
Data Book

T_iAVDW_1119_EN - HFC R410A

i-AV DW

3-150 kW

**FULL INVERTER direct expansion air conditioners for IT Cooling
Equipped with built-in water-cooled condenser**



The picture of the unit is indicative and may vary depending on the model



- Perimeter installation
- Fully hermetic BLDC inverter compressors
- Single or double refrigerant circuit
- Air delivery from the bottom or from the top

- Plug fans with EC electric motor
- Electronic expansion valve
- Air suction temperature up to 40°C

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CERTIFICATIONS

SYSTEM CERTIFICATIONS



ISO 9001 CERTIFICATION
Quality Management System



ISO 14001 CERTIFICATION
Environmental Management System



BS OHSAS 18001 CERTIFICATION
Occupational Health and Safety Management System

PRODUCT CERTIFICATIONS BY COUNTRY



CE MARKING



CCC – CQC CERTIFICATION
(People's Republic of China)



EAC CERTIFICATION
(Russian Federation, Belarus, Kazakhstan)



GENERAL CHARACTERISTICS



UNDER
Downflow air delivery



OVER
Upflow air delivery

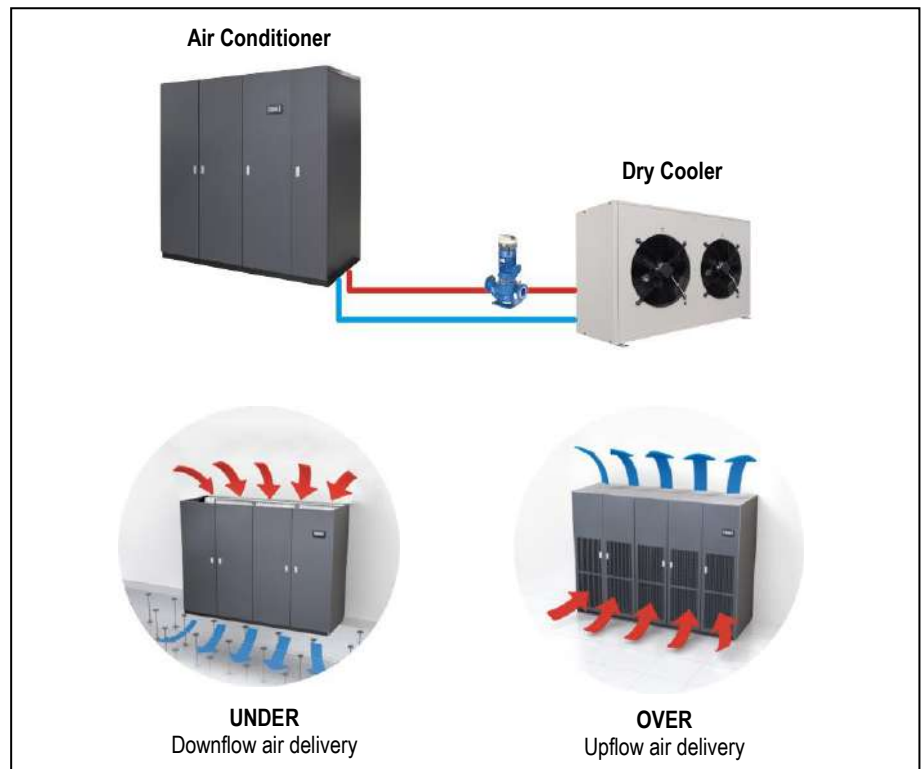
FULL INVERTER Air Conditioners for IT Cooling.

- Direct expansion, water cooled.
- Equipped with built-in water cooled condenser
- BLDC inverter compressors.
- Plug fans with EC electric motor.
- Single or double refrigerant circuit.

This series is offered in 10 models available in the following versions:

- The upflow version (Over) is characterized by air intake from the front through honeycomb grille and air delivery from the top of the unit.
- The downflow version (Under) is characterized by air intake from the top and air delivery from the bottom of the unit.

Cooling capacity: 3 ÷ 150 kW



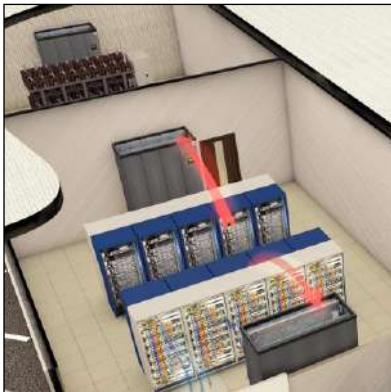
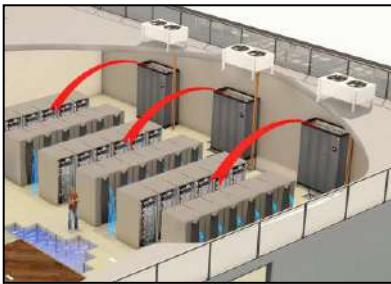
The machines are made for indoor installation.

The constructive solutions and the internal lay-out allow high application flexibility and the frontal access to the main components for the inspection and routine maintenance.

The installation requires electrical and hydraulic connections.

Final assembly on all machines before shipment including running test, reading and monitoring of operating parameters, alarms simulation and visual check.

INSTALLATION



The series is particularly suitable for installation in Data Center of medium / small size with variable load.

DOWNFLOW VERSION (Under)

Typical installation is on the perimeter.

The units are placed along the perimeter of the data center. Air suction from the top of the unit and air delivery in the underfloor void.

The air distribution is achieved by special tiles placed in front of the racks row, forming cold aisle for air diffusion. On the rear of the racks is expelled the hot then aspirated by the unit.

For an optimal installation is advisable to provide the cold aisle containment.



Some solutions provide a service corridor around the server rooms where to place the units. In this case it is necessary to provide the air intake plenum for each unit. With this solution all the space in the Data Center is available for the installation of racks.

UPFLOW VERSION (Over)

The type of installation is practically similar to the previous. The only difference is that for the air distribution in the Data Center is not used the raised floor but ducts in the ceiling.



The series is also suitable for installation in UPS, Batteries, Distribution rooms and in all service areas of the data center that need a service of conditioning.

OPTIONAL

An extensive list of accessories allows the unit to adapt effectively to the real needs of the system, reducing the time and cost of installation.

PRODUCT FEATURES AND BENEFITS

- EER up to 8,17 at partial load;
- Single BLDC scroll inverter compressor for each refrigerant circuit in order to provide always the best efficiency;
- New plug fans with EC electric motors and impeller in composite material, which guarantees a reduction of power consumption;
- New fans electric motor that do not require maintenance;
- Total modulating, capable to follow the increasing demand of Data Center;
- Improvement of the control software with advanced control logic;
- Single or double refrigerant circuit;
- Hinged frontal panels and lateral panels fully removable to facilitate the operations of extraordinary maintenance;

F-GAS DIRECTIVE

The units highlighted in this publication contain <HFC R410A [GWP₁₀₀ 2088]> fluorinated greenhouse gases.



MODEL IDENTIFICATION

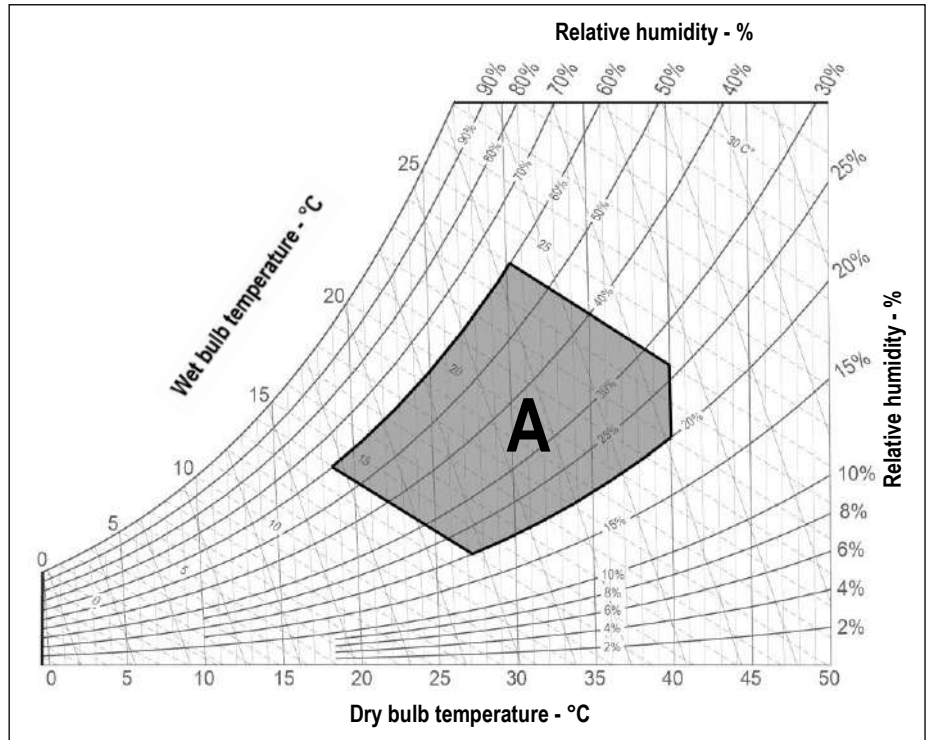
| | |
|--|--|
| Air conditioners for IT Cooling | |
| model: i-AV DW O 047 M1 S E5L | |
| i-AV | Series |
| DW | Unit type DW – direct expansion, water cooled |
| O | Air delivery O = over – upflow air delivery U = under – downflow air delivery |
| 047 | Model / Cooling capacity (kW) at nominal conditions |
| M1 | Compressor type and number M = BLDC inverter compressor for R410A 1 = 1 BLDC inverter compressor 2 = 1 BLDC inverter compressor for refrigerant circuit 4 = 1 BLDC inverter + 1 ON/OFF compressor for refrigerant circuit |
| S | Refrigerant circuit S = single D = double |
| E5L | Size |



TRANSPORT AND STORAGE TEMPERATURE

During transport and if the machine is not installed at the reception, do not remove the packaging and place the machine in an enclosed, dry and protected from sunlight site at temperatures ranging between -30°C and 45°C in absence of superficial condensation.

WORKING LIMITS



ROOM AIR CONDITIONS

Room air temperature:

- 14°C minimum temperature with wet bulb.
- 24°C maximum temperature with wet bulb.
- 18°C minimum temperature with dry bulb
- 40°C maximum temperature with dry bulb.

AREA "A". Machine operating envelope.

Room air humidity:

- 20%RH minimum relative humidity.
- 60%RH maximum relative humidity.

WATER COOLED CONDENSER

Inlet water temperature:

- 6-20°C Inlet water temperature range – the 2-way valve optional for condensing control is required.
- 20-50°C Inlet water temperature range – without necessarily using the 2-way valve optional for condensing control.

Outlet water temperature:

- 25-55°C Outlet water temperature range

Operating ΔT:

- 4-20°C Operating ΔT between water inlet / outlet

All the values are indicative. The working temperatures are influenced by a series of variables as:

- Working conditions;
- Thermal load;
- Set of the microprocessor control.

HYDRAULIC CIRCUIT

- 10 Bar Maximum working pressure of the hydraulic circuit

POWER SUPPLY

- ± 10% Maximum tolerance of the supply voltage (V)
- ± 2% Maximum unbalancing of the phases.

MAIN COMPONENTS



FRAMEWORK

- Base in aluminium extrusion, painted with epoxy powders. Colour RAL 9005;
- Frame in aluminium profile, painted with epoxy powders. The inner frame is provided with seals for the panels. Colour RAL 9005;
- Panels in galvanized steel sheet with protective surfaces treatment in compliance with UNI ISO 9227/ASTMB117 and ISO 7253, and painted with epoxy powders. Colour RAL 7016 hammered;
- Panels insulated with polyurethane foam and seals to ensure air tight.
- Hinged front panels with quick release removal system.
- Total front access for routine maintenance.
- Removable lateral and back side panels.
- Air flow OVER version:
 - Air intake from the front through honeycomb type grille and air delivery from the top.
- Air flow UNDER version:
 - Air intake from the top and air delivery from the bottom.
- Compartment for electrical panel on unit front for direct access to control and regulation devices;

FILTER SECTION

- Washable air filters with COARSE 60% efficiency (according to ISO EN 16890), with cells in synthetic fibre and metallic frame.
- Air filters access:
 - OVER version
 - Frontal access for all machines
 - UNDER version
 - For machines size E1 - E2 - E3 frontal access
 - For machine size E4L - E5L - E7L - E8L - E9L access from upper side
- Clogged filters sensor with differential pressure switch on air side.

BLDC INVERTER COMPRESSORS SECTION

Unit size E1:

- rotary BLDC inverter compressor for R410A refrigerant:

Unit size E2, E3, E4L, E5L, E7L, E8L:

- scroll BLDC inverter compressors with spiral profile optimized for R410A refrigerant:
 - S version, single refrigerant circuit:
 - single BLDC inverter compressor;
 - D version, double refrigerant circuit:
 - single BLDC inverter compressor for each refrigerant circuit;
- Synchronous brushless inverter driven motor.
- Inverter for modulating capacity control.
- Reactance for the reduction of electromagnetic noise and interference.

ONLY FOR UNIT SIZE E9L - DOUBLE REFRIGERANT CIRCUIT

- One BLDC inverter compressor + one on/off compressor for each refrigerant circuit.
- Characteristics of on/off compressor:
 - Scroll rotary compressors with spiral profile optimized for R410A refrigerant.
 - 2-pole 3-phase electric motor with direct on line starting.

FOR ALL COMPRESSORS:

- Crankcase heater for each compressor.
- Soundproof jacket for each compressor.
- Rubber supports.

FAN SECTION

The fan section is contained within the machine and includes:

- Centrifugal fans with backward curved blades with wing profile, single suction and without scroll housings (Plug-fans), directly coupled to external rotor electric motor.
- Impeller in composite material exempt from rust formation.
- Brushless type synchronous EC motor with integrated electronic commutated system and continuous variation of the rotation speed. The motor rotation control is obtained with the EC system (Electronic Commutation) that manage the motor according to the signal coming from the microprocessor control.
- Fans control through ModBus. In case of failure, the control stops the interested fan indicating the type of fault. The machine with more than one fan is not stopped.
- Adjustable External Static Pressure (ESP).
- Fan guard with rubber support (UNDER version)



COOLING SECTION

- Heat exchanger coil with internally corrugated copper tubes and high efficiency aluminium fins, specifically developed to provide high heat transfer and lower pressure drops.
- Frame in galvanized steel or peralluman.
- Condensate tray in peralluman with PVC flexible discharge pipe.
- Temperature sensor on air intake with function of temperature display.
- Temperature sensor on air delivery with function of control and regulation.
- Under floor water alarm through sensor to be placed on the floor.

CONDENSING SECTION

- Copper brazed plate type with cover plates, plates and connections in AISI 316 stainless steel.
- 0÷10V proportional signal to manage the condensing control system

REFRIGERANT CIRCUIT

Components for each refrigerant circuit:

- Electronic expansion valve. The valve allows high performance and system efficiency thanks to a timely and accurate response to changes in temperature and pressure
- Sight glass.
- Filter dryer on liquid line.
- Pressure transducers with indication, control and protection functions, on low and high refrigerant pressure.
- High pressure safety switch with manual reset.
- Liquid receiver.
- Pressure relief valve on liquid receiver for models 047 M1, 094 M2, 120 M4, 150 M4.
- Refrigerant circuit with copper tubing with anticondensate insulation of the suction line.
- R410A refrigerant charge and lubricant oil.

ELECTRICAL PANEL

In accordance with EN60204-1 norms, suitable for indoor installation, complete with:

- Main switch with door lock safety on frontal panel.
- Magnetothermic switches for each compressor.
- Magnetothermic switches for supply fans.
- Contactors for each load. BLDC inverter compressors and supply fans equipped with EC electric motor don't require contactors.
- Unit size E9L, D version, double refrigerant circuit:
 - Phases sequence control relay for the machine. The system checks that the phase sequence of the power supply is correct to prevent the opposite rotation of the three phase electric motors of the machine as compressor motors, fan motors. It is installed downstream the main switch with door lock safety and in case of wrong phase sequence prevents starting the machine;
- Transformer for auxiliary circuit and microprocessor supply.
- Numbered wirings.
- Terminals:
 - OUTLETS
 - Voltage free deviating contact for General Alarm 1,2.
 - Voltage free contact for supply fans status.
 - Voltage free contact for smoke / fire sensor (the sensors are accessory)
 - INLETS
 - External enabling.
- Power supply 400/3+N/50.

CONTROL SYSTEM

Microprocessor control system with graphic display for control and monitor of operating and alarms status. The system includes:

- Built-in clock for alarms date and time displaying and storing;
- Built-in memory for the storing of the intervened events (up to 200 events recorded);
- Predisposition for additional connectivity board housing (MODBUS, LON, BACNET MS/TP RS485, BACNET OVER IP). The electronic cards are optional accessories.
- Main components hour-meter;
- Non-volatile "Flash" memory for data storage in case of power supply faulty;
- Menu with protection password;
- Demand Limit function (for machines with double refrigerant circuit only);
- LAN connection (max 10 units).

REMOTE DRY COOLERS

The descriptions of these series can be found in Chapter REMOTE DRY COOLERS

..... **Remote dry cooler:** Remote dry cooler with coil in copper tubes and aluminium fins and AC axial fans series: **BVE DC-A**

OPTIONAL ACCESSORIES

The descriptions of these additional components can be found in Chapter OPTIONAL ACCESSORIES.

- P121..... **Front air intake + bottom panel.** Unit base noise insulation with special bottom panel for OVER version. Restriction: Non-compatible with "P122 Bottom air intake + blind panels" for OVER version.
- P122..... **Bottom air intake + blind panels.** Blind frontal panel for OVER version. The accessory allows the intake air from the bottom of the machine. Restriction: Not compatible with "P121 Front air intake + bottom panel" for OVER version.
- 601..... **Solenoid valve on liquid line.**
- P201..... **Condenser + 2way ball valve.** Condensing control with 2-way motorized valve, 0÷10 VDC control actuator and emergency manual control.
- A548..... **Constant prevalence.** Automatic system for the air pressure control in the aisle. The system controls the supply fans rotation speed to keep constant the air pressure via a differential pressure transmitter connected to the microprocessor control.
- P091..... **Back-up module controller.** The system guarantees the microprocessor power supply for a few minutes, in case of supply voltage failure. (size E1 excluded).
- 383..... **Numbered wirings + UK requests;**
- 4181 / 4182 / 4184 / 4185... **Serial cards:**
 - 4181 – Serial card MODBUS;
 - 4182 – Serial card LON;
 - 4184 – Serial card BACNET MS/TP RS485;
 - 4185 – Serial card BACNET OVER IP.
- A492..... **Water leakage detector + additional sensor.** Supplied in mounting kit.
- A511..... **Smoke detector.** Supplied in mounting kit.
- A521..... **Fire detector.** Supplied in mounting kit.
- P141..... **Analogue set-point compensation.** - Analogue set point compensation according to an external analogue signal at Customer care.
- P181..... **Network analyser** (standard machine) Multifunction utility for calculating and displaying the machine electrical measurements.
- P182..... **Network analyser+optional** (full optional machine) Multifunction utility for calculating and displaying the machine electrical measurements.
- P183..... **Kit network analyser** (standard machine) Multifunction utility for calculating and displaying the machine electrical measurements. Supplied in mounting kit.
- P184..... **Kit network analyser+optional** (full optional machine). Multifunction utility for calculating and displaying the machine electrical measurements. Supplied in mounting kit.
- A812 (1)..... **Free-cooling direct control.**
- P131..... **Hot water coil + 2-way valve.** Hot water heating system.
- A431..... **Electric heater.** Heating with electric heaters.
- A432..... **Extra power electric heater.** Size E1, E2 excluded.
- 4301 / 4303 / 4305 (2)..... **Humidification:** Modulating steam humidifier with immersed electrodes with electronic control.
 - 4301 - Steam humidifier 3kg/h
 - 4303 - Steam humidifier 8kg/h
 - 4305 - Steam humidifier 15kg/h
- P051 (3)..... **Dehumidification function.**
- A791..... **Air temperature control on suction air.**
- P161..... **T/rH air intake sensor.** Combined Temperature / Humidity sensor on air intake. The optional replace the standard temperature sensor on machine air intake.
- 4666..... **External air probe.** External air temperature probe.
- P071..... **Remote T/rH probe.** Combined Temperature / Humidity sensor for remote installation. The optional is added to the standard temperature sensor on machine air intake.

| | |
|-------------------------|--|
| P113 / P114 | Dual power supply. Dual power supply with automatic change-over. P113 - Dual power supply kit. Supplied in mounting kit P114 - Dual power supply kit + optional. Supplied in mounting kit |
| A381..... | Drain pump. Supplied in mounting kit. The system includes pump with activation float and 10 linear meters long discharge pipe. |
| P084..... | Air filter ePM₁₀ 50%. Washable high efficiency air filter (according to ISO EN 16890). Not compatible with "P017 / P018 / P019 Plenum + filter ePM _{2,5} 50%, ePM ₁ 50%, ePM ₁ 85% (according to ISO EN 16890)". |
| A531 (4)..... | On-off damper. Non-return air damper with frame driven by electric servomotor installed on the machine air delivery. |
| P011..... | Empty plenum. |
| P012..... | Empty plenum CL.A1. Plenum with fire reaction in class "0" or "A1". |
| P013..... | Plenum + 3 grilles on three sides with double adjustable row. |
| P014..... | Plenum + 3 grilles CL.A1. Plenum with grilles on three sides with double adjustable row, with fire reaction in class "0" or "A1". |
| P015..... | Silenced plenum. Not compatible with "P084 Air filter ePM ₁₀ 50%". |
| P016..... | Silenced plenum + 1 grille. Grille with double adjustable row on front side and sound absorbers. |
| P017..... | Plenum + filter ePM_{2,5} 50%. Plenum with high efficiency air filter (according to ISO EN 16890). Not compatible with "P084 Air filter ePM ₁₀ 50%". |
| P018..... | Plenum + filter ePM₁ 50%. Plenum with high efficiency air filter (according to ISO EN 16890). Not compatible with "P084 Air filter ePM ₁₀ 50%". |
| P019..... | Plenum + filter ePM₁ 85%. Plenum with high efficiency air filter (according to ISO EN 16890). Not compatible with "P084 Air filter ePM ₁₀ 50%". |
| P031 (5) | Empty intake plenum. |
| P032 (5) | Empty intake plenum CL.A1. Plenum with fire reaction in class "0" or "A1". |
| P034 (6) | Intake free-cooling plenum. |
| P041 / P042 / P043..... | Support frame with height adjusting rubber holders. Supplied in mounting kit. It is not possible to match the support frame with plenum installed under the machine. P041 – Support frame h 255-350mm P042 – Support frame h 355-450mm P043 – Support frame h 400-510mm |
| 3601 | Compressor operating signal contact. Voltage free contact for compressor status signalling. |
| 2411 | Phase sequence relay. Phases sequence control relay for the machine. |
| A272..... | CL. 0 or A1 (EN 13501-1) insulation: Panelling with fire reaction in class "0" or "A1"; |
| P151..... | Lowered display for Under – for UNDER units equipped with plenum under the unit; |
| 9973 | Wooden cage packing. The machines are delivered on wooden pallet, covered with shrink wrap and packaged in wooden cage. |
| BQ39900001..... | Remote terminal. Graphic display for remote installation, the optional is added to the standard graphic display placed on machine frontal panel. |

WARNING

The Manufacturers reserves the right to accept the matching of the optional installed on the machine.

MANDATORY COMBINATIONS OF ACCESSORIES

1. When optional accessory "A812 Free cooling direct control" is present, it requires mandatory accessories "P161 T/rH air intake sensor" and "4666 External air probe".
2. When optional accessories "4301 / 4303 / 4305 Steam humidifier" are present, they require mandatory accessory "P161 T/rH air intake sensor".
3. When optional accessory "P051 Dehumidification function" is present, it requires mandatory accessory "P161 T/rH air intake sensor".
4. When optional accessory "A531 On-off damper" is present, it requires mandatory accessory "9973 Wooden cage packing".
5. When optional accessories "P031 Empty intake plenum, for OVER version" and "P032 Empty intake plenum CL.A1, for OVER version" are present, they require mandatory accessory "P122 Bottom air intake+blind panels, for OVER version only".
6. When optional accessory "P034 Intake free-cooling plenum" is present, it requires mandatory accessories "P161 T/rH air intake sensor", "4666 External air probe", "A812 Free-cooling direct control" and "P122 Bottom air intake+blind panels, for OVER version only".

TECHNICAL DATA

| VERSION (1) | U / O | | | | | U / O | | | | | |
|--|----------|------------|------|------|------|----------|------------|------|------|------|------|
| MODEL | 012 M1 S | | | | | 018 M1 S | | | | | |
| SIZE | E1 | | | | | E2 | | | | | |
| COOLING CAPACITY (2) | 100% | 80% | 60% | 40% | 30% | 100% | 80% | 60% | 40% | 30% | |
| Total | kW | 11,1 | 8,88 | 6,66 | 4,44 | 3,38 | 23 | 18,4 | 13,8 | 9,2 | 6,88 |
| Sensible | kW | 10,7 | 8,66 | 6,63 | 4,44 | 3,38 | 20,8 | 16,8 | 12,7 | 8,61 | 6,87 |
| SHR (3) | | 0,96 | 0,97 | 0,99 | 1 | 1 | 0,9 | 0,91 | 0,92 | 0,93 | 1 |
| Total power input (Comp. + Fans) | kW | 2,42 | 1,67 | 1,01 | 0,58 | 0,30 | 5,82 | 4,09 | 2,72 | 1,58 | 1,17 |
| Condenser water flow rate | m³/h | 2,29 | -- | -- | -- | -- | 4,90 | -- | -- | -- | -- |
| Condenser pressure drop | kPa | 28,3 | -- | -- | -- | -- | 45,5 | -- | -- | -- | -- |
| "EC" SUPPLY FANS | n. | 1 | | | | | 1 | | | | |
| Air flow | m³/h | 2800 | 2426 | 2052 | 1678 | 1500 | 4100 | 3358 | 2616 | 1874 | 1500 |
| Nominal external static pressure | Pa | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Maximum external static pressure | Pa | 83 | -- | -- | -- | -- | 314 | -- | -- | -- | -- |
| Power input (4) | kW | 0,28 | 0,20 | 0,12 | 0,09 | 0,07 | 0,52 | 0,35 | 0,21 | 0,12 | 0,08 |
| COMPRESSORS | | Rotary | | | | | Scroll | | | | |
| BLDC compressors | n. | 1 | | | | | 1 | | | | |
| On/Off compressors | n. | 0 | | | | | 0 | | | | |
| Cooling Capacity Control | | Modulating | | | | | Modulating | | | | |
| Compressors power input | kW | 2,14 | 1,47 | 0,89 | 0,50 | 0,23 | 5,30 | 3,74 | 2,51 | 1,46 | 1,09 |
| WATER COOLED CONDENSER | n. | 1 | | | | | 1 | | | | |
| Water volume | l | 1,1 | | | | | 1,1 | | | | |
| Max water flow rate | m³/h | 5,7 | | | | | 6,4 | | | | |
| AIR FILTERS | n. | 1 | | | | | 1 | | | | |
| Filtering surface | m² | 0,6 | | | | | 0,8 | | | | |
| Efficiency (ISO EN 16890) | COARSE | 60% | | | | | 60% | | | | |
| REFRIGERANT | | R410A | | | | | R410A | | | | |
| Refrigerant circuit x Refrigerant charge (5) | n x kg | 1x3,2 | | | | | 1x3,8 | | | | |
| HFC R410A - F Gas - CO ₂ equivalent | t | 6,7 | | | | | 7,9 | | | | |
| POWER SUPPLY | V/Ph/Hz | 400/3+N/50 | | | | | 400/3+N/50 | | | | |
| ENERGY EFFICIENCY INDEXES (2) | | | | | | | | | | | |
| EER - Energy Efficiency Ratio | kW/kW | 4,59 | 5,32 | 6,59 | 7,66 | 8,45 | 3,95 | 4,50 | 5,07 | 5,82 | 5,88 |
| DIMENSIONS | | | | | | | | | | | |
| Length | mm | 650 | | | | | 785 | | | | |
| Width | mm | 675 | | | | | 675 | | | | |
| Height | mm | 1925 | | | | | 1925 | | | | |
| NET WEIGHT Over | kg | 230 | | | | | 280 | | | | |
| NET WEIGHT Under | kg | 240 | | | | | 290 | | | | |
| CONNECTIONS ISO 228/1-G | | | | | | | | | | | |
| Condenser water inlet/outlet | M Ø | 1" | | | | | 1" | | | | |
| HYDRAULIC CONNECTIONS | | | | | | | | | | | |
| CONDENSATE DISCHARGE | | | | | | | | | | | |
| Rubber pipe – internal diameter | Ø mm | 19 | | | | | 19 | | | | |

THE COOLING CAPACITY DOES NOT CONSIDER THE SUPPLY FAN MOTOR THERMAL LOAD

1. U = Under, downflow / O = Over, upflow
2. Gross value. Characteristics referred to entering air at 26°C-40%UR; water to the condenser 30-35°C; ESP=20Pa.
3. SHR = Sensible cooling capacity / Total cooling capacity.
4. Corresponding to the nominal external static pressure.
5. **The air conditioner is supplied with R410A refrigerant charge.** Unit refrigerant charge optional excluded. For air conditioners with double refrigerant circuit is indicated the number of circuits x the charge of a single circuit.

The units highlighted in this publication contain <HFC R410A [GWP₁₀₀ 2088]> fluorinated greenhouse gas.

