J R E F

Close Control Units

JA. . .C – Direct Expansion Up/Down Flow
JC. . .C – Chilled Water Up/Down Flow

GENEX **High Technology in Refrigeration Devices**

GB

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JREF = Design & Technology

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 office environments with people working in.
A depth of 449 mm in "C" versions, allows the compatibility with standard office furnitures. 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, valves, 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 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 just in single circuit version.

Frame

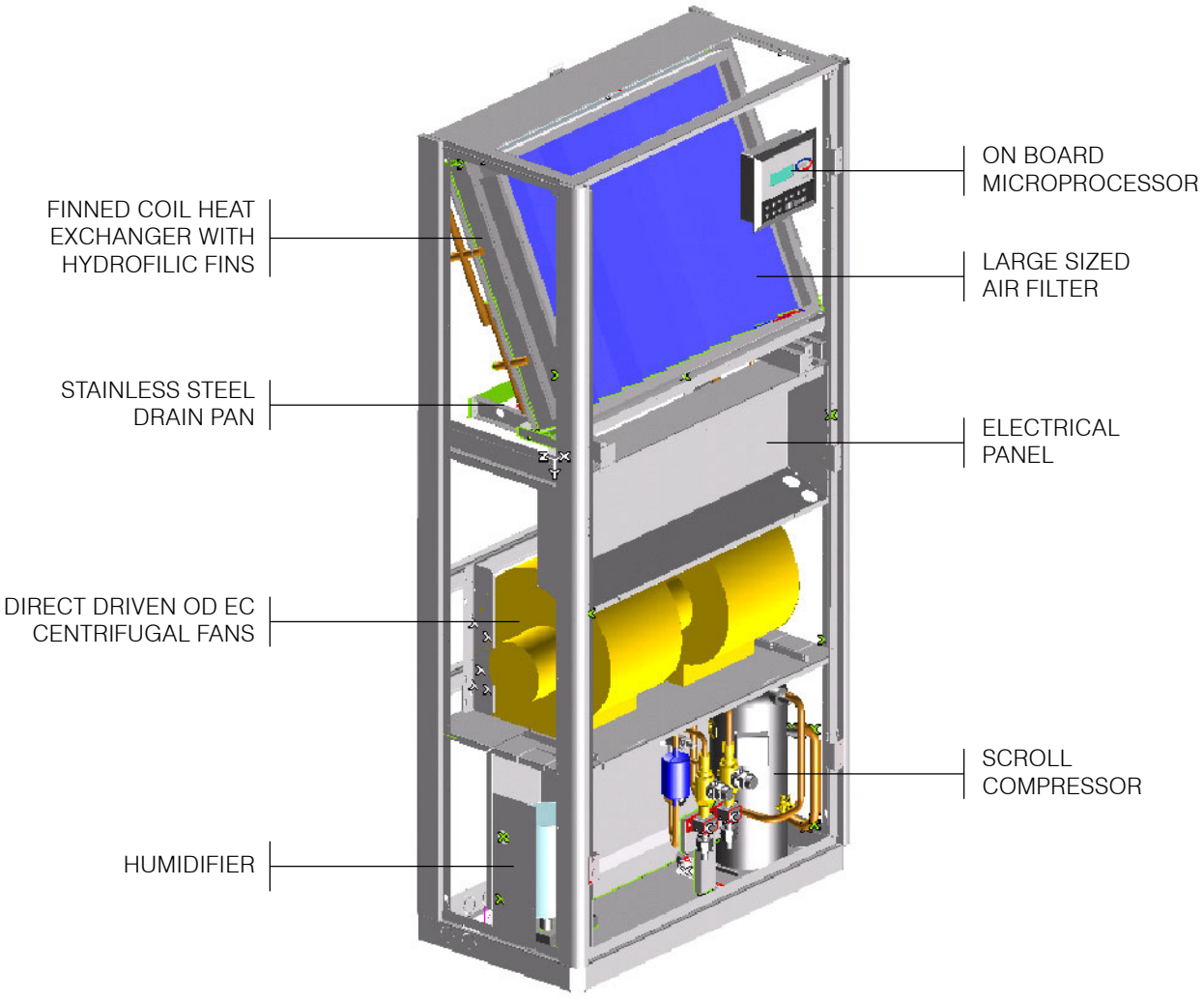
JREF units are designed with a self-supporting frame and all components are made "inhouse" using sophisticated computer driven machines and special tools. All sheet metals are galvanized, the external panels moreover are powder coated in RAL 7016 "graphit grey" colour, giving the units an image and look 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 unit is characterized by rounded edges with 26,5 mm radius as it is 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 refrigeration 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 UL94 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.

JREF Unit Description

Example of a DX Air Cooled Unit [Type: JADC]



DIGIT Configuration

The **JREF product 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	A	D	C	0	1	0	0	1	2	3	4	5	6	7	8	9	10	11

JREF Series

Cooling Capacity "kW x 10"

Configuration DIGIT

DX Version
[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 [Down flow]
- **U** Upsteam [Up flow]
- **X** Displacement ["R" only]

Fans

- **C** Forward curved blades

1	**POWER SUPPLY**	3	400V / 3Ph + N / 50Hz
2	**MICROPROCESSOR**	0	Basic
		B	Advanced [programmable with extended I/O and LCD 4 x 20 display]
3	**REFRIGERANT**	0	R 407C
		1	R 407C with electronic valve
		2	R 22 (*)
		3	R 22 with electronic valve (*)
4	**FAN SELECTION**	0	Standard
		D	HP fans
		E	Brushless *E-Tech*
5	**HUMIDITY CONTROL**	0	None
		4	Dehumidification
		5	Dehumidification + Humidifier
6	**ELECTRICAL HEATER**	0	None
		F	3 steps with Advanced control / 1 step with Basic control
7	**RE-HEATING SYSTEM**	0	None
		4	Hot gas coil On/Off
		5	Hot gas coil with modulating regulation
		7	Hot water coil with modulating valve
8	**AIR FILTRATION**	0	G3 [Standard]
		H	G4
		P	F5
		I	G3 + clogged filter sensor
		L	G4 + clogged filter sensor
		Q	F5 + clogged filter sensor
9	**CONDENSING CONTROL**	0	None
		5	Modulating fan speed - condensing pressure control [air condensing units]
		7	Flooding valve [water condensing units]
		9	Pressostatic valve [water condensing units]
10	**PACKAGING**	0	Standard
		M	Wooden crate with cardboard
		N	Seaworthy
11	**SPECIAL**	0	Standard
		S	Special

DIGIT Configuration

Chilled Water Units CW

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

JREF Series

Cooling Capacity "kW x 10"

Configuration DIGIT

CW Version
[chilled water units]

- **C** Base configuration units
- **S** "Slave" units without microprocessor

Air flow

- **D** Downstream [Down flow]
- **U** Upstream [Up flow]
- **X** Displacement ["R" only]

Fans

- **C** Forward curved blades

1	**POWER SUPPLY**	3	400V / 3Ph + N / 50Hz
		1	230V / 1Ph + N / 50Hz
2	**MICROPROCESSOR**	0	Basic
		B	Advanced [programmable with extended I/O and LCD 4 x 20 display]
		C	Slave [unit without microprocessor]
3	**VALVE**	0	3 way valve with 3 point motor
		3	3 way valve with 0-10V signal activated motor
4	**FAN SELECTION**	0	Standard
		D	HP fans
		E	Brushless *E-Tech*
5	**HUMIDIFIER [ONLY 400V / 3PH + N / 50HZ]**	0	None
		4	Dehumidification
		5	Dehumidification + Humidifier
6	**ELECTRICAL HEATER [ONLY 400V / 3PH + N / 50HZ]**	0	None
		F	3 steps with Advanced control / 1 step with Basic control
7	**RE-HEATING SYSTEM**	0	None
		5	Hot water coil with 3 point activated valve
		6	Hot water coil with 0-10 V signal activated valve [only with Advanced control]
8	**AIR FILTRATION**	0	G3 [Standard]
		H	G4
		I	F5
		I	G3 + clogged filter sensor
		I	G4 + clogged filter sensor
		L	F5 + clogged filter sensor
9	**CONDENSING CONTROL**	0	None
10	**PACKAGING**	0	Standard
		M	Wooden crate with cardboard
		N	Seaworthy
11	**SPECIAL EXECUTIONS**	0	None
		S	Special

Refrigeration Circuit

The entire refrigeration 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, but HiRef's decision in order to take care of the product quality and the customer's satisfaction. All DX units are in single circuit execution and are prechargerd with dry nitrogen for "A", "D" or with R407C refrigerant for "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 [see 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 field where frequent start-up may be possible.

