



High Technology in Refrigeration Devices

PRODUCT DOCUMENTATION

JREF Close Control Units

JA..C
JC..C

- Direct Expansion UP/Down Flow
- Chilled Water UP/Down Flow





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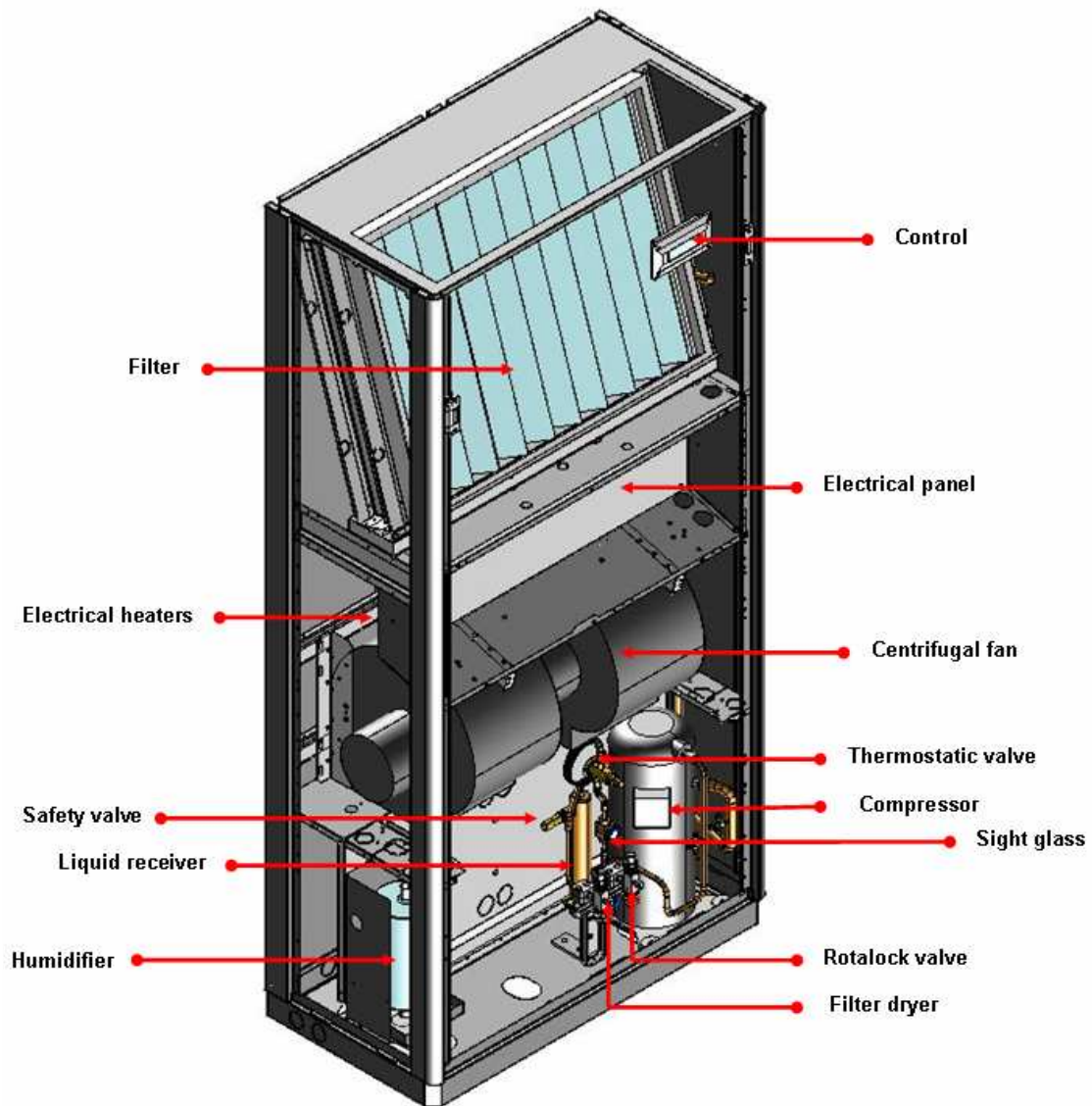
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General Description of JREF units

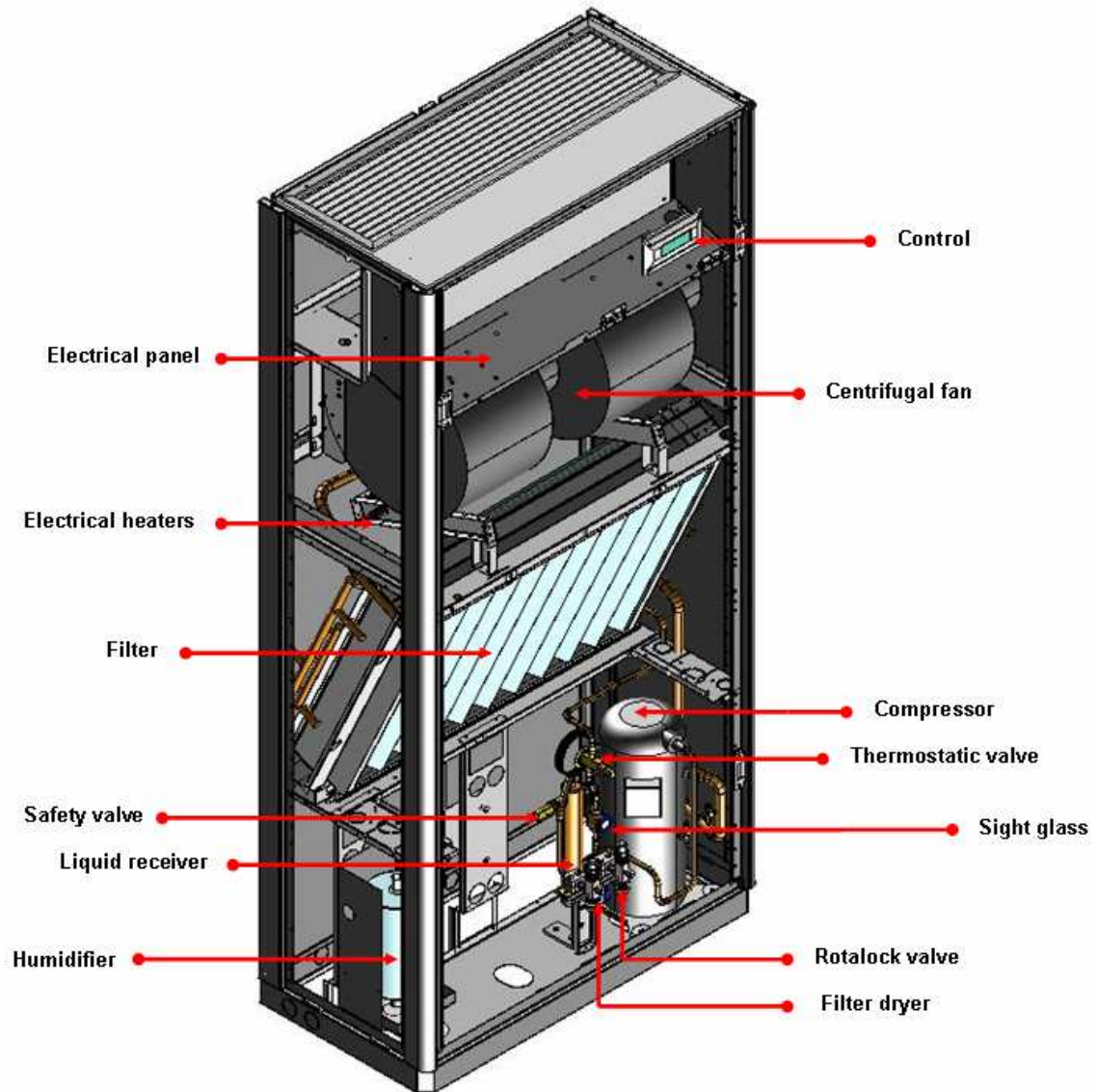
DX version:

