	G3	G3	G3	G3	G3	G3	G3
Overall surface	[m2]	2,2	2,2	3,6	3,6	3,6	5,0	5,0	5,0
Fire resistance class		1	1	1	1	1	1	1	1
Electrical heaters									
Total heating capacity	[kW]	1,6	1,6	3,2	3,2	3,2	3,2	3,2	3,2
N° of heaters		1	1	2	2	2	2	2	2
Material	[-]	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium
Hot Water Reheating Coil									
Heating capacity @ water 45/40° C	[kW]	4,2	4,6	7,8	7,8	8,0	9,2	9,2	9,2
Front surface	[m2]	0,22	0,22	0,37	0,37	0,37	0,37	0,37	0,37
Water Flow	[m3/h]	0,730	0,792	1,365	1,365	1,393	1,595	1,595	1,595
Water side pressure drop	[kPa]	8,2	9,4	15,5	15,5	16,1	20,3	20,3	20,3
Water valve pressure drop	[kPa]	3,3	3,9	4,4	4,4	4,6	6,0	6,0	6,0
Internal volume	[dm3]	0,9	0,9	1,3	1,3	1,3	1,3	1,3	1,3
Humidifier									
Max theoretical capacity	[kg/h]	2,80	3,17	4,45	5,22	5,01	10,09	6,90	6,50
Effective capacity	[kg/h]	3	3	3	3	3	3	3	3
Power consumption	[kW]	2,25	2,25	2,25	2,25	2,25	2,25	2,25	2,25
Sound pressure level**	[dB(A)]	46	48	48	49	51	52	53	53
Weight	[kg]	150	157	195	210	230	245	255	257

*** With Lennox condenser selection (see page 29)**

** **At 1,5 meters height, 2 meters frontal distance in free field – down flow units (30 Pa AESP), nominal air flow**

Technical data DX unit, water cooled

		DHWDR0060 DHWUR0060	DHWDR0080 DHWUR0080	DHWDR0100 DHWUR0100	DHWDR0110 DHWUR0110	DHWDR0130 DHWUR0130	DHWDR0160 DHWUR0160	DHWDR0190 DHWUR0190	DHWDR0205 DHWUR0205
Power supply	[V/Ph/Hz]	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50
Air Flow	[m3/h]	1.785	2.150	3.530	3.530	3.700	5.100	5.100	5.100
Frame									
H	[mm]	1.875	1.875	1.875	1.875	1.875	1.875	1.875	1.875
L	[mm]	600	600	900	900	900	900	900	900
D	[mm]	600	600	600	600	600	600	600	600
T water in/out 40/45 °C (**)									
Cooling Capacity @ 24°C, 50%	[kW]	**5,3**	**7,0**	**8,9**	**10,0**	**11,7**	**15,5**	**17,8**	**19,7**
Power consumption	[kW]	1,7	2,2	2,6	3,1	3,7	4,6	5,3	6,1
Water flow	[l/h]	1205	1568	1966	2222	2625	3424	3936	4385
Water pressure drop	[kPa]	5,79	9,58	9,82	7,48	10,29	8,87	11,59	14,10
Compressori									
Type		Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Nominal Current (**)	[A]	3,1	4,0	4,8	5,5	6,8	8,5	9,4	11,3
FLA	[A]	5	6	6	7	10	13	13	15
LRA	[A]	24	32	40	46	50	66	74	101
Oil charge	[l]	1	1	1,1	1,1	1,36	1,95	1,65	1,65
Finned Coil Evaporator									
Front surface	[m2]	0,27	0,27	0,45	0,45	0,45	0,53	0,53	0,53
Geometry		25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65
Rows	[-]	3	4	3	3	3	4	5	5
Type of fins	[-]	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic
Fin pitch	[mm]	1,8	1,8	1,8	1,8	1,8	1,8	1,8	1,8
SHR	[-]	0,98	0,95	1,00	1,00	0,92	1,00	0,93	0,89
Indoor Fan									
Type		Radial -EC	Radial -EC	Radial -EC	Radial -EC	Radial -EC	Radial -EC	Radial -EC	Radial -EC
Power supply ,	[V/Ph/Hz]	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50
Number of fan		1	1	1	1	1	1	1	1
Nominal current	[A]	0,26	0,35	0,54	0,54	0,50	1,05	1,19	1,19
Power consumption	[W]	163	215	337	337	310	652	743	743
AESP	[Pa]	30	30	30	30	30	30	30	30
AESP @ max fan speed	[Pa]	550	531	473	473	453	174	144	144
Air Filter									
Filtration		G3	G3	G3	G3	G3	G3	G3	G3
Overall surface	[m2]	2,2	2,2	3,6	3,6	3,6	5,0	5,0	5,0
Fire resistance class		1	1	1	1	1	1	1	1
Electrical heaters									
Total heating capacity	[kW]	1,6	1,6	3,2	3,2	3,2	3,2	3,2	3,2
N° of heaters		1	1	2	2	2	2	2	2
Material	[-]	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium
Hot Water Reheating Coil									
Heating capacity @ water 45/40° C	[kW]	4,2	4,6	7,8	7,8	8,0	9,2	9,2	9,2
Front surface	[m2]	0,22	0,22	0,37	0,37	0,37	0,37	0,37	0,37
Water Flow	[m3/h]	0,730	0,792	1,365	1,365	1,393	1,595	1,595	1,595
Water side pressure drop	[kPa]	8,2	9,4	15,5	15,5	16,1	20,3	20,3	20,3
Water valve pressure drop	[kPa]	3,3	3,9	4,4	4,4	4,6	6,0	6,0	6,0
Internal volume	[dm3]	0,9	0,9	1,3	1,3	1,3	1,3	1,3	1,3
Humidifier									
Max theoretical capacity	[kg/h]	2,80	3,17	4,45	5,22	5,01	10,09	6,90	6,50
Effective capacity	[kg/h]	3	3	3	3	3	3	3	3
Power consumption	[kW]	2,25	2,25	2,25	2,25	2,25	2,25	2,25	2,25
Sound pressure level (***)	[dB(A)]	46	48	48	49	51	52	53	53
Weight	[kg]	162	169	207	232	265	273	285	287