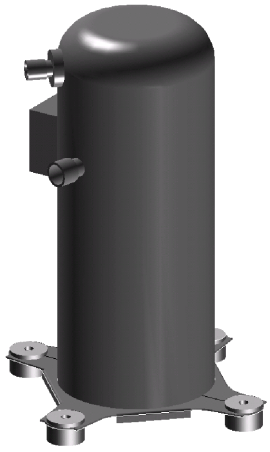


Fig. 1

Plate Heat Exchanger

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 and 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 of "FCHE" is taking part in the **Galletti Group**. All coils are made by using a 25 x 21,65 mm geometry in combination with 9,52 mm copper pipes and 0,10 mm thickness aluminium fins. The expanding process to ensure a 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 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 temperature. 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 a 25 x 21,65 mm geometry in combination with 9,52 mm copper grooved pipes and 0,10 mm 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 and pre-coated 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 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 next to the condensing unit.

Refrigerant 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 this solution in northern Europe 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.

Refrigerant Pipes Characteristics

On site piping has to be done by professional and trained technicians only

use only “CUB” quality copper pipes.

Take care when using nitrogen during all brazing operations in order to avoid humidity and dirt inside the pipes.

Tab.1 - Refrigerant circuit pipes diameter

Cooling Capacity	kW	**4 ÷ 5**	**6 ÷ 7**	**8 ÷ 9**	**10 ÷ 11,5**	**11,5 ÷ 13**	**14 ÷ 16**	**17 ÷ 18**	**19 ÷ 24**
Refrigerant type	-	R 407C							
HP Gas line [0 ÷ 10 m]	mm	12	12	12	16	16	16	16	22
Liquid line [0 ÷ 10 m]	mm	10	10	10	12	12	12	12	16
HP Gas line [10 ÷ 20 m]	mm	12	12	16	16	16	18	18	22
Liquid line [10 ÷ 20 m]	mm	10	10	12	12	12	12	12	16

Tab.2 - Standard copper pipes characteristics

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

Main Components

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 which is continuously checking a fan's faulty situation.

Hydraulic Circuit

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

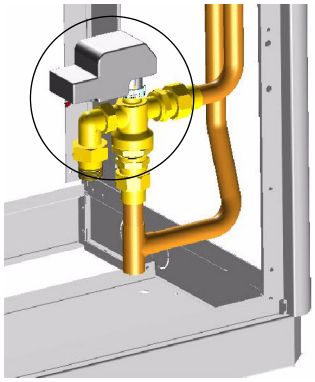


Fig. 2

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 EU 4 according Eurovent 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 drop, 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 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 other 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 on the water characteristics], the cylinder needs to be replaced by a new one: an European average is 3 cylinders / Year in full time operation.

Humidity Control

JREF units can be supplied with a humidity sensor [option]. For an independent control between temperature 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 Version

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 temperature it is possible / necessary to add a 2 way condensing control valve [see Fig. 3]. In case that it is not possible to reduce the water flow, flooding technology is an alternative: in this case only refrigerant side actions occur and the water flow remain constant.

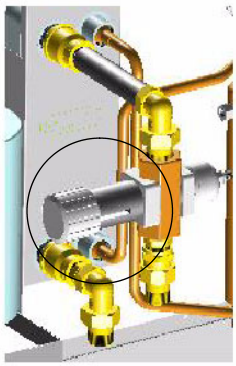


Fig. 3

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 m^3/h independently from 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 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 m^3/h for all models and the relative filter is located just next to the main filter.

Plenum Kit

A suction/delivery plenum [see Fig. 4], in 300 mm and 500 mm 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.

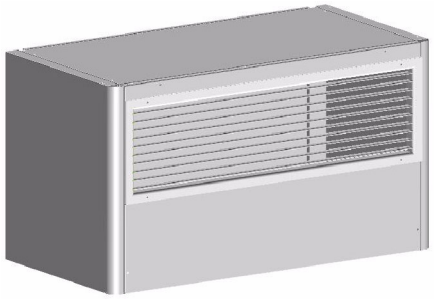


Fig. 4

Base Frames / Floorstands

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

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], [see 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.

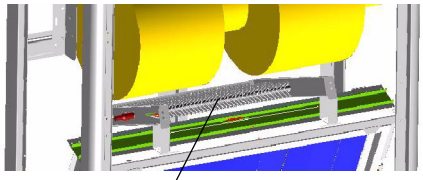


Fig. 5

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

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 IP30 thanks to a transparent plastic sheet protection in front of the components. All remote signals are with low voltage 24Vac adjusted by a transformer. The electrical panel has 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 field conditions and to reduce the speed during dehumidification.

Microprocessor

Two different type are available:

- Basic – Carel μAc.
- 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 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 or RS485.

All Microprocessors can be connected in serial communication for a remote control [BMS systems], the **HSD** [**H**iRef **S**oftware **D**evelopment 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].

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 to 32°C and the R.H. up to 75% for the entire range. It's reliable operation is practically covering all indoor conditions.
Diagram [see Fig. 6] illustrates the application of water cooled DX units.

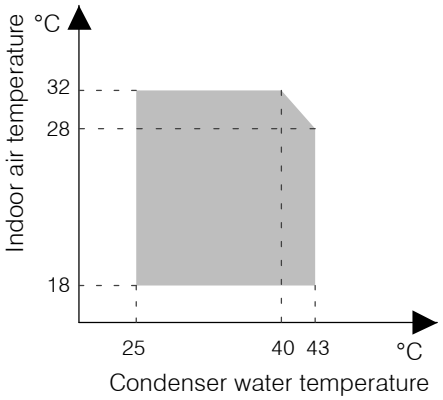


Fig. 6

Water temperatures 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 [see Fig. 7] illustrates the application of air cooled DX units.

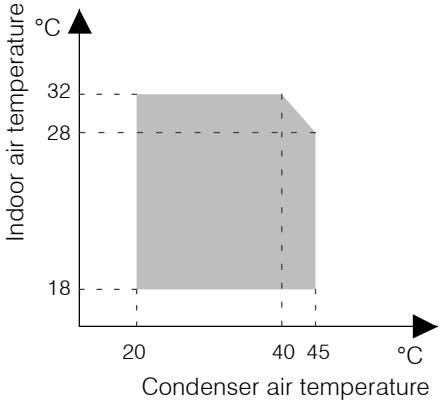


Fig. 7

If extended application ranges are needed, please contact HiRef's R&D department or your local distributor. Applications with external air temperatures below 20°C, require a condensing control to ensure enough pressure drop across the expansion valve. Temperature below -15°C and down to -30°C requires a flooding device [see 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.

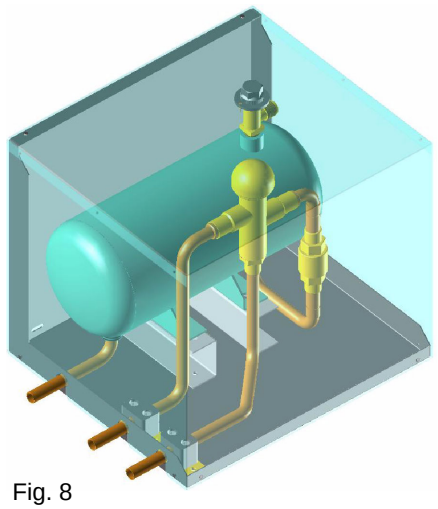


Fig. 8

Compressor 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 lubricating 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.

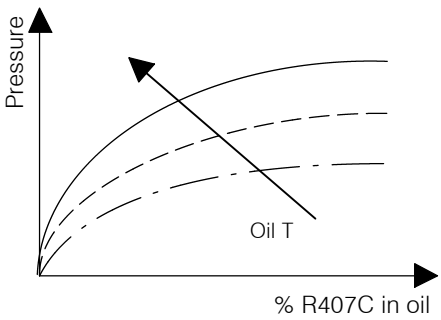


Fig. 9

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 compressors.

Tab.3 - Operating limits

Operating fluid	Water or e-glycol mixtures
Refrigerant	R 407C [HFC - syntetic non dangerous non flammable refrigerant]
PN water side	16 bar
Max. pressure refrigerant cycle HP side	28 bar-r
Max. piping temperature HP side	125 °C
Max. pressure refrigerant cycle LP side	22.6 bar-r *(*)*
Power supply	+/- 10 [to the nominal value]
Max. storage temperature	+ 50 °C
Min. storage temperature	- 10 °C
Max. R.H. during storage	85 %

(*) This value influences the maximum storage temperature for units with a closed refrigerant circuit, like "W" Water cooled, "F" Free cooling, "Q" Dual cooling" units.