NOTE:

Below 30% of cooling capacity, the inverter compressor enters the "cycling" area in which the compressor operates with ON / OFF cycles below the minimum modulation frequency (operation only for short periods).

SELECT THE UNIT IN THE MODULATION FIELD

TECHNICAL DATA

| VERSION (1) | U / O | | | | | | U / O | | | | | |
|--|-------------------|------------|------|------|------|------|----------|------------|------|------|------|--|
| MODEL | 022 M1 S | | | | | | 030 M1 S | | | | | |
| SIZE | E3 | | | | | | E4L | | | | | |
| COOLING CAPACITY (2) | 100% | 80% | 60% | 40% | 30% | | 100% | 80% | 60% | 40% | 30% | |
| Total | kW | 25,4 | 20,3 | 15,2 | 10,2 | 7,32 | 41,3 | 33 | 24,8 | 16,5 | 12,3 | |
| Sensible | kW | 24,8 | 19,5 | 14,9 | 9,61 | 7,32 | 41,3 | 32,9 | 24,8 | 16,5 | 12,3 | |
| SHR (3) | | 0,97 | 0,96 | 0,98 | 0,94 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Total power input (Comp. + Fans) | kW | 5,89 | 4,2 | 2,69 | 1,58 | 1,12 | 10 | 6,9 | 4,48 | 2,6 | 1,81 | |
| Condenser water flow rate | m ³ /h | 5,29 | -- | -- | -- | -- | 8,56 | -- | -- | -- | -- | |
| Condenser pressure drop | kPa | 33,2 | -- | -- | -- | -- | 27,5 | -- | -- | -- | -- | |
| "EC" SUPPLY FANS | n. | 1 | | | | | | 1 | | | | |
| Air flow | m ³ /h | 5500 | 4432 | 3365 | 2297 | 1700 | 10000 | 7978 | 5955 | 3933 | 2900 | |
| Nominal external static pressure | Pa | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | |
| Maximum external static pressure | Pa | 860 | -- | -- | -- | -- | 219 | -- | -- | -- | -- | |
| Power input (4) | kW | 0,72 | 0,39 | 0,23 | 0,12 | 0,07 | 1,95 | 1,06 | 0,47 | 0,19 | 0,11 | |
| COMPRESSORS | | Scroll | | | | | | Scroll | | | | |
| BLDC compressors | n. | 1 | | | | | | 1 | | | | |
| On/Off compressors | n. | 0 | | | | | | 0 | | | | |
| Cooling Capacity Control | | Modulating | | | | | | Modulating | | | | |
| Compressors power input | kW | 5,17 | 3,82 | 2,46 | 1,45 | 1,05 | 8,09 | 5,84 | 4,01 | 2,41 | 1,7 | |
| WATER COOLED CONDENSER | n. | 1 | | | | | | 1 | | | | |
| Water volume | l | 1,9 | | | | | | 3,7 | | | | |
| Max water flow rate | m ³ /h | 6,9 | | | | | | 11,2 | | | | |
| AIR FILTERS | n. | 2 | | | | | | 2 | | | | |
| Filtering surface | m ² | 1,2 | | | | | | 2,1 | | | | |
| Efficiency (ISO EN 16890) | COARSE | 60% | | | | | | 60% | | | | |
| REFRIGERANT | | R410A | | | | | | R410A | | | | |
| Refrigerant circuit x Refrigerant charge (5) | n x kg | 1x4,6 | | | | | | 1x6,8 | | | | |
| HFC R410A - F Gas - CO ₂ equivalent | t | 9,6 | | | | | | 14,2 | | | | |
| POWER SUPPLY | V/Ph/Hz | 400/3+N/50 | | | | | | 400/3+N/50 | | | | |
| ENERGY EFFICIENCY INDEXES (2) | | | | | | | | | | | | |
| EER - Energy Efficiency Ratio | kW/kW | 4,31 | 4,83 | 5,65 | 6,46 | 6,54 | 4,13 | 4,78 | 5,54 | 6,35 | 6,80 | |
| DIMENSIONS | | | | | | | | | | | | |
| Length | mm | 1085 | | | | | | 1630 | | | | |
| Width | mm | 775 | | | | | | 930 | | | | |
| Height | mm | 1925 | | | | | | 1980 | | | | |
| NET WEIGHT Over | kg | 325 | | | | | | 480 | | | | |
| NET WEIGHT Under | kg | 345 | | | | | | 490 | | | | |
| CONNECTIONS ISO 228/1-G | | | | | | | | | | | | |
| Condenser water inlet/outlet | M Ø | 1 1/4" | | | | | | 1 1/2" | | | | |
| HYDRAULIC CONNECTIONS | | | | | | | | | | | | |
| CONDENSATE DISCHARGE | | | | | | | | | | | | |
| Rubber pipe – internal diameter | Ø mm | 19 | | | | | | 19 | | | | |

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3. SHR = Sensible cooling capacity / Total cooling capacity.
4. Corresponding to the nominal external static pressure.
5. **The air conditioner is supplied with R410A refrigerant charge.** Unit refrigerant charge optional excluded. For air conditioners with double refrigerant circuit is indicated the number of circuits x the charge of a single circuit.

The units highlighted in this publication contain <HFC R410A [GWP₁₀₀ 2088]> fluorinated greenhouse gas.

NOTE:

Below 30% of cooling capacity, the inverter compressor enters the "cycling" area in which the compressor operates with ON / OFF cycles below the minimum modulation frequency (operation only for short periods).

SELECT THE UNIT IN THE MODULATION FIELD

TECHNICAL DATA

| VERSION (1) | U / O | | | | | | U / O | | | | | |
|--|-------------------|------------|------|------|------|------|----------|------------|------|------|------|--|
| MODEL | 047 M1 S | | | | | | 042 M2 D | | | | | |
| SIZE | E5L | | | | | | E5L | | | | | |
| COOLING CAPACITY (2) | 100% | 80% | 60% | 40% | 30% | | 100% | 80% | 60% | 40% | 30% | |
| Total | kW | 56,2 | 45 | 33,7 | 22,5 | 17,9 | 51,8 | 41,4 | 31,1 | 20,7 | 15,9 | |
| Sensible | kW | 54,3 | 45 | 33,7 | 22,5 | 17,9 | 51,7 | 41,4 | 31,1 | 20,7 | 15,9 | |
| SHR (3) | | 0,97 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Total power input (Comp. + Fans) | kW | 14,1 | 9,47 | 5,94 | 3,36 | 2,43 | 12,7 | 8,72 | 5,47 | 3,12 | 2,3 | |
| Condenser water flow rate | m ³ /h | 11,77 | -- | -- | -- | -- | 10,76 | -- | -- | -- | -- | |
| Condenser pressure drop | kPa | 50,7 | -- | -- | -- | -- | 23,1 | -- | -- | -- | -- | |
| "EC" SUPPLY FANS | n. | 1 | | | | | | 1 | | | | |
| Air flow | m ³ /h | 12000 | 9858 | 7715 | 5573 | 4700 | 12000 | 9893 | 7787 | 5680 | 4700 | |
| Nominal external static pressure | Pa | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | |
| Maximum external static pressure | Pa | 217 | -- | -- | -- | -- | 217 | -- | -- | -- | -- | |
| Power input (4) | kW | 2,27 | 1,4 | 0,76 | 0,34 | 0,23 | 2,27 | 1,4 | 0,76 | 0,35 | 0,23 | |
| COMPRESSORS | | Scroll | | | | | | Scroll | | | | |
| BLDC compressors | n. | 1 | | | | | | 2 | | | | |
| On/Off compressors | n. | 0 | | | | | | 0 | | | | |
| Cooling Capacity Control | | Modulating | | | | | | Modulating | | | | |
| Compressors power input | kW | 11,9 | 8,07 | 5,18 | 3,02 | 2,2 | 10,5 | 7,31 | 4,7 | 2,77 | 2,07 | |
| WATER COOLED CONDENSER | n. | 1 | | | | | | 1 | | | | |
| Water volume | l | 3,7 | | | | | | 3,4 | | | | |
| Max water flow rate | m ³ /h | 15,4 | | | | | | 14 | | | | |
| AIR FILTERS | n. | 3 | | | | | | 3 | | | | |
| Filtering surface | m ² | 2,6 | | | | | | 2,59 | | | | |
| Efficiency (ISO EN 16890) | COARSE | 60% | | | | | | 60% | | | | |
| REFRIGERANT | | R410A | | | | | | R410A | | | | |
| Refrigerant circuit x Refrigerant charge (5) | n x kg | 1x9,9 | | | | | | 2x4,7 | | | | |
| HFC R410A - F Gas - CO ₂ equivalent | t | 20,7 | | | | | | 19,6 | | | | |
| POWER SUPPLY | V/Ph/Hz | 400/3+N/50 | | | | | | 400/3+N/50 | | | | |
| ENERGY EFFICIENCY INDEXES (2) | | | | | | | | | | | | |
| EER - Energy Efficiency Ratio | kW/kW | 3,99 | 4,75 | 5,67 | 6,7 | 7,37 | 4,08 | 4,75 | 5,69 | 6,63 | 6,91 | |
| DIMENSIONS | | | | | | | | | | | | |
| Length | mm | 1955 | | | | | | 1955 | | | | |
| Width | mm | 930 | | | | | | 930 | | | | |
| Height | mm | 1980 | | | | | | 1980 | | | | |
| NET WEIGHT Over | kg | 580 | | | | | | 610 | | | | |
| NET WEIGHT Under | kg | 590 | | | | | | 620 | | | | |
| CONNECTIONS ISO 228/1-G | | | | | | | | | | | | |
| Condenser water inlet/outlet | M Ø | 2" | | | | | | 2" | | | | |
| HYDRAULIC CONNECTIONS | | | | | | | | | | | | |
| CONDENSATE DISCHARGE | | | | | | | | | | | | |
| Rubber pipe – internal diameter | Ø mm | 19 | | | | | | 19 | | | | |

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4. Corresponding to the nominal external static pressure.
5. **The air conditioner is supplied with R410A refrigerant charge.** Unit refrigerant charge optional excluded. For air conditioners with double refrigerant circuit is indicated the number of circuits x the charge of a single circuit.

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SELECT THE UNIT IN THE MODULATION FIELD

TECHNICAL DATA

| VERSION (1) | U / O | | | | | | U / O | | | | | |
|--|-------------------|------------|-------|-------|------|------|----------|------------|-------|------|------|--|
| MODEL | 068 M2 D | | | | | | 094 M2 D | | | | | |
| SIZE | E7L | | | | | | E8L | | | | | |
| COOLING CAPACITY (2) | 100% | 80% | 60% | 40% | 30% | | 100% | 80% | 60% | 40% | 30% | |
| Total | kW | 82,5 | 66 | 49,5 | 33 | 24,7 | 110 | 88 | 66 | 44 | 34,4 | |
| Sensible | kW | 82,4 | 65,9 | 49,2 | 32,9 | 24,7 | 103 | 83,7 | 62,5 | 42,1 | 34,4 | |
| SHR (3) | | 1 | 1 | 0,99 | 1 | 1 | 0,93 | 0,95 | 0,94 | 0,95 | 1 | |
| Total power input (Comp. + Fans) | kW | 19,8 | 13,6 | 8,8 | 5,16 | 3,63 | 27,4 | 18,4 | 11,6 | 6,63 | 4,75 | |
| Condenser water flow rate | m ³ /h | 17,13 | -- | -- | -- | -- | 23,11 | -- | -- | -- | -- | |
| Condenser pressure drop | kPa | 28,9 | -- | -- | -- | -- | 33,1 | -- | -- | -- | -- | |
| "EC" SUPPLY FANS | n. | 2 | | | | | | 2 | | | | |
| Air flow | m ³ /h | 20000 | 15946 | 11893 | 7839 | 5800 | 22000 | 17926 | 13852 | 9778 | 8000 | |
| Nominal external static pressure | Pa | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | |
| Maximum external static pressure | Pa | 474 | -- | -- | -- | -- | 388 | -- | -- | -- | -- | |
| Power input (4) | kW | 3,37 | 1,87 | 0,9 | 0,34 | 0,23 | 3,72 | 2,22 | 1,08 | 0,5 | 0,35 | |
| COMPRESSORS | | Scroll | | | | | | Scroll | | | | |
| BLDC compressors | n. | 2 | | | | | | 2 | | | | |
| On/Off compressors | n. | 0 | | | | | | 0 | | | | |
| Cooling Capacity Control | | Modulating | | | | | | Modulating | | | | |
| Compressors power input | kW | 16,4 | 11,7 | 7,91 | 4,83 | 3,4 | 23,7 | 16,2 | 10,5 | 6,12 | 4,4 | |
| WATER COOLED CONDENSER | n. | 1 | | | | | | 1 | | | | |
| Water volume | l | 5,6 | | | | | | 7,4 | | | | |
| Max water flow rate | m ³ /h | 22,4 | | | | | | 30 | | | | |
| AIR FILTERS | n. | 4 | | | | | | 5 | | | | |
| Filtering surface | m ² | 3,83 | | | | | | 4,47 | | | | |
| Efficiency (ISO EN 16890) | COARSE | 60% | | | | | | 60% | | | | |
| REFRIGERANT | | R410A | | | | | | R410A | | | | |
| Refrigerant circuit x Refrigerant charge (5) | n x kg | 2x6,9 | | | | | | 2x10,1 | | | | |
| HFC R410A - F Gas - CO ₂ equivalent | t | 28,8 | | | | | | 41,2 | | | | |
| POWER SUPPLY | V/Ph/Hz | 400/3+N/50 | | | | | | 400/3+N/50 | | | | |
| ENERGY EFFICIENCY INDEXES (2) | | | | | | | | | | | | |
| EER - Energy Efficiency Ratio | kW/kW | 4,17 | 4,85 | 5,62 | 6,4 | 6,8 | 4,01 | 4,78 | 5,69 | 6,64 | 7,24 | |
| DIMENSIONS | | | | | | | | | | | | |
| Length | mm | 2499 | | | | | | 2899 | | | | |
| Width | mm | 930 | | | | | | 930 | | | | |
| Height | mm | 1980 | | | | | | 1980 | | | | |
| NET WEIGHT Over | kg | 730 | | | | | | 900 | | | | |
| NET WEIGHT Under | kg | 785 | | | | | | 960 | | | | |
| CONNECTIONS ISO 228/1-G | | | | | | | | | | | | |
| Condenser water inlet/outlet | M Ø | 2 1/2" | | | | | | 2 1/2" | | | | |
| HYDRAULIC CONNECTIONS | | | | | | | | | | | | |
| CONDENSATE DISCHARGE | | | | | | | | | | | | |
| Rubber pipe – internal diameter | Ø mm | 19 | | | | | | 19 | | | | |

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3. SHR = Sensible cooling capacity / Total cooling capacity.
4. Corresponding to the nominal external static pressure.
5. **The air conditioner is supplied with R410A refrigerant charge.** Unit refrigerant charge optional excluded. For air conditioners with double refrigerant circuit is indicated the number of circuits x the charge of a single circuit.

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NOTE:

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SELECT THE UNIT IN THE MODULATION FIELD

TECHNICAL DATA

| VERSION (1) | U | | | | | | U | | | | | |
|--|-------------------|------------|-------|-------|-------|------|----------|------------|-------|-------|------|--|
| MODEL | 120 M4 D | | | | | | 150 M4 D | | | | | |
| SIZE | E9L | | | | | | E9L | | | | | |
| COOLING CAPACITY (2) | 100% | 80% | 60% | 40% | 30% | | 100% | 80% | 60% | 40% | 30% | |
| Total | kW | 116 | 92,8 | 69,6 | 46,4 | 31,9 | 140 | 112 | 84 | 56 | 32,8 | |
| Sensible | kW | 116 | 92,7 | 69,5 | 46,4 | 31,9 | 140 | 112 | 84 | 56 | 32,8 | |
| SHR (3) | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Total power input (Comp. + Fans) | kW | 28,2 | 19,2 | 12,4 | 7,84 | 4,49 | 37,8 | 25 | 16 | 9,33 | 4,69 | |
| Condenser water flow rate | m ³ /h | 24,26 | -- | -- | -- | -- | 29,8 | -- | -- | -- | -- | |
| Condenser pressure drop | kPa | 32,3 | -- | -- | -- | -- | 49,8 | -- | -- | -- | -- | |
| "EC" SUPPLY FANS | n. | 2 | | | | | | 2 | | | | |
| Air flow | m ³ /h | 28000 | 22621 | 17241 | 11862 | 8500 | 32000 | 25862 | 19724 | 13586 | 8500 | |
| Nominal external static pressure | Pa | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | |
| Maximum external static pressure | Pa | 572 | -- | -- | -- | -- | 362 | -- | -- | -- | -- | |
| Power input (4) | kW | 4,2 | 2,46 | 1,29 | 0,6 | 0,33 | 5,99 | 3,46 | 1,77 | 0,78 | 0,33 | |
| COMPRESSORS | | Scroll | | | | | | Scroll | | | | |
| BLDC compressors | n. | 2 | | | | | | 2 | | | | |
| On/Off compressors | n. | 2 | | | | | | 2 | | | | |
| Cooling Capacity Control | | Modulating | | | | | | Modulating | | | | |
| Compressors power input | kW | 24 | 16,7 | 11,1 | 7,24 | 4,16 | 31,8 | 21,5 | 14,2 | 8,56 | 4,36 | |
| WATER COOLED CONDENSER | n. | 1 | | | | | | 1 | | | | |
| Water volume | l | 12 | | | | | | 12 | | | | |
| Max water flow rate | m ³ /h | 42 | | | | | | 42 | | | | |
| AIR FILTERS | n. | 6 | | | | | | 6 | | | | |
| Filtering surface | m ² | 5,24 | | | | | | 5,24 | | | | |
| Efficiency (ISO EN 16890) | COARSE | 60% | | | | | | 60% | | | | |
| REFRIGERANT | | R410A | | | | | | R410A | | | | |
| Refrigerant circuit x Refrigerant charge (5) | n x kg | 2x10,8 | | | | | | 2x10,8 | | | | |
| HFC R410A - F Gas - CO ₂ equivalent | t | 45,1 | | | | | | 45,1 | | | | |
| POWER SUPPLY | V/Ph/Hz | 400/3+N/50 | | | | | | 400/3+N/50 | | | | |
| ENERGY EFFICIENCY INDEXES (2) | | | | | | | | | | | | |
| EER - Energy Efficiency Ratio | kW/kW | 4,11 | 4,83 | 5,61 | 5,92 | 7,1 | 3,7 | 4,48 | 5,25 | 6 | 6,99 | |
| DIMENSIONS | | | | | | | | | | | | |
| Length | mm | 3299 | | | | | | 3299 | | | | |
| Width | mm | 930 | | | | | | 930 | | | | |
| Height | mm | 1980 | | | | | | 1980 | | | | |
| NET WEIGHT Over | kg | -- | | | | | | -- | | | | |
| NET WEIGHT Under | kg | 1100 | | | | | | 1125 | | | | |
| CONNECTIONS ISO 228/1-G | | | | | | | | | | | | |
| Condenser water inlet/outlet | M Ø | 3" | | | | | | 3" | | | | |
| HYDRAULIC CONNECTIONS | | | | | | | | | | | | |
| CONDENSATE DISCHARGE | | | | | | | | | | | | |
| Rubber pipe – internal diameter | Ø mm | 19 | | | | | | 19 | | | | |

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NOTE:

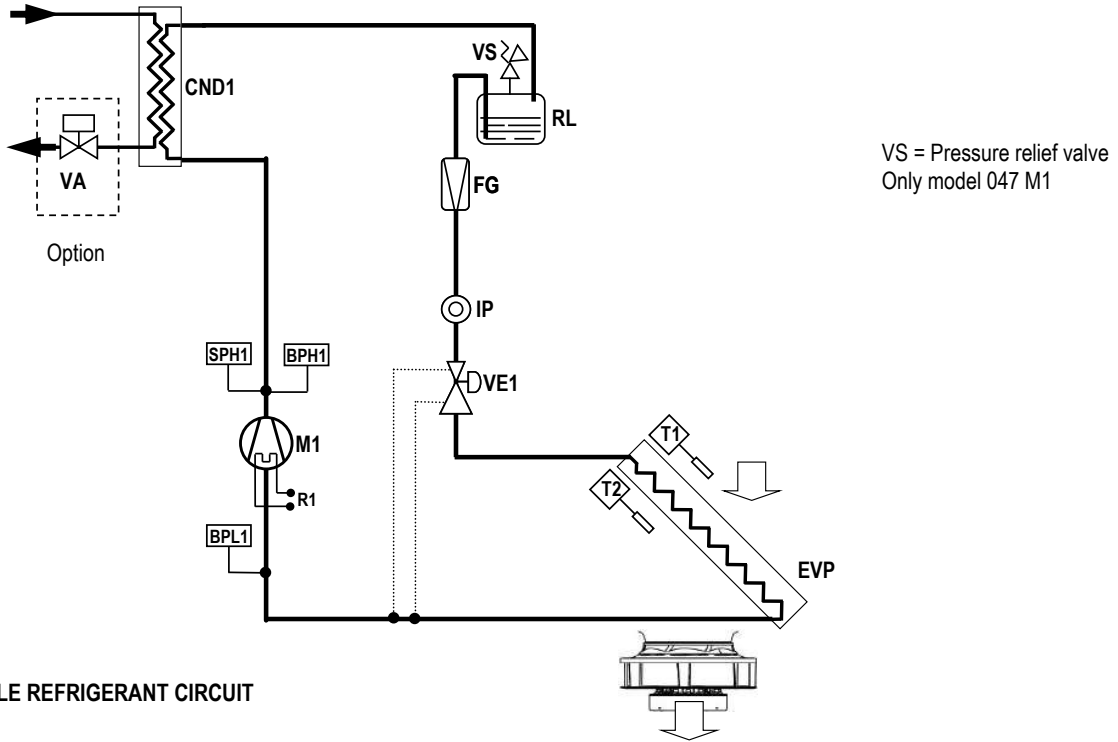
Below 30% of cooling capacity, the inverter compressor enters the "cycling" area in which the compressor operates with ON / OFF cycles below the minimum modulation frequency (operation only for short periods).

SELECT THE UNIT IN THE MODULATION FIELD

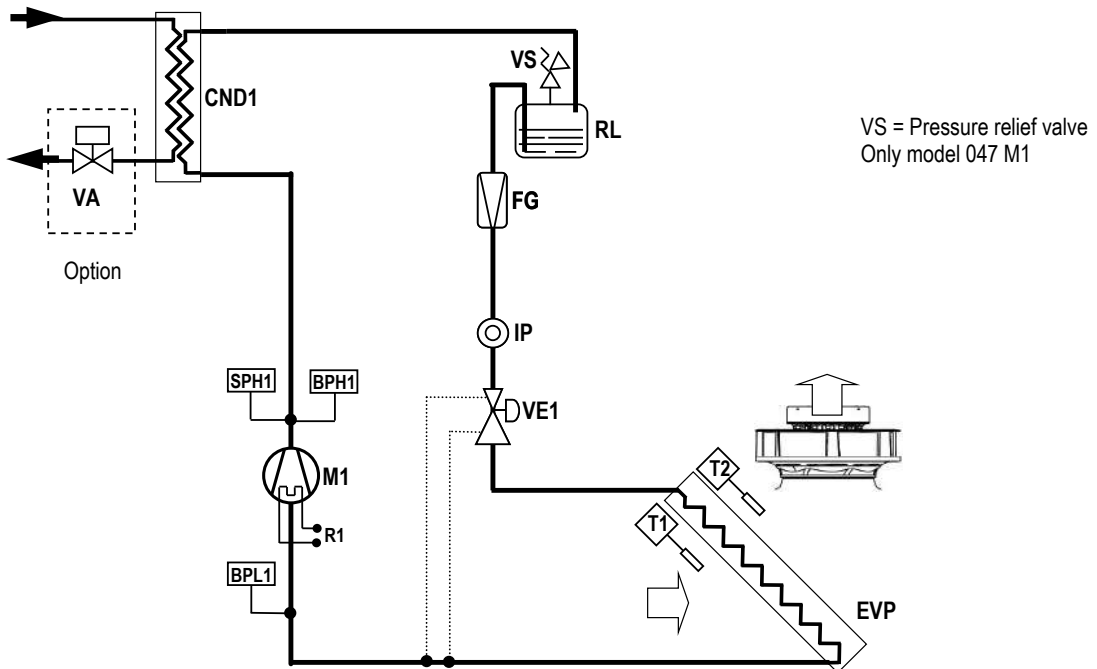
REFRIGERANT CIRCUIT

Below refrigerant diagrams for version with single or double refrigerant circuit. The diagrams refer to the standard configuration, without optional.

UNDER - SINGLE REFRIGERANT CIRCUIT



OVER - SINGLE REFRIGERANT CIRCUIT

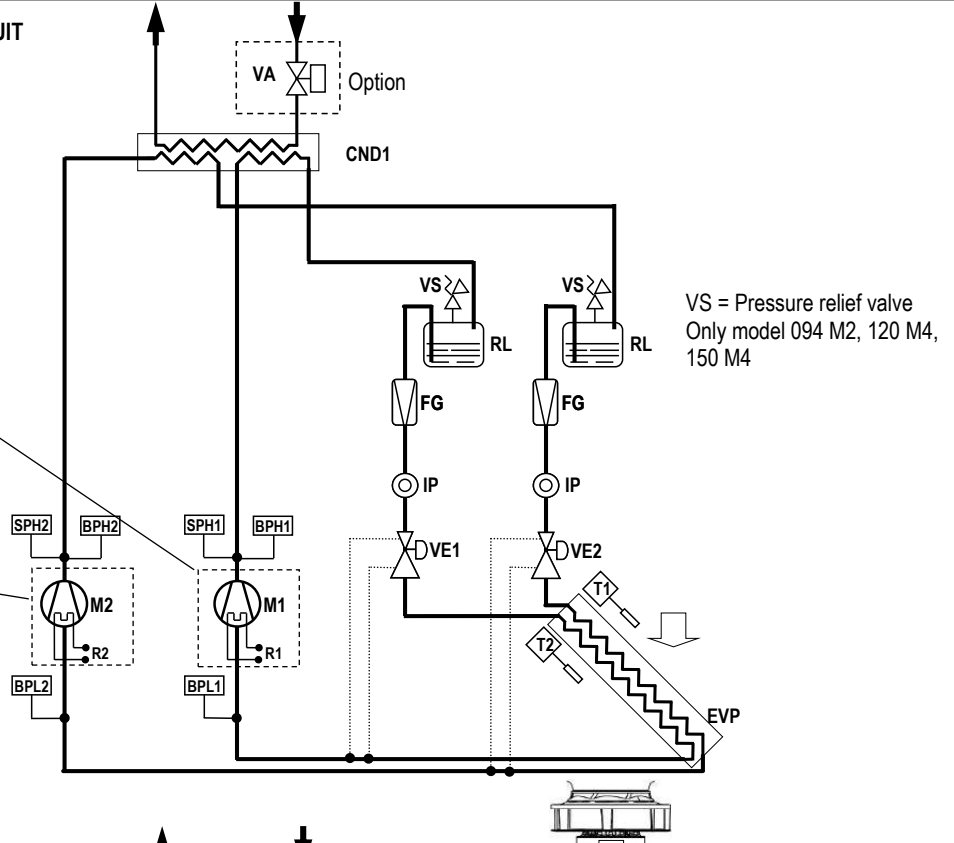
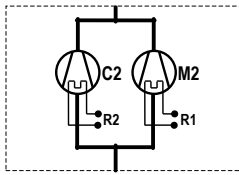
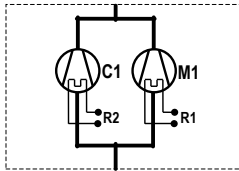


LEGENDA

| | | | | | |
|-----|---------------------------|-----|--------------------------|----|---|
| M1 | BLDC inverter compressor | BPL | Low pressure transducer. | IP | Sight glass. |
| R1 | Crankcase heater | SPH | High pressure switch | VE | Expansion valve. |
| CND | Condenser. | VS | Pressure relief valve. | T | Temperature probes. |
| EVP | Evaporator. | FG | Refrigerant filter. | RL | Liquid receiver |
| BPH | High pressure transducer. | | | VA | Motorized valve for condensing control (option) |

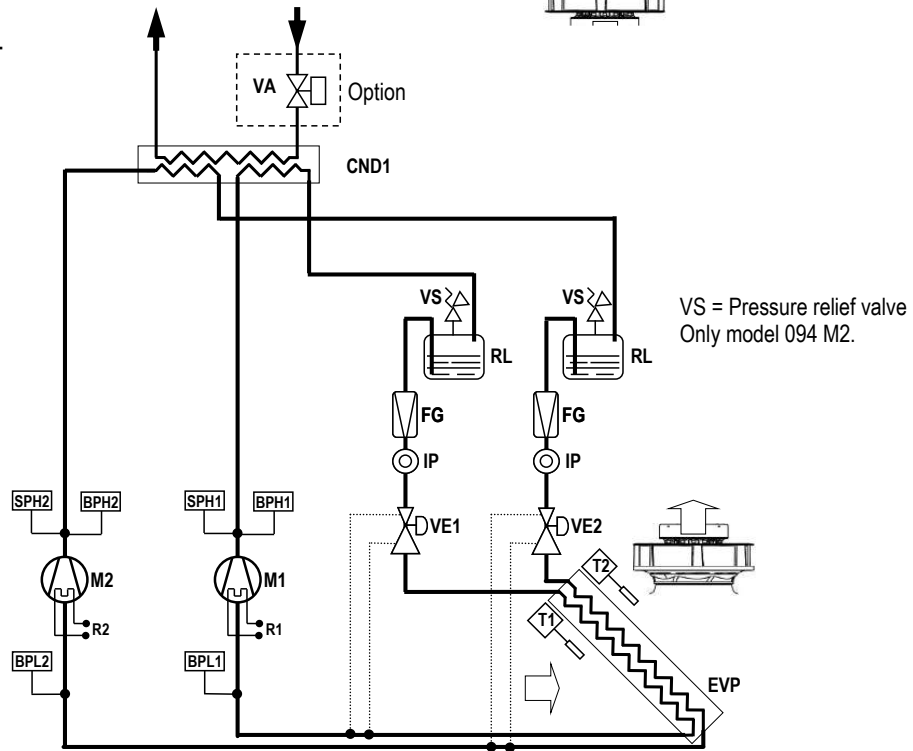
UNDER - DOUBLE REFRIGERANT CIRCUIT

SIZE E9L



VS = Pressure relief valve
Only model 094 M2, 120 M4,
150 M4

OVER - DOUBLE REFRIGERANT CIRCUIT



VS = Pressure relief valve
Only model 094 M2.