** **@ our dry cooler, air 35°C, e.g. 30%**

*** **At 1,5 meters height, 2 meters frontal distance in free field – down flow units (30 Pa AESP), nominal air flow**

Technical data DX unit, dry cooler water cooled “Indirect Free Cooling”

		DHFDR0060 DHFUR0060	DHFDR0080 DHFUR0080	DHFDR0100 DHFUR0100	DHFDR0110 DHFUR0110	DHFDR0130 DHFUR0130	DHFDR0160 DHFUR0160	DHFDR0190 DHFUR0190	DHFDR0205 DHFUR0205
Power supply	[V/Ph/Hz]	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50
Air Flow	[m3/h]	1.785	2.150	3.530	3.530	3.700	5.100	5.100	5.100
Frame									
H	[mm]	1.875	1.875	1.875	1.875	1.875	1.875	1.875	1.875
L	[mm]	600	600	900	900	900	900	900	900
D	[mm]	600	600	600	600	600	600	600	600
T water in/out 40/45 °C (**)									
Cooling Capacity @ 24°C, 50%	[kW]	**5,4**	**7,1**	**9,1**	**10,2**	**11,9**	**15,9**	**18,1**	**20,1**
Power consumption	[kW]	1,7	2,2	2,6	3,1	3,7	4,6	5,3	6,1
Water flow	[l/h]	1220	1593	1990	2254	2658	3493	3987	4462
Water pressure drop	[kPa]	20,97	32,09	32,14	36,39	49,53	61,75	79,43	98,39
FFT	[°C]	1,7	0,8	-1,3	-1,0	-1,8	-2,6	-3,5	-5,3
Compressori									
Type		Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Nominal Current (**)	[A]	3,1	4,0	4,7	5,5	6,8	8,5	9,4	11,3
FLA	[A]	5	6	6	7	10	13	13	15
LRA	[A]	24	32	40	46	50	66	74	101
Oil charge	[l]	1	1	1,1	1,1	1,36	1,95	1,65	1,65
Cooling Finned coil									
Front surface	[m2]	0,27	0,27	0,45	0,45	0,45	0,53	0,53	0,53
Geometry		25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65
Rows	[-]	5	6	5	5	5	6	6	6
Type of fins	[-]	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic
Fin pitch	[mm]	1,8	1,8	1,8	1,8	1,8	1,8	1,8	1,8
SHR	[-]	0,99	0,96	1,00	1,00	0,93	1,00	0,93	0,89
Indoor Fan									
Type		Radial -EC	Radial -EC	Radial -EC	Radial -EC	Radial -EC	Radial -EC	Radial -EC	Radial -EC
Power supply ,	[V/Ph/Hz]	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50
Number of fan		1	1	1	1	1	1	1	1
Nominal current	[A]	0,28	0,36	0,64	0,64	0,58	1,23	1,34	1,34
Power consumption	[W]	175	226	397	397	360	768	834	834
AESP	[Pa]	30	30	30	30	30	30	30	30
AESP @ max fan speed	[Pa]	537	486	441	441	418	138	138	138
Air Filter									
Filtration		G3	G3	G3	G3	G3	G3	G3	G3
Overall surface	[m2]	2,2	2,2	3,6	3,6	3,6	5,0	5,0	5,0
Fire resistance class		1	1	1	1	1	1	1	1
Electrical heaters									
Total heating capacity	[kW]	1,6	1,6	3,2	3,2	3,2	3,2	3,2	3,2
N° of heaters		1	1	2	2	2	2	2	2
Material	[-]	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium
Hot Water Reheating Coil									
Heating capacity @ water 45/40° C	[kW]	4,2	4,6	7,8	7,8	8,0	9,2	9,2	9,2
Front surface	[m2]	0,22	0,22	0,37	0,37	0,37	0,37	0,37	0,37
Water Flow	[m3/h]	0,730	0,792	1,365	1,365	1,393	1,595	1,595	1,595
Water side pressure drop	[kPa]	8,2	9,4	15,5	15,5	16,1	20,3	20,3	20,3
Water valve pressure drop	[kPa]	3,3	3,9	4,4	4,4	4,6	6,0	6,0	6,0
Internal volume	[dm3]	0,9	0,9	1,3	1,3	1,3	1,3	1,3	1,3
Humidifier									
Max theoretical capacity	[kg/h]	2,80	3,17	4,45	5,22	5,01	10,09	6,90	6,50
Effective capacity	[kg/h]	3	3	3	3	3	3	3	3
Power consumption	[kW]	2,25	2,25	2,25	2,25	2,25	2,25	2,25	2,25
Sound pressure level (***)	[dB(A)]	46	48	48	49	51	52	53	53
Weight	[kg]	162	169	207	232	265	273	285	287