Technical Section

Thermodinamics

Refrigerants

JREF units are charged exclusively with HFC refrigerants that are not harmful to the ozone and comply with the specifications of EEC regulation 2037/00. Standard units are configured for the use of fluid R407C, a ternary mixture of R32 [23%], R125 [25%] and 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 [see 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

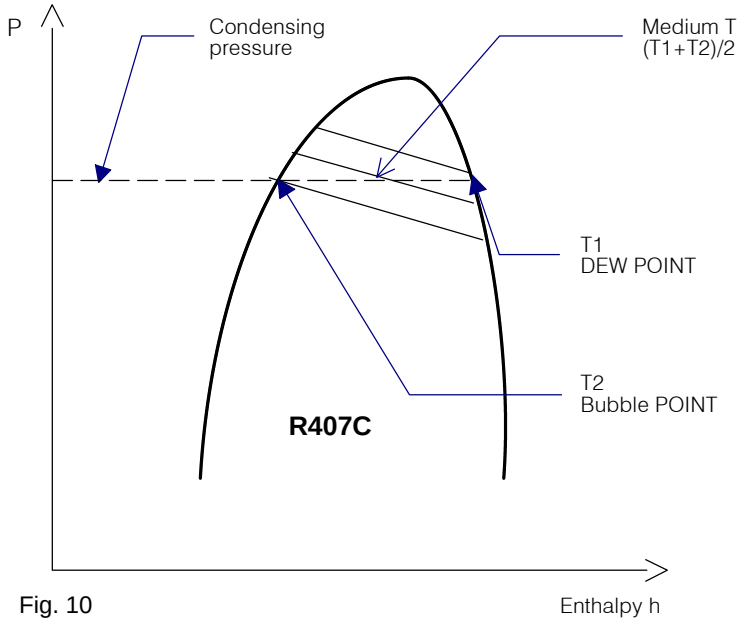


Fig. 10

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.

Diagram of electronic expansion valve installation

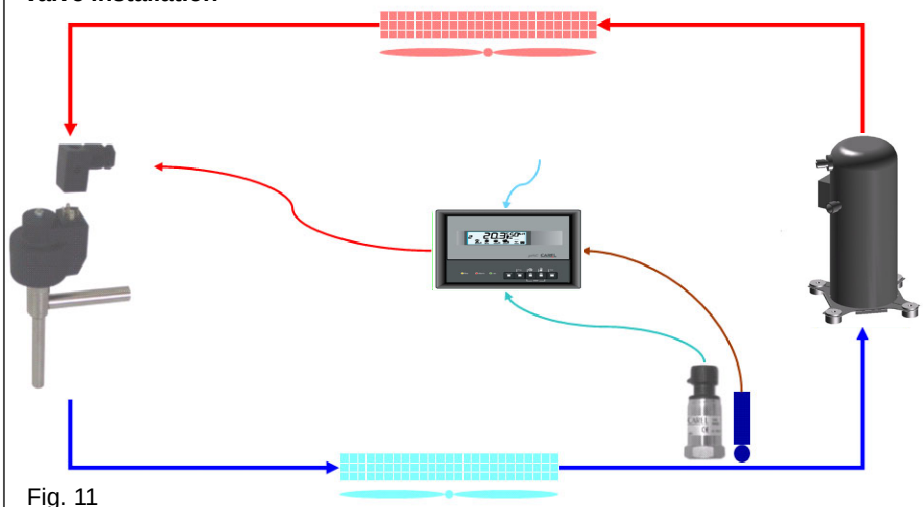


Fig. 11

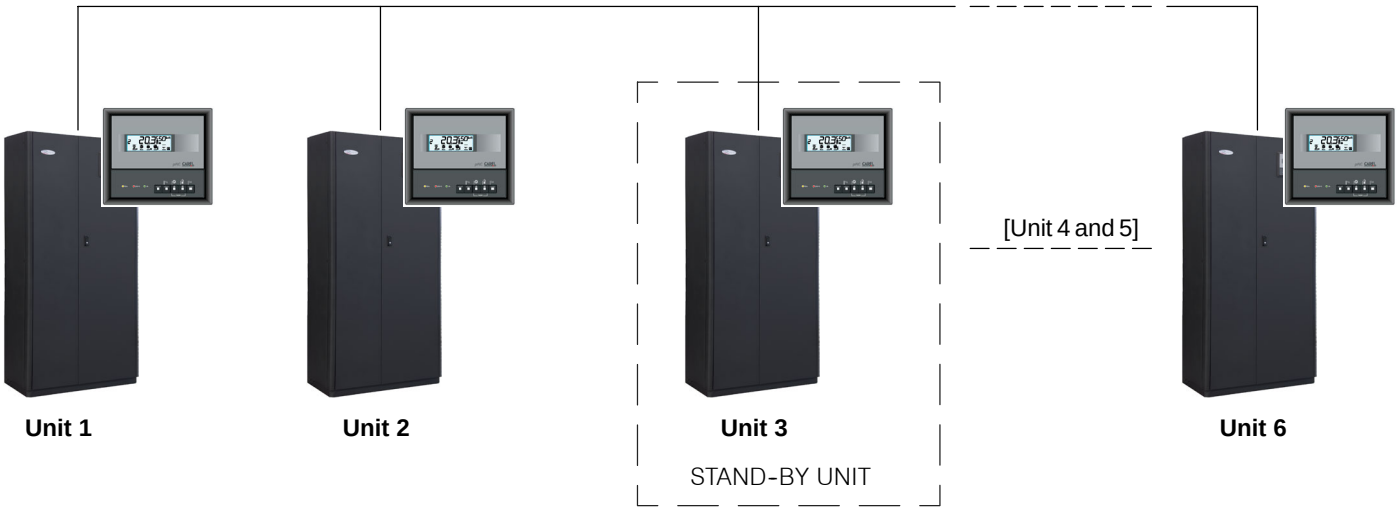
On all **HiRef** products it is possible to install innovative electronically controlled electric expansion valves [optional] which have a far superior modulating capacity compared to traditional mechanical thermostatic valves. This characteristic makes it possible to operate below reduced pressure differentials 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 compressors. Return of investments can thus be achieved in shortest time. HiRef can support you with calculations for different specific thermal loads and outside temperature profiles.

The simple schema [see Fig. 11] shows how the valve is managed: a pressure transmitter is reading the evaporating pressure and a temperature sensor is measuring the Refrigerant temperature. 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.

Interconnectivity Systems

Basic Control μAC



Max. number of units: 6

Description

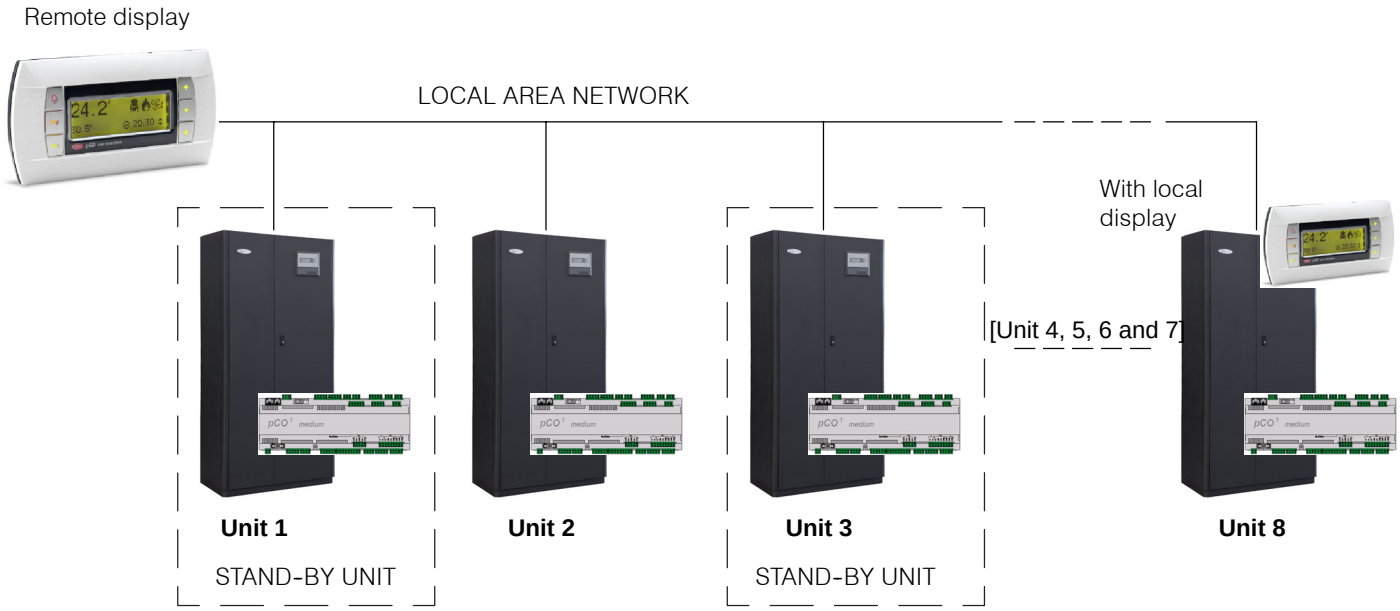
- This combination allows the timed rotation of a unit in stand-by within a group of maximum 6 units. If one of the connected units generates an alarm, the stand-by unit will be activated.

  ATTENTION:
  Please note that this is not a LAN.

  Rotation time: 0 ÷ 250 hours.

- 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.