LEGENDA

- M1...2 BLDC inverter compressor 1, 2
- C1...2 on/off compressor 1, 2
- R1...2 Crankcase heater 1, 2
- CND Condenser.
- EVP Evaporator.
- BPH High pressure transducer.

- BPL Low pressure transducer.
- SPH High pressure switch
- VS Pressure relief valve.
- FG Refrigerant filter.

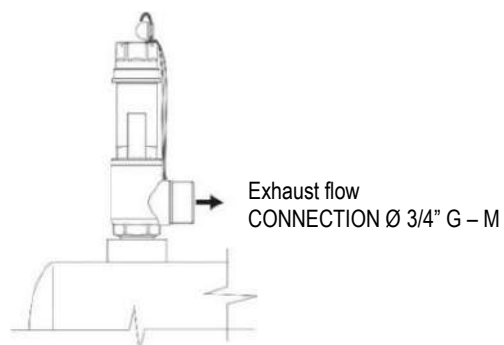
- IP Sight glass.
- VE Expansion valve.
- T Temperature probes.
- RL Liquid receiver
- VA Motorized valve for condensing control

PRESSURE RELIEF VALVE

The pressure relief valve of the refrigerant circuit is installed in the machines when required by Directive 2014/68/EU.

The valve is installed on liquid receiver and oil separator of each refrigerant circuit of the machine with the purpose to protect the circuit from overpressure.

| Factory installed components | |
|--|-------|
| Pressure relief valve on liquid receiver | |
| Model | [bar] |
| 012 M1 S | --- |
| 018 M1 S | --- |
| 022 M1 S | --- |
| 030 M1 S | --- |
| 047 M1 S | 41,5 |
| 042 M2 D | --- |
| 068 M2 D | --- |
| 094 M2 D | 41,5 |
| 120 M4 D | 41,5 |
| 150 M4 D | 41,5 |



WATER QUALITY OF THE HYDRAULIC CIRCUITS

The values shown in the table must be guaranteed during the entire life cycle of the machine.

| | Description | Symbol | Range |
|----|---|--|------------|
| 1 | Hydrogen Ions | pH | 7.5 ÷ 9 |
| 2 | Presence of calcium (Ca) and magnesium (Mg) | Hardness | 4 ÷ 8.5 °D |
| 3 | Chlorine ions | Cl ⁻ | < 150 ppm |
| 4 | Iron Ions | Fe ³⁺ | < 0.5 ppm |
| 5 | Manganese Ions | Mn ²⁺ | < 0.05 ppm |
| 6 | Carbon dioxide | CO ₂ | < 10 ppm |
| 7 | Hydrogen sulphide | H ₂ S | < 50 ppb |
| 8 | Oxygen | O ₂ | < 0.1 ppm |
| 9 | Chlorine | Cl ₂ | < 0.5 ppm |
| 10 | Ammonia | NH ₃ | < 0.5 ppm |
| 11 | Ratio between carbonates and sulphates | HCO ₃ ⁻ /SO ₄ ²⁻ | > 1 |
| 12 | Sulphate ions | SO ₄ ⁻ | < 100 ppm |
| 13 | Phosphate ions | PO ₄ ³⁻ | < 2.0 ppm |

where: 1/1.78°D = 1°Fr with 1°Fr = 10 gr CaCO₃ / m³

ppm = parts for millions

ppb = part for billion

Explanatory notes:

- ref.1: A greater concentration of hydrogen ions (pH) than 9 implies a high risk of deposits, whereas a lower pH than 7 implies a high risk of corrosion.
- ref.2: The hardness measures the amount of Ca and Mg carbonate dissolved in the water with a temperature lower than 100°C (temporary hardness). A high hardness implies a high risk of deposits.
- ref.3: The concentration of chloride ions with higher values than those indicated causes corrosion.
- ref. 4 - 5 - 8: The presence of iron and manganese ions and oxygen leads to corrosion.
- ref.6 - 7: Carbon dioxide and hydrogen sulphide are impurities that promote corrosion.
- ref.9: Usually in water from the waterworks it is a value of between 0.2 and 0.3 ppm. High values cause corrosion.
- ref.10: The presence of ammonia reinforces the oxidising power of oxygen
- ref.11: Below the value shown in the table, there is a risk of corrosion due to the trigger of galvanic currents between copper and other less noble metals.
- ref.12: The presence of sulphates ions triggers corrosion phenomenon.
- ref.13: The presence of phosphates ions triggers corrosion phenomenon.

It is necessary to carry out periodic checks, with withdrawals at different points of the hydraulic system. During the first year of operation, checks are recommended every 4 months which can be reduced every 6 months starting from the second year of operation.

WARNING:

Values of the parameters outside the indicated ranges can lead to the formation of deposits and limescale and/or favour corrosive phenomena within the plant. For operating fluids other than water (mixtures of ethylene and propylene glycol) it is recommended to use specific inhibitors, designed to offer thermal stability within the operating temperature range and protection against corrosion. It is necessary that, in the presence of dirty and / or aggressive waters, an intermediate heat exchanger is installed upstream of the heat exchangers.

ANTIFREEZE MIXTURES

In plants that are not adequately protected by heating cables, protect the hydraulic circuit with an anti-freeze mixture when the ambient air temperature can drop below 5°C.

| | | | | | | | | | |
|---|----|---|----|----|-----|-----|-----|-----|-----|
| Minimum ambient air temperature | °C | 5 | 0 | -5 | -10 | -15 | -20 | -25 | -30 |
| ETHYLENE GLYCOL (suggested % in weight) | % | 0 | 12 | 20 | 30 | 35 | 40 | 45 | 50 |

| | | | | | | | | | |
|--|----|---|----|----|----|-----|-----|-----|-----|
| Minimum ambient air temperature | °C | 5 | 2 | -3 | -9 | -13 | -17 | -23 | -29 |
| PROPYLENE GLYCOL (suggested % in weight) | % | 0 | 10 | 20 | 30 | 35 | 40 | 45 | 50 |

The values are indicative and may significantly vary depending on the glycol manufacturer. Refer to your glycol supplier for detail. The values consider a precautionary difference of 5°C between the minimum ambient air temperature and the freezing temperature of the mixture.

In the hydraulic circuit do not send fluids other than water or mixtures with ethylene / propylene glycol.

If other products are provided, in addition to mixtures of water and ethylene or propylene glycol, contact the Manufacturer to check the compatibility with the machine components.

ACOUSTIC DATA

Acoustic data of the standard machine at full load working conditions.

WARNING:

In a closed room the noise produced by a sound source reaches the listener in two different ways:

- Directly
- Reflected from the surrounding walls, floor, ceiling, from furniture.

With the same sound source, the noise produced in a closed room is greater than that produced outdoors. In fact, the sound pressure level generated by the source, must be added to the one reflected from the room. Also, the shape of the room affects the sound.

| MODEL | | 012 M1 S | 018 M1 S | 022 M1 S | 030 M1 S | 047 M1 S |
|--------------------------|-------|----------|----------|----------|----------|----------|
| SIZE | | E1 | E2 | E3 | E4L | E5L |
| COOLING CAPACITY | | 100% | 100% | 100% | 100% | 100% |
| SOUND LEVEL ISO 3744 (1) | | | | | | |
| On air delivery Under | dB(A) | 64,7 | 71,4 | 69,6 | 81,1 | 81,5 |
| On air intake Under | dB(A) | 55,9 | 57,1 | 55,6 | 66,9 | 68,9 |
| On front side Under | dB(A) | 47 | 48 | 46 | 57 | 59 |
| On air delivery Over | dB(A) | 64,7 | 71,4 | 69,6 | 81,1 | 81,5 |
| On air intake Over (2) | dB(A) | 53 | 47 | 49 | 58 | 64 |
| On front side Over (3) | dB(A) | 46,2 | 40,2 | 42,8 | 53,4 | 59,4 |

| MODEL | | 042 M2 D | 068 M2 D | 094 M2 D | 120 M4 D | 150 M4 D |
|--------------------------|-------|----------|----------|----------|----------|----------|
| SIZE | | E5L | E7L | E8L | E9L | E9L |
| COOLING CAPACITY | | 100% | 100% | 100% | 100% | 100% |
| SOUND LEVEL ISO 3744 (1) | | | | | | |
| On air delivery Under | dB(A) | 81,5 | 80,1 | 82,5 | 83,4 | 83,4 |
| On air intake Under | dB(A) | 68,9 | 67,5 | 69,9 | 70,9 | 70,9 |
| On front side Under | dB(A) | 59 | 58 | 60 | 62 | 62 |
| On air delivery Over | dB(A) | 81,5 | 80,1 | 82,5 | -- | -- |
| On air intake Over (2) | dB(A) | 64 | 62 | 65 | -- | -- |
| On front side Over (3) | dB(A) | 59,4 | 58,1 | 60,4 | -- | -- |

1. Noise pressure level at 1 meter in free field – ISO 3744
2. Air intake from the front
3. Air intake from the bottom

ELECTRICAL DATA

| VERSION (1) | | U / O | U / O | U / O | U / O | U / O |
|-----------------------------|---------|------------|------------|------------|------------|------------|
| MODEL | | 012 M1 S | 018 M1 S | 022 M1 S | 030 M1 S | 047 M1 S |
| SIZE | | E1 | E2 | E3 | E4L | E5L |
| 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 |
| Maximum current input (FLA) | A | 17,3 | 19,7 | 21,2 | 29,2 | 29,4 |

| VERSION (1) | | U / O | U / O | U / O | U | U |
|-----------------------------|---------|------------|------------|------------|------------|------------|
| MODEL | | 042 M2 D | 068 M2 D | 094 M2 D | 120 M4 D | 150 M4 D |
| SIZE | | E5L | E7L | E8L | E9L | E9L |
| 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 |
| Maximum current input (FLA) | A | 38,4 | 58,9 | 58,9 | 90,9 | 90,9 |

1. U = Under, downflow / O = Over, upflow

WARNING:

The electric data indicated refer only to the indoor unit.

Optional accessory electric data are included within the dedicated chapters and must be added.

Please refer to ELCA WORLD selection program to calculate the electrical data of the air conditioner according to the requested optional accessories.

MICROPROCESSOR CONTROL SYSTEM



Controller



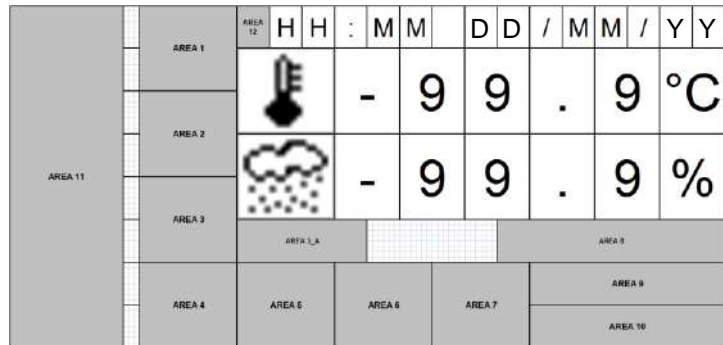
Keyboard and Display

The unit is equipped with the controller connected to a 6 keys keyboard with graphic display on which all information in English language or easily identifiable symbols are displayed.
 The controller disposes of a “flash” memory that preserves the information even in absence of power supply. Part of memory is dedicated to the registration of intervened events - up to 200 events.

DISPLAY – KEYBOARD FUNCTIONS

| | | |
|--|------------|--|
| | ALARM | Alarm presence with red light. Push for alarm description. In case of more alarms scroll by UP / DOWN. |
| | PRG | Menu list, scrolled by UP/DOWN: Unit; Set-point; In/Out; Clock; History; User; Service; Factory. ENTER to execute. |
| | ESC | Home. Used to come back to the previous menu level or to the main screen. |
| | UP DOWN | Changes pages and values of sets. By pressing in HOME mask, the synoptic of the main controls is displayed. |
| | ENTER | Moving the cursor on adjustable Program(s) fields to confirm the changes. Press ENTER to get out the fields. |

DISPLAY - MAIN MASK



The main mask shows time, date, room temperature and humidity values (if the relative probe is present) and areas for displaying operating and alarm status with dedicated icons:

- Area 1: Status of the unit: on / off
- Area 2: Status detail
- Area 3: Type of event (only in case of an event)
- Area 3_A: Code and type of event
- Area 4: Active cooling devices
- Area 5: Active free-cooling devices
- Area 6: Active humidity devices
- Area 7: Active heating devices
- Area 8: on / off parameters
- Area 9: BMS address
- Area 10: LAN address
- Area 11: Schematic representation of units
- Area 12: Active function presence icon

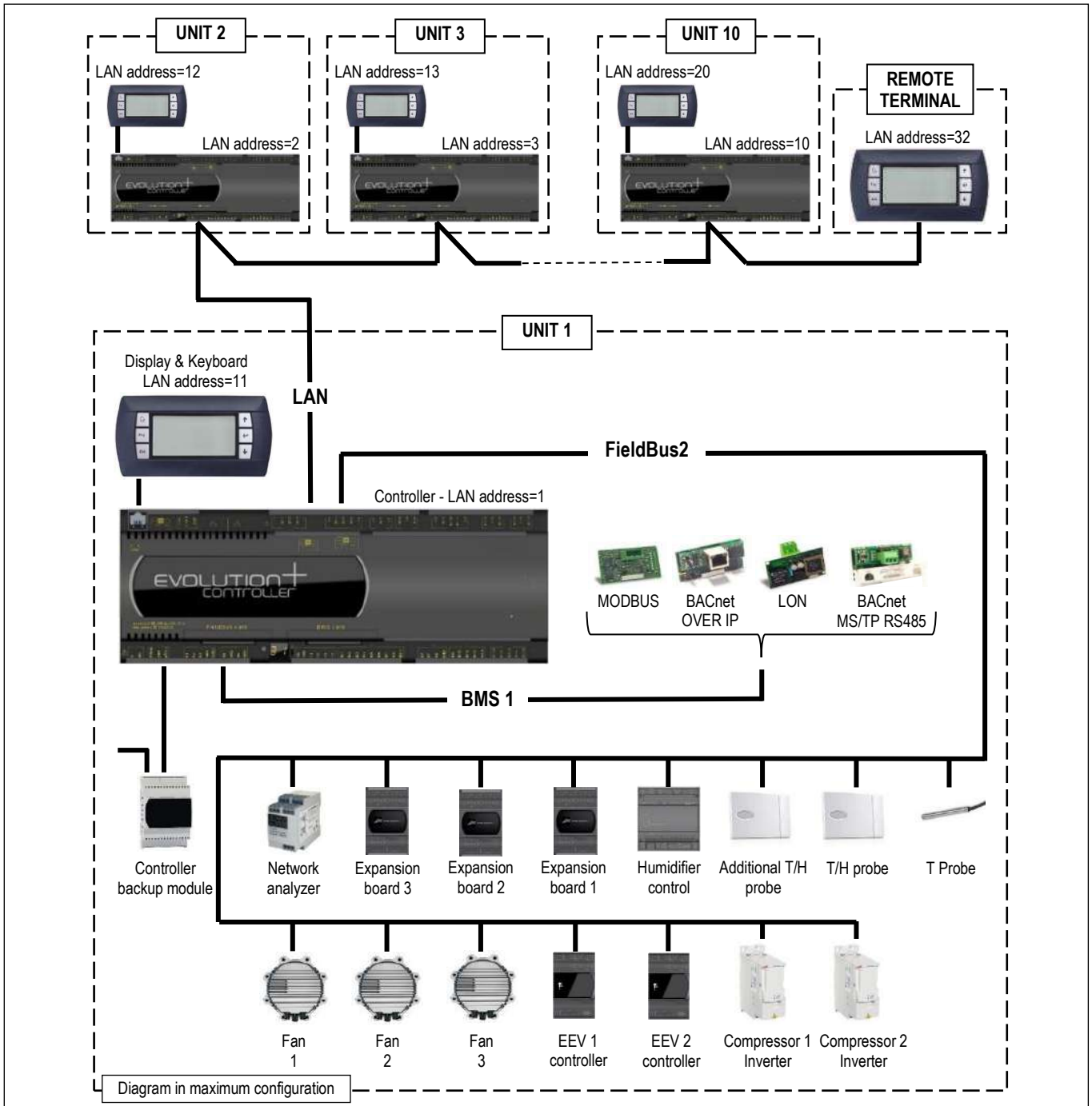
CONNECTIVITY

Through the optional serial port, the microprocessor control enables communication with the modern buildings BMS systems with the following protocols: MODBUS; LON; BACNET MS/TP RS485; BACNET OVER IP.

PASSWORD

- Level 1: On request of the End User. Allowing to reach USER menu
- Level 2: Asks to Service: Allowing to reach SERVICE menu
- Level 3: Asks to Service: Allowing to reach FACTORY menu
- No passwords request to enter: UNIT, SETPOINT, IN/OUT, CLOCK, HISTORY menu





LAN NETWORK

The LAN is part of the control software and it is possible to connect up to 10 units. This type of connection allows to control the units in coherent way, moreover the units can be controlled and managed from a shared remote terminal.

LAN ADDRESS LIST

| Unit # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Remote Terminal |
|----------------------|----|----|----|----|----|----|----|----|----|----|-----------------|
| Mother board address | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | -- |
| Terminal address | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 32 |

The unit connection to the local network (LAN) allows to perform the following functions:

- Balancing the operating hours among the different units by rotating the reserve units (Stand-by)
- Turning on the reserve units in case other units should turn off due to an alarm, maintenance or power feed interruption
- Turning on reserve units to offset the excessive thermal load
- Checking up to 10 units with a single user terminal (shared user terminal)



DEMAND LIMIT

Demand Limit function is part of the control software for machines with double refrigerant circuit. It allows to limit the absorbed current of the machine.
The function must be activated and configured. A digital inlet on electrical panel connecting terminals allows the remote enabling of the function with an external signal without tension.
The software allows to select the resources to disable (compressors, electric heaters,...).

TEMPERATURE PROBE ON AIR RETURN / DELIVERY



Temperature probe installed on the air return and delivery of the unit.
Standard temperature control and regulation on air delivery.
Is possible to select the optional accessory A791 "Air temperature control on suction air" to realize the temperature control and regulation on suction air.
With the following optional accessories installed temperature control and regulation are exclusively on suction air:

- A431 – Electric Heater;
- A432 – Extra power electric heaters;
- P131 – Hot water coil + 2-way valve.

CLOGGED FILTERS SENSOR



The system includes a differential pressure switch installed in the electrical panel or in the front of the indoor unit and the plastic hoses for the relief of the pressure upstream and downstream the air filters.

Control range: 0.3 ... 4.0 mbar (30 ... 400 Pa)
Differential for intervention: 0.15 mbar (15 Pa)

FLOOD SENSOR



The system includes an electronic relay installed in the electrical panel of the machine and a water detector.
The electrical connections for the probe and the alarm contact are present in the machine's terminal board.
Sensor is supplied to be connected and installed at customer care.

COMPRESSOR SOUNDPROOF JACKET



The system includes a soundproof jacket for each compressor to obtain a reduction of the sound level of the unit.

POSSIBLE AIR INTAKE FOR OVER VERSIONS

OVER VERSION - AIR INTAKE FROM THE BOTTOM

Thanks to the particular basement design, it is possible to have the intake from the bottom side. The air flow is equal to the nominal.

With this solution, it is necessary to foresee the optional blind frontal panels

OVER VERSION - AIR INTAKE FROM THE BACK SIDE

(Sizes E4L, E5L, E6L, E7L, E8L, E9L excluded)

It is possible to have the unit air intake from the back side.

Due to the limited size of the air intake, the air flow is limited to the 20% of the nominal one.

The air intake has to be made by Customer during installation.

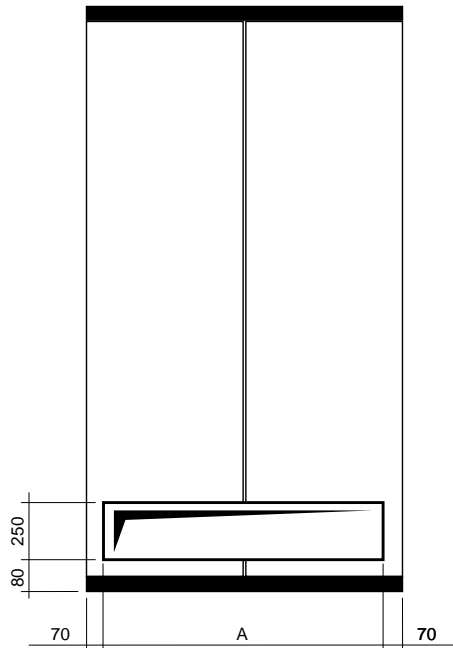
In case the air intake is used for fresh air, it is necessary the temperature / humidity probe reposition in front of the heat exchanger, to allow for optimum reading of the values of temperature / humidity.

The electric cable of the probe has sufficient length for the repositioning.

AIR INTAKE FROM THE BACK SIDE

Back side view

**OVER
E1 - E2 - E3**



| SIZE | | E1 | E2 | E3 |
|--------------|-------------------|-----|------|------|
| A | mm | 510 | 645 | 945 |
| Max air flow | m ³ /h | 600 | 1000 | 1500 |

REMOTE DRY COOLERS

Remote dry coolers for matching to air conditioners for IT Cooling.
The constructive solutions allow high application flexibility.
Horizontal air flow, from coil to fan.
The series has an independent power supply from the indoor unit.
Among the indoor unit and the dry cooler is necessary the electrical connection of the condensing proportional control signal and the alarms.

BVE DC SERIES



BVE DC-A

BVE DC-A: Dry coolers equipped with axial fans and coil with copper tubes and aluminium fins.
The machines are suitable for outdoor installation.

Equipped with AC axial fans.

The series is available in 3 versions:

- STD - No air flow and sound level reduction.
- LNO - Air flow reduction at 85% with consequent sound level reduction.
- ELN - Air flow reduction at 70% with further sound level reduction.

IMPORTANT

For further information about the units, please refer to "BVE DC" Data Book.

WARNING:

Please refer to ELCA WORLD selection program to calculate the technical data of the air conditioner according to the selected dry coolers in STD, LNO and ELN versions.

OPTIONAL ACCESSORIES: P121 – FRONT AIR INTAKE+BOTTOM PANEL

Available for OVER units.

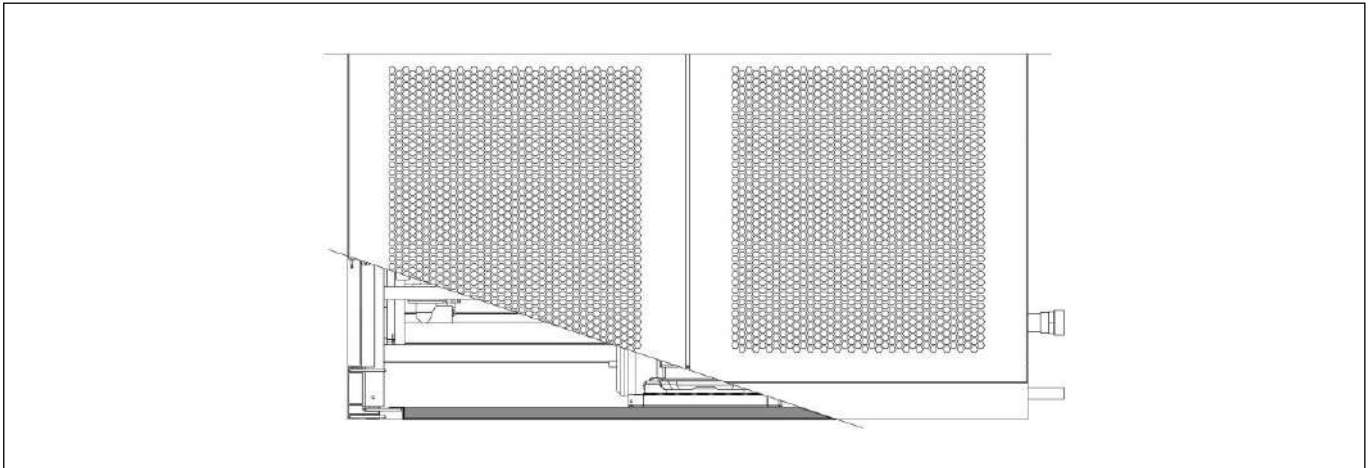
The optional is not compatible with "P122 Bottom air intake+blind panels" for OVER units.

With this accessory, it is possible a noise insulation of the machine base, when the machine is installed directly on floor as raised floor, wood floor etc.

The accessory includes:

- Panel in galvanized steel sheet.
- Noise insulation with special soundproof material.

The bottom panel is supplied assembled inside the unit base and does not modify the unit dimensions.



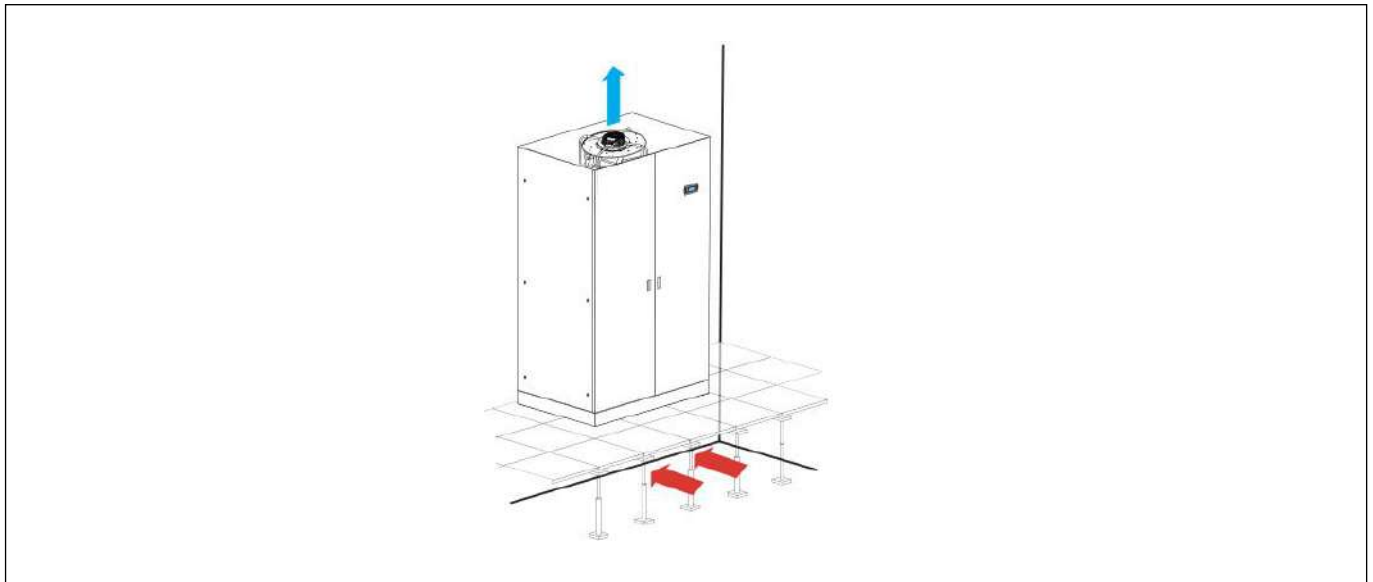
OPTIONAL ACCESSORIES: P122 - BOTTOM AIR INTAKE+BLIND PANELS

Available for OVER units.

The optional is not compatible with "P121 Front air intake+bottom panel" for OVER units.

Thanks to the design of the basement is possible the air suction from the unit bottom. The air flow rate is the nominal one

The accessory foresees the blind frontal panels.



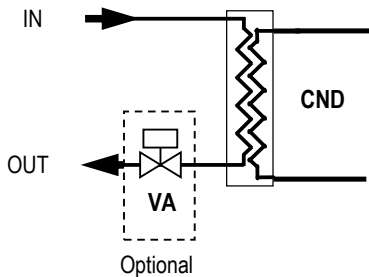
OPTIONAL ACCESSORIES: 601 – SOLENOID VALVE ON LIQUID LINE



The accessory has the function of closing the liquid line, in the event of the machine stopping or blackout, avoiding the risk of liquid refrigerant migration into the evaporator.

- Recommended accessory for:
- Machines equipped with electronic expansion valve.

OPTIONAL ACCESSORIES: P201 - CONDENSER + 2WAY BALL VALVE



CND Condenser
VA Condensing control valve

The optional accessory, installed on the condenser outlet side, includes a 2-way motorized valve for condensing control with 0÷10 VDC control actuator and emergency manual control.

The water flow control is achieved through a **2-way modulating ball valve with equal percentage flow control** ensured by the integrated characterizing disc.