* * **@ our dry cooler, air 35°C, e.g. 30%**

*** **At 1,5 meters height, 2 meters frontal distance in free field – down flow units (30 Pa AESP), nominal air flow**

Technical data DX unit, city water cooled

		DHZDR0060 DHZUR0060	DHZDR0080 DHZUR0080	DHZDR0100 DHZUR0100	DHZDR0110 DHZUR0110	DHZDR0130 DHZUR0130	DHZDR0160 DHZUR0160	DHZDR0190 DHZUR0190	DHZDR0205 DHZUR0205
Power supply	[V/Ph/Hz]	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50
Air Flow	[m3/h]	1.785	2.150	3.530	3.530	3.700	5.100	5.100	5.100
Frame									
H	[mm]	1.875	1.875	1.875	1.875	1.875	1.875	1.875	1.875
L	[mm]	600	600	900	900	900	900	900	900
D	[mm]	600	600	600	600	600	600	600	600
T water in/out 15/30 °C									
Cooling Capacity @ 24°C, 50%	[kW]	**6,2**	**8,3**	**10,3**	**11,5**	**13,6**	**18,0**	**21,0**	**23,1**
Power consumption	[kW]	1,2	1,5	1,7	2,1	2,5	3,2	3,7	4,2
Water flow	[l/h]	422	558	686	772	918	1210	1406	1554
Water pressure drop	[kPa]	3,70	6,37	9,54	8,67	12,26	16,61	22,34	24,73
Compressori									
Type		Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Nominal Current	[A]	2,4	3,1	3,7	4,2	5,3	7,0	7,0	8,8
FLA	[A]	5	6	6	7	10	13	13	15
LRA	[A]	24	32	40	46	50	66	74	101
Oil charge	[l]	1	1	1,1	1,1	1,36	1,95	1,65	1,65
Finned Coil Evaporator									
Front surface	[m2]	0,27	0,27	0,45	0,45	0,45	0,53	0,53	0,53
Geometry		25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65
Rows	[-]	3	4	3	3	3	4	5	5
Type of fins	[-]	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic
Fin pitch	[mm]	1,8	1,8	1,8	1,8	1,8	1,8	1,8	1,8
SHR	[-]	0,87	0,86	0,99	0,9	0,85	0,92	0,87	0,81
Indoor Fan									
Type		Radial -EC	Radial -EC	Radial -EC	Radial -EC	Radial -EC	Radiale -EC	Radial -EC	Radial -EC
Power supply ,	[V/Ph/Hz]	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50
Number of fan		1	1	1	1	1	1	1	1
Nominal current	[A]	0,26	0,35	0,54	0,54	0,50	1,05	1,19	1,19
Power consumption	[W]	163	215	337	337	310	652	743	743
AESP	[Pa]	30	30	30	30	30	30	30	30
AESP @ max fan speed	[Pa]	550	531	473	473	453	174	144	144
Air Filter									
Filtration		G3	G3	G3	G3	G3	G3	G3	G3
Overall surface	[m2]	2,2	2,2	3,6	3,6	3,6	5,0	5,0	5,0
Fire resistance class		1	1	1	1	1	1	1	1
Electrical heaters									
Total heating capacity	[kW]	1,6	1,6	3,2	3,2	3,2	3,2	3,2	3,2
N° of heaters		1	1	2	2	2	2	2	2
Material	[-]	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium
Hot Water Reheating Coil									
Heating capacity @ water 45/40° C	[kW]	4,2	4,6	7,8	7,8	8,0	9,2	9,2	9,2
Front surface	[m2]	0,22	0,22	0,37	0,37	0,37	0,37	0,37	0,37
Water Flow	[m3/h]	0,730	0,792	1,365	1,365	1,393	1,595	1,595	1,595
Water side pressure drop	[kPa]	8,2	9,4	15,5	15,5	16,1	20,3	20,3	20,3
Water valve pressure drop	[kPa]	3,3	3,9	4,4	4,4	4,6	6,0	6,0	6,0
Internal volume	[dm3]	0,9	0,9	1,3	1,3	1,3	1,3	1,3	1,3
Humidifier									
Max theoretical capacity	[kg/h]	2,80	3,17	4,45	5,22	5,01	10,09	6,90	6,50
Effective capacity	[kg/h]	3	3	3	3	3	3	3	3
Power consumption	[kW]	2,25	2,25	2,25	2,25	2,25	2,25	2,25	2,25
Sound pressure level (**)	[dB(A)]	46	48	48	49	51	52	53	53
Weight	[kg]	162	169	207	232	265	273	285	287

** **At 1,5 meters height, 2 meters frontal distance in free field – down flow units (30 Pa AESP), nominal air flow**

Technical data for CW units

		DHCDR0080 DHCUR0080	DHCDR0110 DHCUR0110	DHCDR0140 DHCUR0140	DHCDR0160 DHCUR0160	DHCDR0200 DHCUR0200	DHCDR0230 DHCUR0230
Power supply	V/Ph/Hz	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50	400/ 3+N /50
Frame							
H	[mm]	1.875	1.875	1.875	1.875	1.875	1.875
L	[mm]	600	600	900	900	900	900
D	[mm]	600	600	600	600	600	600
Air Flow	[m3/h]	2.300	2.400	3.800	3.800	5.100	5.100
Water flow @ 7/12°	[l/s]	0,36	0,50	0,67	0,75	1,00	1,06
Water pressure drop @ 7/12 °	[kPa]	24,59	52,46	23,26	32,18	41,45	49,25
Water flow @ 10/16°	[l/s]	0,25	0,33	0,44	0,50	0,65	0,71
Water pressure drop @ 10/15°	[kPa]	12,24	23,30	10,42	14,62	17,90	22,15
Cooling Capacity							
Cooling capacity @ w, 7/12 °	[kW]	7,7	10,6	14,2	15,8	21,2	23,4
Cooling capacity @ w, 10/15 °	[kW]	5,3	6,9	9,4	10,5	13,8	14,8
Cooling Finned coil							
Frontal surface	[m2]	0,26	0,26	0,44	0,44	0,51	0,51
Geometry		25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65	25 x 21,65
Rows	[-]	3	4	3	4	4	5
Type of fins	[-]	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic	Hydrophilic
Fin pitch	[mm]	1,8	1,8	1,8	1,8	1,8	1,8
SHR @ water 7/12℃	[-]	0,88	0,84	0,84	0,83	0,84	0,83
SHR @ water 10/15℃	[-]	1,00	1,00	1,00	1,00	1,00	1,00
Indoor Fan							
Type		Radial -EC	Radial -EC	Radial -EC	Radial -EC	Radial -EC	Radial -EC
Power supply ,		1	1	1	1	1	1
Number of fan	[A]	0,34	0,39	0,63	0,64	0,91	1,03
Nominal current	[W]	211	245	395	397	564	643
Power consumption	[Pa]	30	30	30	30	30	30
AESP	[Pa]	506	473	432	401	174	144
Air Filter							
Filtration		G3	G3	G3	G3	G3	G3
Overall surface	[m2]	2,2	2,2	3,6	3,6	5,0	5,0
Fire resistance class		1	1	1	1	1	1
Electrical heaters							
Total heating capacity	[kW]	1,6	1,6	3,2	3,2	3,2	3,2
N° of heaters		1	1	2	2	3	3
Material	[-]	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium
Hot Water Reheating Coil							
Heating capacity @ water 45/40° C	[kW]	4,7	4,8	8,1	8,1	9,2	9,2
Front surface	[m2]	0,22	0,22	0,37	0,37	0,37	0,37
Water Flow	[m3/h]	0,815	0,830	1,409	1,409	1,595	1,595
Water side pressure drop	[kPa]	9,9	10,3	16,4	16,4	20,3	20,3
Water valve pressure drop	[kPa]	4,15	4,31	4,70	4,70	6,20	6,20
Internal volume	[dm3]	0,9	0,9	1,3	1,3	1,3	1,3
Humidifier							
Max theoretical capacity	[kg/h]	2,92	3,55	6,44	5,83	9,87	8,66
Effective capacity	[kg/h]	3	3	3	3	3	3
Power consumption	[kW]	2,25	2,25	2,25	2,25	2,25	2,25
Sound pressure level (**)	[dB(A)]	48	50	51	51	52	52
Weight	[kg]	125	135	150	160	170	175