Advanced Control pCO - Local Area Network

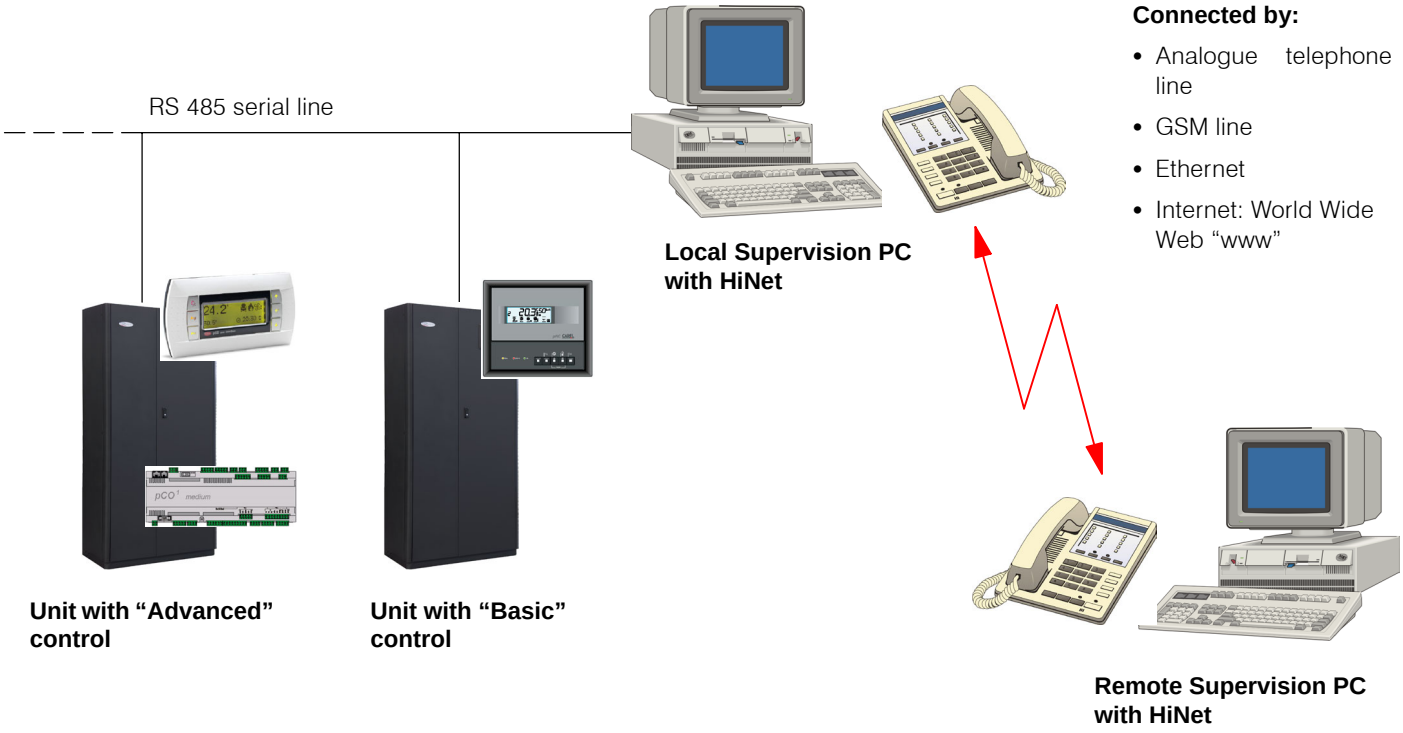


Max. number of units: 8

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 are exceeding the setpoint -even by just a few decimal points. In case of a black-out or of a 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 units [N is the number of installed units].

HiNet Supervising Systems



Description

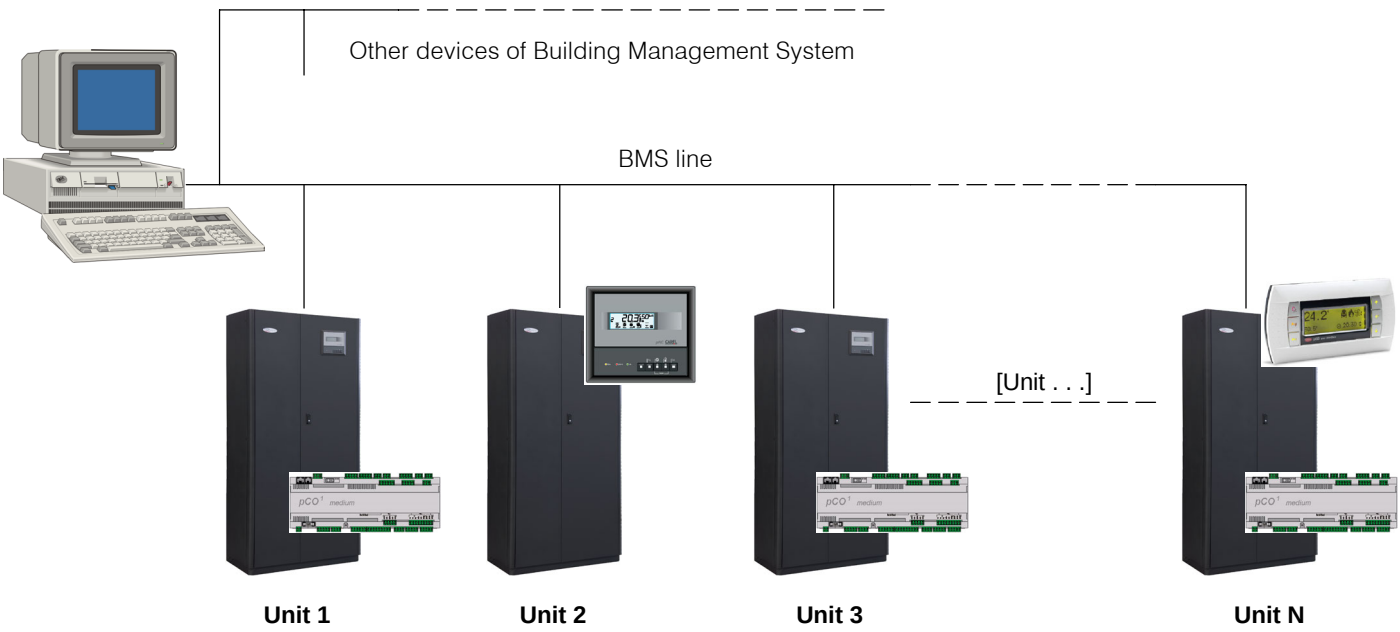
This system allows air-conditioning systems to be monitored and controlled using a simple Internet browser: the pages displayed on the PC are in HTML format, the used language is of the worldwide web.

BMS Integration

Description

JREF units can be connected to BMS in following modes:

- 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 specific 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 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].

Technical Data

Tab.4 - Air Cooled DX Units - JADC / JAUC

MODELS: **JADC / JAUC**		**0060**	**0080**	**0100**	**0110**	**0130**	**0160**	**0190**	**0205**
Power supply	V/Ph/Hz	400V / 3Ph + N + PE / 50Hz							
Air flow	m^3/h	1785	2150	3530	3530	3470	5115	4990	4990
COMPRESSOR									
Type	-	Scroll							
Cooling capacity [24°C; 50% R.H.; external air temperature 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	m^2	0.29	0.29	0.47	0.47	0.47	0.65	0.65	0.65
Geometry	-	25 x 21.65							
Rows	N°	3	4	3	3	3	3	4	4
Type of fins	-	Hydrofilic							
Fin pitch	mm	1.8							
SHR	-	1.00	1.00	1.00	1.00	0.96	0.98	0.98	0.96
INDOOR FAN									
Type of fans	-	Centrifugal							
Number of fans	N°	1		2					
Power supply	V/Ph/Hz	230V / 1Ph / 50Hz							
Absorbed current	A	1.2	1.6	3.2	3.2	3.2	3.8	3.8	3.8
Absorbed power	W	173	282	563	563	563	668	668	668
AESP [std. fans]	Pa	20							
AESP [HP fans - option]	Pa	244	217	253	253	250	108	118	118
AIR FILTER SECTION									
Efficiency	-	G3							
Overall surface	m^2	2.2	2.2	3.6	3.6	3.6	5.0	5.0	5.0
Fire resistance class	-	1							
ELECTRICAL HEATERS									
Total heating capacity	kW	1.6		3.2					
Heaters [n. of steps]	N°	1		2					
Material	-	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	m^2	0.23	0.23	0.39	0.39	0.39	0.55	0.55	0.55
HOT WATER REHEATING COIL									
Heating capacity [45/40°C water T]	kW	4.1	4.9	7.4	7.9	8.6	11.8	12.6	13.3
Front surface	m^2	0.23	0.23	0.39	0.39	0.39	0.55	0.55	0.55
Water flow	m^3/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	dm^3	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							
Absorbed power	kW	2.25							
DIMENSIONS									
Lenght x Heigh x Depth	mm	600 x 1850 x 449		900 x 1850 x 449			1200 x 1850 x 449		
Unit weight	kg	150	157	195	210	230	245	255	257
SOUND LEVEL									
Sound pressure level (*)	dB(A)	46	48	48	49	51	52	53	53