DOWN





UP

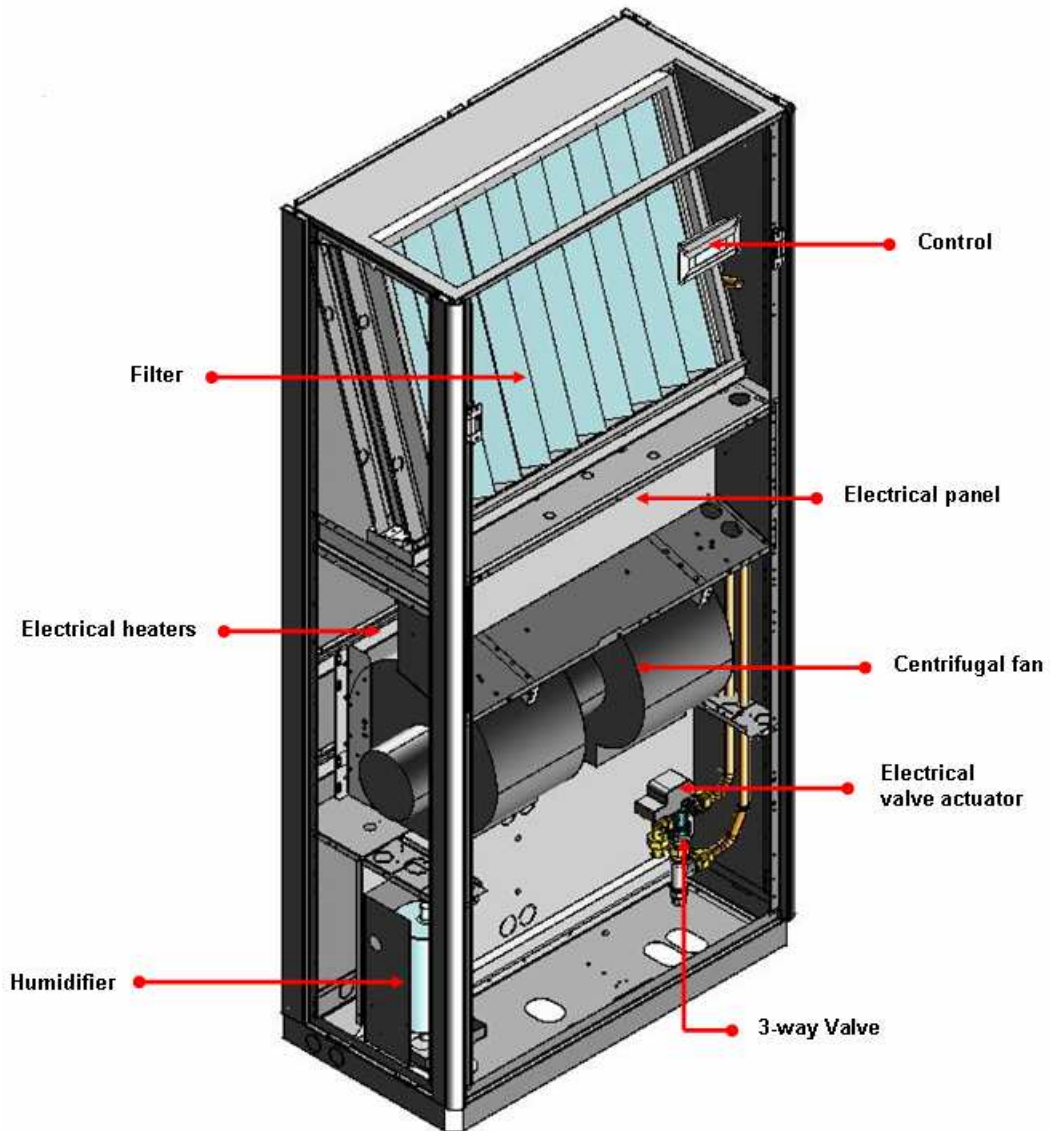




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CW version:

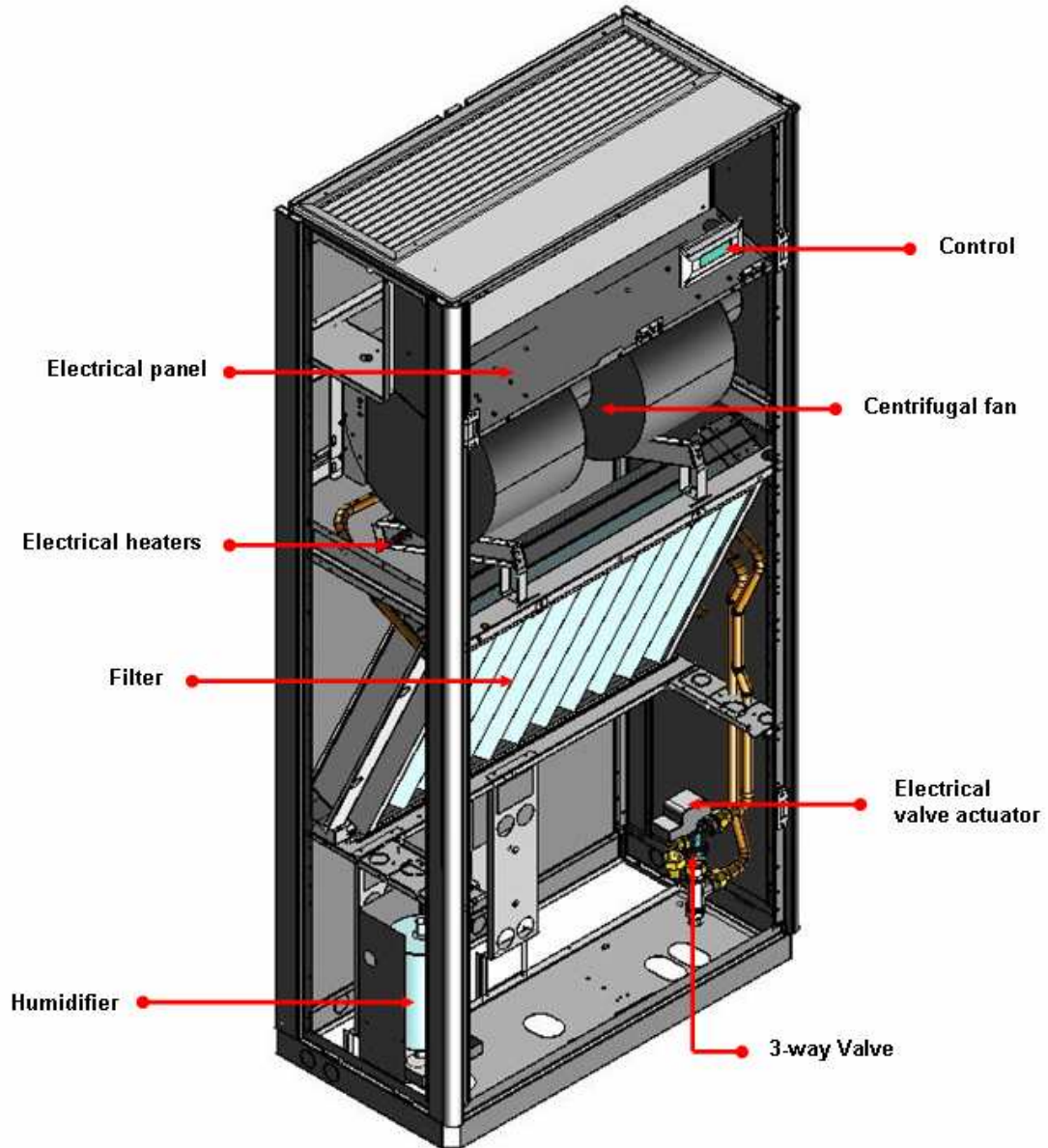
DOWN



UP



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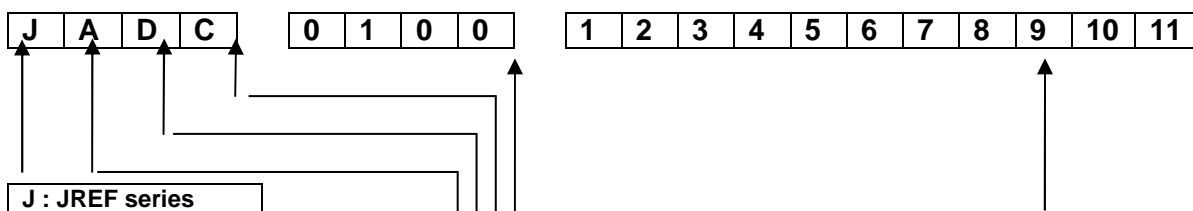