** **At 1,5 meters height, 2 meters frontal distance in free field – down flow units (30 Pa AESP), nominal air flow**

Remote Condenser Technical Data Collection

STANDARD EXECUTION									
Model		**SVHN 7/7**	**SVHN 13/9**	**SVHN 13/9**	**SVHN 13/9**	**SVHN 20/4**	**SVHN 20/4**	**SVHN 23/2**	**SVHN 38/1**
INNOV@ Model		**0060**	**0080**	**0100**	**0110**	**0130**	**0160**	**0190**	**0205**
Nr. Of fans x Ø	Mm	**1 x 350**	**2 x 330**	**2 x 330**	**2 x 330**	**2 x 350**	**2 x 350**	**3 x 350**	**4 x 350**
Air Flow	m3/h	**2.400**	**3.200**	**3.200**	**3.200**	**4.600**	**4.600**	**7.200**	**8.400**
Power supply	V/ph/Hz	**230/1/50**	**230/1/50**	**230/1/50**	**230/1/50**	**230/1/50**	**230/1/50**	**230/1/50**	**230/1/50**
Absorbed power	W	**180**	**270**	**270**	**270**	**360**	**360**	**540**	**720**
Absorbed current	A	**0,85**	**1,2**	**1,2**	**1,2**	**1,7**	**1,7**	**2,5**	**3,4**
Sound pressure level in free field	dB(A)	**40**	**41**	**41**	**41**	**43**	**43**	**45**	**46**
Dimensions (vertical airflow)	L mm	**723**	**1.057**	**1.057**	**1.057**	**1.294**	**1.294**	**1.853**	**1.298**
	P mm	**600**	**500**	**500**	**500**	**600**	**600**	**600**	**1150**
	H mm	**763**	**600**	**600**	**600**	**763**	**763**	**763**	**763**
Dimensions (horizontal air flow)	L mm	**723**	**1.057**	**1.057**	**1.057**	**1.294**	**1.294**	**1.853**	**1.298**
	P mm	**363**	**305**	**305**	**305**	**363**	**363**	**363**	**363**
	H mm	**560**	**460**	**460**	**460**	**560**	**560**	**560**	**1130**
Weight	Kg	**16**	**25**	**25**	**25**	**37**	**37**	**42**	**64**

LOW NOISE EXECUTION									
Model		**SVHS 8/2**	**SVHS 18/0**	**SVHS 18/0**	**SVHS 18/0**	**SVHS 20/2**	**SVHS 20/2**	**SVHS 27/1**	**SVHS 36/0**
INNOV@ Model		**0060**	**0080**	**0100**	**0110**	**0130**	**0160**	**0190**	**0205**
Nr. Of fans x Ø	Mm	**2 x 330**	**3 x 350**	**3 x 350**	**3 x 350**	**3 x 350**	**3 x 350**	**4 x 350**	**6 x 350**
Air Flow	m3/h	**2.200**	**4.500**	**4.500**	**4.500**	**3.900**	**3.900**	**5.200**	**9.000**
Power supply	V/ph/Hz	**230/1/50**	**230/1/50**	**230/1/50**	**230/1/50**	**230/1/50**	**230/1/50**	**230/1/50**	**230/1/50**
Absorbed power	W	**130**	**210**	**210**	**210**	**210**	**210**	**280**	**420**
Absorbed current	A	**0,6**	**1,0**	**1,0**	**1,0**	**1,0**	**1,0**	**1,3**	**2,0**
Sound pressure level in free field	dB(A)	**32**	**35**	**35**	**35**	**35**	**35**	**36**	**38**
Dimensions (vertical airflow)	L mm	**1.057**	**1.853**	**1.853**	**1.853**	**1.853**	**1.853**	**1.298**	**1.853**
	P mm	**500**	**600**	**600**	**600**	**600**	**600**	**1150**	**1150**
	H mm	**600**	**763**	**763**	**763**	**763**	**763**	**863**	**863**
Dimensions (horizontal air flow)	L mm	**1.057**	**1.853**	**1.853**	**1.853**	**1.853**	**1.853**	**1.298**	**1.853**
	P mm	**305**	**305**	**305**	**305**	**305**	**305**	**363**	**363**
	H mm	**460**	**460**	**460**	**460**	**460**	**460**	**1130**	**1130**
Weight	Kg	**21**	**42**	**42**	**42**	**48**	**48**	**64**	**72**

- **Selection related to 35°C Air Temperature**
- **N.B. The standard condenser selection is done to reach a maximum external temperature of 45°C, in spite of the most other products on the market**