This type of valve offers the following series of benefits:

- Equal percentage flow control.
- No peaks initial flow.
- Excellent stability control thanks to the integrated characterizing disc.
- Excellent characteristic in partialisation.
- Stability in control.
- Maintenance free.
- Self-cleaning.

CHARACTERISTICS OF THE 2-WAY BALL VALVE

- Closing seal with leakage rate in Class A (EN 12266-1)
- Maximum fluid pressure $P_s=1600\text{kPa}$
- Maximum closing pressure (Close-off) $\Delta P_s=1400\text{kPa}$

The rotative actuator is controlled by a signal 0 ... 10VDC from the microprocessor controller. The actuator is equipped with an emergency button for manual operation and is maintenance-free.

TECHNICAL DATA

| VERSION (1) | U / O | U / O | U / O | U / O | U / O |
|---------------------------------|-----------------------|----------|----------|----------|----------|
| MODEL | 012 M1 S | 018 M1 S | 022 M1 S | 030 M1 S | 047 M1 S |
| SIZE | E1 | E2 | E3 | E4L | E5L |
| CONDENSING CONTROL VALVE | | | | | |
| k_v – Flow coefficient | m^3/h | 4,0 | 6,3 | 6,3 | 10,0 |

| VERSION (1) | U / O | U / O | U / O | U | U |
|---------------------------------|-----------------------|----------|----------|----------|----------|
| MODEL | 042 M2 D | 068 M2 D | 094 M2 D | 120 M4 D | 150 M4 D |
| SIZE | E5L | E7L | E8L | E9L | E9L |
| CONDENSING CONTROL VALVE | | | | | |
| k_v – Flow coefficient | m^3/h | 16,0 | 25,0 | 25,0 | 40,0 |

1. U = Under, downflow / O = Over, upflow

IMPORTANT

For further information, please refer to chapter “VALVE PRESSURE DROP CALCULATION AS FUNCTION OF WATER FLOW RATE”

OPTIONAL ACCESSORIES: A548 - CONSTANT PREVALENCE



The optional is a differential pressure sensor with a 0...20mA output signal. The device is installed in the machine.

The sensor is connected to the microprocessor control of the indoor unit and allows the control of:

A548 - CONSTANT PREVALENCE

The system controls the air pressure in the raised floor (Under version) or in the duct (Over version). Through the relief piping of the room pressure (low pressure side) and the air supply of the fan (high pressure side) the fan rotation speed is controlled to keep the air pressure constant. Pressure control range from 0 to 100 Pa.

OPTIONAL ACCESSORIES: P091 - BACK-UP MODULE CONTROLLER



The optional is installed within the electrical panel.
The optional is not available for size E1.
The system powers the microprocessor for a few minutes in the event of a power failure or voltage surges, preventing the re-boot of the controller.

OPTIONAL ACCESSORIES: 383 – NUMBERED WIRINGS + UK REQUESTS

The machine's electrical cables are all numbered for easy identification. For the power section it is possible to change the colour for the UK market.

| CABLE | 383 – COLOUR FOR UK |
|--------------|---------------------|
| EARTH | YELLOW / GREEN |
| NEUTRAL | BLUE SKY |
| PHASE 1 (L1) | BROWN |
| PHASE 2 (L2) | BLACK |
| PHASE 3 (L3) | GREY |
| AUXILIARIES | RED |

OPTIONAL ACCESSORIES: 4181 – SERIAL CARD MODBUS



The card is factory installed.
Consult the Interface Manual for all technical information.

OPTIONAL ACCESSORIES: 4182 – SERIAL CARD LON



The card is factory installed.
The manufacturer will supply the serial card and .NXE file and a .XIF files necessary for LonWorks technicians to configure the network.
The board is programmed by the technician in charge of the integration.
Consult the Interface Manual for all technical information.

OPTIONAL ACCESSORIES: 4184 – SERIAL CARD BACNET MS/TP RS485



The card is factory installed.
The supervision network is set up by the technicians developing the BACnet interface.
The Modbus protocol database is used for interfacing.
Consult the Interface Manual for all technical information.

OPTIONAL ACCESSORIES: 4185 – SERIAL CARD BACNET OVER IP



The card is factory installed.
The supervision network is set up by the technicians developing the BACnet interface. The Modbus protocol database is used for interfacing.
The manufacturer will supply the card and .MIB file necessary for technicians to configure the network.
The board is programmed by the technician in charge of the integration.
Consult the Interface Manual for all technical information and what is necessary for Internet connection to view and modify variables.

OPTIONAL ACCESSORIES: A492 – WATER LEAKAGE DETECTOR + ADDITIONAL DETECTOR



The system includes an electronic relay installed in the electrical panel of the indoor machine and 2 water detectors to be connected in series.
The electrical connections for the probe and the alarm contact are present in the indoor machine's terminal board.
The sensors are supplied to be connected and installed at customer care.

OPTIONAL ACCESSORIES: A511 - SMOKE DETECTORS
OPTIONAL ACCESSORIES: A521 – FIRE DETECTORS

Is possible to install one or both of the following sensors. Sensors are supplied in mounting kit. Installation within the room at customer care.



A511 - SMOKE DETECTOR

The device is supplied in mounting kit.
The optical smoke detector senses the presence of combustion by-products (visible smoke) and activates an alarm.
The operating principle is based on the light scattering technique (Tyndall effect).
The device is in conformity to EN 54-7 standard.
Technical features:

| | | | |
|-----------------------|-------------------|---------------------|---------------------|
| Material | ABS | Relative humidity | <93% not-condensing |
| Power supply | 12...28 Vdc | Index of protection | IP 20 |
| Normal current | 50µA 24 Vdc | Testing by magnet | Yes |
| Alarm current | 25mA 24 Vdc | Relay | max. 1A 30Vdc |
| LED visibility | 360° (double led) | Signal repeater | 14mA 24 Vdc |
| Storage temperature | -10...+70°C | Covered area | 40m² max. |
| Operating temperature | -10...+70°C | Shielded connection | Min. 0.5 mm² |
| Max. speed air | 0.2 m/s | Colour | White |

Supplied with unit to be connected and installed at customer care close to the unit.



A521 - FIRE DETECTOR

The device is supplied in mounting kit.
The fire detector has been designed to identify temperatures at which fires may start. When the temperature exceeds the set threshold or when there is a rapid variation in temperature, the relay is activated to signal an alarm.
The device is in conformity to EN 54-5 standard.
Technical features:

| | | | |
|-----------------------|---------------------|---------------------|---------------|
| Material | ABS | Index of protection | IP 20 |
| Power supply | 12...28 Vdc | Testing by magnet | Yes |
| Normal current | 50µA 24 Vdc | Relay | max. 1A 30Vdc |
| Alarm current | 25mA 24 Vdc | Signal repeater | 14mA - 24 Vdc |
| LED visibility | 360° (double LED) | Alarm temperature | 62°C |
| Storage temperature | -10...+70°C | Covered area | 40m² max. |
| Operating temperature | -10...+70°C | Shielded connection | Min. 0.5 mm² |
| Relative humidity | <93% non-condensing | Colour | White |

Supplied with unit to be connected and installed at customer care close to the unit.

OPTIONAL ACCESSORIES: P141 – ANALOGUE SET-POINT COMPENSATION

Analogue set point compensation according to an external analogue signal at Customer care.
The microprocessor control, through the additional module "expansion card", can manage a compensation signal of the return air setpoint by analogue input (0...1V; 0...5V; 0.5...4.5V; 4...20mA; 0...20mA). The compensation curve allows to assign a temperature setpoint offset respectively to the minimum and maximum signal managed by the input.



OPTIONAL ACCESSORIES: P181 – NETWORK ANALYZER
OPTIONAL ACCESSORIES: P182 – NETWORK ANALYZER+OPTIONAL
OPTIONAL ACCESSORIES: P183 – KIT NETWORK ANALYZER
OPTIONAL ACCESSORIES: P184 – KIT NETWORK ANALYZER+OPTIONAL



INTERNAL installation

This device provides continuous measurement of power consumption, monitoring current, voltage and power. These values are sent to unit microprocessor via RS485 serial cable, as shown on the unit wiring diagram.

The displayed variables are:

- Phase to phase voltage, only for three-phase units;
- Phase voltage (phase-neutral);
- Phase current;
- Neutral current only for three-phase units;
- Active phase power, only for three-phase units;
- Total active power;
- Active energy;
- Hour counts

INSTALLATION

| Frame | Power Supply | Installation | Code |
|-------|--------------|---------------------------------------|-----------------|
| E1 | 400/3+N/50 | EXTERNAL to the unit, supplied in kit | P183 / P184 (*) |
| E2 | 400/3+N/50 | EXTERNAL to the unit, supplied in kit | P183 / P184 (*) |
| E3 | 400/3+N/50 | EXTERNAL to the unit, supplied in kit | P183 / P184 (*) |
| E4L | 400/3+N/50 | INTERNAL (on unit electrical panel) | P181 / P182 (*) |
| E5L | 400/3+N/50 | INTERNAL (on unit electrical panel) | P181 / P182 (*) |
| E7L | 400/3+N/50 | INTERNAL (on unit electrical panel) | P181 / P182 (*) |
| E8L | 400/3+N/50 | INTERNAL (on unit electrical panel) | P181 / P182 (*) |
| E9L | 400/3+N/50 | INTERNAL (on unit electrical panel) | P181 / P182 (*) |

(*) P182, P184 for units with optional (with electric heaters and/or humidifier)



EXTERNAL installation

INTERNAL INSTALLATION

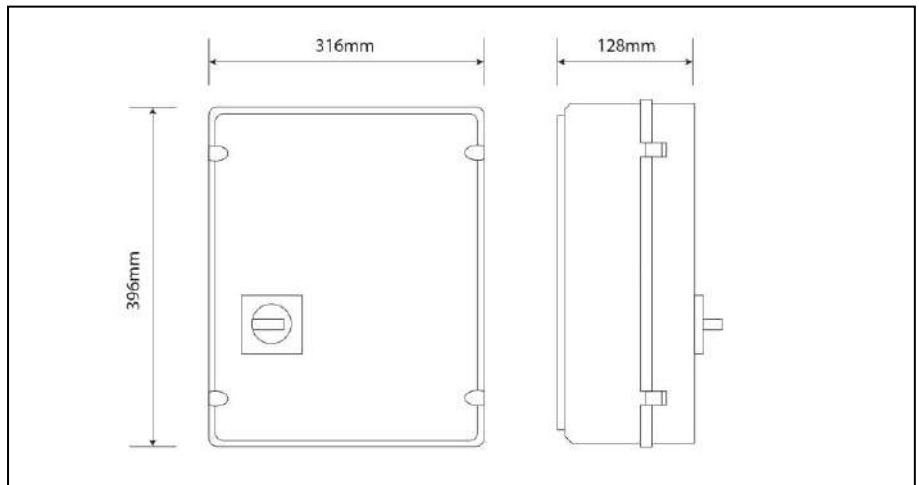
The optional is installed within the electrical box downstream the main switch with door safety lock and includes:

- Network transducer;
- Current transformers, one for each power supply phase cable.

MOUNTING KIT

The optional is supplied in box for external installation to the machine with the dimensions showed in the figure below, and includes:

- Main switch with door lock safety;
- Fuse;
- Network transducer;
- Current transformers, one for each power supply phase cable;
- Terminals.



OPTIONAL ACCESSORIES: A812 – FREE-COOLING DIRECT CONTROL

Preparation of the machine and the electrical panel for the direct free-cooling system "P034 Intake free-cooling plenum "

OPTIONAL ACCESSORIES: P131 – HOT WATER COIL+2WAY VALVE



Hot water heating system installed downstream the main cooling coil.
The optional accessory is factory installed and don't modify the overall dimensions of the unit.
Components:

- Heat exchanger coil with internally corrugated copper tubes and high efficiency aluminium fins, specifically developed to provide high heat transfer and lower pressure drops.
- 2-way motorized valve for water flow regulation with 0÷10 VDC control actuator and emergency manual control.
- Temperature probes on water inlet
- Frame in galvanized steel.

The hot water heating system can be installed in combination with the "A431 electric heater". The operation is alternate with priority to the hot water heating coil.

About water quality, please refer to chapter "WATER QUALITY OF THE HYDRAULIC CIRCUITS"
Temperature control on suction air.

TECHNICAL DATA

| VERSION (1) | | U / O | U / O | U / O | U / O | U / O |
|-----------------------------|-------------------|-------------|-------------|-------------|-------------|------------|
| MODEL | | 012 M1 S | 018 M1 S | 022 M1 S | 030 M1 S | 047 M1 S |
| SIZE | | E1 | E2 | E3 | E4L | E5L |
| THERMAL CAPACITY (2) | kW | 24,8 | 35,5 | 45,9 | 83,9 | 103 |
| HEATING COIL | | | | | | |
| Water flow rate (2) | m ³ /h | 2,17 | 3,11 | 4,02 | 7,36 | 9,01 |
| dP coil + valve (2) | kPa | 26,6 | 25,9 | 23,9 | 10,4 | 21,1 |
| Water volume | l | 2,6 | 2,6 | 3,9 | 6,9 | 9,1 |
| NET WEIGHT (3) | kg | 15 | 18 | 25 | 35 | 42 |
| HYDRAULIC CONNECTIONS | | | | | | |
| WATER INLET / OUTLET | ISO 7/1 - R Ø | 3/4" | 3/4" | 1" | 1 1/4" | 1 1/2" |

| VERSION (1) | | U / O | U / O | U / O | U | U |
|-----------------------------|-------------------|------------|------------|------------|------------|------------|
| MODEL | | 042 M2 D | 068 M2 D | 094 M2 D | 120 M4 D | 150 M4 D |
| SIZE | | E5L | E7L | E8L | E9L | E9L |
| THERMAL CAPACITY (2) | kW | 103 | 155 | 175 | 247 | 237 |
| HEATING COIL | | | | | | |
| Water flow rate (2) | m ³ /h | 9,01 | 13,6 | 15,4 | 21,6 | 20,7 |
| dP coil + valve (2) | kPa | 21,1 | 6,94 | 9,62 | 21,5 | 20,4 |
| Water volume | l | 9,1 | 12,3 | 14,2 | 16,9 | 16,9 |
| NET WEIGHT (3) | kg | 42 | 57 | 65 | 75 | 75 |
| HYDRAULIC CONNECTIONS | | | | | | |
| WATER INLET / OUTLET | ISO 7/1 - R Ø | 1 1/2" | 2" | 2" | 2" | 2" |

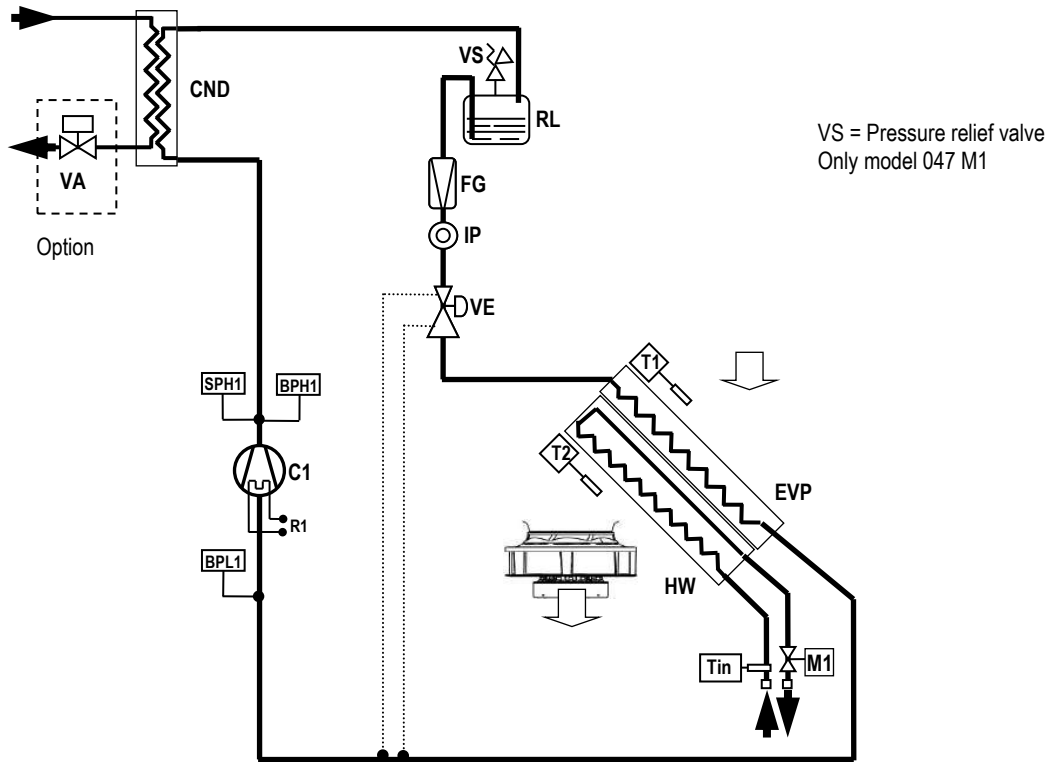
1. U = Under, downflow / O = Over, upflow

2. Characteristics referred to entering air at 20°C-50%RH with hot water temperature 70/60°C - 0% glycol.

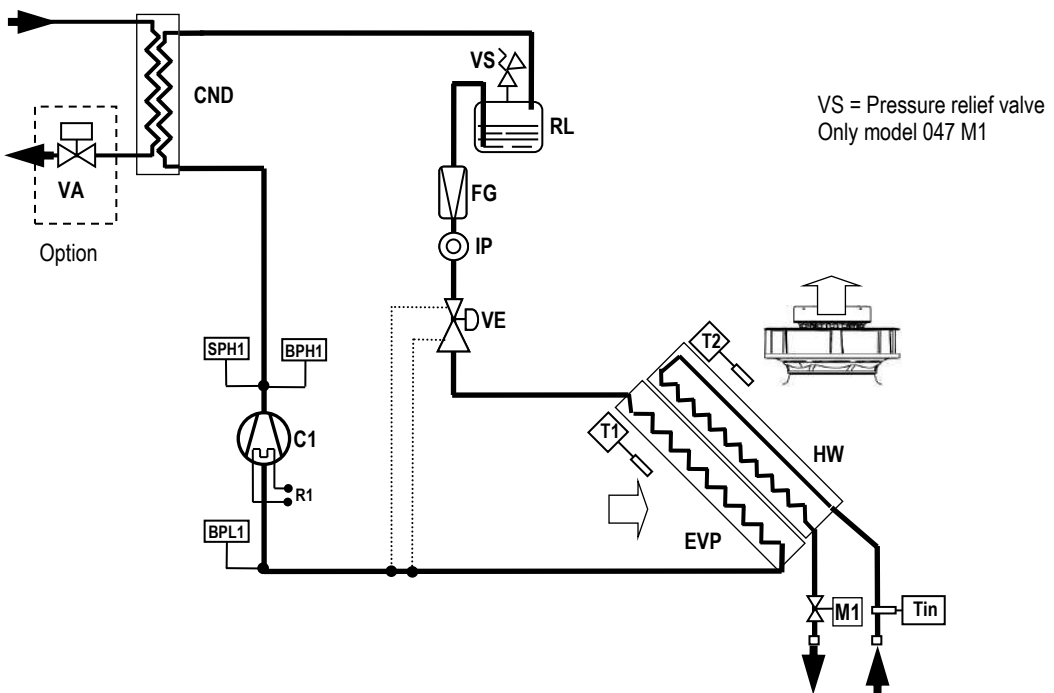
3. Value to be added to the weight of the standard unit. Does not include the weight of the water content.

HOT WATER HEATING HYDRAULIC / REFRIGERANT CIRCUIT

UNDER - SINGLE REFRIGERANT CIRCUIT



OVER - SINGLE REFRIGERANT CIRCUIT

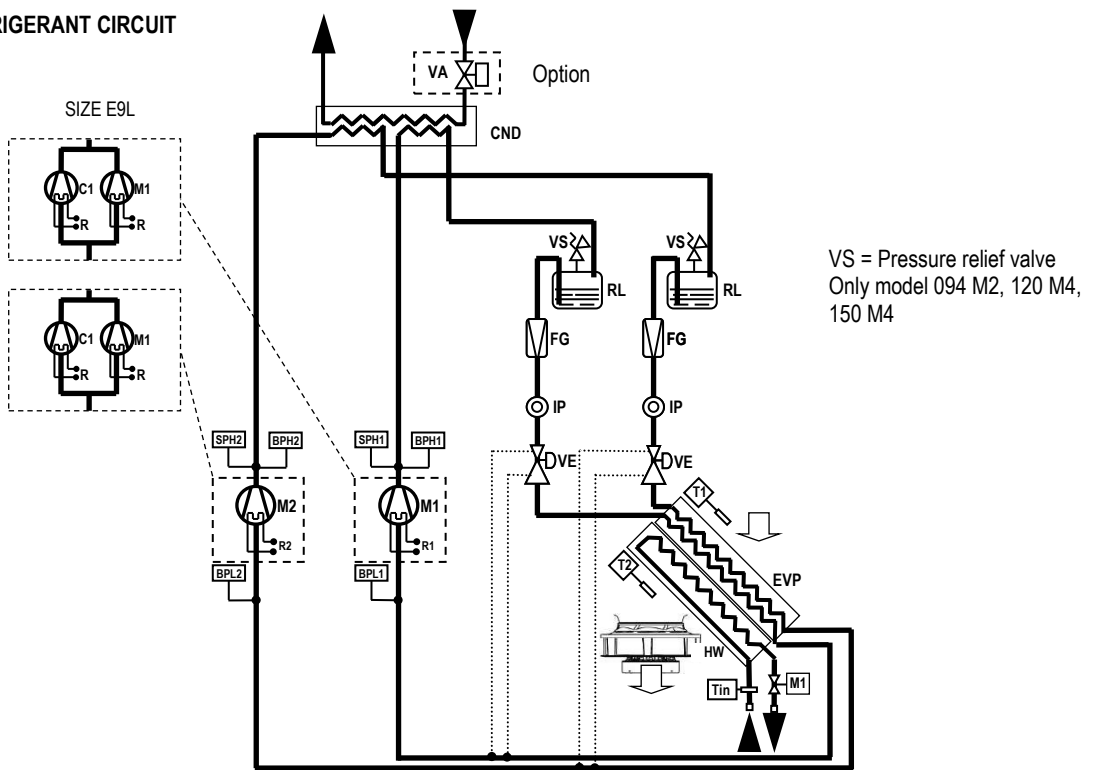


LEGENDA

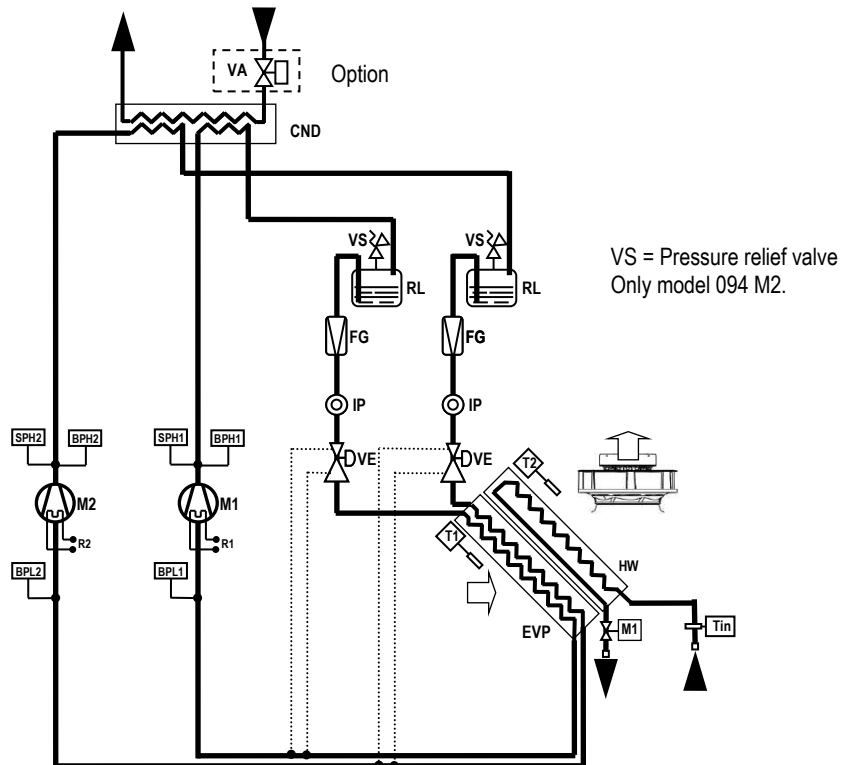
| | | | | | |
|-----|---------------------------|-----|------------------------------------|----|---------------------|
| C1 | BLDC inverter compressor | BPH | High pressure transducer. | IP | Sight glass. |
| R1 | Crankcase heater | VA | 2-way valve for condensing control | VE | Expansion valve. |
| CND | Condenser. | SPH | High pressure switch | T | Temperature probes. |
| EVP | Evaporator | M1 | Hot water 2-way valve | RU | Valves |
| HW | Hot water coil | VS | Pressure relief valve. | RL | Liquid receiver |
| BPH | High pressure transducer. | FG | Refrigerant filter. | | |

HOT WATER HEATING HYDRAULIC / REFRIGERANT CIRCUIT

UNDER - DOUBLE REFRIGERANT CIRCUIT



OVER - DOUBLE REFRIGERANT CIRCUIT



LEGENDA

- | | | | | | |
|--------|-------------------------------|-----|---------------------------|----|---------------------|
| M1...2 | BLDC inverter compressor 1, 2 | BPH | High pressure transducer. | IP | Sight glass. |
| C1...2 | On/off compressor 1, 2 | BPL | Low pressure transducer. | VE | Expansion valve. |
| R1...2 | Crankcase heater 1, 2 | SPH | High pressure switch | T | Temperature probes. |
| CND | Condenser. | M1 | Hot water 2-way valve | RU | Valves |
| EVP | Evaporator | VS | Pressure relief valve. | RL | Liquid receiver |
| HW | Hot water coil | FG | Refrigerant filter. | | |

2-WAY BALL VALVE FOR HOT WATER FLOW CONTROL



The water flow control in the finned coil is achieved through a **2-way modulating ball valve with equal percentage flow control** ensured by the integrated characterizing disc.

This type of valve offers the following series of benefits:

- Equal percentage flow control.
- No peaks initial flow.
- Excellent stability control thanks to the integrated characterizing disc.
- Excellent characteristic in partialisation.
- Stability in control.
- Maintenance free.
- Self-cleaning.

CHARACTERISTICS OF THE 2-WAY BALL VALVE

- Closing seal with leakage rate in Class A (EN 12266-1)
- Maximum fluid pressure $P_s=1600\text{kPa}$
- Maximum closing pressure (Close-off) $\Delta P_s=1400\text{kPa}$

The rotative actuator is controlled by a signal 0 ... 10VDC from the microprocessor controller. The actuator is equipped with an emergency button for manual operation and is maintenance-free.

OPTIONAL ACCESSORIES: A431 – ELECTRIC HEATERS

OPTIONAL ACCESSORIES: A432 – EXTRA POWER ELECTRIC HEATERS



A431 – ELECTRIC HEATERS

Electric heater consisting of finned aluminum elements, ensuring low surface temperature and deleting the air ionization problems. The optional is installed downstream the main cooling coil.

In electric heaters with three working steps the activation is binary type.

Components:

- Electric heater in aluminium armoured elements with integral fins
- Electrical control
- Safety thermostat.

The electric heater can be installed in combination with the "P131 hot water coil + 2-way valve". The operation is alternate with priority to the hot water heating coil.

Temperature control on suction air.

TECHNICAL DATA

| VERSION (1) | | U / O | U / O | U / O | U / O | U / O |
|-------------------------|-----------|------------|------------|------------|------------|-------------|
| MODEL | | 012 M1 S | 018 M1 S | 022 M1 S | 030 M1 S | 047 M1 S |
| SIZE | | E1 | E2 | E3 | E4L | E5L |
| THERMAL CAPACITY | kW | 5,1 | 5,1 | 6,0 | 9,0 | 13,5 |
| Absorbed current (OA) | A | 7,4 | 7,4 | 8,7 | 13,0 | 19,5 |
| First working step | kW | 5,1 | 5,1 | 3,0 | 3,0 | 4,5 |
| Second working step | kW | - | - | 3,0+3,0 | 6,0 | 9,0 |
| Third working step | kW | - | - | - | 3,0 + 6,0 | 4,5+9,0 |
| NET WEIGHT (2) | kg | 4 | 4 | 7 | 15 | 10 |

| VERSION (1) | | U / O | U / O | U / O | U | U |
|-------------------------|-----------|-------------|-------------|-------------|-------------|-------------|
| MODEL | | 042 M2 D | 068 M2 D | 094 M2 D | 120 M4 D | 150 M4 D |
| SIZE | | E5L | E7L | E8L | E9L | E9L |
| THERMAL CAPACITY | kW | 13,5 | 13,5 | 18,0 | 18,0 | 18,0 |
| Absorbed current (OA) | A | 19,5 | 19,5 | 26,0 | 26,0 | 26,0 |
| First working step | kW | 4,5 | 4,5 | 4,5 | 4,5 | 4,5 |
| Second working step | kW | 9,0 | 9,0 | 13,5 | 13,5 | 13,5 |
| Third working step | kW | 4,5+9,0 | 4,5+9,0 | 4,5+13,5 | 4,5+13,5 | 4,5+13,5 |
| NET WEIGHT (2) | kg | 10 | 9,5 | 11 | 11 | 11 |

1. U = Under, downflow / O = Over, upflow
2. Value to be added to the weight of the standard unit.

A432 – EXTRA POWER ELECTRIC HEATERS

The optional is not available for size E1, E2

The components are the same of the standard accessory

It is not possible to combine the extra power electric heaters with the "P131 hot water coil + 2-way valve"
Temperature control on suction air.