DIGIT

DIGIT Configuration

The **JREF** 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



J : JREF series

DX Direct expansion units	
A:	remote air condensed units
W:	water condensed units
F:	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)

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

Fans	
C:	forward curved blades

Cooling capacity	
KW / 10	

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		
Standard		0
HP centrifugal fan		D
Brushless <i>EC Technology</i> (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)		5
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		
No		0
Modulating fan speed – condensing pressure control with remote		5
10 Packaging		
Standard		0
Wooden crate with cardboard		M
Seaworthy		N
11 Special		
Standard		0
Special		S



DIGIT

Configuration DIGIT

Chilled water units: Example...



	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 microprocessor (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	
	Standard	0
	HP centrifugal fan	D
	Brushless <i>EC-Technology</i> (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

JREF CCAC Units

JREF CCAC self-contained units are specially designed for installation in technological environments such as Computer rooms, laboratories and anywhere else where a high precision in climate control and a 24h/day operation is requested. JREF units represent the state of the art between technology and design as well as all **HiRef S.p.A.** products. Thanks to their characteristics, JREF can be installed also in offices environments with people are working in. A depth of 449mm in "C" versions, allows the compatibility with standard office furniture. Furthermore the innovative design and the high tech colours match JREF units to the last generation of IT devices. The internal design of the units was developed primary to the background of efficiency and reliability but nevertheless 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 very an additional very important feature especially 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) represent highest possible quality level in efficiency, reliability, maintenance time, pre and after sales support. All DX units are available in single circuit version.

Frame

JREF units are designed with a self-supporting frame and all components are made "inhouse" using sophisticated computer driven machines and special tools. All sheet metals are galvanized, the external panels moreover are powder coated RAL 7016 "graphit grey" colour, giving the units an image and 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 substitute a damaged side panel: all this problems are very rare, but with JREF units it is possible to solve them. The shape of the units is characterized by rounded edges with 26,5 mm radius as it common with all HiRef products. This special feature is produced by using special tools and it gives both, a new aesthetic appearance and advantages in injuries 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 in stainless steel in order to ensure long lifetime 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. Sandwich panels are available optional. They are made of mineral fibres laying between the external panel and a second metal sheet, giving a maximum of internal smoothness. Double skin panels are classified as non flammable materials class A1 according DIN 4102 norms. The sound absorption is better than in standard version, but the level of internal reflected sound power will increase on airflow discharge side.

Refrigerating circuit

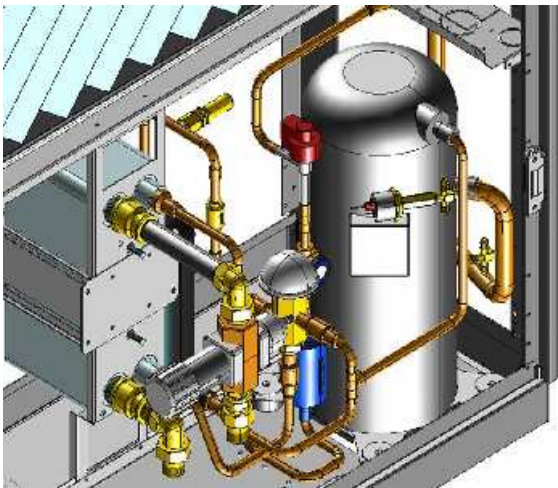
The entire refrigerating circuit is assembled in HiRef's production including all pipe work and using only primary brand for components. The employees involved in the welding and pipe work process are qualified by a third part according CEE 97/23 PED directive: not necessary to outline that this kind of qualification for workers is not a requirement, HiRef's in order to take care of the product quality and 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 refrigerants such as R22, R134a, R410A are available on request only and previous to checks of local laws.

- Compressors: Only primary brand scroll compressors are installed in JREF units (fig.1). The scroll compressor represents the best solution in terms of efficiency and reliability for CCAC units. The internal compression ratio is very close to the typical operating condition of CCAC applications giving the maximum in terms of COP. The perfectly balanced pressures in start-up phases gives big advantages for the electrical motor in terms of reliability, mainly in this filed where frequent start-up may be possible.



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- Plate heat exchangers: only AISI 304 BPHE with low carbon steel connections are used. The special design of the plates gives both the advantages to increase the turbulences reducing the fouling, increasing the efficiency reducing the overall dimensions: this feature allows to install the BPHE behind the compressor compartment, leaving more space for piping and other components.



- Finned coil heat exchanger: the know-how in development and production for "FCHE" is taking part in the **Galletti Group**. All coils are made by using the 25 x 21,65 mm geometry in combination with 9,52mm copper pipes and 0,10mm thickness aluminium fins. The expanding process to ensure perfect contact between pipes and fins is one of the most critical processes and it is 100% monitored in the entire production. The design criteria for our R&D department and our laboratories, can be summarized in 4 main points:
 - Reduction of pressure drops by using a large coil front surface
 - Hydrophilic treatment on the fins to allow the film condensation of dehumidification water
 - The reduction of the vertical length to avoid big thickness in water film and, as a consequence, the possibility to operate also at high air volume and high relative humidity without detaching of water in down flow units.
 - Special Corrugated Fins increase the heat transfer coefficient on air side in order improve the SHR.

For chilled water units a special attention was paid on checking the behaviour of the Reynolds number inside pipes during the modulation of the three way valve: a transition between laminar and turbulent flow may cause a big benefit in heat exchanging efficiency but loosing accuracy in T control. In order to reduce spare parts stock, as common to all HiRef 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 in combination with 9,52mm copper grooved pipes and 0,10mm thickness aluminium louvered fins. The combination of this technologies allows the maximum reduction in internal volume and consequently a reduction of the refrigerant charge quantity. The adopted fans are only with external rotor motor and in 4 or 6 poles execution, depending on the selected sound power level. There are already two selections available in the catalogue, but on special request our R&D department can work out further solutions. Panels are made in galvanized precoated metal sheet and special brackets for horizontal installation are available for the whole range (option). For different climatic areas you can choose amongst three different type of condensing controls:

- None
- Modulating fan speed control installed on board of the CCAC => down to -15°C
- Flooding technology in addition to the fan speed control for temperatures below -15°C and up down to -30°C. This last option will be supplied as a kit including liquid receiver, back pressure valve, safety valve, 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 equalisation.
 - Electronic expansion valve for insuperable performances in middle and winter season: the pay back of the solution in northern European countries is less than 1 Year.
 - Liquid receiver according CEE 97/23 PED directive
 - HP pressostat with manual reset according cat. IV CEE 97/23 PED.
 - LP pressostat with automatic reset and delayed time during start up.
 - Schrader valves for maintenance and or controls.

Electrical panel & components

- Electrical panel: the electrical panel is fully integrated into the unit and is designed according 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 adjusted by a transformer. The electrical panel has



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a circulation air system in order to manage 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. Units with HP fan or with dehumidification option, are provided with a manual [6-steps] indoor fan speed control: this device allows to adjust the right air volume to the specific filed conditions and to reduce the speed during dehumidification.

- **Microprocessor:** two different type are available:
 - Basic – Carel μ Ac
 - Advanced – Carel series pCO.For this control the HiRef Software Development Team is ready to customise the software according to customer specifications.