Dry Cooler Technical Data

STANDARD EXECUTION									
Model		**SHLR 15M**	**SHLN 24D**	**SHLN 24D**	**SHLN 29L**	**SHLN 30D**	**SHLN 50C**	**SHLN 58D**	**SHLN 58D**
INNOV@ Model		**0060**	**0080**	**0100**	**0110**	**0130**	**0160**	**0190**	**0205**
Nr. Of fans x Ø	mm	**1 x 500**	**1 x 500**	**1 x 500**	**1 x 500**	**1 x 630**	**2 x 500**	**2 x 500**	**2 x 500**
Air Flow	m3/h	**2.820**	**6..350**	**6.350**	**6.440**	**7.800**	**12.700**	**12.880**	**12.880**
Water flow	m3/h	**2.1**	**3.6**	**3.6**	**3.9**	**3.9**	**7.2**	**8.1**	**8.1**
Water pressure drop	kPa	**33**	**35**	**35**	**23**	**23**	**28**	**53**	**53**
Power supply	V/ph/Hz	**230/1/50**	**230/1/50**	**230/1/50**	**230/1/50**	**230/1/50**	**230/1/50**	**230/1/50**	**230/1/50**
Absorbed power	W	**136**	**741**	**741**	**741**	**620**	**1.482**	**1.482**	**1.482**
Absorbed current	A	**0.60**	**3.30**	**3.30**	**3.30**	**2.80**	**6.60**	**6.60**	**6.60**
Sound pressure level in free field	dB(A)	**29**	**47**	**47**	**47**	**45**	**50**	**50**	**50**
Dimensions (vertical airflow)	L mm	**1.085**	**1.085**	**1.085**	**1.085**	**1.393**	**1.895**	**1.895**	**1.895**
	P mm	**810**	**810**	**810**	**810**	**1110**	**810**	**810**	**810**
	H mm	**1.070**	**1.070**	**1.070**	**1.070**	**1.270**	**1.070**	**1.070**	**1.070**
Dimensions (horizontal air flow)	L mm	**1.085**	**1.085**	**1.085**	**1.085**	**1.393**	**1.895**	**1.895**	**1.895**
	P mm	**470**	**470**	**470**	**470**	**705**	**470**	**470**	**470**
	H mm	**830**	**830**	**830**	**830**	**1.040**	**830**	**830**	**830**
Weight	kg	**56**	**56**	**56**	**60**	**123**	**94**	**102**	**102**

LOW NOISE EXECUTION									
Model		**SHLR 15M**	**SHLS 19M**	**SHLS 19M**	**SHLS 38D**	**SHLS 38D**	**SHLS 38D**	**SHLS 59D**	**SHLS 59D**
INNOV@ Model		**0060**	**0080**	**0100**	**0110**	**0130**	**0160**	**0190**	**0205**
Nr. Of fans x Ø	mm	**1 x 500**	**1 x 500**	**1 x 500**	**2 x 500**	**2 x 500**	**2 x 500**	**3 x 500**	**3 x 500**
Air Flow	m3/h	**2.820**	**4.500**	**4.500**	**8.300**	**8.300**	**8.300**	**12.400**	**12.400**
Water flow	m3/h	**2.1**	**2.8**	**2.8**	**5.7**	**5.7**	**5.7**	**8.5**	**8.5**
Water pressure drop	kPa	**33**	**57**	**57**	**51**	**51**	**51**	**46**	**46**
Power supply	V/ph/Hz	**230/1/50**	**230/1/50**	**230/1/50**	**230/1/50**	**230/1/50**	**230/1/50**	**230/1/50**	**230/1/50**
Absorbed power	W	**136**	**272**	**272**	**544**	**544**	**544**	**816**	**816**
Absorbed current	A	**0.60**	**2.80**	**2.80**	**2.40**	**2.40**	**2.40**	**3.60**	**3.60**
Sound pressure level in free field	dB(A)	**29**	**38**	**38**	**41**	**41**	**41**	**42**	**42**
Dimensions (vertical airflow)	L mm	**1.085**	**1.085**	**1.085**	**1.895**	**1.895**	**1.895**	**2.705**	**2.705**
	P mm	**810**	**810**	**810**	**810**	**810**	**810**	**810**	**810**
	H mm	**1.070**	**1.070**	**1.070**	**1.070**	**1.070**	**1.070**	**1.070**	**1.070**
Dimensions (horizontal air flow)	L mm	**1.085**	**1.085**	**1.085**	**1.895**	**1.895**	**1.895**	**2.705**	**2.705**
	P mm	**470**	**470**	**470**	**470**	**470**	**470**	**470**	**470**
	H mm	**830**	**830**	**830**	**830**	**830**	**830**	**830**	**830**
Weight	kg	**56**	**56**	**56**	**94**	**94**	**94**	**132**	**132**

- **Selection related to 30°C Air Temperature and 45/40°C 30%e.g. water conditions.**
- **Max Air T = 40°C**

Correction Factors

DX Units- Air Cooled

Cooling Capacity

		T_{amb} [°C] (*)				
		20	22	24	26	28
T_{est} [°C]	25	0,97	1,04	1,13	1,19	1,30
	30	0,91	0,98	1,07	1,13	1,23
	35	0,85	0,91	1,00	1,05	1,15
	40	0,79	0,85	0,93	0,98	1,08
	45	0,72	0,78	0,85	0,90	0,99

(*) R.h. 50%

Absorbed Power

		T_{amb} [°C] (*)				
		20	22	24	26	28
T_{est} [°C]	25	0,809	0,804	0,795	0,789	0,774
	30	0,906	0,900	0,891	0,886	0,874
	35	1,015	1,009	1,000	0,997	0,985
	40	1,135	1,132	1,123	1,120	1,111
	45	1,279	1,276	1,270	1,267	1,258

(*) R.h. 50%

Absorbed Current

		T_{amb} [°C] (*)				
		20	22	24	26	28
T_{est} [°C]	25	0,878	0,873	0,866	0,863	0,855
	30	0,939	0,936	0,929	0,926	0,919
	35	1,008	1,005	1,000	0,997	0,990
	40	1,087	1,084	1,079	1,076	1,071
	45	1,179	1,177	1,174	1,171	1,166

(*) R.h. 50%

DX Units - Water Cooled

Cooling Capacity

		T_{amb} [°C] (*)				
		20	22	24	26	28
T_{H2O-in} [°C]	15	0,86	0,92	1,00	1,05	1,15

(*) R.h. 50%

Absorbed Power

		T_{amb} [°C] (*)				
		20	22	24	26	28
T_{H2O-in} [°C]	15	1,017	1,010	1,00	0,990	0,976

(*) R.h. 50%

Absorbed Current

		T_{amb} [°C] (*)				
		20	22	24	26	28
T_{H2O-in} [°C]	15	1,013	1,007	1,00	0,995	0,986

(*) R.h. 50%

Chiller water units

Cooling Capacity

				T_{amb} [°C] (*)				
				20	22	24	26	28
T_{H2O-in} [°C]	7	$T_{H2O-out}$ [°C]	12	0,680	0,817	1,00	1,159	1,360
	8		13	0,629	0,731	0,881	1,076	1,282
	10		15	0,524	0,628	0,729	0,897	1,104

(*) R.h. 50%

Refrigerant Pipes

On-site piping has to be installed by professional workers using only CUB quality copper pipes. Take care in use of nitrogen during all brazing operations in order to avoid humidity and dirty in pipes.