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

Tab.5 - Water Cooled DX Units - JWDC / JWUC

MODELS: **JWDC / JWUC**		**0060**	**0080**	**0100**	**0110**	**0130**	**0160**	**0190**	**0205**
Power supply	V/Ph/Hz	400V / 3Ph + N + PE / 50Hz							
Air flow	m^3/h	1785	2150	3530	3530	3470	5115	4990	4990
WATER TEMPERATURE [15°C] (*)									
Cooling capacity [24°C; 50% R.H.]	kW	6.59	8.48	10.70	12.15	14.21	17.98	20.86	21.50
Power consumption	kW	1.25	1.61	1.92	2.21	2.77	3.46	4.07	4.73
MIXTURE TEMPERATURE [40°C/30% E.G. + ENLARGED BPHE]									
Cooling capacity [24°C; 50% R.H.]	kW	5.66	7.16	9.04	10.27	12.00	14.90	17.55	19.02
Power consumption	kW	1.65	2.17	2.60	2.99	3.70	4.63	5.35	6.11
COMPRESSOR									
Type	-	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	m^2	0.29	0.29	0.48	0.48	0.48	0.66	0.66	0.66
Geometry	-	25 x 21.65							
Rows	N°	3	4	3	3	4	3	4	4
Type of fins	-	Hydrofilic							
Fin pitch	mm	1.8							
SHR	-	1.00	1.00	1.00	1.00	0.96	0.98	0.98	0.96
INDOOR FAN									
Type	-	Centrifugal							
Fans	N°	1		2					
Power supply	V/Ph/Hz	230V / 1Ph / 50Hz							
Absorbed current	A	1.2	1.6	3.2	3.2	3.2	3.8	3.8	3.8
Absorbed power	W	173	282	563	563	563	668	668	668
AESP [std. fans]	Pa	20							
AESP [HP fans - option]	Pa	200	190	220	205	185	108	118	118
AIR FILTER SECTION									
Efficiency	-	G3							
Overall surface	m^2	2.2	2.2	3.6	3.6	3.6	5.0	5.0	5.0
Fire resistance class	-	1							
ELECTRICAL HEATERS									
Total heating capacity	kW	1.6		3.2					
Heaters	N°	1		2					
Material	-	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	m^2	0.23	0.23	0.39	0.39	0.39	0.55	0.55	0.55
HOT WATER REHEATING COIL									
Heating capacity [45/40°C water T]	kW	4.1	4.9	7.4	7.9	8.6	11.8	12.6	13.3
Front surface	m^2	0.23	0.23	0.39	0.39	0.39	0.55	0.55	0.55
Water flow	m^3/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	dm^3	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							
Absorbed power	kW	2.25							
DIMENSIONS									
Lenght x Heigh x Depth	mm	600 x 1875 x 449		900 x 1875 x 449			1200 x 1875 x 449		
Unit weight	kg	162	169	207	232	265	273	285	287
SOUND LEVEL									
Sound pressure level (*)	dB(A)	46	48	48	49	51	52	53	53

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

Tab.6 - Chilled Water CW Units - JCDC / JCUC

MODELS: **JCDC / JCUC**		**0080**	**0110**	**0140**	**0160**	**0200**	**0230**
Power supply (*)	V/Ph/Hz	230V / 1Ph / 50Hz					
Air flow	m^3/h	1785	2150	3530	3470	5115	4990
Water flow	l/s	0.36	0.50	0.66	0.74	0.92	1.06
COOLING CAPACITY							
Cooling capacity [7/12°C water T]	kW	7.6	10.6	13.9	15.6	19.3	22.2
Cooling capacity [15/10°C water T]	kW	5.3	6.2	9.8	11.3	14.0	15.7
FINNED COIL EVAPORATOR							
Front surface	m^2	0.29	0.29	0.47	0.47	0.65	0.65
Geometry	-	25 x 21.65					
Rows	N°	3	4	3	4	3	4
Type of fins	-	Hydrofilic					
Fin pitch	mm	1.8					
SHR [7/12°C water T]	-	0.83	0.83	0.84	0.83	0.84	0.83
SHR [15/10°C water T]	-	1	0.96	1	0.97	1	0.96
INDOOR FAN							
Type	-	Centrifugal					
Fans	N°	1		2			
Absorbed current	A	1.5	1.6	1.6	1.6	1.9	1.9
Absorbed power	W	216	282	282	282	334	334
AESP [std. fans]	Pa	20					
AESP [HP fans - option]	Pa	244	167	242	206	115	100
AIR FILTER SECTION							
Efficiency	-	G3					
Overall surface	m^2	2.2	2.2	3.6	3.6	5.0	5.0
Fire resistance class	-	1					
ELECTRICAL HEATERS							
Total heating capacity	kW	1.6		3.2			
Heaters	N°	1	1	2	2	3	3
Material	-	Aluminium					
HOT WATER REHEATING COIL							
Heating capacity [45/40°C water T]	kW	5.3	7.2	9.7	10.8	13.6	15.5
Front surface	m^2	0.23	0.23	0.39	0.39	0.55	0.55
Water flow	m^3/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	dm^3	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					
Absorbed power	kW	2.25					
DIMENSIONS							
Lenght x Heigh x Depth	mm	600 x 1875 x 449		900 x 1875 x 449		1200 x 1875 x 449	
Unit weight	kg	125	135	150	160	170	175
SOUND LEVEL							
Sound pressure level (**)	dB(A)	48	50	51	51	52	52

(*) 400V / 3Ph+N / 50Hz with humidifier or electrical heaters [option]
(**) At 1,5 meters height, 2 meters frontal distance in free field; downflow units [20 Pa AESP]

Tab.7 - Standard Remote Condenser - SVHN

MODEL: **SVHN**		**7/7**	**13/9**	**13/9**	**13/9**	**20/4**	**20/4**	**23/2**	**38/1**
JREF models	Mod.	**0060**	**0080**	**0100**	**0110**	**0130**	**0160**	**0190**	**0205**
Power supply	V/Ph/Hz	220V / 1Ph / 50Hz							
Air flow	m^3/h	2400	3200	3200	3200	4600	4600	7200	8400
Absorbed power	W	180	270	270	270	360	360	540	720
Absorbed current	A	0.85	1.20	1.20	1.20	1.70	1.70	2.50	3.40
Fans	N°	1	2	2	2	2	2	3	4
	Ø	350	330	330	330	350	350	350	350
Sound pressure level [in free field]	dB(A)	40	41	41	41	43	43	45	46
Dimensions [vertical air flow]	L	723	1057	1057	1057	1294	1294	1853	1294
	D	600	500	500	500	600	600	600	1150
	H	763	600	600	600	763	763	763	763
Dimensions [horizontal air flow]	L	723	1057	1057	1057	1294	1294	1853	1853
	D	363	305	305	305	363	363	363	363
	H	560	460	460	460	560	560	560	1130
Unit weight	kg	16	25	25	25	37	37	42	64

L = Lenght, D = Depth, H = Heigh in mm
Selection related to 35°C air temperature

Tab.8 - Low Noise Remote Condenser - SVHS

MODEL: **SVHS**		**8/2**	**18/0**	**18/0**	**18/0**	**20/2**	**20/2**	**27/1**	**36/0**
JREF models	Mod.	**0060**	**0080**	**0100**	**0110**	**0130**	**0160**	**0190**	**0205**
Power supply	V/Ph/Hz	220V / 1Ph / 50Hz							
Air flow	m^3/h	2200	4500	4500	4500	3900	3900	5200	9000
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
Fans	N°	2	3	3	3	3	3	4	6
	Ø	330				350			
Sound pressure level [in free field]	dB(A)	32	35	35	35	35	35	36	38
Dimensions [vertical air flow]	L	1057	1853	1853	1853	1853	1853	1298	1853
	D	500	600	600	600	600	600	1150	1150
	H	600	763	763	763	763	763	863	863
Dimensions [horizontal air flow]	L	1057	1853	1853	1853	1853	1853	1298	1853
	D	305	305	305	305	305	305	363	363
	H	460	460	460	460	460	460	1130	1130
Unit weight	kg	21	42	42	42	48	48	64	72

L = Lenght, D = Depth, H = Heigh in mm
Selection related to 35°C air temperature

Tab.9 - Standard Dry Cooler - SHLN

MODEL: **SHLN**		**SHLR 15M**	**24 D**	**24 D**	**29 L**	**30 D**	**50 C**	**58 D**	**58 D**
JREF models	Mod.	**0060**	**0080**	**0100**	**0110**	**0130**	**0160**	**0190**	**0205**
Power supply	V/Ph/Hz	220V / 1Ph / 50Hz							
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
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
Fans	N°	1					2		
	Ø	500	500	500	500	630	500	500	500
Sound pressure level [in free field]	dB(A)	29	47	47	47	45	50	50	50
Dimensions [vertical air flow]	L	1085	1085	1085	1085	1393	1895	1895	1895
	D	810	810	810	810	1110	810	810	810
	H	1070	1070	1070	1070	1270	1070	1070	1070
Dimensions [horizontal air flow]	L	1085	1085	1085	1085	1393	1895	1895	1895
	D	470	470	470	470	705	470	470	470
	H	830	830	830	830	1040	830	830	830
Unit weight	kg	56	56	56	60	123	94	102	102