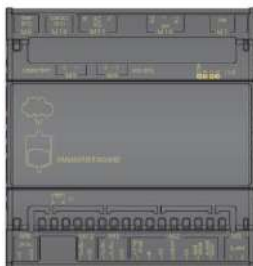
TECHNICAL DATA

| VERSION (1) | | U / O | U / O | U / O | U / O | U / O |
|-------------------------|-----------|----------|----------|------------|-------------|-------------|
| MODEL | | 012 M1 S | 018 M1 S | 022 M1 S | 030 M1 S | 047 M1 S |
| SIZE | | E1 | E2 | E3 | E4L | E5L |
| THERMAL CAPACITY | kW | - | - | 9,0 | 13,5 | 18,0 |
| Absorbed current (OA) | A | - | - | 13,0 | 13,0 | 26,0 |
| First working step | kW | - | - | 4,5 | 4,5 | 4,5 |
| Second working step | kW | - | - | 4,5+4,5 | 9,0 | 13,5 |
| Third working step | kW | - | - | - | 4,5+9,0 | 4,5+13,5 |
| NET WEIGHT (2) | kg | - | - | 7 | 9,5 | 12 |

| VERSION (1) | | U / O | U / O | U / O | U | U |
|-------------------------|-----------|-------------|-------------|-------------|-------------|-------------|
| MODEL | | 042 M2 D | 068 M2 D | 094 M2 D | 120 M4 D | 150 M4 D |
| SIZE | | E5L | E7L | E8L | E9L | E9L |
| THERMAL CAPACITY | kW | 18,0 | 18,0 | 27,0 | 27,0 | 27,0 |
| Absorbed current (OA) | A | 26,0 | 26,0 | 39,0 | 39,0 | 39,0 |
| First working step | kW | 4,5 | 4,5 | 9,0 | 9,0 | 9,0 |
| Second working step | kW | 13,5 | 13,5 | 18,0 | 18,0 | 18,0 |
| Third working step | kW | 4,5+13,5 | 4,5+13,5 | 9,0+18,0 | 9,0+18,0 | 9,0+18,0 |
| NET WEIGHT (2) | kg | 12 | 11,5 | 14,5 | 14,5 | 14,5 |

1. U = Under, downflow / O = Over, upflow
2. Value to be added to the weight of the standard unit.

OPTIONAL ACCESSORIES: 4301 – STEAM HUMIDIFIER 3KG/H
OPTIONAL ACCESSORIES: 4303 – STEAM HUMIDIFIER 8KG/H
OPTIONAL ACCESSORIES: 4305 – STEAM HUMIDIFIER 15KG/H



Humidifier control board

Modulating steam humidifier with immersed electrodes fitted with safety and running accessories. The optional includes the control board.

The optional requires mandatory accessory "P161 T/rH air intake sensor".

The optional is factory installed and requires only water filling connection.

Humidifier water charge and discharge pipes are not supplied.

It is recommended to install a filter and a shut-off valve on the pipe to the water inlet.

This humidifier produces non-pressurized steam by electrodes immersed in the water inside the cylinder: they bring the electric phase in the water that works as an electrical resistance and overheats. The steam so produced is distributed with dedicated distributors and used for ambient humidification or for industrial processes.

CHARACTERISTICS OF THE SUPPLY WATER

The quality of the used water influences the evaporation process, so the humidifier can be fed with **not-treated water, only when potable and non-demineralised.**

LIMIT VALUES

| | | Min | Max |
|---------------------------------------|-------------------------------------|---------|-----|
| Hydrogen ions | pH | 7 | 8,5 |
| Specific conductivity at 20°C | $\sigma_{R, 20^\circ C}$ $\mu S/cm$ | 350 | 750 |
| Total dissolved solids | TDS mg/l | (1) | (1) |
| Dry residue at 180°C | R ₁₈₀ mg/l | (1) | (1) |
| Total hardness | TH mg/l CaCO ₃ | 100 (2) | 400 |
| Temporary hardness | mg/l CaCO ₃ | 60 (3) | 300 |
| Iron + Manganese | mg/l Fe + Mn | 0 | 0,2 |
| Chlorides | ppm Cl | 0 | 30 |
| Silica | mg/l SiO ₂ | 0 | 20 |
| Residual chlorine | mg/l Cl ⁻ | 0 | 0,2 |
| Calcium sulphate | mg/l CaSO ₄ | 0 | 100 |
| Metallic impurities | mg/l | 0 | 0 |
| Solvents, diluents, soaps, lubricants | mg/l | 0 | 0 |

(1) Values depending on specific conductivity; in general: TDS $\cong 0,93 * \sigma_{R, 20^\circ C}$; R₁₈₀ $\cong 0,65 * \sigma_{R, 20^\circ C}$

(2) Not lower than 200% of the chloride content in mg/l di Cl⁻

(3) Not lower than 300% of the chloride content in mg/l di Cl⁻

WARNING:

- Use only with drinking water.
- There is no reliable relationship between hardness and water conductivity
- Do not treat water with softeners! This could cause corrosion of the electrodes or the formation of foam, leading to potential operating problems or failures.
- Do not add disinfectants or corrosion inhibitors to water, as these substances are potentially irritant.
- Is absolutely forbidden to use well water, industrial water or water drawn from cooling circuits; in general, avoid using potentially contaminated water, either from a chemical or bacteriological point of view.

TECHNICAL DATA

| VERSION (1) | | U / O | U / O | U / O | U / O | U / O |
|----------------------------------|-------------|------------|------------|------------|------------|------------|
| MODEL | | 012 M1 S | 018 M1 S | 022 M1 S | 030 M1 S | 047 M1 S |
| SIZE | | E1 | E2 | E3 | E4L | E5L |
| VAPOUR PRODUCTION | kg/h | 3,0 | 3,0 | 3,0 | 8,0 | 8,0 |
| Power input | kW | 2,3 | 2,3 | 2,3 | 6,0 | 6,0 |
| Absorbed current (OA) | A | 3,2 | 3,2 | 3,2 | 8,7 | 8,7 |
| Max absorbed current (OA) | A | 4,5 | 4,5 | 4,5 | 12,4 | 12,4 |
| Water content | l | 3,9 | 3,9 | 3,9 | 6,4 | 6,4 |
| Max water supply pressure | Bar | 1÷8 | 1÷8 | 1÷8 | 1÷8 | 1÷8 |
| NET WEIGHT (2) | kg | 4 | 4 | 4 | 10 | 10 |
| HYDRAULIC CONNECTION | | | | | | |
| WATER INLET - ISO 228/1 – G F | Ø | 3/4" | 3/4" | 3/4" | - | - |
| WATER INLET - ISO 228/1 – G M | Ø | - | - | - | 3/4" | 3/4" |
| WATER OUTLET – internal diameter | Ø mm | 19 | 19 | 19 | - | - |
| WATER OUTLET – external diameter | Ø mm | - | - | - | 19 | 19 |

1. U = Under, downflow / O = Over, upflow

2. Value to be added to the weight of the standard unit. Does not include the weight of the water content.

TECHNICAL DATA

| MODEL | | U / O | U / O | U / O | U | U |
|----------------------------------|------|----------|----------|----------|----------|----------|
| SIZE | | 042 M2 D | 068 M2 D | 094 M2 D | 120 M4 D | 150 M4 D |
| VERSION (1) | | E5L | E7L | E8L | E9L | E9L |
| VAPOUR PRODUCTION | kg/h | 8,0 | 8,0 | 8,0 | 8,0 | 8,0 |
| Power input | kW | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 |
| Absorbed current (OA) | A | 8,7 | 8,7 | 8,7 | 8,7 | 8,7 |
| Max absorbed current (OA) | | 12,4 | 12,4 | 12,4 | 12,4 | 12,4 |
| Water content | l | 6,4 | 6,4 | 6,4 | 6,4 | 6,4 |
| Max water supply pressure | Bar | 1÷8 | 1÷8 | 1÷8 | 1÷8 | 1÷8 |
| NET WEIGHT (2) | kg | 10 | 10 | 10 | 10 | 10 |
| HYDRAULIC CONNECTION | | | | | | |
| WATER INLET - ISO 228/1 – G F | Ø | - | - | - | - | - |
| WATER INLET - ISO 228/1 – G M | Ø | 3/4" | 3/4" | 3/4" | 3/4" | 3/4" |
| WATER OUTLET – internal diameter | Ø mm | - | - | - | - | - |
| WATER OUTLET – external diameter | Ø mm | 19 | 19 | 19 | 19 | 19 |

1. U = Under, downflow / O = Over, upflow
2. Value to be added to the weight of the standard unit. Does not include the weight of the water content.

EXTRA POWER HUMIDIFIERS

The optional is not available for size E1, E2, E3.

The components are the same of the standard accessory

TECHNICAL DATA

| VERSION (1) | | U / O | U / O | U / O | U / O | U / O |
|----------------------------------|------|----------|----------|----------|----------|----------|
| MODEL | | 012 M1 S | 018 M1 S | 022 M1 S | 030 M1 S | 047 M1 S |
| SIZE | | E1 | E2 | E3 | E4L | E5L |
| VAPOUR PRODUCTION | kg/h | -- | -- | -- | 15,0 | 15,0 |
| Power input | kW | -- | -- | -- | 11,3 | 11,3 |
| Absorbed current (OA) | A | -- | -- | -- | 16,2 | 16,2 |
| Max absorbed current (OA) | A | -- | -- | -- | 23 | 23 |
| Water content | l | -- | -- | -- | 10,3 | 10,3 |
| Max water supply pressure | Bar | -- | -- | -- | 1÷8 | 1÷8 |
| NET WEIGHT (2) | kg | -- | -- | -- | 16 | 16 |
| HYDRAULIC CONNECTION | | | | | | |
| WATER INLET - ISO 228/1 – G F | Ø | -- | -- | -- | - | - |
| WATER INLET - ISO 228/1 – G M | Ø | -- | -- | -- | 3/4" | 3/4" |
| WATER OUTLET – internal diameter | Ø mm | -- | -- | -- | - | - |
| WATER OUTLET – external diameter | Ø mm | -- | -- | -- | 19 | 19 |

TECHNICAL DATA

| VERSION (1) | | U / O | U / O | U / O | U | U |
|----------------------------------|------|----------|----------|----------|----------|----------|
| MODEL | | 042 M2 D | 068 M2 D | 094 M2 D | 120 M4 D | 150 M4 D |
| SIZE | | E5L | E7L | E8L | E9L | E9L |
| VAPOUR PRODUCTION | kg/h | 15,0 | 15,0 | 15,0 | 15,0 | 15,0 |
| Power input | kW | 11,3 | 11,3 | 11,3 | 11,3 | 11,3 |
| Absorbed current (OA) | A | 16,2 | 16,2 | 16,2 | 16,2 | 16,2 |
| Max absorbed current (OA) | A | 23 | 23 | 23 | 23 | 23 |
| Water content | l | 10,3 | 10,3 | 10,3 | 10,3 | 10,3 |
| Max water supply pressure | Bar | 1÷8 | 1÷8 | 1÷8 | 1÷8 | 1÷8 |
| NET WEIGHT (2) | kg | 16 | 16 | 16 | 16 | 16 |
| HYDRAULIC CONNECTION | | | | | | |
| WATER INLET - ISO 228/1 – G F | Ø | - | - | - | - | - |
| WATER INLET - ISO 228/1 – G M | Ø | 3/4" | 3/4" | 3/4" | 3/4" | 3/4" |
| WATER OUTLET – internal diameter | Ø mm | - | - | - | - | - |
| WATER OUTLET – external diameter | Ø mm | 19 | 19 | 19 | 19 | 19 |

1. U = Under, downflow / O = Over, upflow
2. Value to be added to the weight of the standard unit. Does not include the weight of the water content.

OPTIONAL ACCESSORIES : P051 – DEHUMIDIFICATION FUNCTION

The optional requires mandatory accessory “P161 T/rH air intake sensor”.

Components:

- T / rH air intake sensor.
- Electronic control system of the dew point temperature for the combined intervention of cooling capacity and air flow.

OPTIONAL ACCESSORIES: P161 - T/RH AIR INTAKE SENSOR

OPTIONAL ACCESSORIES: P071 - REMOTE T/RH PROBE



P161: T/RH AIR INTAKE SENSOR

The accessory replaces the temperature sensor installed on the air intake in the unit and allows the displaying of the relative humidity room value

The sensor is mandatorily required with following option:

- 4301 / 4303 / 4305 Humidifier;
- P161 Dehumidification function;
- P034 Intake free-cooling plenum.

P071: REMOTE T/RH PROBE

The accessory is added to the standard temperature sensor or to the temperature / humidity sensor (optional) on the machine air intake. For indoor installation in a specific point of the room to be conditioned.

OPTIONAL ACCESSORIES: 4666 – EXTERNAL AIR PROBE



The probe must be installed protected against atmospheric agent and allows the displaying of the external air temperature.

The sensor is mandatorily required with following option:

- P034 Intake free-cooling plenum.

OPTIONAL ACCESSORIES: P111 – DUAL POWER SUPPLY

OPTIONAL ACCESSORIES: P112 – DUAL POWER SUPPLY + OPTIONAL

OPTIONAL ACCESSORIES: P113 – KIT DUAL POWER SUPPLY

OPTIONAL ACCESSORIES: P114 – KIT DUAL POWER SUPPLY + OPTIONAL



The motorised changeover switches automatically manage changeover under load between two three-phase power supplies, or manually for emergency operations.

These devices are suitable for low voltage systems with interruption of the supply to the load during transfer.

The model supplied in the automatic version checks the source and switches over automatically, based on configurable parameters.

OPEN TRANSITION TYPE TRANSFER SWITCH WITH A MINIMUM INTERRUPTION OF THE SUPPLY DURING TRANSFER.

To maintain the microprocessor powered and avoid its restarts it is suggested the “P091 Back-up module controller” optional accessory. The back-up module guarantees the microprocessor power supply for a few minutes, in case of supply voltage failure.

INSTALLATION

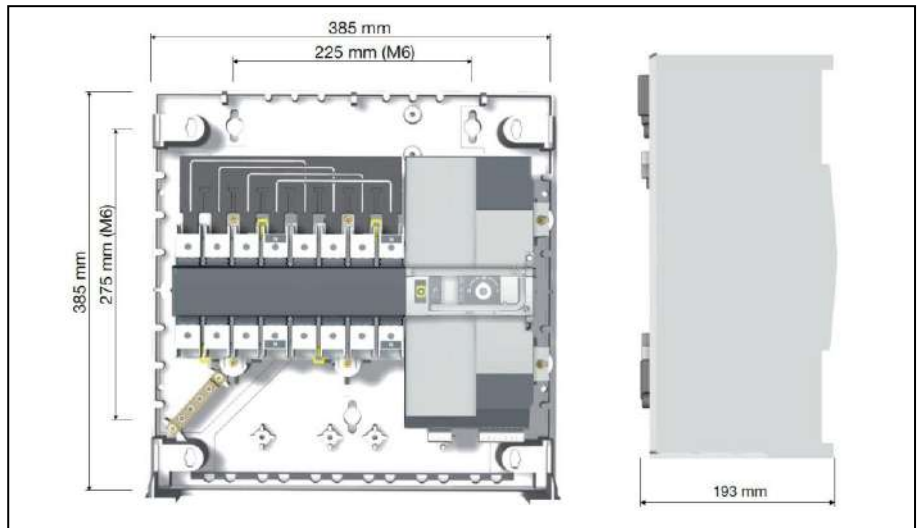
| Frame | Power Supply | Installation | Code |
|-------|--------------|---------------------------------------|----------------|
| E1 | 400/3+N/50 | EXTERNAL to the unit, supplied in kit | P113, P114 (*) |
| E2 | 400/3+N/50 | EXTERNAL to the unit, supplied in kit | P113, P114 (*) |
| E3 | 400/3+N/50 | EXTERNAL to the unit, supplied in kit | P113, P114 (*) |
| E4L | 400/3+N/50 | EXTERNAL to the unit, supplied in kit | P113, P114 (*) |
| E5L | 400/3+N/50 | EXTERNAL to the unit, supplied in kit | P113, P114 (*) |
| E7L | 400/3+N/50 | EXTERNAL to the unit, supplied in kit | P113, P114 (*) |
| E8L | 400/3+N/50 | EXTERNAL to the unit, supplied in kit | P113, P114 (*) |
| E9L | 400/3+N/50 | EXTERNAL to the unit, supplied in kit | P113, P114 (*) |

(*) P114 for units with optional (with electric heaters and/or humidifier)



MOUNTING KIT

For EXTERNAL installation, the optional accessory is supplied in special box with IP 3X ingress protection, with the dimensions shown in the figure below.



OPTIONAL ACCESSORIES: A381 - DRAIN PUMP



A plastic case contains the vertical type pump, the water tank with float plus safety switch and hydraulic and electric connection.

Together the pump 10 linear meters anti-crushing plastic discharge spiral tube is supplied

The optional has to be installed as shown in the documentation delivered together with the unit.

Wiring includes power supply and an alarm, displayed on microprocessor, that includes motor pump thermal protection and tank overflow.

The condensate discharge pump operation is fully automatic.

WARNING

For all the machines the optional accessory is supplied in mounting kit.

TECHNICAL DATA

Power supply: 230V~ 50Hz

Electrical data: 70W – 0,67A

Maximum water flow: 500 l/h

Maximum delivery height: 5.0 m

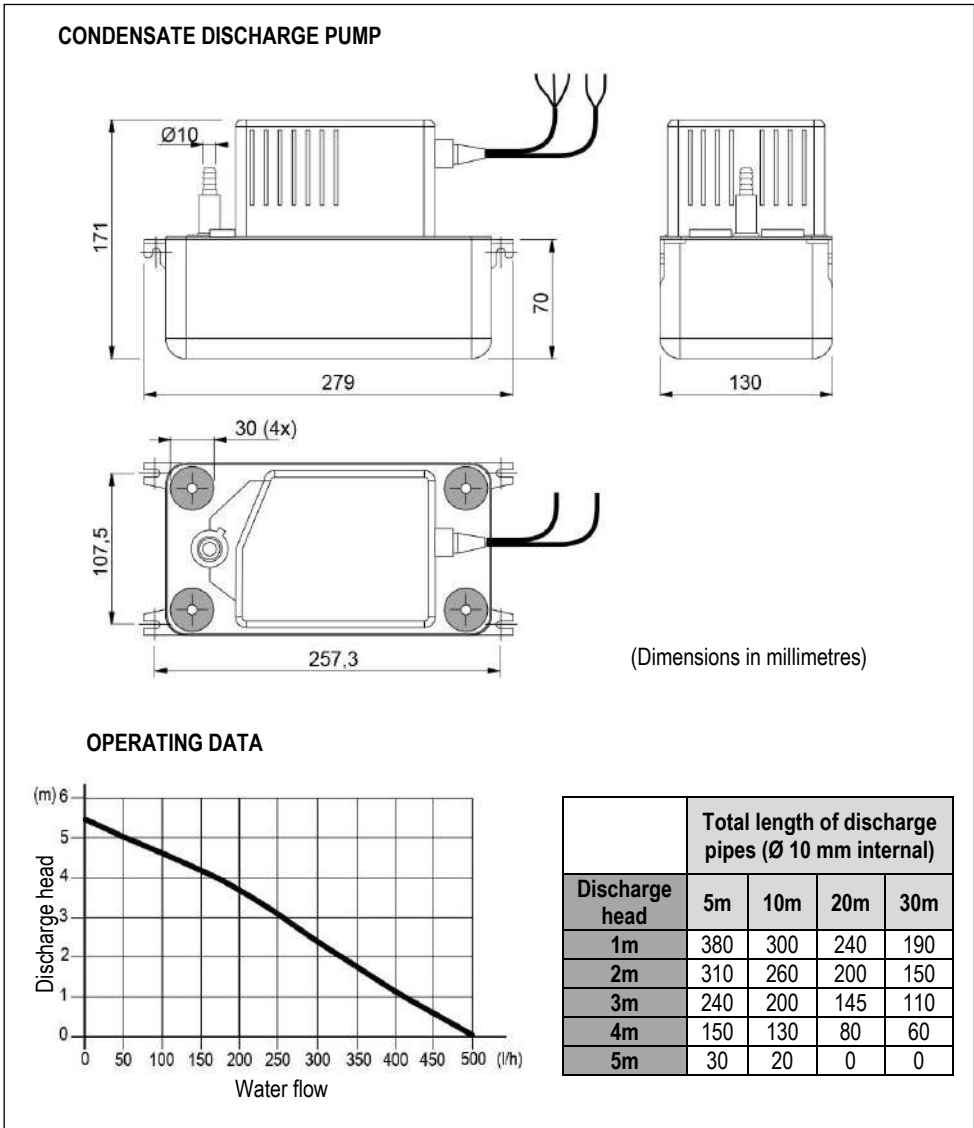
Sound level: 45dBA a 1 m

Maximum water temperature: 70°C

Water acidity: pH>2.5

Tray volume: 2.0 l

Protection IP 20



OPTIONAL ACCESSORIES: P084 – AIR FILTER ePM₁₀ 50%

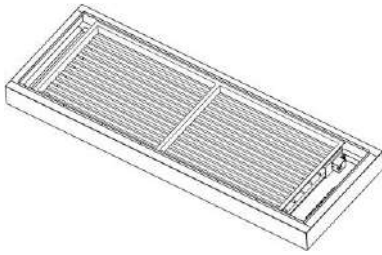
The ISO ePM₁₀ 50% air filters (according to ISO EN 16890), replace the standard one. The filters generate a pressure drops higher than the standard ones. The filters are made of glass micro-fibre and are not regenerable.

| VERSION (1) | U / O | U / O | U / O | U / O | U / O | |
|-------------------------------|----------|----------|----------|----------|----------|----|
| MODEL | 012 M1 S | 018 M1 S | 022 M1 S | 030 M1 S | 047 M1 S | |
| SIZE | E1 | E2 | E3 | E4L | E5L | |
| Additional pressure drops (2) | Pa | 48 | 68 | 43 | 22 | 34 |

| VERSION (1) | U / O | U / O | U / O | U | U | |
|-------------------------------|----------|----------|----------|----------|----------|----|
| MODEL | 042 M2 D | 068 M2 D | 094 M2 D | 120 M4 D | 150 M4 D | |
| SIZE | E5L | E7L | E8L | E9L | E9L | |
| Additional pressure drops (2) | Pa | 34 | 40 | 48 | 74 | 74 |

1. U = Under, downflow / O = Over, upflow
2. Additional pressure drops referred to nominal air flow and clean filter.

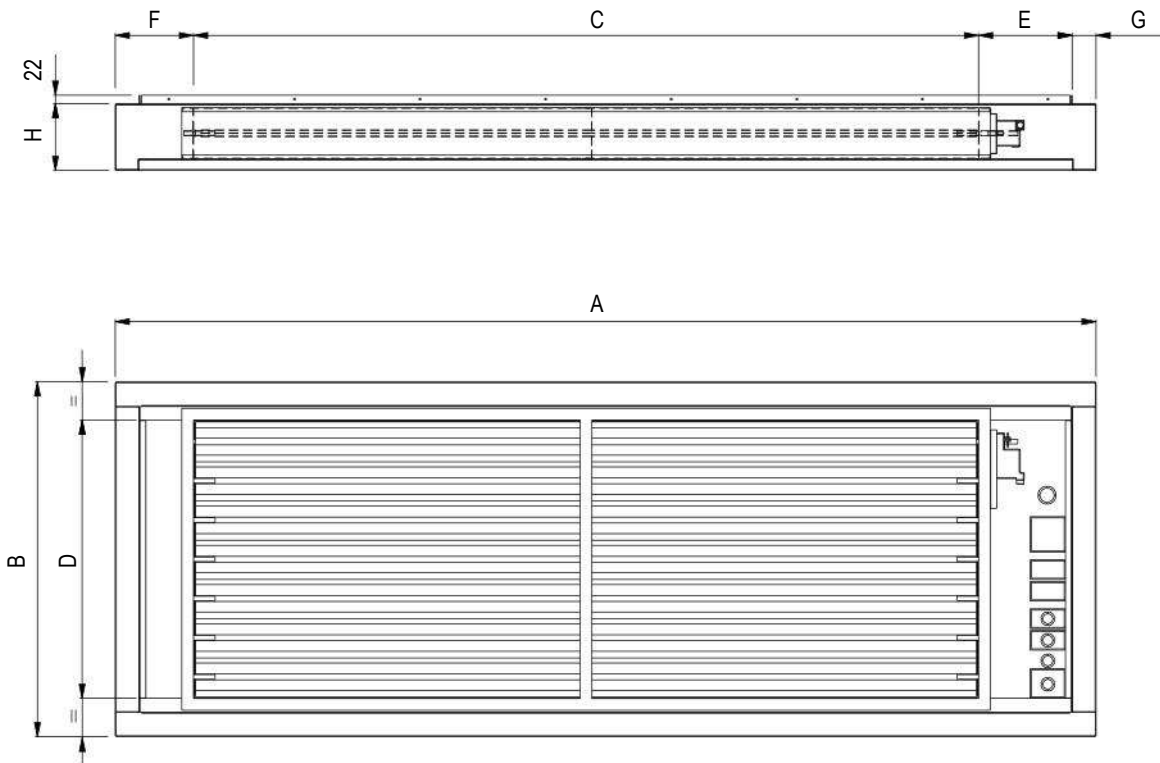
OPTIONAL ACCESSORIES: A531 – ON-OFF DAMPER



Non-return air damper with frame driven by electric servomotor.
 Accessory to install on units air delivery and it can be matched to plenums and floor stand.
 The accessory requires mandatory accessory "9973 Wooden cage packing".

FRAMEWORK

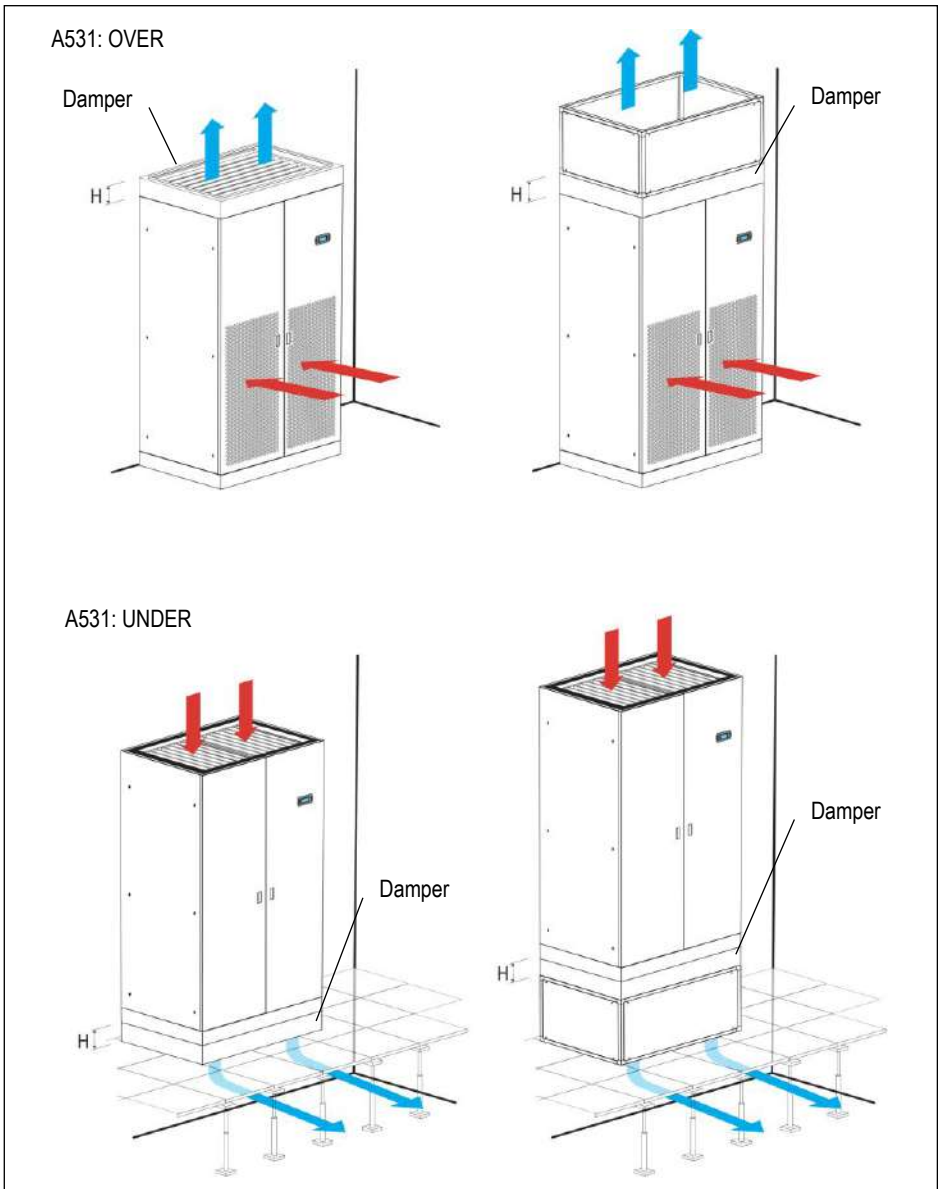
- Frame in galvanized steel sheet with protective surfaces treatment in compliance with UNI ISO 9227/ASTMB117 and ISO 7253, and painted with epoxy powders. Colour RAL 9005;
- Opposed blade dampers in galvanized steel sheet.
- Actuator for damper control.
- Terminals for electric connection to the unit.



| VERSION (1) | | U / O | U / O | U / O | U / O | U / O | U / O | U / O | U |
|-------------|----|-------|-------|-------|-------|-------|-------|-------|-------|
| SIZE | | E1 | E2 | E3 | E4L | E5L | E7L | E8L | E9L |
| A | mm | 650 | 785 | 1085 | 1630 | 1955 | 2499 | 2899 | 3299 |
| B | mm | 650 | 650 | 750 | 905 | 905 | 905 | 905 | 905 |
| C | mm | 300 | 450 | 750 | 900 | 1250 | 1750 | 2000 | 2300 |
| D | mm | 510 | 510 | 610 | 710 | 710 | 710 | 710 | 710 |
| E | mm | 231 | 216 | 216 | 467 | 529 | 550,5 | 638,5 | 638,5 |
| F | mm | 73 | 73 | 73 | 202 | 115 | 137,5 | 199,5 | 299,5 |
| G | mm | 46 | 46 | 46 | 61 | 61 | 61 | 61 | 61 |
| H | mm | 170 | 170 | 170 | 170 | 170 | 170 | 170 | 170 |
| Weight (2) | kg | 20 | 23 | 30 | 45 | 55 | 70 | 80 | 95 |

1. U = Under, downflow / O = Over, upflow
 2. Add this value to the total unit weight

INSTALLATION EXAMPLE



WORKING LOGIC

The damper opens at supply fans activation to allow air flow.