The main functions are summarised in:

- Input of main parameters by means of the keyboard.
- Displaying of operating conditions, alarms, devices
- Switching ON/OFF or modulating (3 way valve, humidifier) resources to keep constant the environment parameters constant;
- Modulating the three way valve for hot water reheating (option)
- Activating / Deactivating the solenoid valve for hot gas re-heating [option] in DX version only;
- Modulating the humidifier capacity;
- Activating 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.
- Serial communications (option) RS232 o RS485

All Microprocessors can be connected in serial communication for a remote control (BMS systems), the HSD [HiRef Software Development Team] is available to support customers in system integration. Inter-connectivity is every day more a must :

- **Serial ports:**
 - RS232
 - RS485
- **Modem GSM:** check with your local provider for the right contract for the SIM card. After activation,

JREF is ready for a stand alone bi-directional communication (only with Advanced pCO).

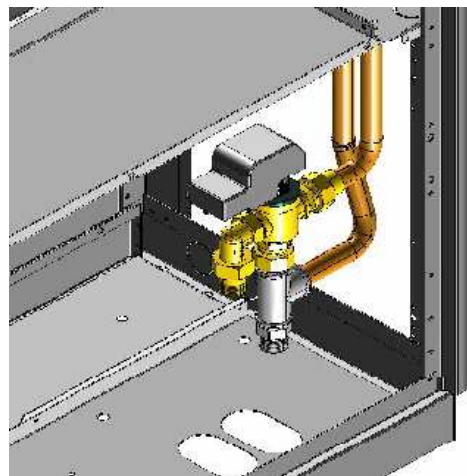
- **Protocols:**
 - Carel [Built In]
 - Modbus® [Built In with Advanced mP]
 - Modbus® [with external gateway with basic mP]
 - LonWorks® [option to be selected at unit's ordering]
 - BACnet™ [with external gateway]
 - TCP-IP[with external gateway]
 - TREND® [option to be selected at unit's ordering]

Aeraulic section

Fans for "C" versions are of centrifugal direct driven type in combination with 6 poles motors (standard) or 4 poles motors (HP fans). Fans are statically and dynamically balanced ensuring a drastic reduction in noise and vibrations. Optional for all units: fans with brushless motors are available. This technology allows to reduce energy consumption mainly at partial load and allows to maintain an exact air flow independently from external conditions. The air circuit is completed with an air flow switch is continuously checking a fan's faulty situation.

Hydraulic Circuit

CW units are fully assembled and pressure tested in a factory final test. The 3 way valves (Fig.2) are selected according to their characteristic Kvs to the coil pressure drop in order to give to the valve enough authority 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 connection are standard supplied with 3 parts quick connections to reduce on site working time.



Air Filter

The filter is positioned on the suction side just before the coil and is made in synthetic material with metallic frame. Filtration efficiency is EU4 according Eurovent



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4/5 document. For reaching the filter, simply open the door/s and remove it. As an option in the same dimension it is possible to install filters up EU5 class but, due to the increased pressure drops, only in combination with HP fans. For more filtration efficiency up to EU9, an external plenum can be provided. In this case an EU3 filter will be part of the option as a pre-filter; for up flow units the high filtration plenum is positioned on the delivery side.

Humidifier Section

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

Humidity control

JREF units can be supplied with humidity sensor (option). For an independent control between T and r.h. it is necessary to adopt one of the reheating possibilities (options)

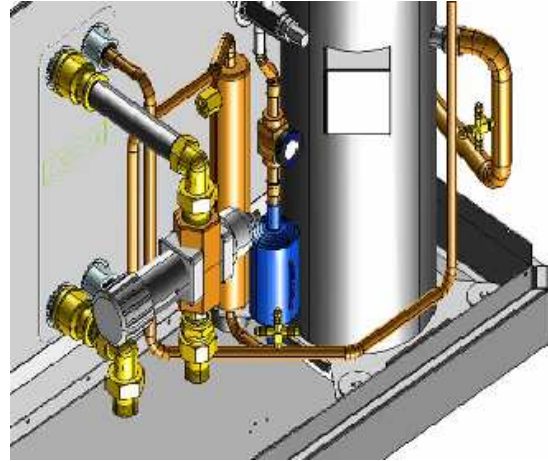
- Electrical reheating.
- Hot Water with 3 way modulating valve.
- Hot gas reheating: this solution is for DX version only with no additional energy consumption for the heating process. The coil design criteria allows to have a bigger heating capacity than sensible cooling capacity allowing to dehumidify even when there is no thermal load inside.

Water condensed versions

DX Units water condensed "W" ("Q" "F" versions with plug fan only) are equipped with an AISI 304 brazed plate condenser. Units are supplied fully tested and charged with POE oil and refrigerant: during final factory test procedure, all operating parameters are measured.

Depending on the water T it is possible / necessary to add a 2 way condensing control valve (Fig.3). In case that it is not possible to reduce the water flow, flooding technology is the alternative: in this case only refrigerant side actions occur and the water flow remain constant.

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

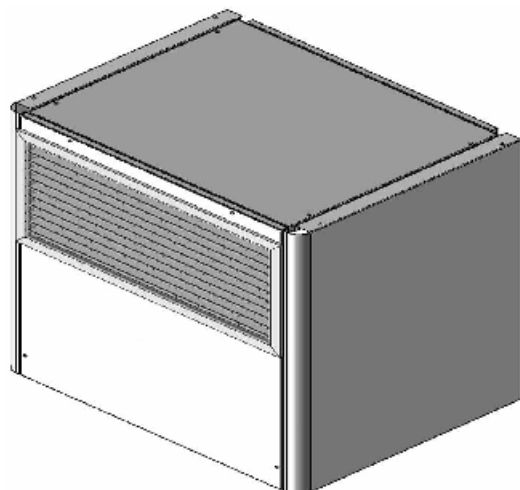


Fresh air kit

Fresh air kit consists of a flexible pipe and a cartridge EU3 filter and under normal conditions supplies roughly 100 m³/h independently from the unit size. In down flow units the filter is located in the fan sector. Before changing the filter is necessary to stop the unit and to remove the sheet metal in front of the fan's compartment. In up flow units an additional booster fan is provided to supply roughly 80 m³/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 and 500mm heights are available optional. 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.





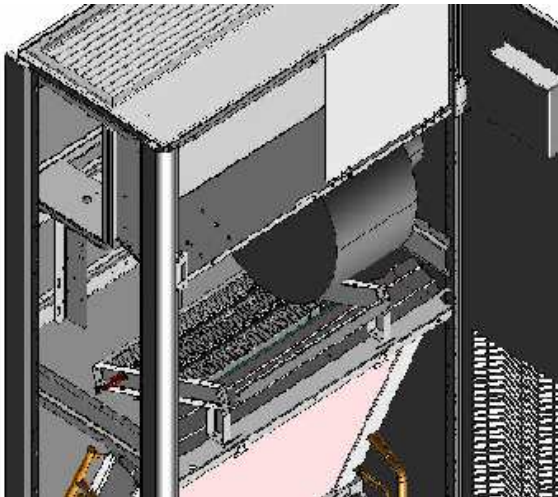
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Base Frames / Floorstands

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

Electrical Heaters

Realized for 3 steps operation and 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 to extract them from the front of all models, UP and Down flow.



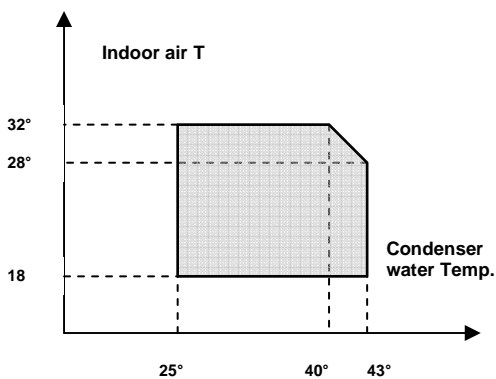
Before any maintenance on the electrical heaters, disconnect the unit from the power supply and wait for 30 minutes, allowing the temperature to decrease.