Refrigerant		R407C	R407C	R407C	R407C	R407C	R407C	R407C	R407C
Cooling Capacity	[kW]	4-5	6-7	8-9	10-11.5	11.5-13	14-16	17-18	19-24
HP Gas line 0-10m	[mm]	12	12	12	16	16	16	16	22
Liquid line 0-10m	[mm]	10	10	10	12	12	12	12	16
HP Gas line 11-20m	[mm]	12	12	16	16	16	18	18	22
Liquid line 11-20m	[mm]]	10	10	12	12	12	12	12	16

Standard Copper pipes

Diameter [mm]	Thikness [mm]	Minimum bending radius [mm]	System design pressurePS [bar]	PED Category	Max Copper σs [N/mm2]	Real copper σ [N/mm2]	Safety ratio
10	1	36	28	A3 P3	227	11,2	20,3
12	1	36	28	A3 P3	227	14	16,2
16	1	46	28	A3 P3	227	19,6	11,6
18	1	56	28	A3 P3	227	21	10,8
22	1,5	67	28	A3 P3	227	17,3	13,1
28	1,5	96	28	A3 P3	227	23,3	9,8
35	1,5	70	28	A3P3	227	29,8	7,6
42	1,5	84	28	A3P3	227	36,4	6,2
54	2,0	108	28	A3P3	227	35	6,4

Refrigerant Charge

The following table gives an idea of the total refrigerant charge (unit + condenser): this should be used just as first reference but the right charge should be performed on site by a qualified installer .
Note: The INNOV@ units as well as the remote condenser are shipped filled with nitrogen or dry air.

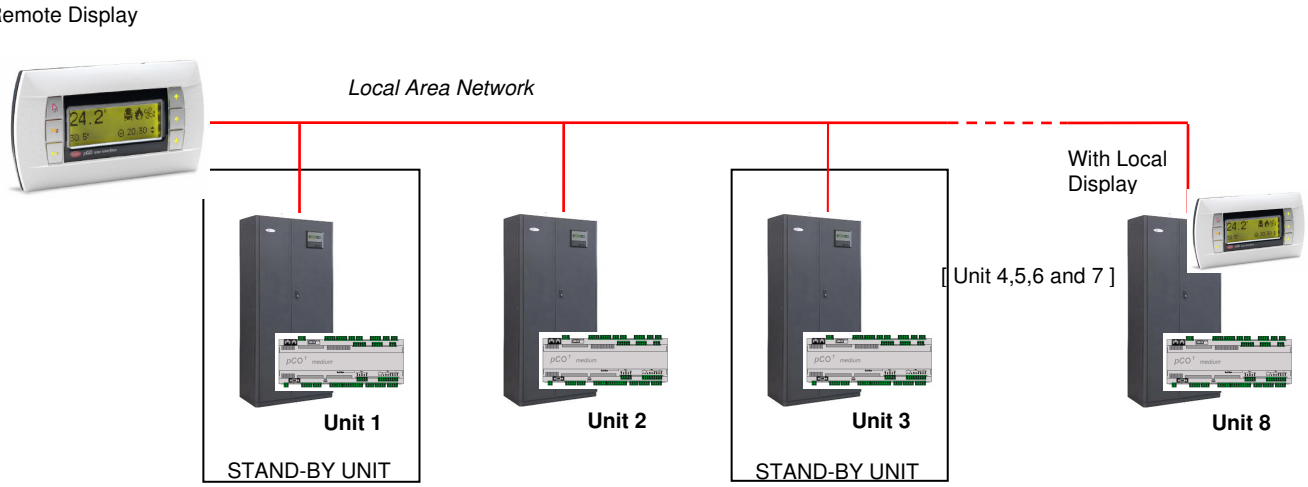
INNOV@ Model		060	080	100	110	130	160	190	205
Unit + Condenser Charge	[kg]	2,26	3,86	4,36	4,38	6,21	6,58	7,72	8,24
Charge for line *	[g/m]	91	91	98	98	98	98	98	98

Note: approximated values (± 20%), to be verified on site.

(*) referred to distance between inside and outside unit.

Interconnectivity Systems

Advanced Control pCO - Local Area Network (LAN)



Description:

Stand-by rotation:

- Max. Number of units: 8

- Stand-by rotation of 1 to N unit (N is the number of installed unit).

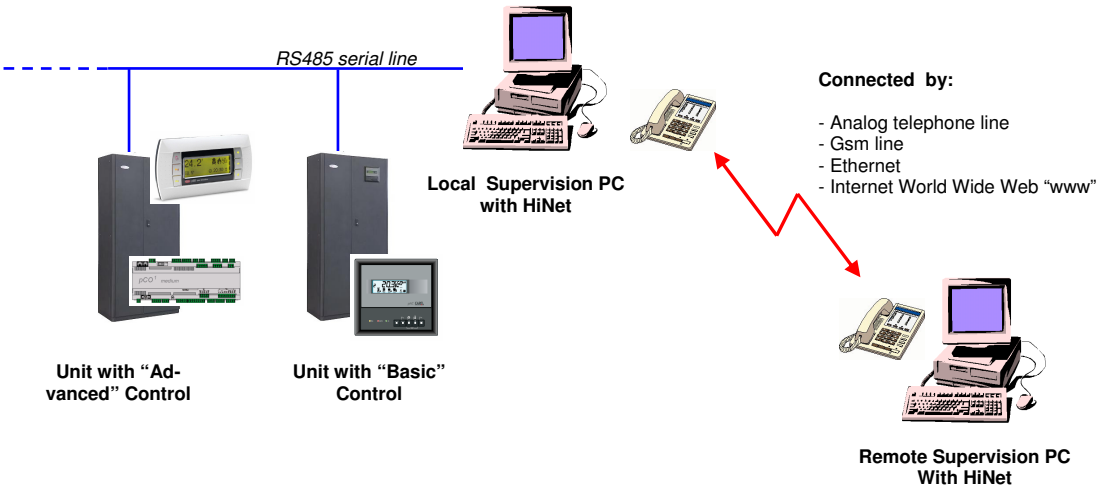
- Stand-by rotation activated by timing, time band or by alarm.