When the fans stop for failure or stop command, the damper closes, preventing air flow into the unit.

OPTIONAL ACCESSORIES: P011 - EMPTY PLENUM

OPTIONAL ACCESSORIES: P012 - EMPTY PLENUM CL.A1

OPTIONAL ACCESSORIES: P031 - EMPTY INTAKE PLENUM

OPTIONAL ACCESSORIES: P032 - EMPTY INTAKE PLENUM CL.A1

OPTIONAL ACCESSORIES: P013 - PLENUM + 3 GRILLES

OPTIONAL ACCESSORIES: P014 - PLENUM + 3 GRILLES CL.A1

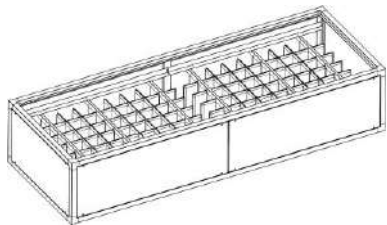
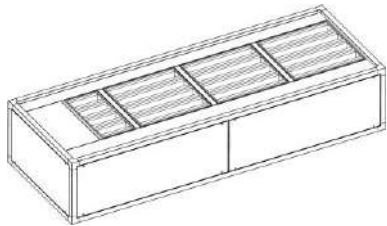
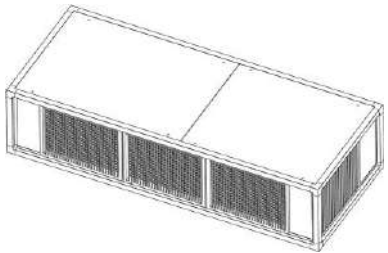
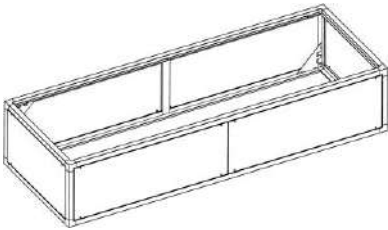
OPTIONAL ACCESSORIES: P015 - SILENCED PLENUM

OPTIONAL ACCESSORIES: P016 - SILENCED PLENUM + 1 GRILLE

OPTIONAL ACCESSORIES: P017 - PLENUM + FILTER EPM2.5 50%

OPTIONAL ACCESSORIES: P018 - PLENUM + FILTER EPM1 50%

OPTIONAL ACCESSORIES: P019 - PLENUM + FILTER EPM1 85%



The optional is supplied separately and the installation on the unit is at Customer care.
The plenums have same technical characteristics and dimensions of the machine cabinet.

It is possible to install only a single plenum to ensure stability to the unit.

FRAMEWORK

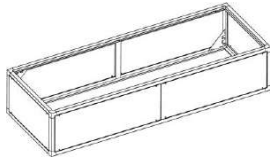
- Frame in aluminium extrusion, painted with epoxy powders. Colour RAL 9005;
- Panels in galvanized steel sheet with protective surfaces treatment in compliance with UNI ISO 9227/ASTMB117 and ISO 7253, and painted with epoxy powders. Colour RAL 9005;
- Panels insulated with polyurethane foam and seals to ensure air tight.
- Panels fixed with screws.
- Removable panels.
- Set of fixing elements to fasten the plenum to the unit.

WARNING

In UNDER version units the piping is inside the machine.

The air delivery plenums sometime don't allow the extension of the pipes downwards.

In special cases, to keep the connections inside the machine, foresee a plenum 200mm higher than the standard one.



P011 / P012 – P031 / P032: EMPTY PLENUM

The plenum is void and can be used to rise the intake/delivery air inlet/outlet. Remove the frontal panels for inspection.

Also available with fire reaction in class “0” or “A1” (EN 13501-1).

The optional accessories “P031 Empty intake plenum, for OVER version” and “P032 Empty intake plenum CL.A1, for OVER version” require mandatory accessory “P122 Bottom air intake+blind panels, for OVER version only”.

P011 / P012 OVER

P031 / P032 OVER

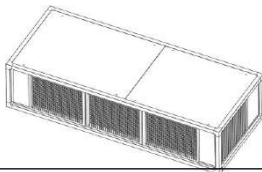
P122 Bottom air intake+blind panels

P011 / P012 UNDER

P031 / P032 UNDER

| VERSION (1) | | U / O | U / O | U / O | U / O | U / O | U / O | U / O | U |
|------------------------------------|----|-------|-------|-------|-------|-------|-------|-------|-----|
| SIZE | | E1 | E2 | E3 | E4L | E5L | E7L | E8L | E9L |
| A | mm | 490 | 490 | 490 | 510 | 510 | 510 | 510 | 510 |
| Weight (2) | kg | 20 | 21 | 20 | 40 | 45 | 60 | 70 | 80 |
| Weight CL.0 or A1 (EN 13501-1) (2) | kg | 25 | 27 | 27 | 50 | 56 | 74 | 85 | 97 |

1. U = Under, downflow / O = Over, upflow
 2. Add this value to the total unit weight



P013 / P014: PLENUM + 3 GRILLES

The plenum must be installed on air delivery.

The plenum allows the air distribution directly into the room. The plenum is supplied with air distribution grilles with double row adjustable grilles on front and lateral side.

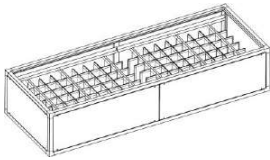
Also available with fire reaction in class “0” or “A1” (EN 13501-1).

P013 / P014 OVER

P013 / P014 UNDER

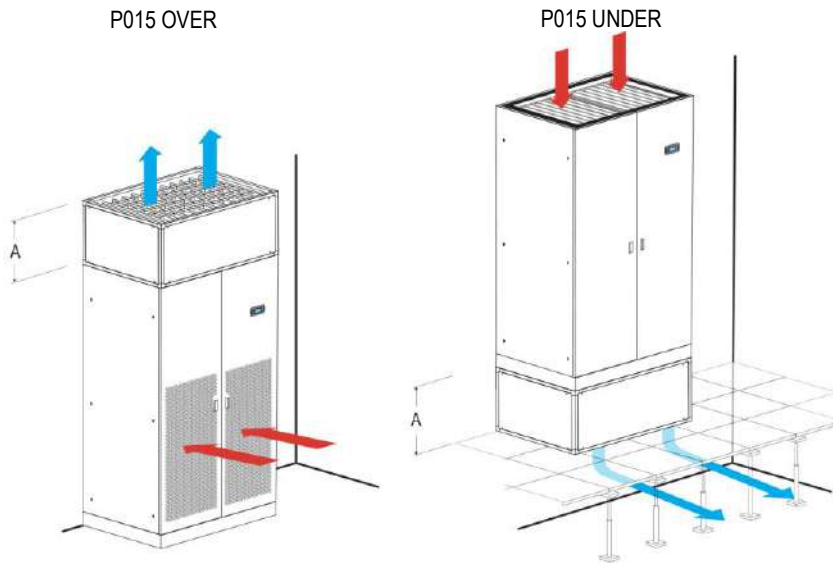
| VERSION (1) | | U / O | U / O | U / O | U / O | U / O | U / O | U / O | U |
|------------------------------------|----|-------|-------|-------|-------|-------|-------|-------|-----|
| SIZE | | E1 | E2 | E3 | E4L | E5L | E7L | E8L | E9L |
| A | mm | 490 | 490 | 490 | 510 | 510 | 510 | 510 | 510 |
| Weight (2) | kg | 21 | 23 | 30 | 50 | 55 | 90 | 100 | 120 |
| Weight CL.0 or A1 (EN 13501-1) (2) | kg | 25 | 28 | 37 | 61 | 68 | 106 | 118 | 140 |

1. U = Under, downflow / O = Over, upflow
 2. Add this value to the total unit weight



P015: SILENCED PLENUM

The plenum must be installed on air delivery.
 The plenum is fitted with noise absorption partitions to reduce the noise emission.
 Remove the frontal panels for inspection.



| VERSION (1) | | U / O | U / O | U / O | U / O | U / O | U / O | U | |
|-------------|----|-------|-------|-------|-------|-------|-------|-----|-----|
| SIZE | | E1 | E2 | E3 | E4L | E5L | E7L | E8L | E9L |
| A | mm | 490 | 490 | 490 | 510 | 510 | 510 | 510 | 510 |
| Weight (2) | kg | 25 | 27 | 30 | 50 | 55 | 90 | 100 | 110 |

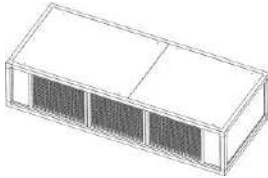
1. U = Under, downflow / O = Over, upflow
2. Add this value to the total unit weight

ACOUSTIC DATA

| VERSION (1) | | U / O | U / O | U / O | U / O | U / O |
|---------------------------------|-------------------|----------|----------|----------|----------|----------|
| MODEL | | 012 M1 S | 018 M1 S | 022 M1 S | 030 M1 S | 047 M1 S |
| SIZE | | E1 | E2 | E3 | E4L | E5L |
| SOUND LEVEL ISO 3744 (2) | | | | | | |
| On air delivery, Under | dB(A) | 61,0 | 67,3 | 64,1 | 70,5 | 77,1 |
| On air intake, Under | dB(A) | 55,4 | 57,6 | 54,4 | 60,7 | 68,8 |
| On front side, Under | dB(A) | 46,2 | 48,1 | 44,8 | 51,1 | 59,3 |
| On air delivery, Over | dB(A) | 61,0 | 60,6 | 61,2 | 66,6 | 77,1 |
| On air intake, Over (3) | dB(A) | 53,2 | 47,5 | 48,5 | 52,2 | 63,4 |
| On front side, Over (4) | dB(A) | 45,7 | 41,4 | 41,7 | 47,1 | 59,3 |
| Air flow (5) | m ³ /h | 2700 | 4100 | 5100 | 7500 | 12000 |

| VERSION (1) | | U / O | U / O | U / O | U | U |
|---------------------------------|-------------------|----------|----------|----------|----------|----------|
| MODEL | | 042 M2 D | 068 M2 D | 094 M2 D | 120 M4 D | 150 M4 D |
| SIZE | | E5L | E7L | E8L | E9L | E9L |
| SOUND LEVEL ISO 3744 (2) | | | | | | |
| On air delivery, Under | dB(A) | 77,1 | 73,0 | 78,1 | 79,1 | 79,1 |
| On air intake, Under | dB(A) | 68,8 | 64,6 | 69,7 | 70,9 | 70,9 |
| On front side, Under | dB(A) | 59,3 | 55,2 | 60,3 | 61,4 | 61,4 |
| On air delivery, Over | dB(A) | 77,1 | 73,0 | 78,1 | - | - |
| On air intake, Over (3) | dB(A) | 63,4 | 59,5 | 64,5 | - | - |
| On front side, Over (4) | dB(A) | 59,3 | 55,2 | 60,3 | - | - |
| Air flow (5) | m ³ /h | 12000 | 17500 | 22000 | 32000 | 32000 |

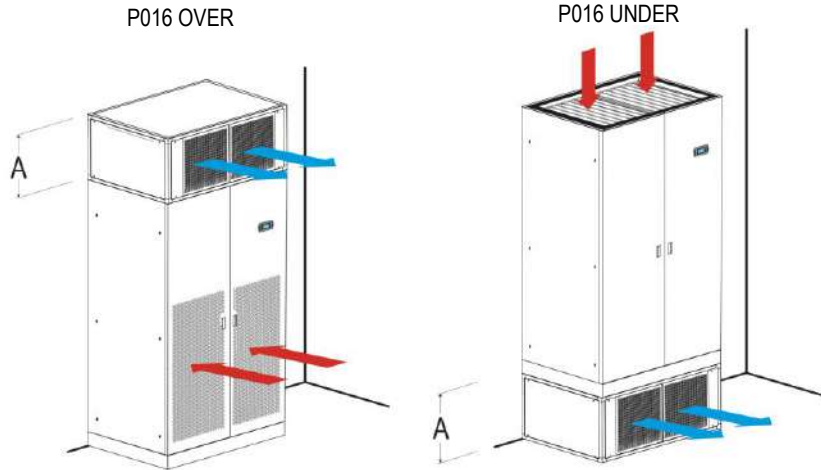
1. U = Under, downflow / O = Over, upflow
2. Noise pressure level at 1 meter in free field – ISO 3744
3. Air intake from the front
4. Air intake from the bottom
5. Nominal air flow with noise absorption partitions plenum installation and external static pressure 20 Pa.



P016: SILENCED PLENUM + 1 GRILLE

The plenum must be installed on air delivery.

The plenum allows the frontal air distribution directly into the room and a noise reduction of the air delivery. The plenum is supplied with air distribution grille with double row adjustable grilles on front side and noise absorption partitions,



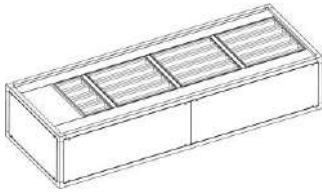
| SIZE | | U / O | U / O | U / O | U / O | U / O | U / O | U / O | U |
|--------------------|----|-----------|-----------|-----------|------------|------------|------------|------------|------------|
| VERSION (1) | | E1 | E2 | E3 | E4L | E5L | E7L | E8L | E9L |
| A | mm | 490 | 490 | 490 | 510 | 510 | 510 | 510 | 510 |
| Weight (2) | kg | 30 | 30 | 37 | 72 | 77 | 115 | 130 | 140 |

1. U = Under, downflow / O = Over, upflow
2. Add this value to the total unit weight

| VERSION (1) | | U / O | U / O | U / O | U / O | U / O |
|--------------------------------------|-------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| MODEL | | 012 M1 S | 018 M1 S | 022 M1 S | 030 M1 S | 047 M1 S |
| SIZE | | E1 | E2 | E3 | E4L | E5L |
| SOUND LEVEL ISO 3744 (2) | | | | | | |
| On air delivery, Under | dB(A) | 60,0 | 62,1 | 61,2 | 65,9 | 76,4 |
| On air intake, Under | dB(A) | 55,8 | 58,8 | 55,5 | 61,1 | 68,6 |
| On front side, Under | dB(A) | 46,6 | 50,9 | 45,6 | 50,7 | 59,2 |
| On air delivery, Over | dB(A) | 60,0 | 62,1 | 61,2 | 65,9 | 76,4 |
| On air intake, Over (3) | dB(A) | 53,4 | 48,7 | 48,9 | 52,2 | 63,3 |
| Irradiated, Over (4) | dB(A) | 46,1 | 43,1 | 42,4 | 47,1 | 59,2 |
| ADDITIONAL PRESSURE DROPS (5) | Pa | 52 | 83 | 50 | 52 | 84 |
| AIR FLOW | m ³ /h | 2700 | 4100 | 5100 | 7500 | 12000 |

| VERSION (1) | | U / O | U / O | U / O | U | U |
|--------------------------------------|-------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| MODEL | | 042 M2 D | 068 M2 D | 094 M2 D | 120 M4 D | 150 M4 D |
| SIZE | | E5L | E7L | E8L | E9L | E9L |
| SOUND LEVEL ISO 3744 (2) | | | | | | |
| On air delivery, Under | dB(A) | 76,4 | 72,5 | 77,3 | 78,5 | 78,5 |
| On air intake, Under | dB(A) | 68,6 | 64,7 | 69,6 | 70,9 | 70,9 |
| On front side, Under | dB(A) | 59,2 | 55,3 | 60,2 | 61,5 | 61,5 |
| On air delivery, Over | dB(A) | 76,4 | 72,5 | 77,3 | -- | -- |
| On air intake, Over (3) | dB(A) | 63,3 | 59,6 | 64,4 | -- | -- |
| Irradiated, Over (4) | dB(A) | 59,2 | 55,3 | 60,1 | -- | -- |
| ADDITIONAL PRESSURE DROPS (5) | Pa | 84 | 102 | 120 | 190 | 190 |
| AIR FLOW | m ³ /h | 12000 | 17500 | 22000 | 32000 | 32000 |

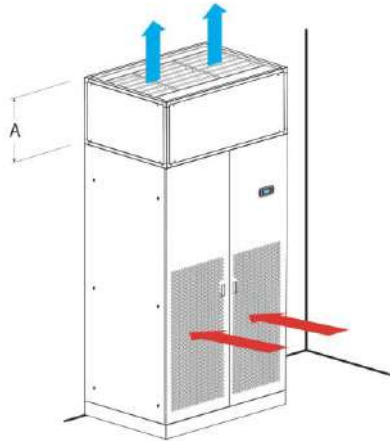
1. U = Under, downflow / O = Over, upflow
2. Noise pressure level at 1 meter in free field – ISO 3744
3. Air intake from the front
4. Air intake from the bottom
5. Value to be subtracted from the nominal external static pressure of the unit



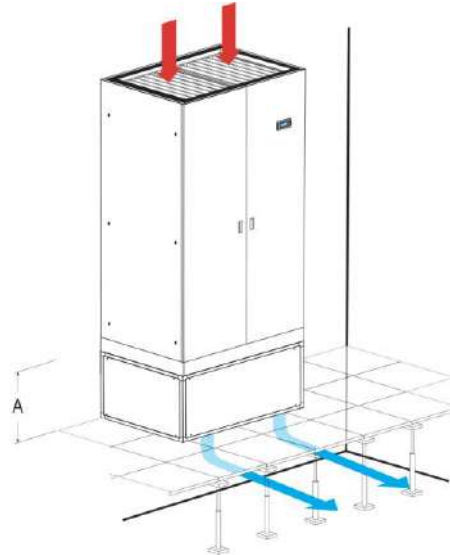
P017 / P018 / P019: SUPPLY PLENUM + FILTER

The plenum must be installed on air delivery.
 The optional is not compatible with "P084 Air filter ePM10 50%".
 The plenum is fitted with high efficiency rigid bag filters.
 Filters are made of glass micro fibre and are not regenerable.
 Remove the frontal panels for filters replacement.

P017 / P018 / P019 OVER



P017 / P018 / P019 UNDER



| VERSION (1) | | U / O | U / O | U / O | U / O | U / O | U / O | U / O | U |
|-------------|----|-------|-------|-------|-------|-------|-------|-------|-----|
| SIZE | | E1 | E2 | E3 | E4L | E5L | E7L | E8L | E9L |
| A | mm | 490 | 490 | 490 | 510 | 510 | 510 | 510 | 510 |
| Weight (2) | kg | 26 | 27 | 30 | 55 | 60 | 90 | 100 | 110 |

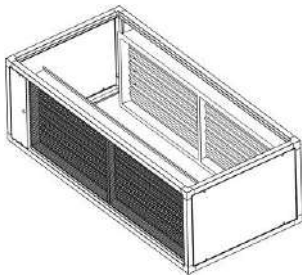
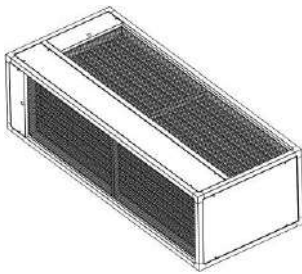
1. U = Under, downflow / O = Over, upflow
2. Add this value to the total unit weight

| VERSION (1) | | U / O | U / O | U / O | U / O | U / O |
|-----------------------------------|----|----------|----------|----------|----------|----------|
| MODEL | | 012 M1 S | 018 M1 S | 022 M1 S | 030 M1 S | 047 M1 S |
| SIZE | | E1 | E2 | E3 | E4L | E5L |
| PRESSURE DROPS (2) | | | | | | |
| Filtri ISO ePM _{2.5} 50% | Pa | 58 | 113 | 64 | 45 | 81 |
| Filtri ISO ePM ₁ 50% | Pa | 72 | 115 | 79 | 55 | 99 |
| Filtri ISO ePM ₁ 85% | Pa | 86 | 138 | 97 | 67 | 121 |

| VERSION (1) | | U / O | U / O | U / O | U | U |
|-----------------------------------|----|----------|----------|----------|----------|----------|
| MODEL | | 042 M2 D | 068 M2 D | 094 M2 D | 120 M4 D | 150 M4 D |
| SIZE | | E5L | E7L | E8L | E9L | E9L |
| PRESSURE DROPS (2) | | | | | | |
| Filtri ISO ePM _{2.5} 50% | Pa | 81 | 86 | 116 | 172 | 172 |
| Filtri ISO ePM ₁ 50% | Pa | 99 | 105 | 118 | 210 | 210 |
| Filtri ISO ePM ₁ 85% | Pa | 121 | 128 | 144 | 255 | 255 |

1. U = Under, downflow / O = Over, upflow
2. Data referred to the nominal air flow and clean filters. Value to be subtracted from the maximum external static pressure of the unit.

OPTIONAL ACCESSORIES: P034 – INTAKE FREE-COOLING PLENUM

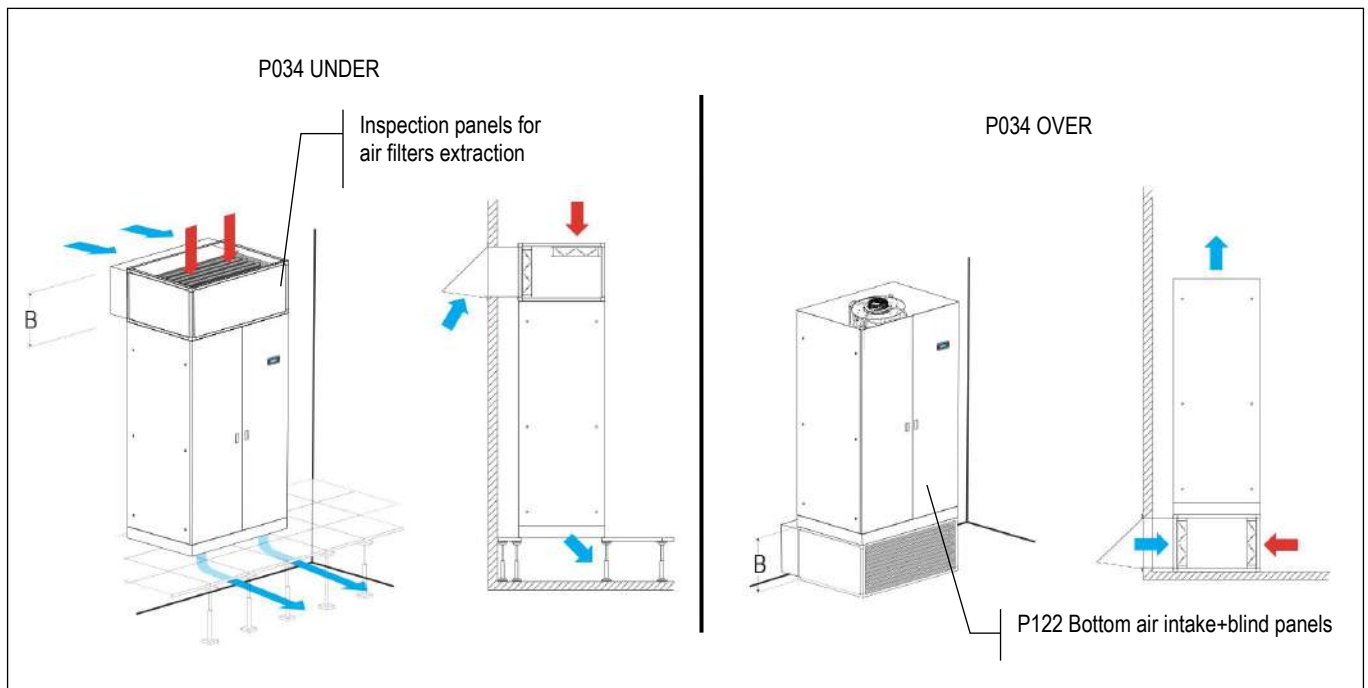


The optional is supplied separately and the installation on the unit is at Customer care.
 The optional requires mandatory accessories "P161 T/rH air intake sensor", "4666 External air probe", "A812 Free-cooling direct control" and "P122 Bottom air intake+blind panels, for OVER version only".
 The plenums have same technical characteristics and base dimensions of the machine cabinet.
 The optional allow to obtain free-cooling by direct ambient air intake into the room.
 The dampers are proportionally managed by the microprocessor control, that regulates the quantity of the ambient air to put in the room per the set-point.

COMPONENTS

- Frame in aluminium extrusion, painted with epoxy powders. Colour RAL 9005;
- Panels in galvanized steel sheet with protective surfaces treatment in compliance with UNI ISO 9227/ASTMB117 and ISO 7253, and painted with epoxy powders. Colour RAL 9005;
- Panels insulated with polyurethane foam and seals to ensure air tight.
- Removable panels with screws.
- Opposed blade dampers in galvanized steel sheet and safety grille for ambient air and room air suction.
- Actuator for each damper.
- Terminals for electric connection to the unit.
- Set of fixing elements to fasten the plenum to the unit.
- T / rH air intake sensor. The sensor must be moved outside the air conditioners for a proper read of the room temperature value.
- External air probe. The sensor must be installed in the outdoor air suction duct or anyway protected against atmospheric agent.
- Free contact for free-cooling operating status monitoring.
- Terminals on indoor unit for:
 - 24 Vac power supply for the overpressure damper servomotor
 - 0-10Vdc control signal for the servomotor

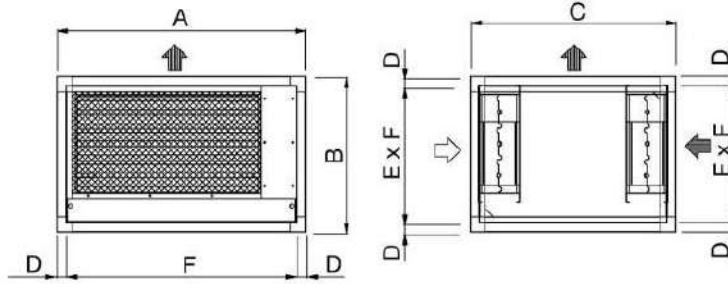
INSTALLATION EXAMPLE



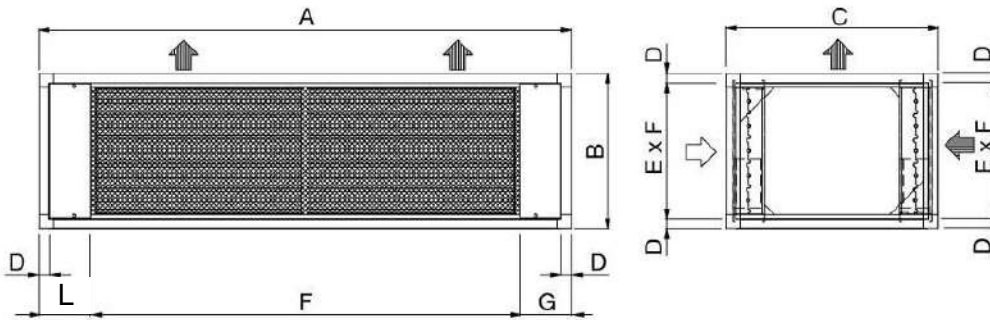
Ducting for ambient air suction are at Customer care.
 A rain cover with grille on ambient air intake is recommended.