L = Lenght, D = Depth, H = Heigh in mm
Selection related to 30°C air temperature and 45/40°C, 30% e.g. water conditions
Max. air temperature 40°C

Tab.10 - Low Noise Dry Cooler - SHLS

MODEL: **SHLS**		**SHLR 15M**	**19 M**	**19 M**	**38 D**	**38 D**	**38 D**	**59 D**	**59 D**
JREF models	Mod.	**0060**	**0080**	**0100**	**0110**	**0130**	**0160**	**0190**	**0205**
Power supply	V/Ph/Hz	220V / 1Ph / 50Hz							
Air flow	m^3/h	2200	4500	4500	4500	3900	3900	5200	7200
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
Absorbed power	W	136	272	272	544	544	544	1482	1482
Absorbed current	A	0.60	1.20	1.20	2.40	2.40	2.40	6.60	6.60
Fans	N°	1			2				
	Ø	500							
Sound pressure level [in free field]	dB(A)	29	38	38	41	41	41	50	50
Dimensions [vertical air flow]	L	1085			1895				
	D	810			810				
	H	1070			1070				
Dimensions [horizontal air flow]	L	1085			1895				
	D	470			470				
	H	830			830				
Unit weight	kg	56	56	56	94	94	94	132	132

L = Lenght, D = Depth, H = Heigh in mm
Selection related to 30°C air temperature and 45/40°C, 30% e.g. water conditions
Max. air temperature 40°C

Correction Factors

DX Air Cooled Units

Tab.11 - Cooling Capacity

$T_{amb.}$ [°C]		20	22	24	26	28
Φ amb. [%]		50				
$T_{est.}$ [°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

Tab.12 - Absorbed Current

$T_{amb.}$ [°C]		20	22	24	26	28
Φ amb. [%]		50				
$T_{est.}$ [°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

Tab.13 - Absorbed Power

$T_{amb.}$ [°C]		20	22	24	26	28
Φ amb. [%]		50				
$T_{est.}$ [°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

DX Water Cooled Units

Tab.14 - Cooling Capacity

$T_{amb.}$ [°C]		20	22	24	26	28
Φ amb. [%]		50				
T_{H2O-In} [°C]	15	0.86	0.92	1.00	1.05	1.15

Tab.15 - Absorbed Current

$T_{amb.}$ [°C]		20	22	24	26	28
Φ amb. [%]		50				
T_{H2O-In} [°C]	15	1.013	1.007	1.000	0.995	0.986

Tab.16 - Absorbed Power

$T_{amb.}$ [°C]		20	22	24	26	28
Φ amb. [%]		50				
T_{H2O-In} [°C]	15	1.017	1.010	1.000	0.990	0.976

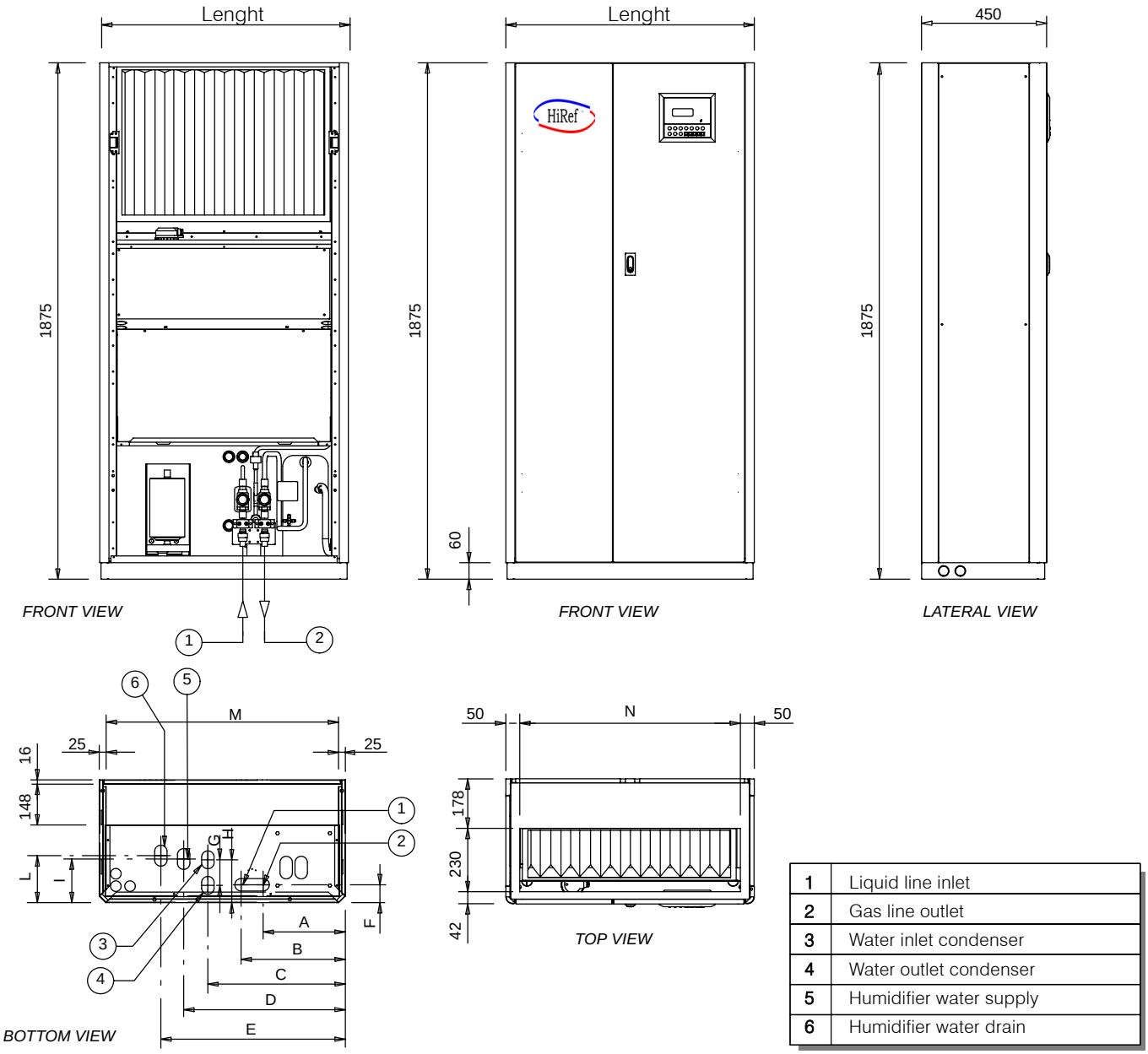
CW Chilled Water Units

Tab.17 - Cooling Capacity

$T_{amb.}$ [°C]				20	22	24	26	28
Φ amb. [%]				50				
T_{H2O-In} [°C]	7	$T_{H2O-Out}$ [°C]	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