Master function:

The “Master” unit’s temperature and humidity probes must be located in an “intermediate” position inside the controlled environment. The “Master” unit drives the logic that is adopted by every connected unit. This is important to avoid situations in which units in dehumidification and units in humidification contra-work at the same time in the same environment. The “Master” unit changes the working logic in case of exceeding the set point by the measured temperature or humidity, even of just a few decimal points. In case of black-out or of disconnection of the “Master” unit from the pLAN network, the connected units will start to operate stand-alone based just on the their own probes.

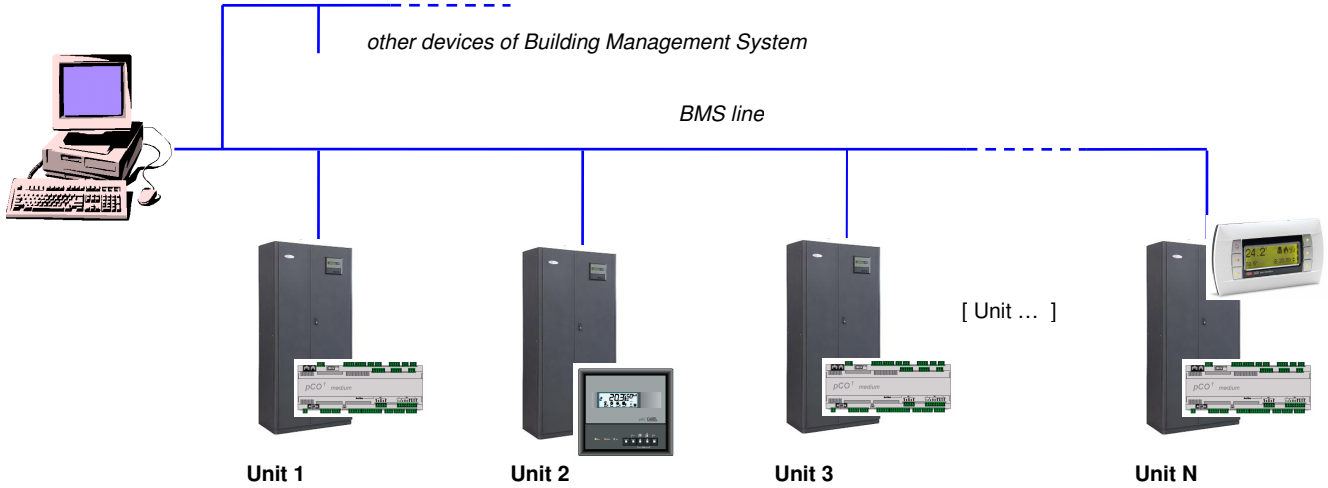
DataWeb Supervising Systems

The system allows air-conditioning to be monitored and controlled using just a simple Internet browser: the pages displayed on the PC are in HTML format, the language of the worldwide web.


RS485 serial line
Local Supervision PC with HiNet
Connected by:
- Analog telephone line
- Gsm line
- Ethernet
- Internet World Wide Web “www”
Unit with “Advanced” Control
Unit with “Basic” Control
Remote Supervision PC With HiNet

BMS integration

INNOV@ units can be connected to BMS in the following ways:
- Directly, without using a gateway, thanks to the ability of the advanced control pCO to select the protocol used;
- using a gateway that translates the Carel proprietary protocol to the specific BMS protocol;
- integrating the driver for the management of the Carel specific protocol into the BMS.



Following Serial port / protocols are used by Lennox to ensure connectivity to the other systems:

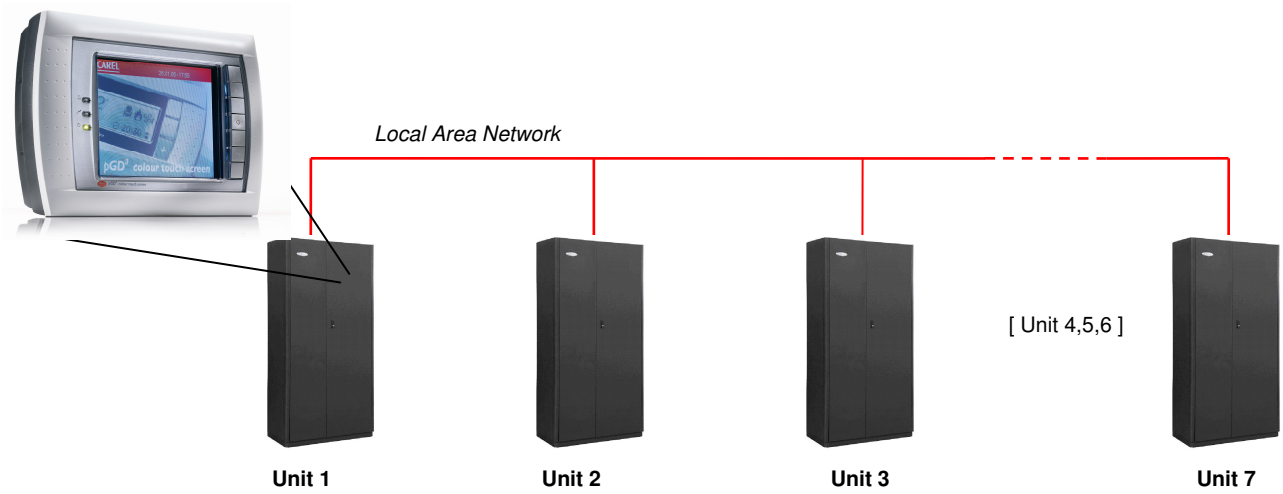
<u>With advanced microprocessor:</u>

- RS485 / Carel o Modbus® ;
- Modem GSM + RS 232 / sms (units status advice by sms in case of alarm);
- LonWorks® FTT-10 card / LonWorks®
- pCOweb Ethernet connection / BACnet™ o SNMP (TCP-IP)
- pCOweb RS485 connector / BACnet™
- TREND® serial card / TREND®