OVER VERSION

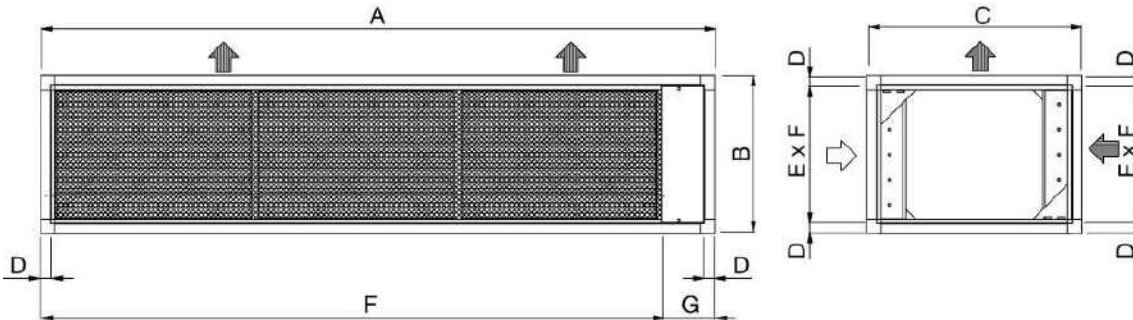
SIZE E1 / E2 / E3



SIZE E4L / E5L



SIZE E6L / E7L / E8L

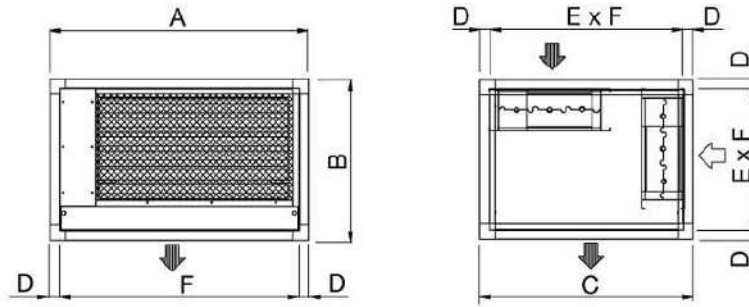


| VERSION (1) | | O | O | O | O | O | O | O | O |
|-------------|----|-----|-----|------|-------|-------|------|------|-----|
| SIZE | | E1 | E2 | E3 | E4L | E5L | E7L | E8L | E9L |
| A | mm | 650 | 785 | 1085 | 1630 | 1955 | 2499 | 2899 | -- |
| B | mm | 490 | 490 | 490 | 630 | 630 | 630 | 630 | -- |
| C | mm | 650 | 650 | 750 | 905 | 905 | 905 | 905 | -- |
| D | mm | 30 | 30 | 30 | 40 | 40 | 40 | 40 | -- |
| E | mm | 430 | 430 | 430 | 550 | 550 | 550 | 550 | -- |
| F | mm | 590 | 725 | 1025 | 1335 | 1335 | 1965 | 2220 | -- |
| G | mm | -- | -- | -- | 147,5 | 472,5 | 534 | 679 | -- |
| L | mm | -- | -- | -- | 147,5 | 147,5 | -- | -- | -- |
| Weight (2) | kg | 24 | 27 | 35 | 61 | 66 | 110 | 130 | -- |

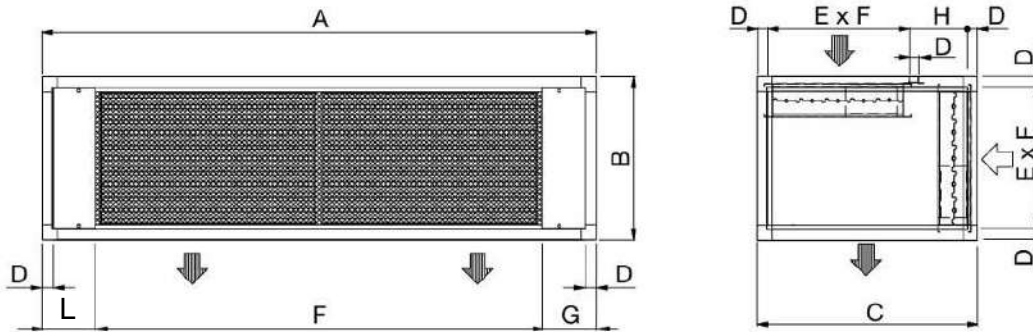
1. U = Under, downflow / O = Over, upflow
2. Add this value to the total unit weight

UNDER VERSION

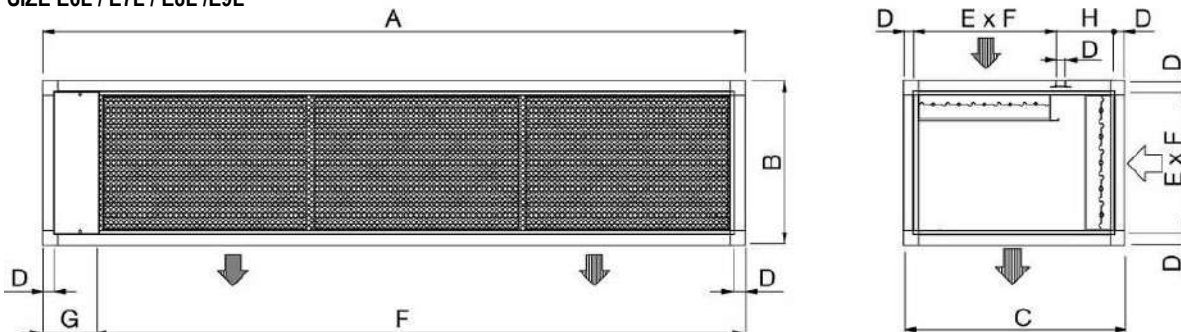
SIZE E1 / E2 / E3



SIZE E4L / E5L



SIZE E6L / E7L / E8L / E9L



| VERSION (1) | | U | U | U | U | U | U | U | U |
|-------------|----|-----|-----|------|-------|-------|------|------|------|
| SIZE | | E1 | E2 | E3 | E4L | E5L | E7L | E8L | E9L |
| A | mm | 650 | 785 | 1085 | 1630 | 1955 | 2499 | 2899 | 3299 |
| B | mm | 490 | 490 | 490 | 630 | 630 | 630 | 630 | 630 |
| C | mm | 650 | 650 | 750 | 905 | 905 | 905 | 905 | 905 |
| D | mm | 30 | 30 | 30 | 40 | 40 | 40 | 40 | 40 |
| E | mm | 430 | 430 | 430 | 550 | 550 | 550 | 550 | 550 |
| F | mm | 590 | 725 | 1025 | 1335 | 1335 | 1965 | 2220 | 2375 |
| G | mm | -- | -- | -- | 147,5 | 472,5 | 534 | 679 | 924 |
| H | mm | -- | -- | -- | 275 | 275 | 275 | 275 | 275 |
| L | mm | -- | -- | -- | 147,5 | 147,5 | -- | -- | -- |
| Weight (2) | kg | 24 | 27 | 35 | 61 | 66 | 110 | 130 | 150 |

1. U = Under, downflow / O = Over, upflow
2. Add this value to the total unit weight

WARNING

IT IS COMPULSORY TO INSTALL INTO THE ROOM AN APPROPRIATELY SIZED OVERPRESSURE DAMPER TO ALLOW THE ROOM AIR EXHAUSTION DURING FREE-COOLING WORKING MODE

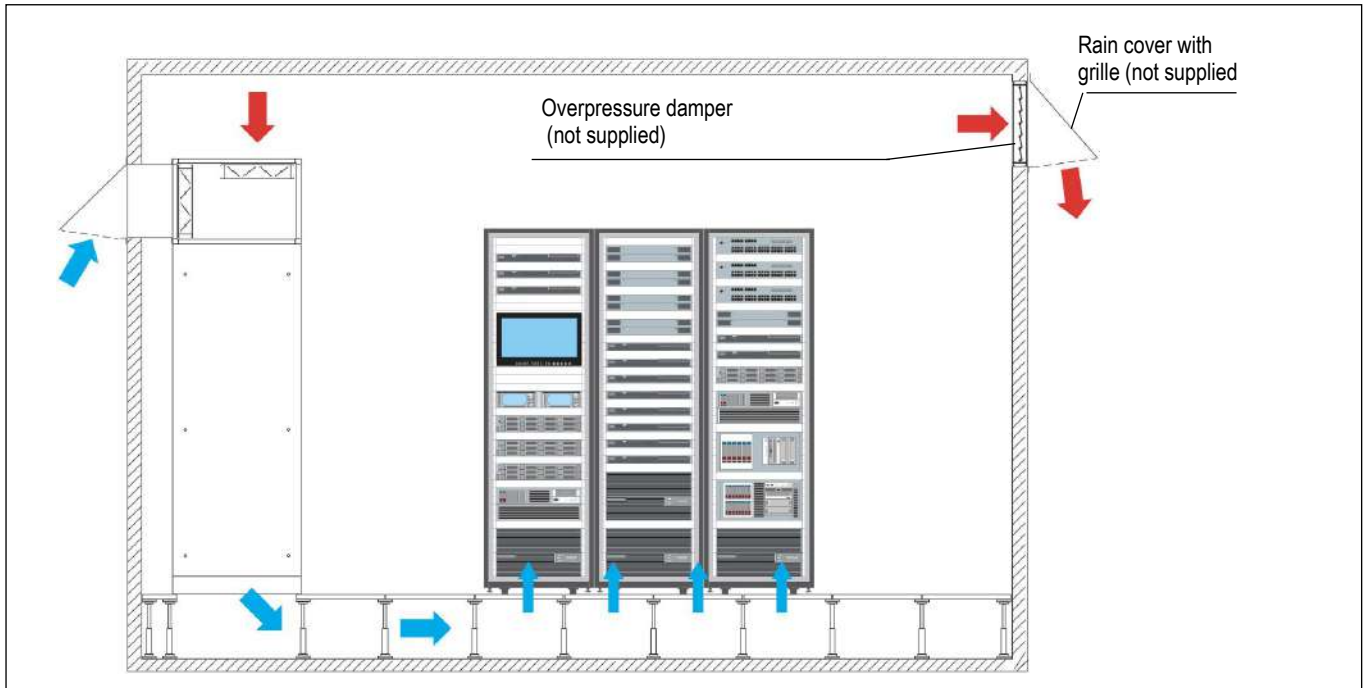
OVERPRESSURE DAMPER – Not supplied

During free-cooling operation, the air conditioner supplies ambient air directly into the room, this causes an increase in air pressure inside the room.

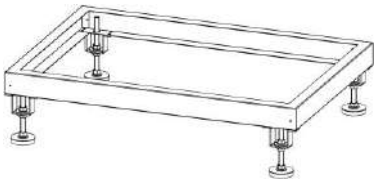
The overpressure damper avoids the increase in pressure in the room.

The damper must be installed at the highest point of the room to expel excess hot air to the outside. Install the damper if possible in opposite position to air conditioner.

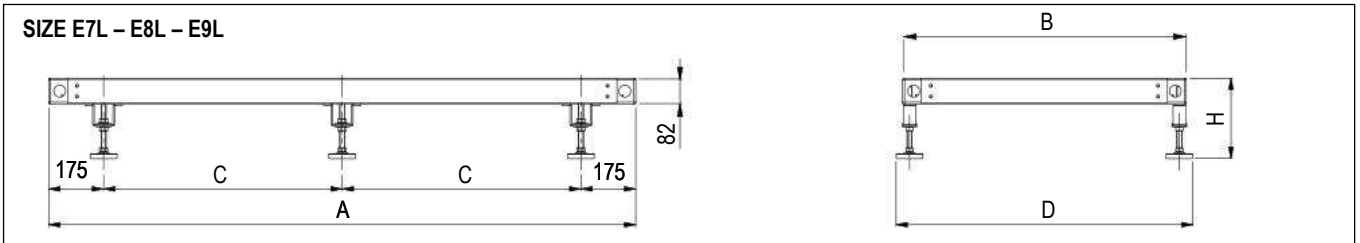
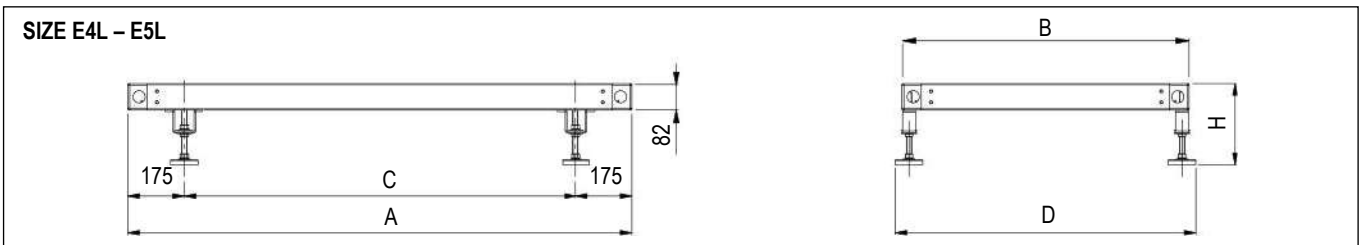
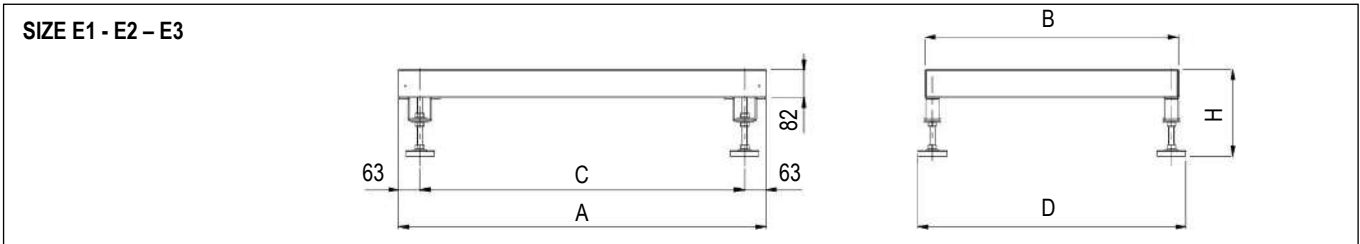
Air exhaustion must be protected with a rain cover and a grille (at Customer care).



OPTIONAL ACCESSORIES: P041 – SUPPORT FRAME H 255-350MM
OPTIONAL ACCESSORIES: P042 – SUPPORT FRAME H 355-450MM
OPTIONAL ACCESSORIES: P043 – SUPPORT FRAME H 400-510MM



The accessory is supplied as an assembly kit.
 It is not possible to match the unit floor stand with plenum installed under the machine.
 The floor stand is available in 3 different heights.



| VERSION (1) | | U / O | U / O | U / O | U / O | U / O | U / O | U / O | U |
|-------------|----|-------|-------|-------|-------|-------|--------|--------|--------|
| SIZE | | E1 | E2 | E3 | E4L | E5L | E7L | E8L | E9L |
| A | mm | 650 | 785 | 1085 | 1630 | 1955 | 2499 | 2899 | 3299 |
| B | mm | 650 | 650 | 750 | 905 | 905 | 905 | 905 | 905 |
| C | mm | 524 | 659 | 959 | 1280 | 1605 | 1074,5 | 1274,5 | 1474,5 |
| D | mm | 691 | 691 | 791 | 945 | 945 | 945 | 945 | 945 |

| MODEL | | P041 - Hmax350 | P042 - Hmax450 | P043 - Hmax510 |
|--------------|----|----------------|----------------|----------------|
| H min height | mm | 255 | 355 | 400 |
| H max height | mm | 350 | 450 | 510 |

1. U = Under, downflow / O = Over, upflow

OPTIONAL ACCESSORIES: 3601 – COMPRESSOR OPERATING SIGNAL CONTACT

A voltage free electrical contact is supplied for remote signalling "Compressor operation".
 Electrical connection on the machine's terminal board.



OPTIONAL ACCESSORIES: 2411 – PHASE SEQUENCE RELAY



The system checks that the phase sequence of the power supply is correct to prevent the opposite rotation of the three phase electric motors of the machine as compressors. The optional is installed in the electrical box downstream the main switch with door lock safety and in case of wrong phase sequence prevents starting the machine.

OPTIONAL ACCESSORIES: A272 – CL.0 or A1 (EN13501-1) INSULATION

The optional is designed **TO SUPPLY THE PANELING ONLY WITH FIRE REACTION IN CLASS “0” OR “A1 (EN 13501-1)”**; furthermore allows a noise insulation of the panels of the air conditioners.

The pressure level reduction of the unit is about 2 dB(A). The reduction refers **ONLY** to the sound level radiated from the unit or in front of the unit. The noise level data on return and delivery air do not undergo reductions.

The accessory includes:

- External part as standard panel.
- Internal part in galvanized steel sheet.
- The inside noise insulation with special soundproof material.

REACTION TO FIRE CLASSIFICATION

On Italian territory, the classification is per the D.M. of June 26, 1984 and subsequent amendments, providing for a sort in "Classes" from 0 (non-combustible material) to 5 (extremely flammable material). The EN 13501-1 regulation is ordered in classes from A1 (non-combustible material) to F (extremely flammable material).

A comparison of the classes is not possible because the methods and evaluation criteria are completely different. The comparison table below is being considered purely indicative.

| Definition | Italian classes | EN 13501-1 |
|---|-----------------|------------|
| Non-combustible material | Class 0 | A1 |
| Combustible material, very limited contribution to fire | Class 1 | A2 – B |
| Combustible material, limited contribution to fire | Class 2 | A2 – B - C |
| Combustible material, medium contribution to fire | Class 3 | C – D |
| Combustible material, highly contribution to fire | Class 4 | E |
| Combustible material, easily flammable | Class 5 | F |

Is possible to provide the sandwich panels for the OVER units with air flow from the top. This implies that the air intake must necessarily be from the base of the unit with front blind paneling.

The accessory increase the unit weight:

| OVER | | | | | | | | | |
|-----------------------|----|----|----|----|-----|-----|-----|-----|-----|
| Size | | E1 | E2 | E3 | E4L | E5L | E7L | E8L | E9L |
| Weight increasing (1) | kg | 30 | 42 | 48 | 64 | 72 | 100 | 115 | -- |
| UNDER | | | | | | | | | |
| Size | | E1 | E2 | E3 | E4L | E5L | E7L | E8L | E9L |
| Weight increasing (1) | kg | 26 | 48 | 55 | 70 | 86 | 130 | 145 | 165 |

1. Add this value to the total unit weight

OPTIONAL ACCESSORIES: P151 – LOWERED DISPLAY FOR UNDER

For machines installed above the supply plenum. The display / keypad on the front panel of the machine is installed lowered by about 50cm to facilitate consultation and use.



MACHINE DRAWINGS
Dimensions in mm – UNDER E1

The drawings show the damper from multiple perspectives:

- Top View (Left):** Shows the damper's footprint with a width of 650 mm and a height of 60 mm.
- Side View (Middle):** Shows the damper's profile with a total height of 1925 mm and a depth of 650 mm.
- Front View (Right):** Shows the damper's front face with a height of 650 mm and a depth of 120 mm. A detail view shows the inspection side with a minimum height of 85 mm.
- Detail View (Top Left):** A detailed view of the damper's internal components, labeled with numbers 4 through 15.
- Support Surfaces (Bottom):** Two diagrams show the required support areas:
 - FLOOR SUPPORT AREA:** A rectangular area with a width of 650 mm and a height of 45 mm.
 - PLENUM SUPPORT AREA:** A rectangular area with a width of 650 mm and a height of 45 mm.

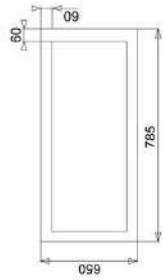
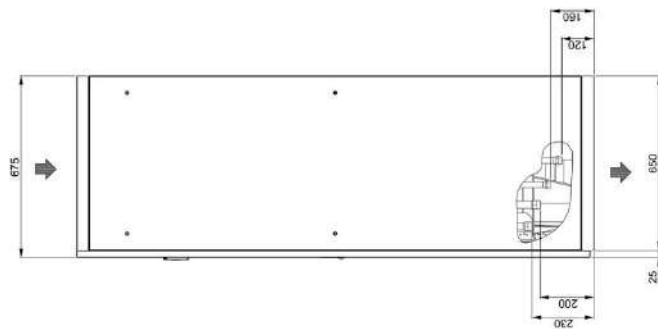
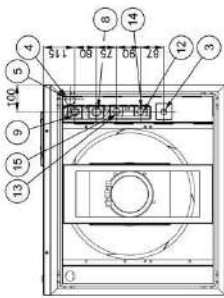
CONNECTIONS / CONNESSIONI

| CONNESSIONI / CONNESSIONI | CONNECTIONS |
|---------------------------|--------------------------------------|
| 15 | USCITA FREIE COOLING R.1 |
| 14 | INGRESSO FREIE COOLING R.1 |
| 13 | USCITA ACQUA DUAL FLUID SYSTEM R.1 |
| 12 | INGRESSO ACQUA DUAL FLUID SYSTEM R.1 |
| 9 | USCITA CONDENSATORE AD ACQUA R.1 |
| 8 | INGRESSO CONDENSATORE AD ACQUA R.1 |
| 7 | USCITA CONDENSATORE AD ACQUA R.1 |
| 6 | INGRESSO CONDENSATORE AD ACQUA R.1 |
| 4 | CARICO ACQUA UMIDIFICATORE 5 3/4" |
| 3 | SCARICO ACQUA UMIDIFICATORE 5 3/4" |

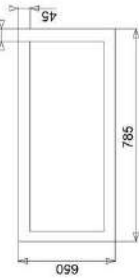
*** CON SERRANDA DI NON RITORNO**
ALTEZZA TOTALE = 2095

*** WITH NON RETURN MOTORIZED DAMPER**
TOTAL HEIGHT = 2095

LATO ISPEZIONE
INSPECTION SIDE



SUPERFICIE APOGGIO A PAVIMENTO
FLOOR SUPPORT AREA

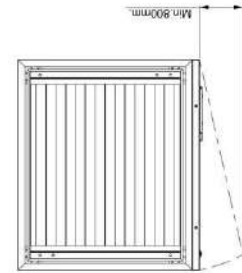


SUPERFICIE PER APOGGIO PLENUM
PLENUM SUPPORT AREA

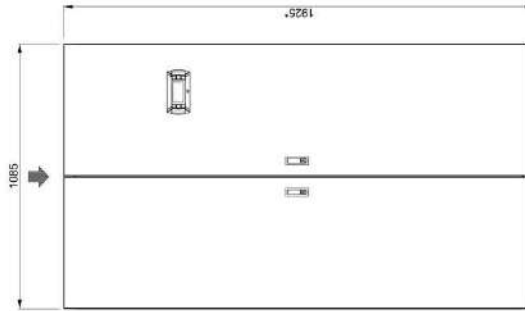
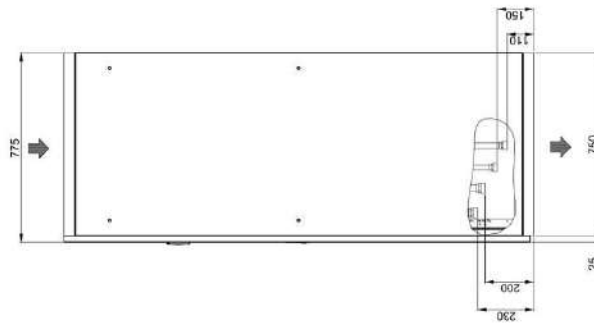
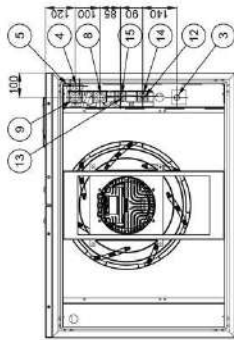
* CON SERRANDA DI NON RITORNO
ALTEZZA TOTALE = 2095

* WITH NON RETURN MOTORIZED DAMPER
TOTAL HEIGHT = 2095

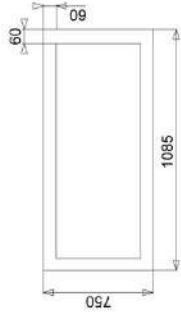
| CONNESSIONI / CONNECTIONS | |
|---------------------------|-----------------------------------|
| 15 | USCITA FREE COOLING R1 |
| 14 | USCITA FREE COOLING R2 |
| 13 | USCITA ACQUA DALLA FLUID SYSTEM 1 |
| 12 | USCITA ACQUA DALLA FLUID SYSTEM 2 |
| 11 | USCITA CONDENSATORE AD-AQUA R1 |
| 10 | USCITA CONDENSATORE AD-AQUA R2 |
| 9 | USCITA CONDENSATORE AD-AQUA R3 |
| 8 | USCITA CONDENSATORE AD-AQUA R4 |
| 7 | USCITA CONDENSATORE AD-AQUA R5 |
| 6 | USCITA CONDENSATORE AD-AQUA R6 |
| 5 | ALIMENTAZIONE ELETTRICA |
| 4 | SCARICO ACQUA LUBRIFICATORE 15mm |
| 3 | SCARICO CONDENSATE 15mm |