Application Field

JREF units are designed for indoor installation in technological environments but have been tested also under extreme conditions, typical e.g. in Far and Middle East market. The indoor temperature limits are covered from 18°C and 32°C and the r.h up to 75% for the entire range. It's reliable operation is practically covering all indoor conditions.

Diagram (Fig.6) illustrates the application of water cooled DX units.

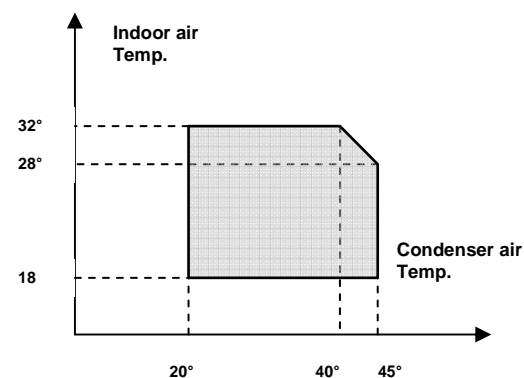
▪ Water condensed:



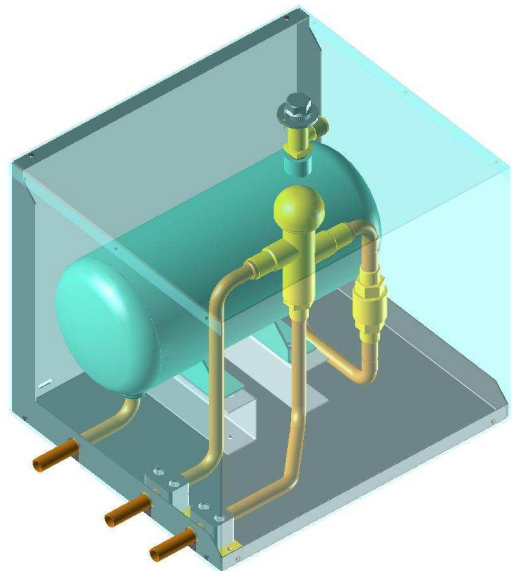
Water temperature below 25°C require a condensing control valve (option):

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

The diagram (fig.7) illustrates the application of air cooled DX units.



If extended application ranges are needed, please contact HiRef R&D department or your local distributor. Applications with external air temperature below 20 °C, require a condensing control to ensure enough pressure drops across the expansion valve. T below -15° and down to -30°C requires a flooding device (Fig.8) in order to flood the condenser internal surface allowing the right condensing T even in case of strong and cold winds. This device is added as a kit, consisting of a back pressure valve, a receiver, a safety valve and assembly instructions. The installation is very simple, just close to the condensing unit at bottom side.



Compressors Oil Heaters

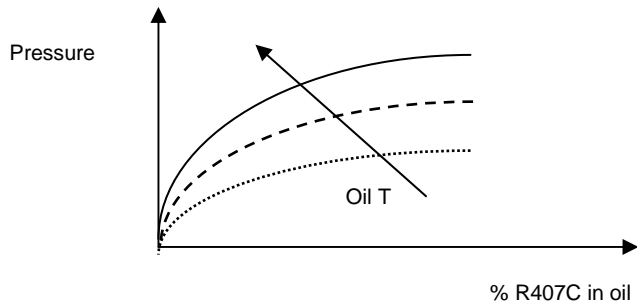
Fig.9 illustrates a specific property [Charles' law] of gases, which are more soluble in liquids as the pressure increases but less soluble as the temperature increases: if the oil in the crankcase heater is held at a constant pressure, an increase in temperature will significantly reduce the amount of refrigerant dissolved in it, thus ensuring that the function desired is maintained.

The problem of inadequate lubrication occurs if the crankcase is not duly heated, above all after a longer period of standstill when, due to the suction effect of the compressor, there is an abrupt drop in pressure inside the crankcase, which results in considerable evaporation of the refrigerant previously dissolved in the oil. In the absence of heating elements, this phenomenon would cause two problems:

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



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Using heating elements is of fundamental importance above all when starting up for the first time; in this case it is recommended to leave them on for at least 12 hours before starting the compressor.

Application limits short table

- operating fluid : water or e-glycol mixtures.
- syntetic non dangerous 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 influence the maximum storage T for units with a closed refrigerant circuits, like "W" water cooled, "F" free cooling, "Q" Dual cooling" units.

Technical section

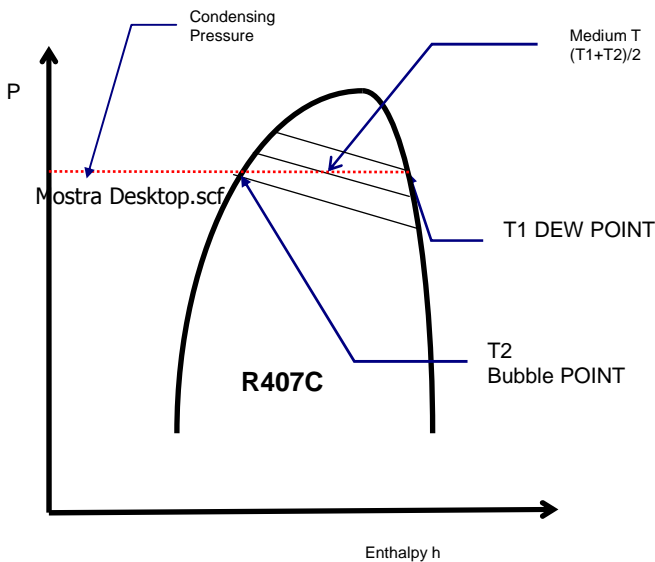
Thermodynamics

Refrigerants

JREF units are charged exclusively with HFC refrigerants that are not harmful to specifications of EEC regulation 2037/00. Standard units are configured for the use of fluid R407C, a ternary mixture of R32 (23%), R125(25%) R134a (52%). This mixture displays a characteristic phase change temperature “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 causes a sort of fractional evaporation/condensation which imposes an accurate sizing of the heat exchangers and a careful choice of the type of flow which occurs in them, i.e. in the opposite or same direction.

The diagram (Fig.10) illustrates this “temperature glide” as well as the beginning condensing T (dew point) and saturated liquid/end of condensation process (bubble point)

- Begin = DEW POINT
- End = BUBBLE POINT

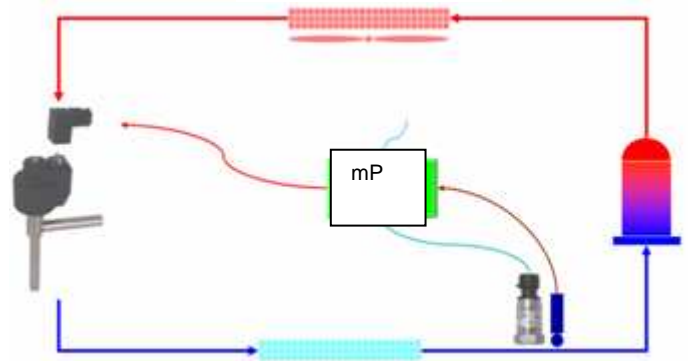


electronically controlled electric expansion valves (optional) which have a far superior modulating capacity compared to traditional mechanical thermostatic valves. This characteristic makes it possible to operate below reduced pressure differentials during middle and winter seasons. The minimum allowed condensing T (Dew Point) is 28°C due to the scroll compressor’s mechanical limits.

In this period it is possible to cut energy consumption by as much as 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 compressor. Return of investments can thus be achieved in shortest time. HiRef can support you with calculations for different specific thermal load and outside T profiles.

The simple schema shows how the valve is managed: a pressure transmitter is reading the evaporating pressure and a T sensor is measuring the Refrigerant T. The mP calculates the superheating and, using special algorithms part of them patented by HiRef S.p.A. (pat. nr. BO2002A000785 ITA), drives opening/closing of the valve by means of a stepper motor. Only two valves and only one coil cover the JREF Range giving important advantages for eventual spares and, in addition, the same valve is used for hot gas bypass in “Constant” units.