<u>With basic microprocessor:</u>

- RS485 / Carel
- External Modbus® gateway / Modbus®

pGD3 Graphical touch screen color display (panel mounted)



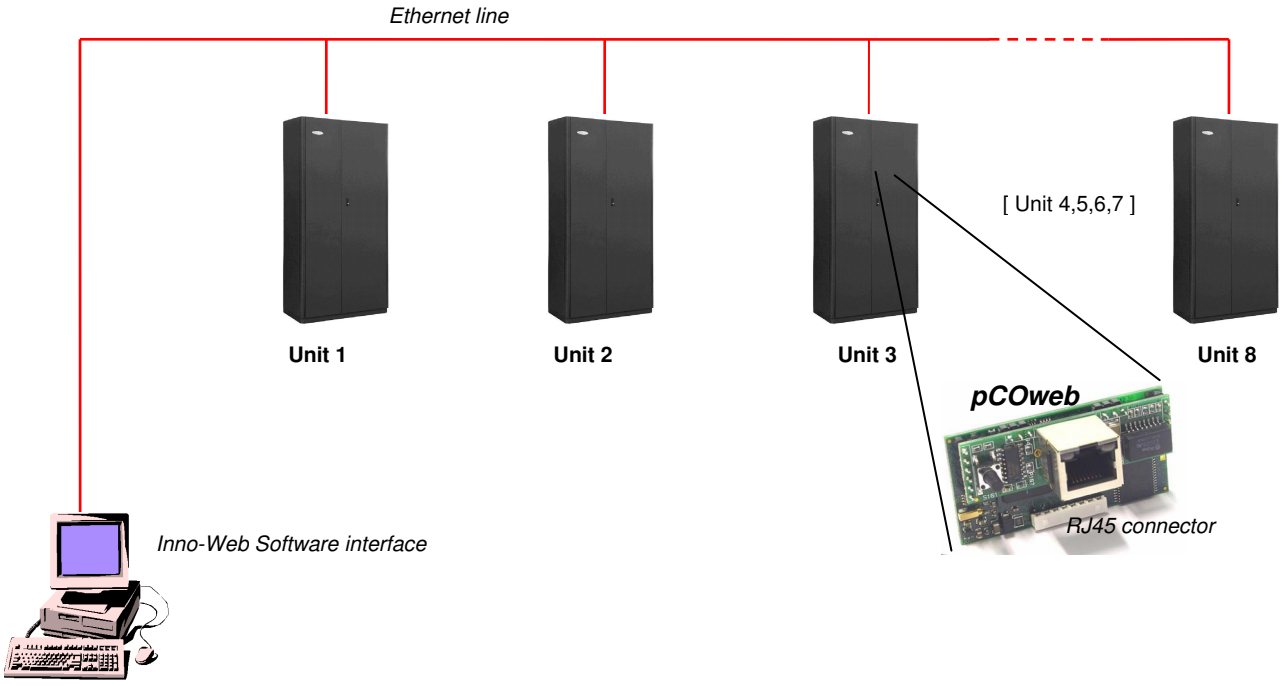
The pGD3 display can show:

- Temperature trend graphics of the single unit or the average value between all the units connected on the LAN.
- Humidity trend graphics of the single unit or the average value between all the units connected on the LAN.

Note:

- With pGD3 display, at most 7 units can be connected on a LAN
- Inside the electrical panel of all the units connected, a pGD0 display is installed; this allows the unit to manage when it is disconnected from the LAN and for the advanced configuration.

Inno-web Interface card for BACnet/SNMP with Ethernet RJ45 connection



The pCOweb Ethernet connection function are:

a) Only hardware

Hardware requirements:
- pCOweb interface card

Functions:
- BACnet protocol converter
- SNMP protocol converter
- Data logging of a maximum of 10 variables and download of the data via FTP
- Sending of an email in case of alarms using an external mail server

b) Complete Lennox solution

Software requirements :
-Inno-Web for pCOweb (option)

Hardware requirements:
- Inno-web interface card

Functions:
- Reading the status of the units
- Modification of the parameter of the units
- Data logging of a maximum of 10 variables and download of the data via FTP
- Sending of an email in case of alarms using an external mail server.

Appendix “A”: Supply water limit values for immersed electrode humidifiers

			MEDIUM-LOW CONDUCTIVITY		NORMAL-HIGH CONDUCTIVITY		HIGH CONDUCTIVITY	
			MIN	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**
Specific conductivity at 20°C	**σ_{20}**	µS/cm	125	350	350	750	750	1250
Total dissolved solids	**TDS**	mg/l	([1])	([1])	([1])	([1])	([1])	([1])
Dry residue at 180°C	**R_{180}**	mg/l	([1])	([1])	([1])	([1])	([1])	([1])
Hydrogen ion activity	**pH**	-	7	8.5	7	8.5	7	8.5
Total hardness	**TH**	mg/l $CaCO_3$	-	200	150	400	150	400
Temporary hardness	**TH**	mg/l $CaCO_3$	-	150	-	200	-	200
Chlorides		ppm Cl	-	20	-	30	-	30
Iron + Manganese		mg/l Fe+Mn	-	0.2	-	0.2	-	0.2
Silica		mg/l SiO_2	-	20	-	20	-	20
Residual chlorine		mg/l Cl^-	-	0.2	-	0.2	-	0.2
Calcium sulphate		Mg/l $CaSO_4$	-	60	-	100	-	100

([1]) Values depend on the specific conductivity; in general: TDS ≅ 0.93 * σ_{20} ; R_{180} ≅ 0.65 *

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