Overall Dimensions

DIRECT EXPANSION DX UNIT: **JADC**

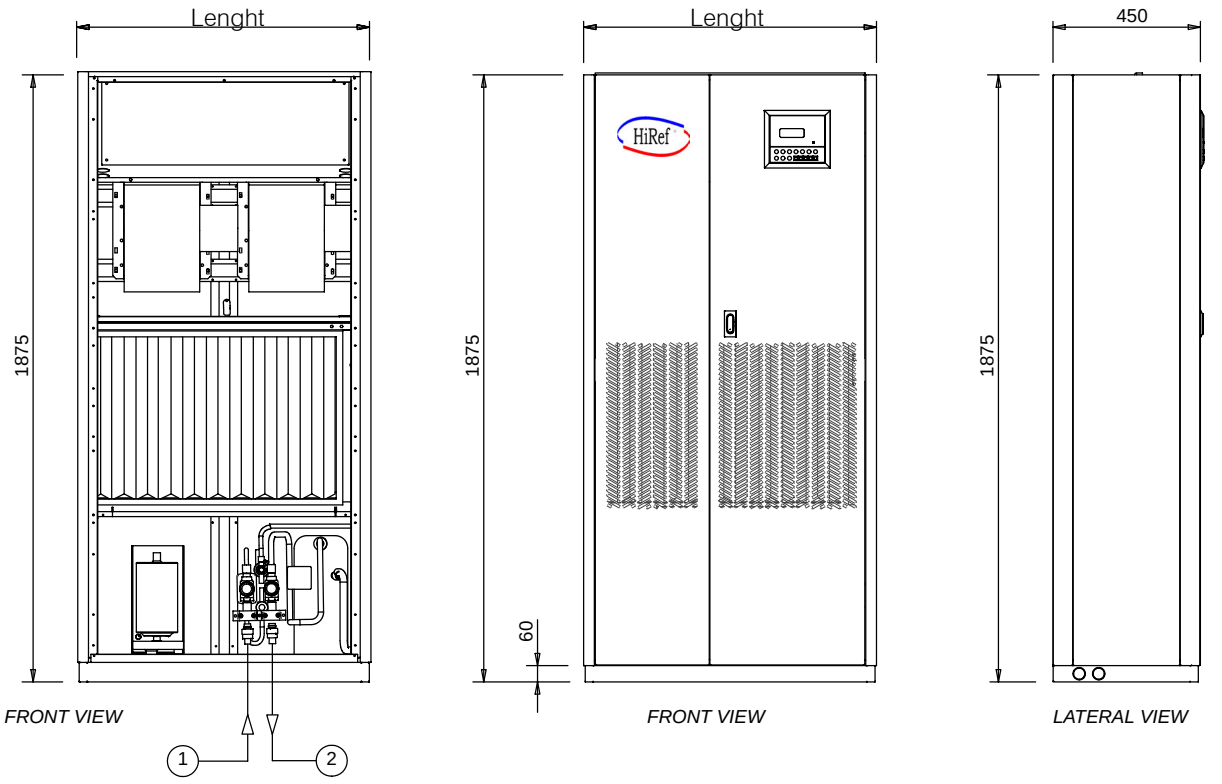


JADC	0060 - 0080	0100 - 0110 - 0130	0160 - 0190 - 0205
A	298	298	298
B	378	378	378
C	378	500	500
D	436	586	736
E	519	670	820
F	65	65	65
G	-	63	63

JADC	0060 - 0080	0100 - 0110 - 0130	0160 - 0190 - 0205
H	155	155	155
I	158	158	158
L	170	170	170
M	542	842	1142
N	500	800	1100
Lenght	600	900	1200
Frame	1	2	3

Overall Dimensions

DIRECT EXPANSION DX UNIT: **JAUC**



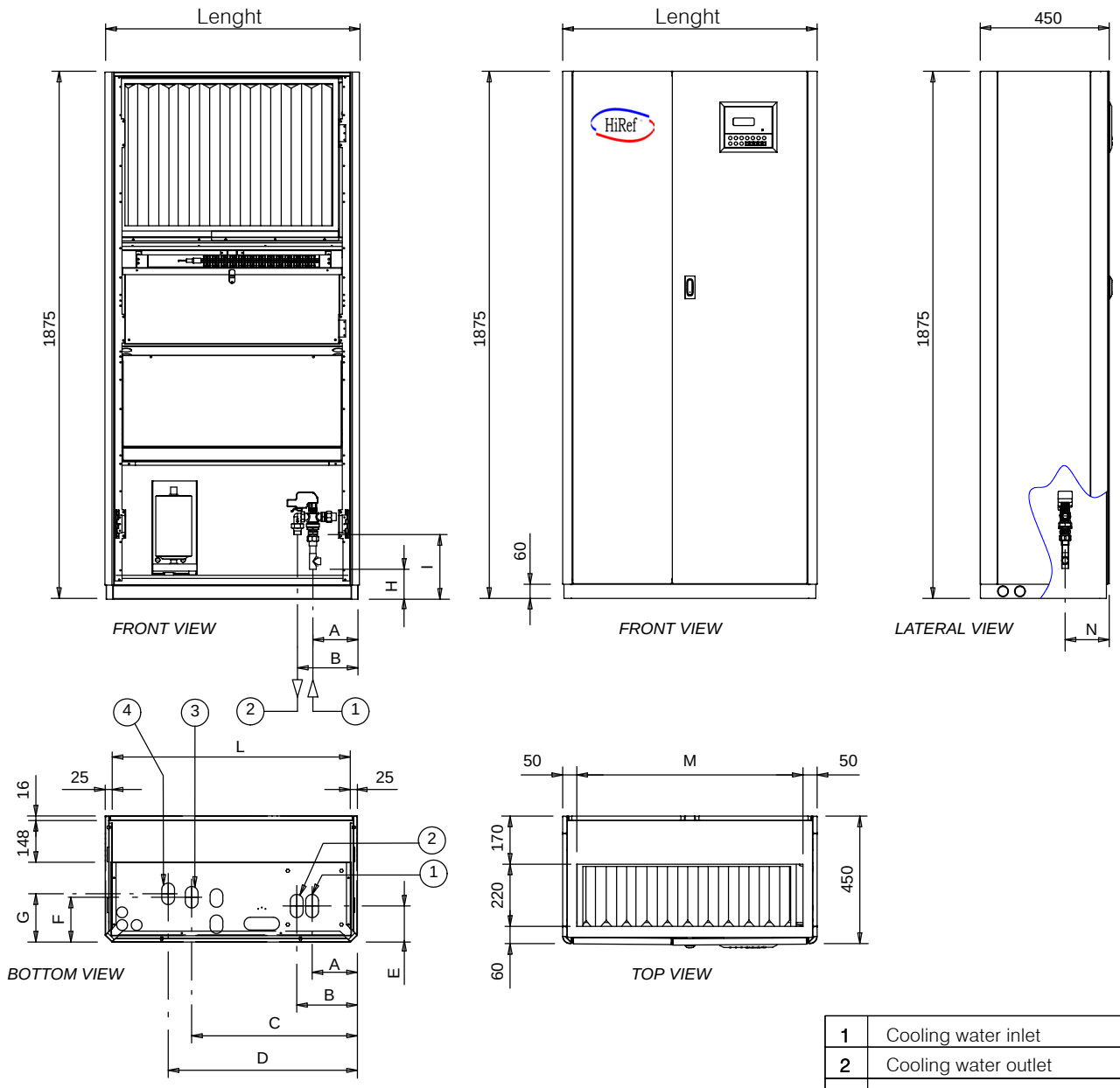
1	Liquid line inlet
2	Gas line outlet
3	Water inlet condenser
4	Water outlet condenser
5	Humidifier water supply
6	Humidifier water drain

JAUC	0060 - 0080	0100 - 0110 - 0130	0160 - 0190 - 0205
A	298	298	298
B	378	378	378
C	378	500	500
D	436	586	736
E	519	670	820
F	65	65	65
G	-	63	63

JAUC	0060 - 0080	0100 - 0110 - 0130	0160 - 0190 - 0205
H	155	155	155
I	158	158	158
L	170	170	170
M	542	842	1142
N	500	800	1100
Lenght	600	900	1200
Frame	1	2	3

Overall Dimensions

CHILLED WATER CW UNIT: **JCDC**



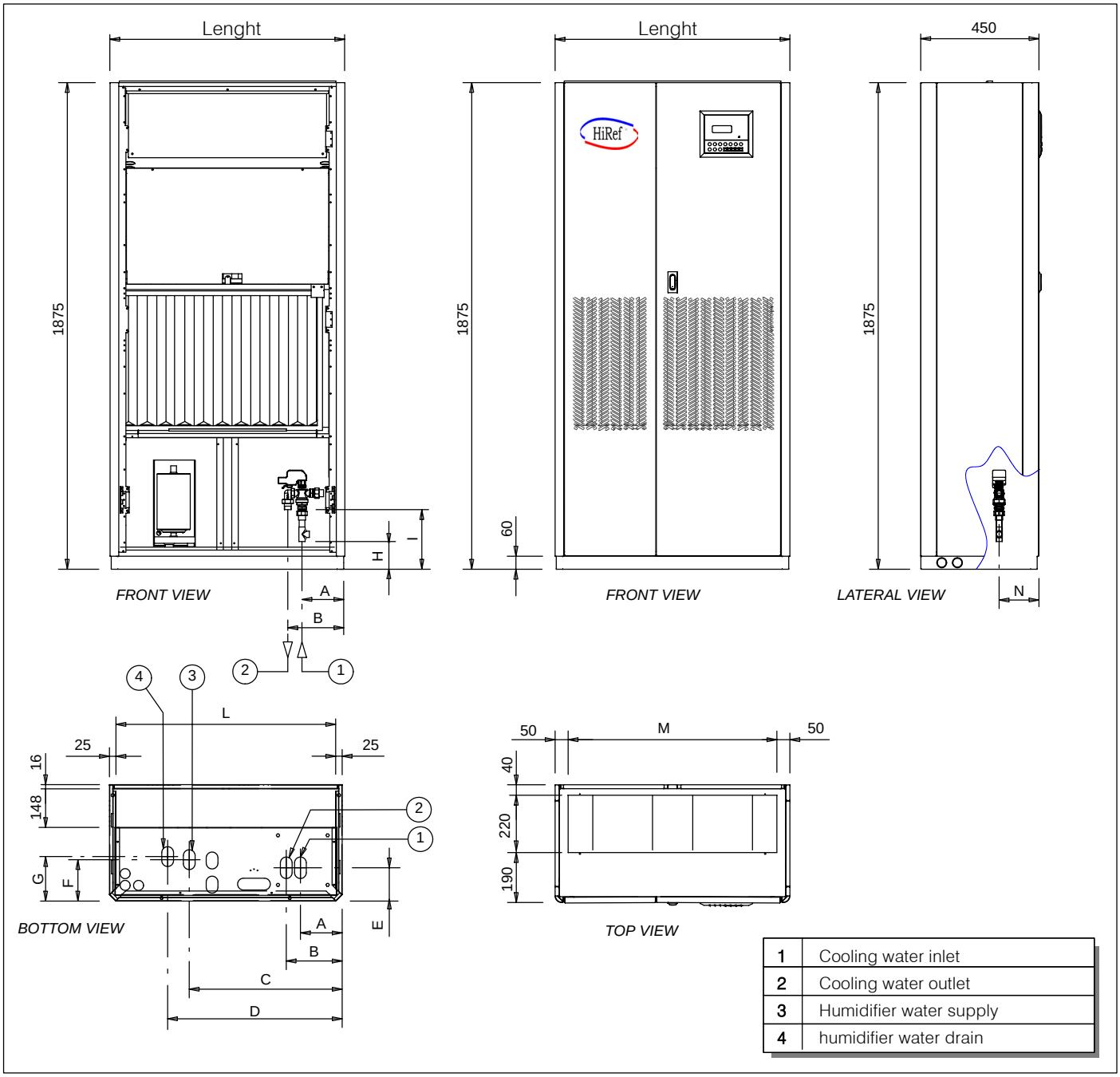
1	Cooling water inlet
2	Cooling water outlet
3	Humidifier water supply
4	humidifier water drain