ETV schema



ETV picture



Expansion Valves

The expansion valve is just a mass flow regulator ensuring the right flow while checking the superheating at the evaporator outlet. The mass flow depends mainly on the % of opening and on the Delta pressure available across the valve. Mechanical valves have a very little modulating capacity and to ensure the mass flow, a significant Delta P across has to be maintained. On all HiRef products it is possible to install innovative



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Technical Data for DX Units – Air Cooled

		JADC0060	JADC0080	JADC0100	JADC0110	JADC0130	JADC0160	JADC0190	JADC0205
		JAUC0060	JAUC0080	JAUC0100	JAUC0110	JAUC0130	JAUC0160	JAUC0190	JAUC0205
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]	1785	2150	3530	3530	3470	5115	4990	4990
Frame									
H	[mm]	1850	1850	1850	1850	1850	1850	1850	1850
L	[mm]	600	600	900	900	900	1200	1200	1200
P	[mm]	449	449	449	449	449	449	449	449
Compressor									
Type		Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Cooling Capacity @ 24°C 50% UR – external air temp. 35°C	[kW]	5.9	7.7	9.3	10.6	12.6	15.6	18.2	19.9
Power consumption	[kW]	1.5	1.9	2.3	2.6	3.2	4.1	4.7	5.5
Nominal Current	[A]	2.9	3.7	4.5	5.1	6.2	8.0	8.7	10.5
FLA	[A]	5	6	7	7	10	13	14	15
LRA	[A]	24	32	40	46	50	66	74	101
POE Oil charge	[l]	1	1	1.1	1.1	1.36	1.95	1.65	1.65
Finned coil evaporator									
Front Surface	[m2]	0.29	0.29	0.47	0.47	0.47	0.65	0.65	0.65
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	3	4	4
Type of fins	[-]	Hydrofilic	Hydrofilic	Hydrofilic	Hydrofilic	Hydrofilic	Hydrofilic	Hydrofilic	Hydrofilic
Fin pitch	[mm]	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
SHR	[-]	1.00	1.00	1.00	1.00	0.96	0.98	0.98	0.96
Indoor fan									
Type		Centrifugal	Centrifugal	Centrifugal	Centrifugal	Centrifugal	Centrifugal	Centrifugal	Centrifugal
Fans 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
Number of fans		1	1	2	2	2	2	2	2
Fans absorbed current	[A]	1.2	1.6	3.2	3.2	3.2	3.8	3.8	3.8
Fans absorbed power	[W]	173	282	563	563	563	668	668	668
AESP with std fan	[Pa]	20	20	20	20	20	20	20	20
AESP with hp fan (option)	[Pa]	244	217	253	253	250	108	118	118
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 steps		1	1	2	2	2	2	2	2
Material	[-]	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium
Hot gas Reheating Coil									
Heating capacity	[kW]	5.5	6.3	10.2	10.79	11.7	16.9	18.0	19.2
Front Surface	[m2]	0.23	0.23	0.39	0.39	0.39	0.55	0.55	0.55
Hot Water reahating coil									
Heating capacity @ 45/40° water T	[kW]	4.1	4.9	7.4	7.9	8.6	11.8	12.6	13.3
Front Surface	[m2]	0.23	0.23	0.39	0.39	0.39	0.55	0.55	0.55
Water flow	[m3/h]	0.643	0.872	1.036	1.163	1.499	1.847	2.166	2.290
Water side pressure drop	[kPa]	3.6	6	12	14	23	43	57	62
Water valve pressure drop	[kPa]	10	10	10	10	10	13	18	20
Internal volume	[dm3]	0.547	0.547	0.939	0.920	0.920	1.312	1.312	1.312
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
Absorbed power	[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

** At 1,5 meters height, 2 meters frontal distance in free field – downflow units (20 Pa AESP)



High Technology in Refrigeration Devices

Technical Data DX Units – Water Cooled

		JWDC0060	JWDC0080	JWDC0100	JWDC0110	JWDC0130	JWDC0160	JWDC0190	JWDC0205
		JWUC0060	JWUC0080	JWUC0100	JWUC0110	JWUC0130	JWUC0160	JWUC0190	JWUC0205
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]	1785	2150	3530	3530	3470	5115	4990	4990
Frame									
H	[mm]	1875	1875	1875	1875	1875	1875	1875	1875
L	[mm]	600	600	900	900	900	1200	1200	1200
P	[mm]	449	449	449	449	449	449	449	449
T H2O 15°C (*)									
Cooling Capacity @ 24°C 50%UR	[kW]	6.59	8.48	10.70	12.15	14.21	17.98	20.86	21.50
CP Power consumption	[kW]	1.25	1.61	1.92	2.21	2.77	3.46	4.07	4.73
T H2O 40°C/30% e.g. + enlarged BPHE									
Cooling Capacity @ 24°C 50%UR	[kW]	5.66	7.16	9.04	10.27	12.00	14.90	17.55	19.02
CP Power consumption	[kW]	1.65	2.17	2.60	2.99	3.70	4.63	5.35	6.11
Compressor									
Type		Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Nominal Current (*)	[A]	2.9	3.7	4.48	5.13	6.16	8.01	8.66	11.35
FLA	[A]	5	6	7	7	10	13	14	15
LRA	[A]	24	32	40	46	50	66	74	101
POE Oil charge	[l]	1	1	1.1	1.1	1.36	1.95	1.65	1.65
Finned coil evaporator									
Front Surface	[m2]	0.29	0.29	0.48	0.48	0.48	0.66	0.66	0.66
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	3	4	4
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	1.00	1.00	1.00	0.96	0.98	0.98	0.96
Indoor fan									
Type		Centrifugal	Centrifugal	Centrifugal	Centrifugal	Centrifugal	Centrifugal	Centrifugal	Centrifugal
Fans 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
Number of fans		1	1	2	2	2	2	2	2
Fans absorbed current	[A]	1.2	1.6	3.2	3.2	3.2	3.8	3.8	3.8
Fans absorbed power	[W]	173	282	563	563	563	668	668	668
AESP with std fan	[Pa]	20	20	20	20	20	20	20	20
AESP with hp fan (option)	[Pa]	200	190	220	205	185	108	118	118
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 steps		1	1	2	2	2	2	2	2
Material	[-]	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium
Hot gas Reheating Coil									
Heating capacity	[kW]	5.5	6.3	10.2	10.79	11.7	16.9	18.0	19.2
Front Surface	[m2]	0.23	0.23	0.39	0.39	0.39	0.55	0.55	0.55
Hot Water reahating coil									
Heating capacity @ 45/40° water T	[kW]	4.1	4.9	7.4	7.9	8.6	11.8	12.6	13.3
Front Surface	[m2]	0.23	0.23	0.39	0.39	0.39	0.55	0.55	0.55
Water flow	[m3/h]	0.643	0.872	1.036	1.163	1.499	1.847	2.166	2.290
Water side pressure drop	[kPa]	3.6	6	12	14	23	43	57	62
Water valve pressure drop	[kPa]	10	10	10	10	10	13	18	20
Internal volume	[dm3]	0.547	0.547	0.939	0.920	0.920	1.312	1.312	1.312
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
Absorbed power	[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 – downflow units (20 Pa AESP)



Technical Data for CW Units

		JCDC0080	JCDC0110	JCDC0140	JCDC0160	JCDC0200	JCDC0230
		JCUC0080	JCUC0110	JCUC0140	JCUC0160	JCUC0200	JCUC0230
Power Supply*	V/Ph/Hz	230/1/50	230/1/50	230/1/50	230/1/50	230/1/50	230/1/50
Frame							
H	[mm]	1875	1875	1875	1875	1875	1875
L	[mm]	600	600	900	900	1200	1200
P	[mm]	449	449	449	449	449	449
Air Flow	[m3/h]	1785	2150	3530	3470	5115	4990
Water flow	[l/s]	0.36	0.50	0.66	0.74	0.92	1.06
Frame							
Total cooling capacity @ 7/12° Water Temperature	[kW]	7.6	10.6	13.9	15.6	19.3	22.2
Total cooling capacity @ 15/10° Water Temperature	[kW]	5.3	6.2	9.8	11.3	14.0	15.7
Finned coil evaporator							
Front Surface	[m2]	0.29	0.29	0.47	0.47	0.65	0.65
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	3	4
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°C)	[-]	0.83	0.83	0.84	0.83	0.84	0.83
SHR (water 10/15°C)	[-]	1	0.96	1	0.97	1	0.96
Indoor fan							
Type		Centrifugal	Centrifugal	Centrifugal	Centrifugal	Centrifugal	Centrifugal
Number of fans		1	1	2	2	2	2
Fans absorbed current	[A]	1.5	1.6	1.6	1.6	1.9	1.9
Fans absorbed power	[W]	216	282	282	282	334	334
AESP with std fan	[Pa]	20	20	20	20	20	20
AESP with hp fan (option)	[Pa]	244	167	242	206	115	100
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 steps		1	1	2	2	3	3
Material	[-]	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium
Hot Water reahating coil							
Heating capacity @ 45/40° water T	[kW]	5.3	7.2	9.7	10.8	13.6	15.5
Front Surface	[m2]	0.23	0.23	0.39	0.39	0.55	0.55
Water flow	[m3/h]	0.91	1.24	1.67	1.86	2.33	2.67
Water side pressure drop	[kPa]	6	11	27	32	22	26
Water valve pressure drop	[kPa]	12	16	19.5	22.5	24.5	28
Internal volume	[dm3]	0.547	0.547	0.920	0.920	1.293	1.293
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
Absorbed power	[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

- 400V/3Ph+N/50Hz with Humidifier or Electrical heater option
- ** At 1,5 meters height, 2 meters frontal distance in free field – downflow units (20 Pa AESP)



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
JREF 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	2400	3200	3200	3200	4600	4600	7200	8400
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 in case of vertical air flow	L mm	723	1057	1057	1057	1294	1294	1853	1298
	P mm	600	500	500	500	600	600	600	1150
	H mm	763	600	600	600	763	763	763	763
Dimensions in case of horizontal air flow	L mm	723	1057	1057	1057	1294	1294	1853	1298
	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
JREF 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	2200	4500	4500	4500	3900	3900	5200	9000
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 in case of vertical air flow	L mm	1057	1853	1853	1853	1853	1853	1298	1853
	P mm	500	600	600	600	600	600	1150	1150
	H mm	600	763	763	763	763	763	863	863
Dimensions in case of horizontal air flow	L mm	1057	1853	1853	1853	1853	1853	1298	1853
	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

L= length, P= Depth, H= height

Selection related to 35°C Air Temperature



Dry cooler Technical data

STANDARD EXECUTION									
Model		SHLR 15M	SHLN 24D	SHLN 24D	SHLN 29L	SHLN 30D	SHLN 50C	SHLN 58D	SHLN 58D
JREF 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	m ³ /h	2820	6350	6350	6440	7800	12700	12880	12880
Water flow	m ³ /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	1482	1482	1482
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 in case of vertical air flow	L mm	1085	1085	1085	1085	1393	1895	1895	1895
	P mm	810	810	810	810	1110	810	810	810
	H mm	1070	1070	1070	1070	1270	1070	1070	1070
Dimensions in case of horizontal air flow	L mm	1085	1085	1085	1085	1393	1895	1895	1895
	P mm	470	470	470	470	705	470	470	470
	H mm	830	830	830	830	1040	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
JREF 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	m ³ /h	2820	4500	4500	8300	8300	8300	12400	12400
Water flow	m ³ /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 in case of vertical air flow	L mm	1085	1085	1085	1895	1895	1895	2705	2705
	P mm	810	810	810	810	810	810	810	810
	H mm	1070	1070	1070	1070	1070	1070	1070	1070
Dimensions in case of horizontal air flow	L mm	1085	1085	1085	1895	1895	1895	2705	2705
	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

L= length, P= Depth, H= height

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



Correction Factors For Air Cooled Units

Cooling Capacity	T_{amb} [°C]	20	22	24	26	28
	Φ_{amb} [%]	50	50	50	50	50
T_{ext} [°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

Absorbed Power	T_{amb} [°C]	20	22	24	26	28
	Φ_{amb} [%]	50	50	50	50	50
			3.6	5.9	7.3	9.7
			5.9	8.2	9.6	12
T_{ext} [°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

Absorbed Current	T_{amb} [°C]	20	22	24	26	28
	Φ_{amb} [%]	50	50	50	50	50
T_{ext} [°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



Correction Factors For Water Cooled Units

Cooling Capacity	T_{amb} [°C]	20	22	24	26	28
	Φ_{amb} [%]	50	50	50	50	50
T_{H2Oin} [°C]						
15		0.86	0.92	1.00	1.05	1.15

Absorbed Power	T_{amb} [°C]	20	22	24	26	28
	Φ_{amb} [%]	50	50	50	50	50
T_{H2Oin} [°C]						
15		1.017	1.010	1.000	0.990	0.976

Absorbed Current	T_{amb} [°C]	20	22	24	26	28
	Φ_{amb} [%]	50	50	50	50	50
T_{H2Oin} [°C]						
15		1.013	1.007	1.000	0.995	0.986

Correction Factors For Chilled Water Units

Cooling Capacity	T_{amb} [°C]	20	22	24	26	28
	Φ_{amb} [%]	50	50	50	50	50
T_{H2Oin} [°C]	T_{H2Oout} [°C]					
7	12	0.680	0.817	1.000	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



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

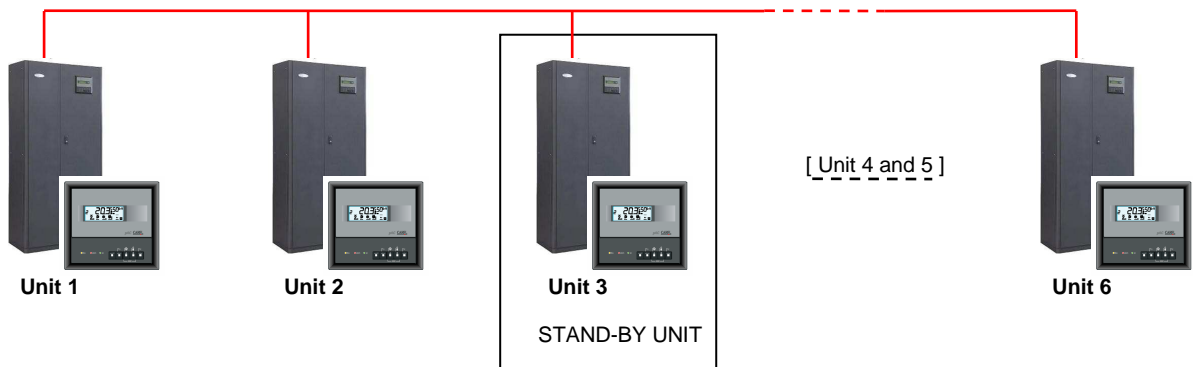
Standard Copper pipes

Diameter [mm]	Thickness [mm]	Minimum bending radius [mm]	System design pressure PS [bar]	PED Category	Max Copper σ_s [N/mm ²]	Real copper σ [N/mm ²]	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



Interconnectivity Systems

Basic Control μ AC



Max. number of units: 6

Description

- This combination allows the timed rotation of a unit in stand-by within a group of maximum 6 units. If one of the connected units generates an alarm, the stand-by unit will be activated.

- Master function: unit number 1 is defined as the master unit. This unit sends the command to activate and deactivate the unit in stand-by.