JCDC	0080 0110	0140 0160	0200 0230
A	160	160	160
B	215	215	215
C	436	586	736
D	520	670	820
E	130	130	130
F	160	160	160
G	170	170	170

JCDC	0080 0110	0140 0160	0200 0230
H	105	105	105
I	230	230	230
L	542	842	1142
M	500	800	1100
N	155	155	155
Lenght	600	900	1200
Frame	1	2	3

Overall Dimensions

CHILLED WATER CW UNIT: **JCUC**



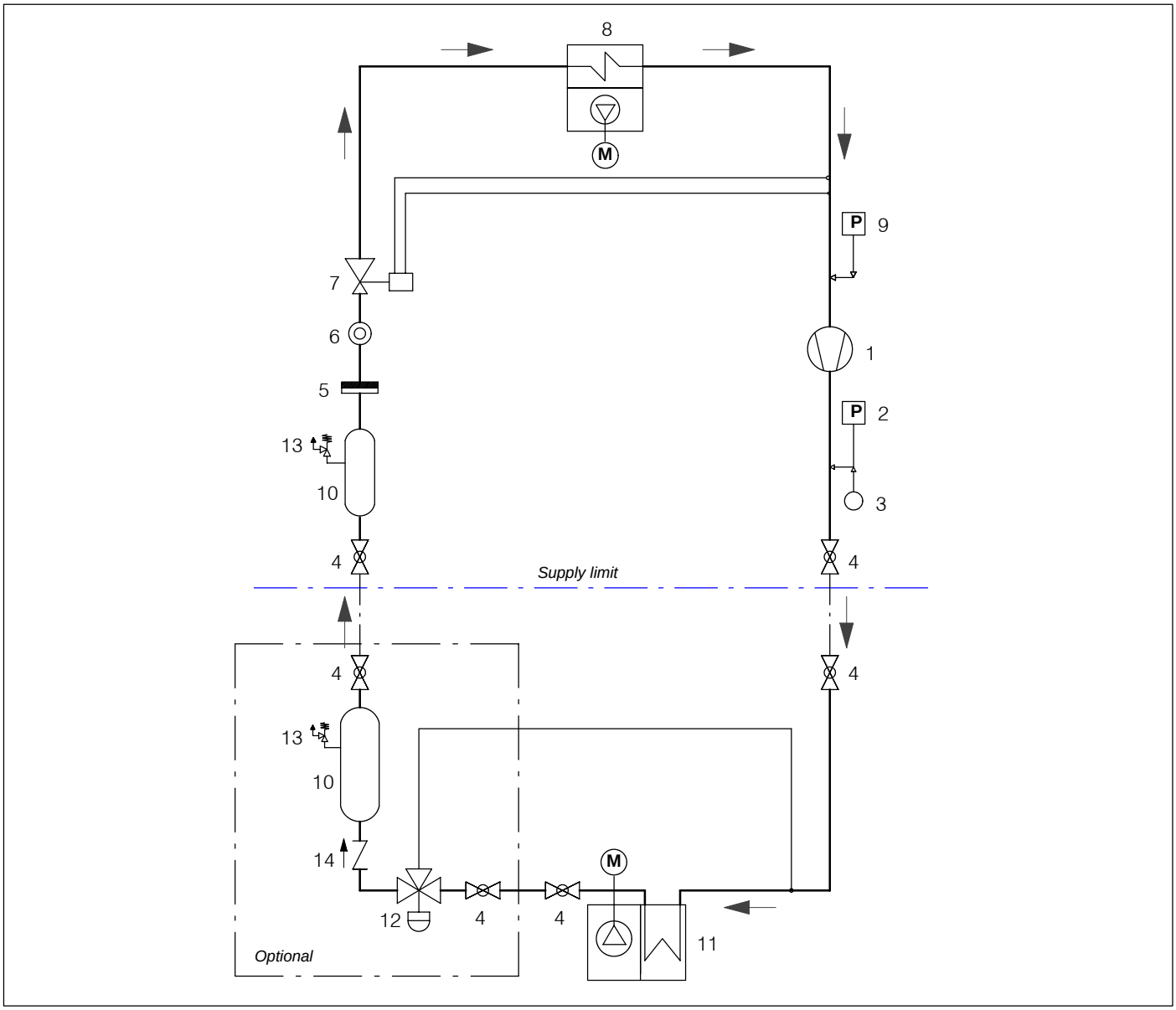
1	Cooling water inlet
2	Cooling water outlet
3	Humidifier water supply
4	humidifier water drain

JCUC	0080 0110	0140 0160	0200 0230
A	160	160	160
B	215	215	215
C	436	586	736
D	520	670	820
E	130	130	130
F	160	160	160
G	170	170	170

JCUC	0080 0110	0140 0160	0200 0230
H	105	105	105
I	230	230	230
L	542	842	1142
M	500	800	1100
N	155	155	155
Lenght	600	900	1200
Frame	1	2	3

Refrigeration Diagram

DIRECT EXPANSION DX UNIT

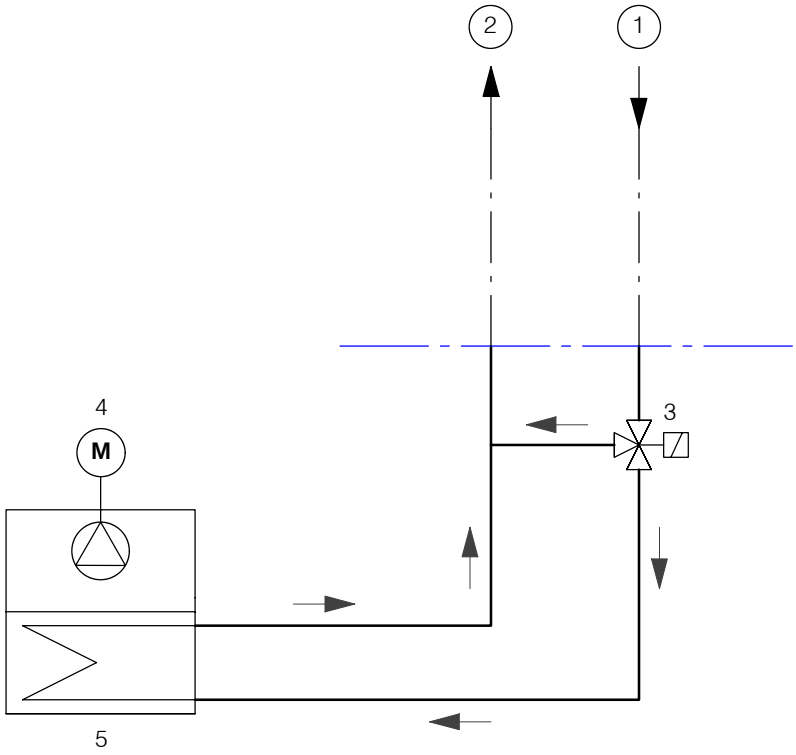


Tab.18 – Refrigeration Components

REF.	DESCRIPTION	REF.	DESCRIPTION
1	Compressor	8	Evaporator
2	High pressure switch [HP]	9	Low pressure switch [LP]
3	Pressure probe [Opt.]	10	Liquid receiver
4	Ball valve	11	Condenser
5	Filter dryer	12	Flooding valve
6	Sight glass	13	Safety valve
7	Thermostatic valve	14	Check valve

Hydraulic Diagram

JREF UNIT



Tab.19 - Hydraulic Components

REF.	DESCRIPTION
1	Chilled water inlet
2	Chilled water outlet
3	3-way valve
4	Motoventilator
5	Chilled water exchanger