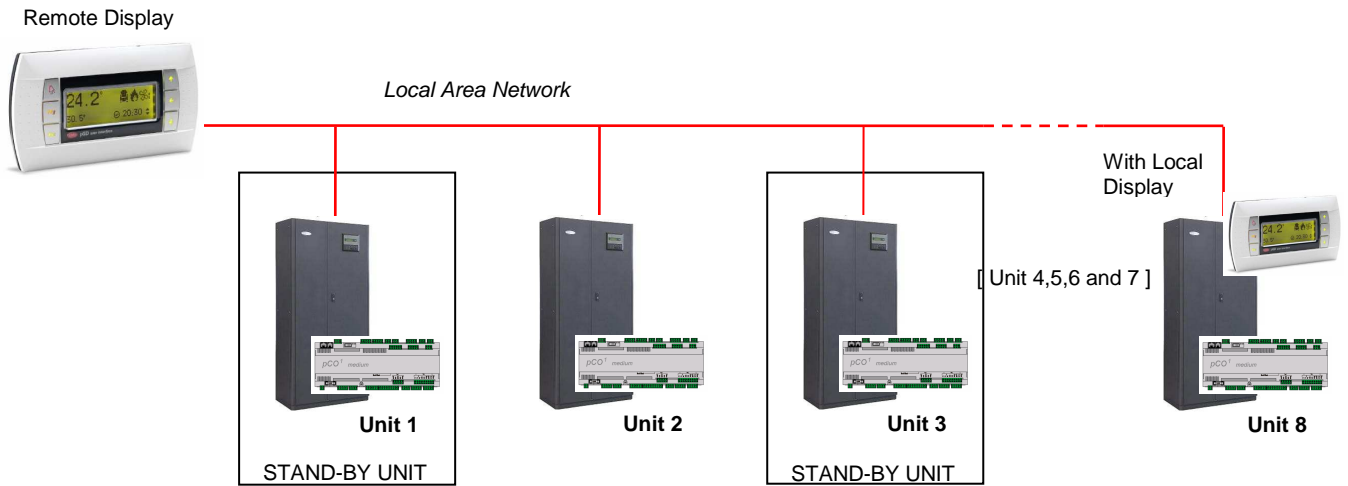
ATTENTION:

Please note that this is not a LAN.

Rotation time: 0÷250 hours



Advanced Control pCO - Local Area Network



Max. number of units: 8

Description:

- Master / Slave 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 which is adopted by all connected units. 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 modifies the

working logic in case that the measured temperature or humidity exceeding the set point, even by 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 function independently based just on the their own probes.

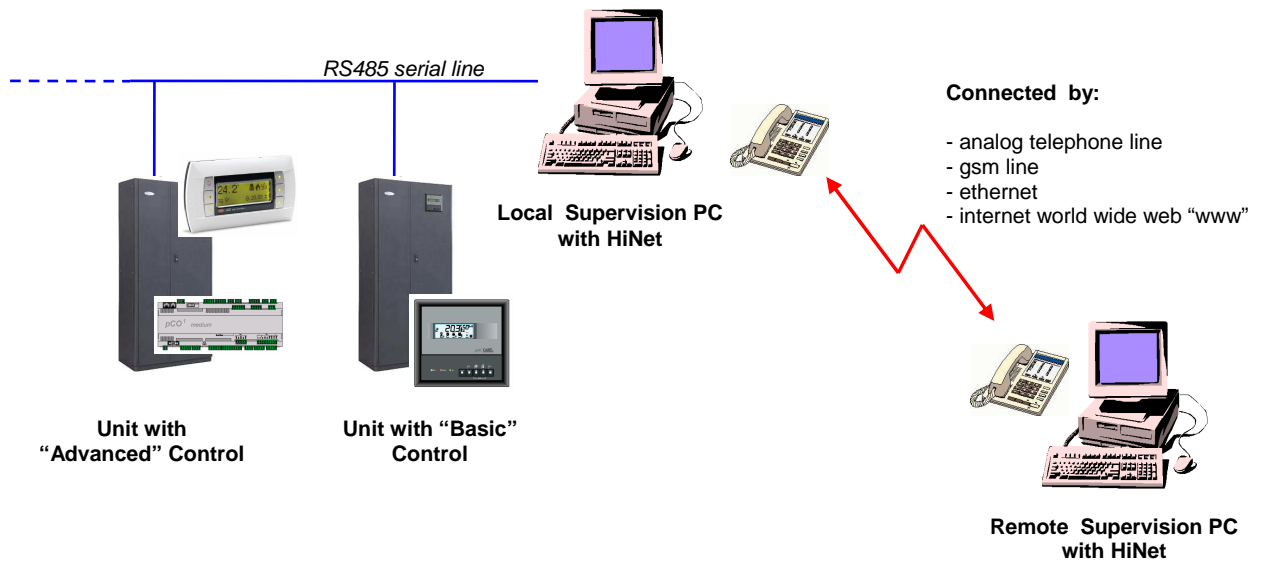
- Stand-by & rotation activated by timing, time band or automatically on event.
- Stand-by & rotation of 1 to N unit (N is the number of installed unit).



HiNet Supervising Systems

The system allows air-conditioning to be monitored and controlled using a simple

Internet browser: the pages displayed on the PC are in HTML format, the language of the worldwide web.



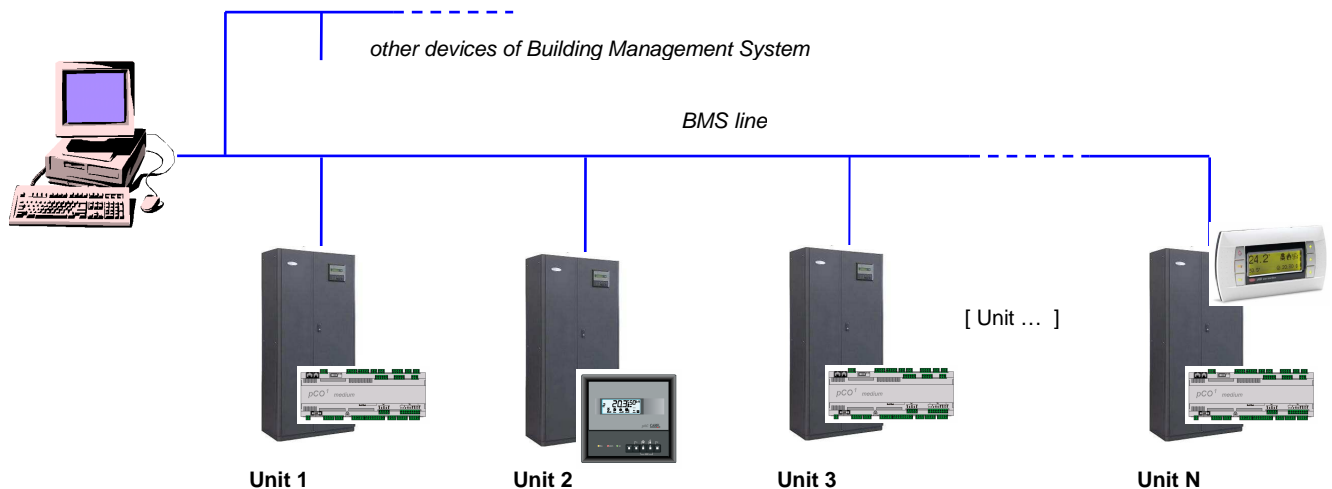


BMS integration

JREF 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 converts the Carel proprietary protocol to the specific BMS protocol;
- integrating the driver for the management of the Carel specific protocol into the BMS.



Following protocols are used by Hiref to ensure connectivity to the other systems:

- Carel proprietary (with HiNet supervision system, $N = 200$)
- Modbus (with gateway for Basic Control, $N = 16$; integrated for Advanced Control, $N =$)
- Bacnet (with gateway, $N = 8$)

- TCP/IP (with web-gate, $N = 16$)
- Echelon LonWorks (only with Advanced Control)
- Trend (only with Advanced Control)
- OPC standard (OLE for Process Control). This allows a simple integration to SCADA OPC Client Systems. [SCADA =Supervisory Control And Data Acquisition]



High Technology in Refrigeration Devices



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