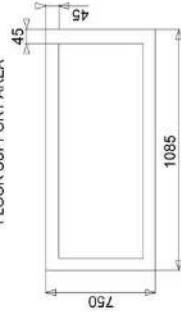
LATO ISPEZIONE
INSPECTION SIDE



LATO ISPEZIONE
INSPECTION SIDE



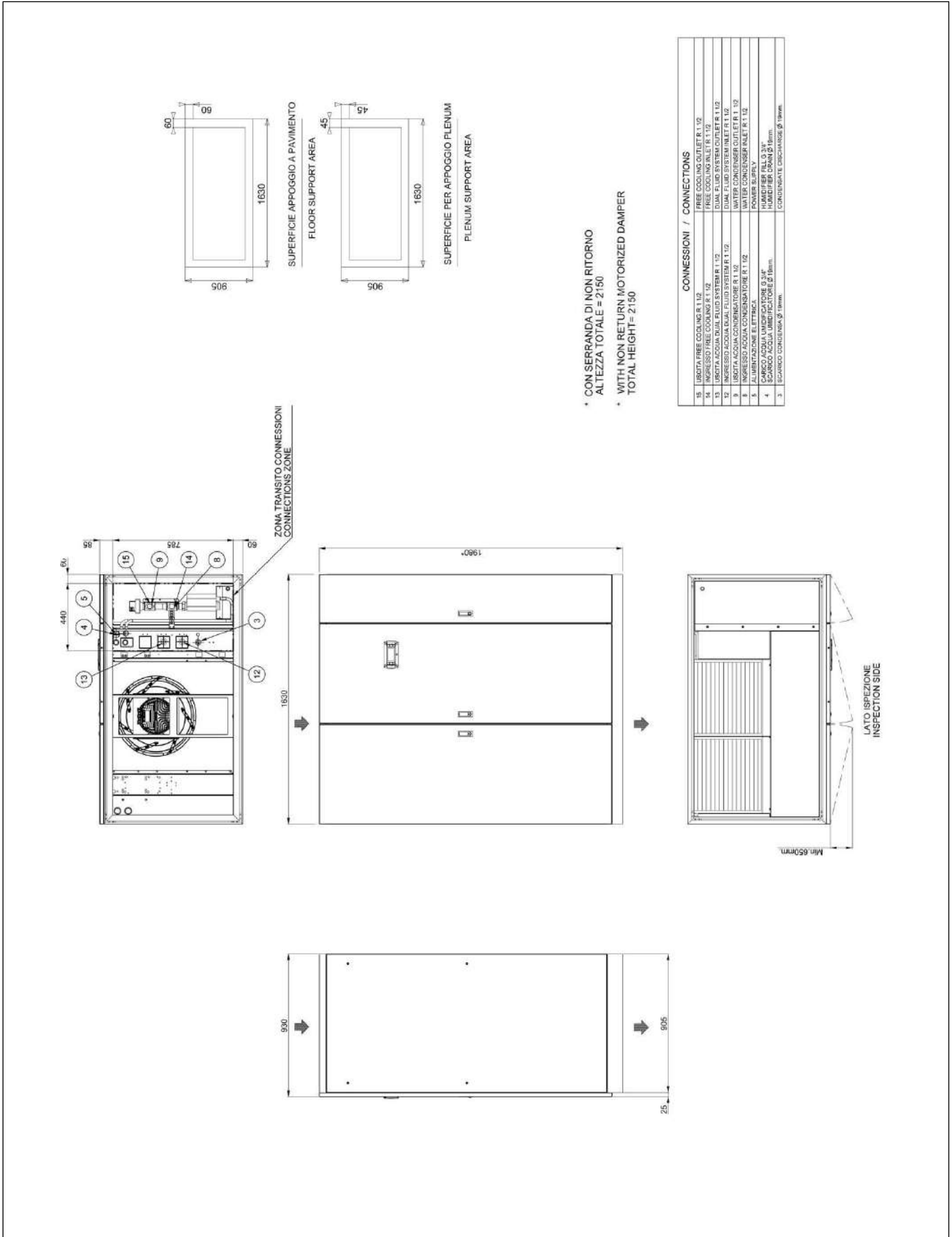
SUPERFICIE APPOGGIO A PAVIMENTO
FLOOR SUPPORT AREA

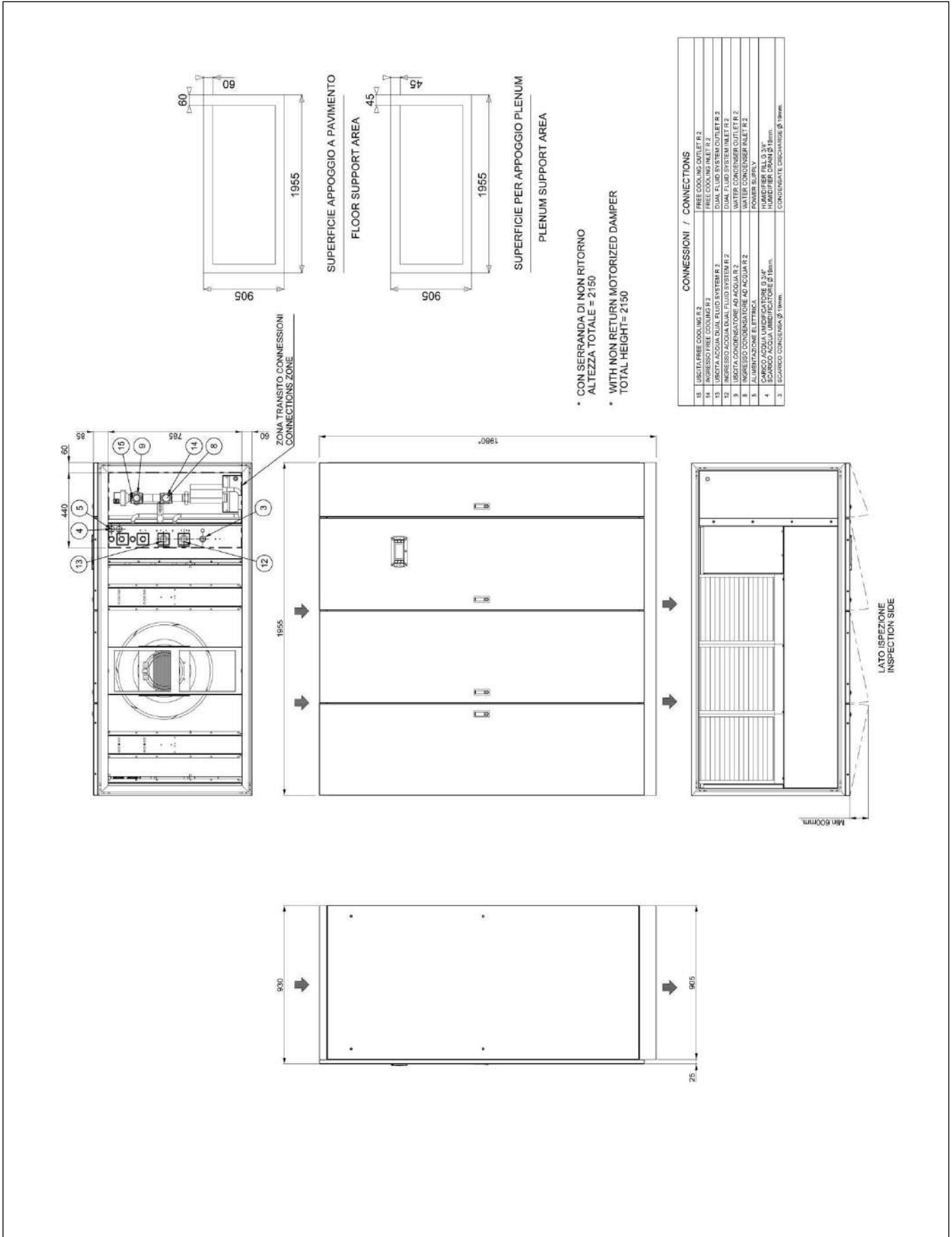


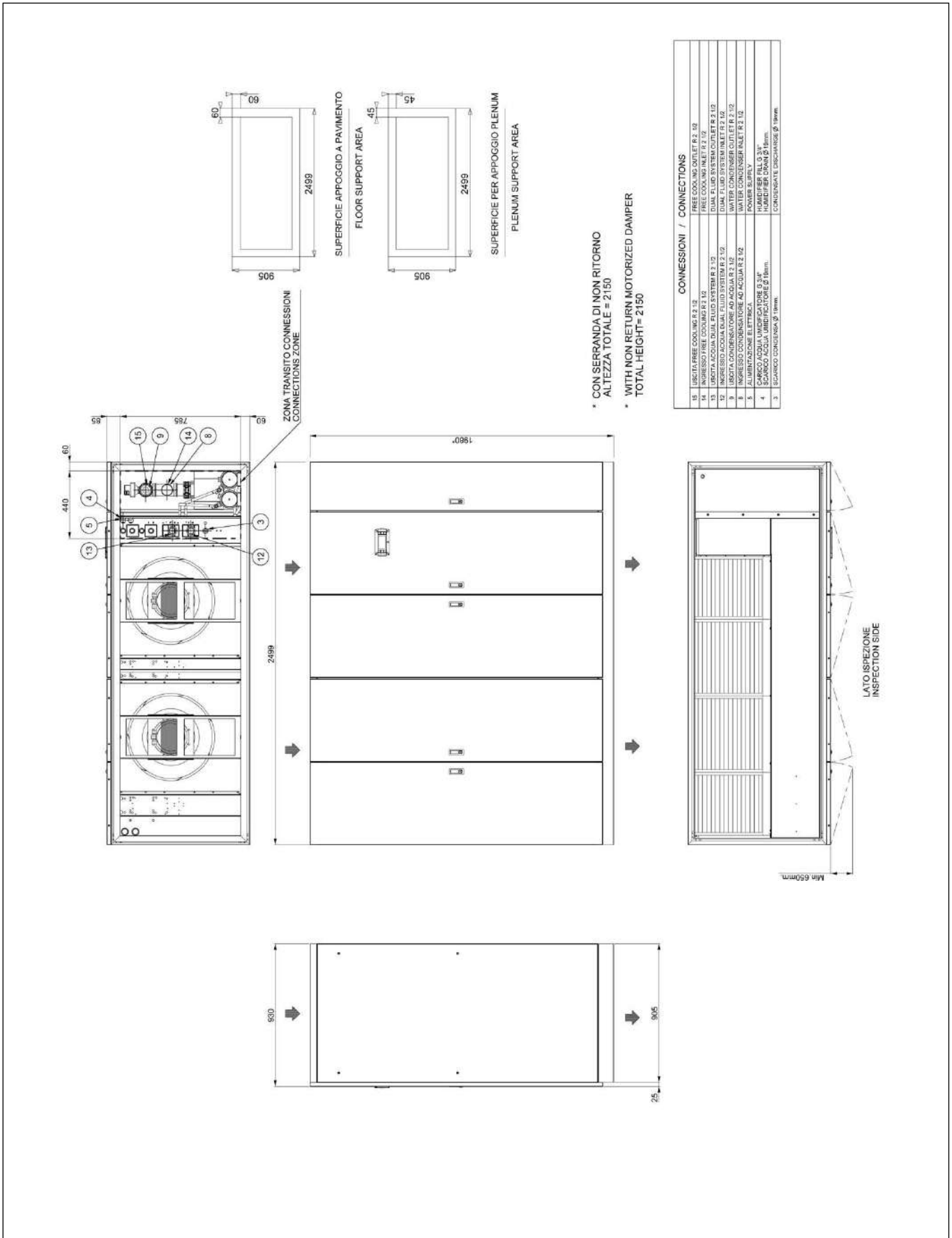
SUPERFICIE PER APPOGGIO PLENUM
PLENUM SUPPORT AREA

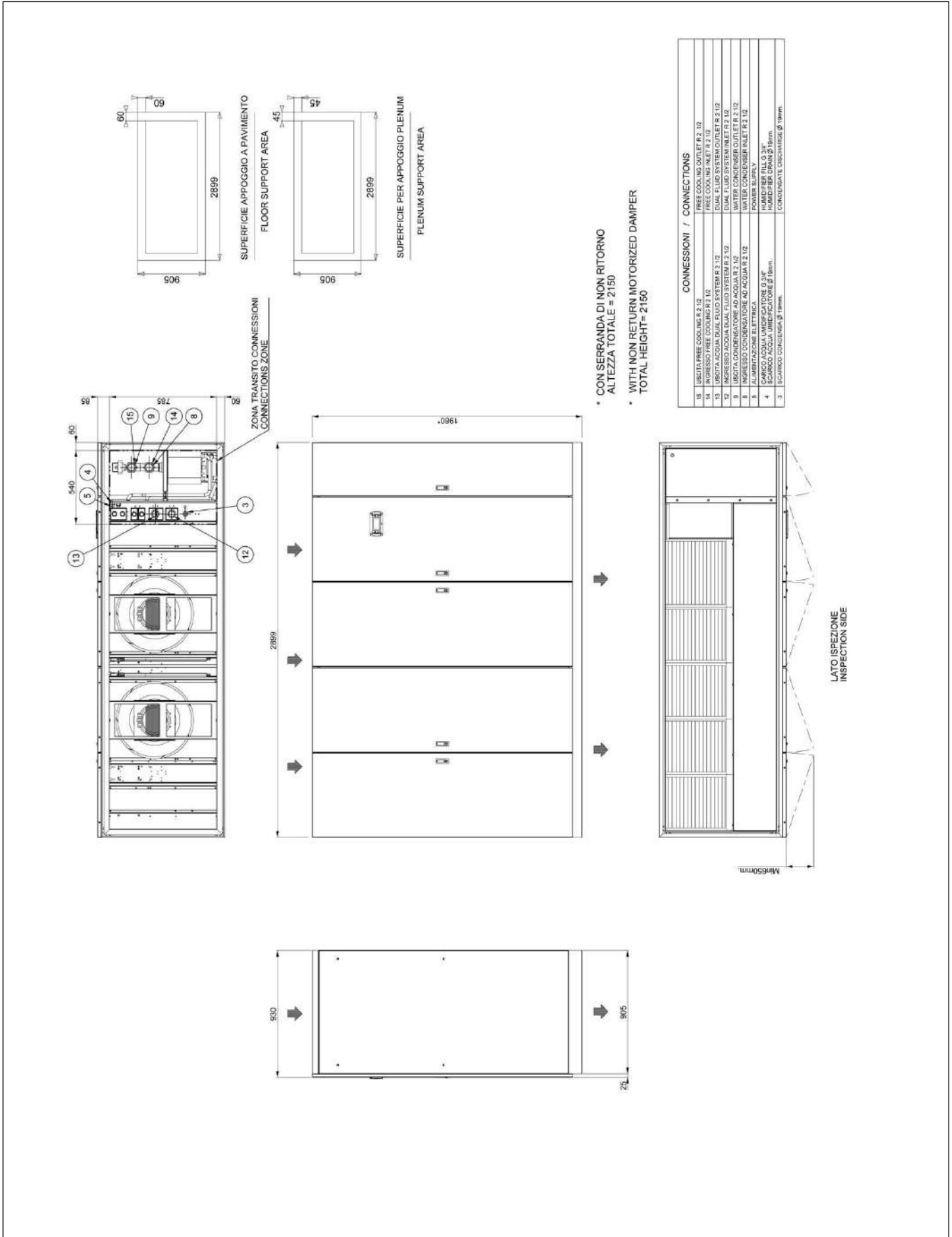
- CON SERRANDA DI NON RITORNO
ALTEZZA TOTALE = 2095
- WITH NON RETURN MOTORIZED DAMPER
TOTAL HEIGHT= 2095

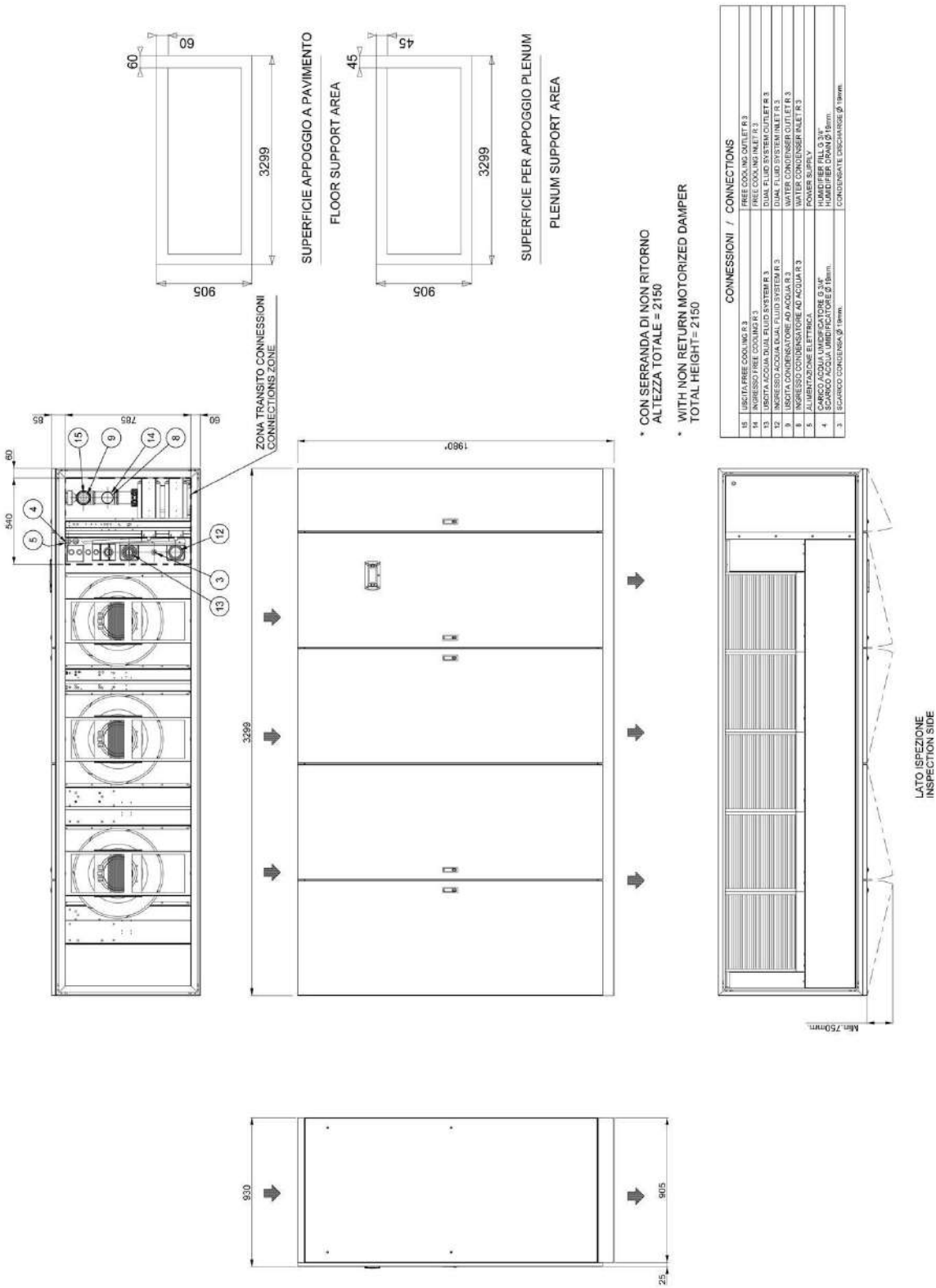
| CONNESSIONI / CONNECTIONS | |
|---------------------------|---|
| 15 | USCITA FREE COOLING R.T. 1/4" |
| 14 | USCITA ACQUA DALLA FLUID SYSTEM R. 1/4" |
| 13 | USCITA ACQUA DALLA FLUID SYSTEM R.T. 1/4" |
| 12 | INGRESSO ACQUA DALLA FLUID SYSTEM R.T. 1/4" |
| 11 | INGRESSO ACQUA DALLA FLUID SYSTEM R. 1/4" |
| 10 | USCITA CONDENSATORE AD ACQUA R.T. 1/4" |
| 9 | USCITA CONDENSATORE AD ACQUA R. 1/4" |
| 8 | INGRESSO CONDENSATORE AD ACQUA R.T. 1/4" |
| 7 | INGRESSO CONDENSATORE AD ACQUA R. 1/4" |
| 6 | ALIMENTAZIONE ELETTRICA |
| 5 | ALIMENTAZIONE ELETTRICA |
| 4 | SCARICO ACQUA LUBRIFICATORE Ø 3/8" |
| 3 | SCARICO ACQUA LUBRIFICATORE Ø 1/8" |
| 2 | CONDENSATE DISCHARGE Ø 1/8" |

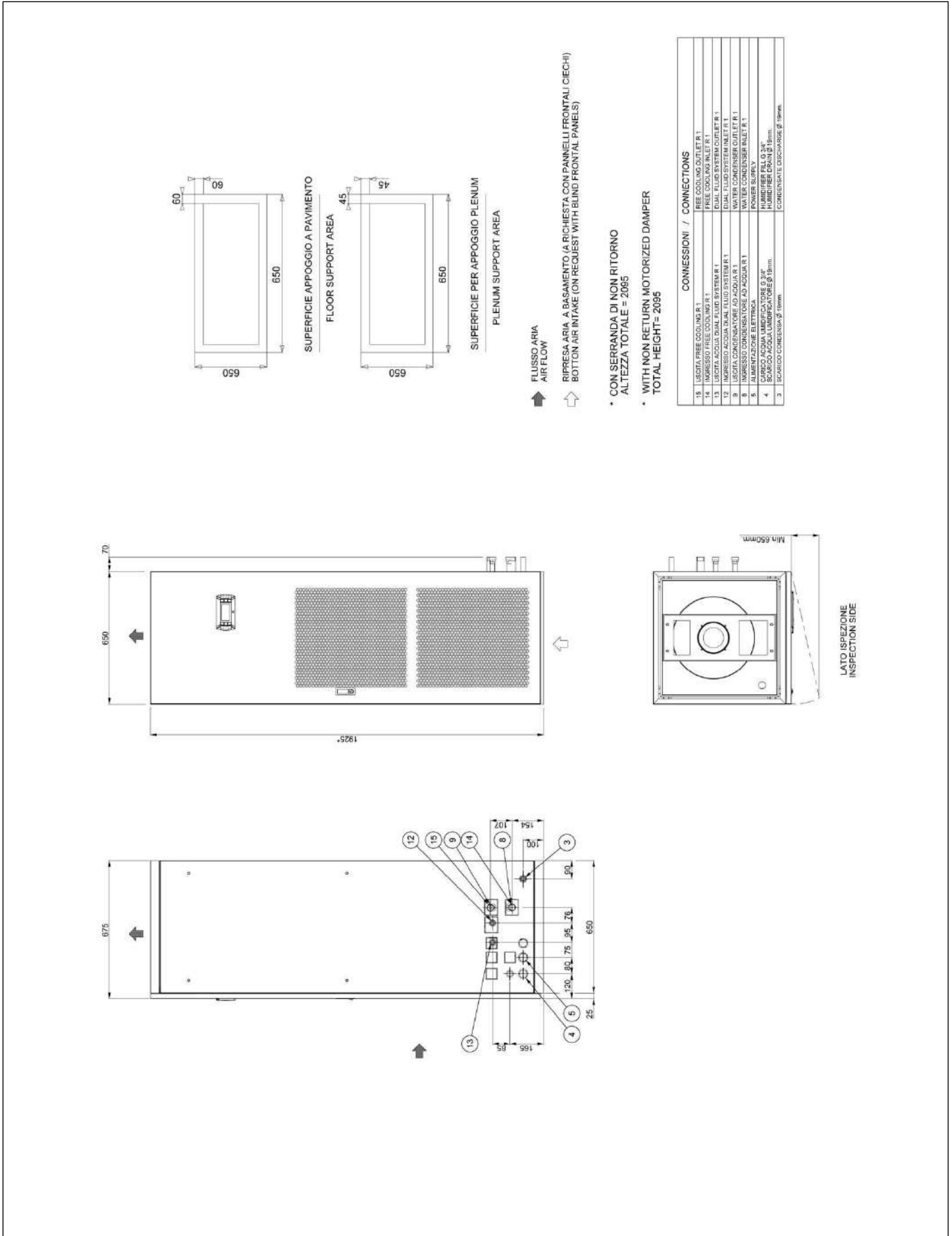


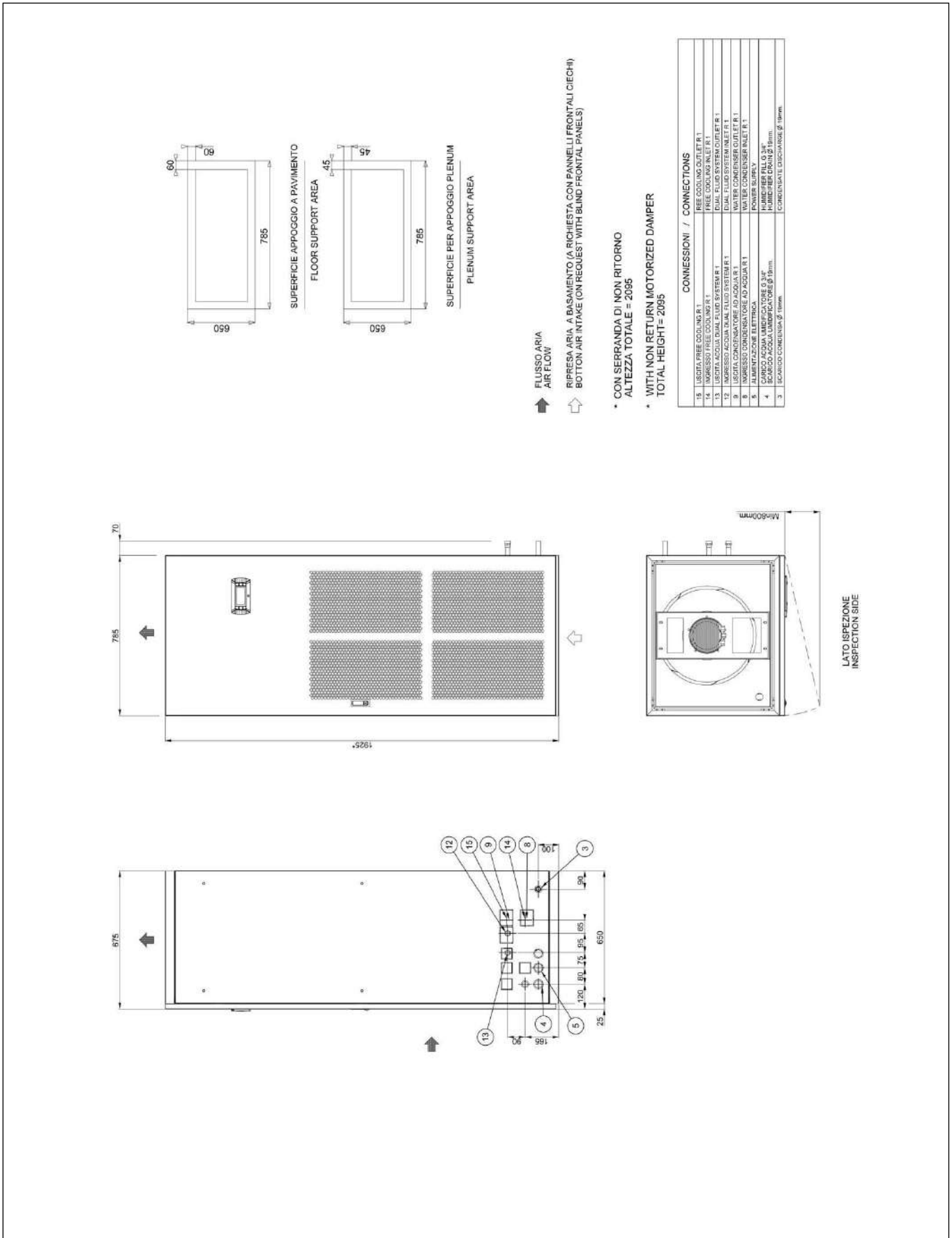


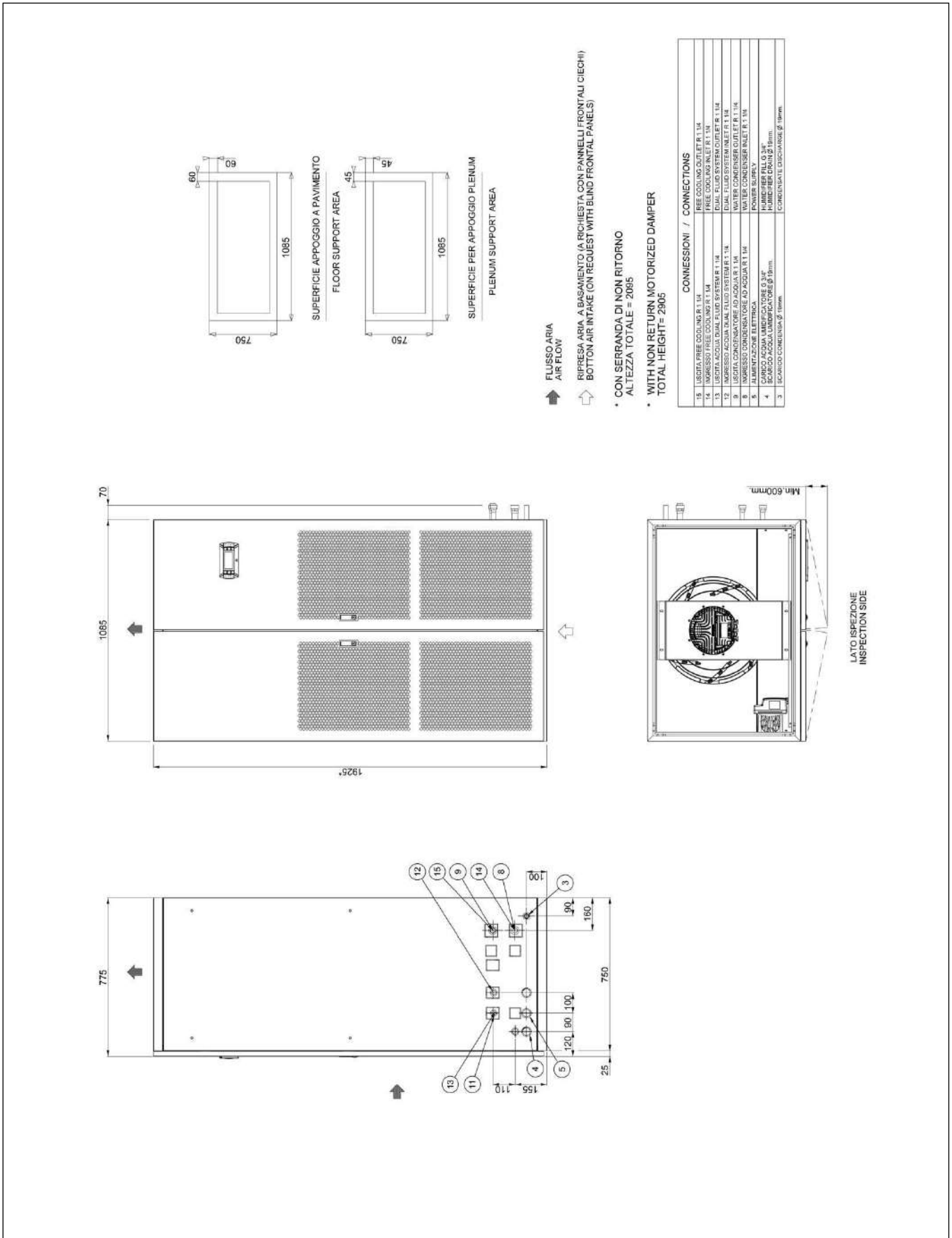


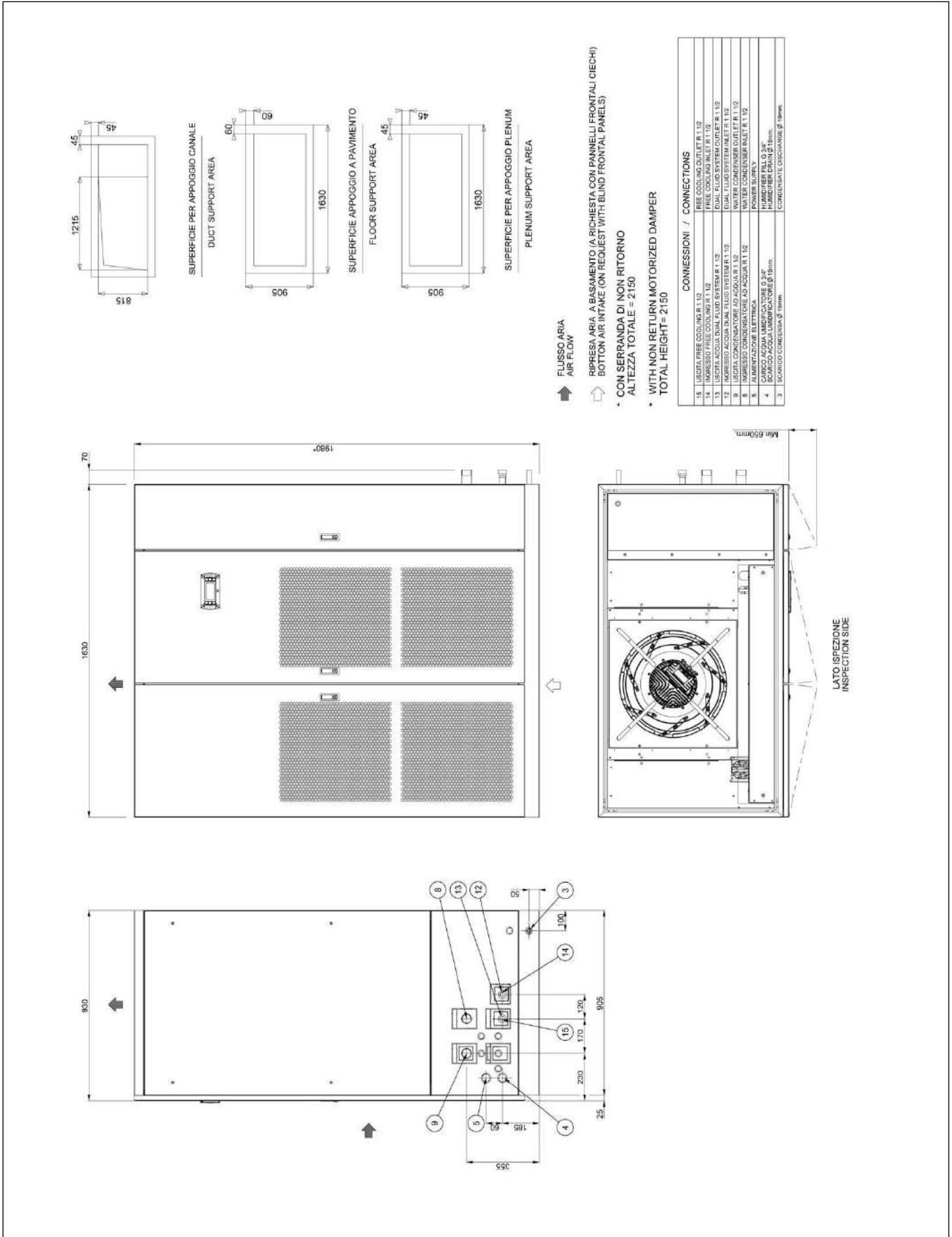


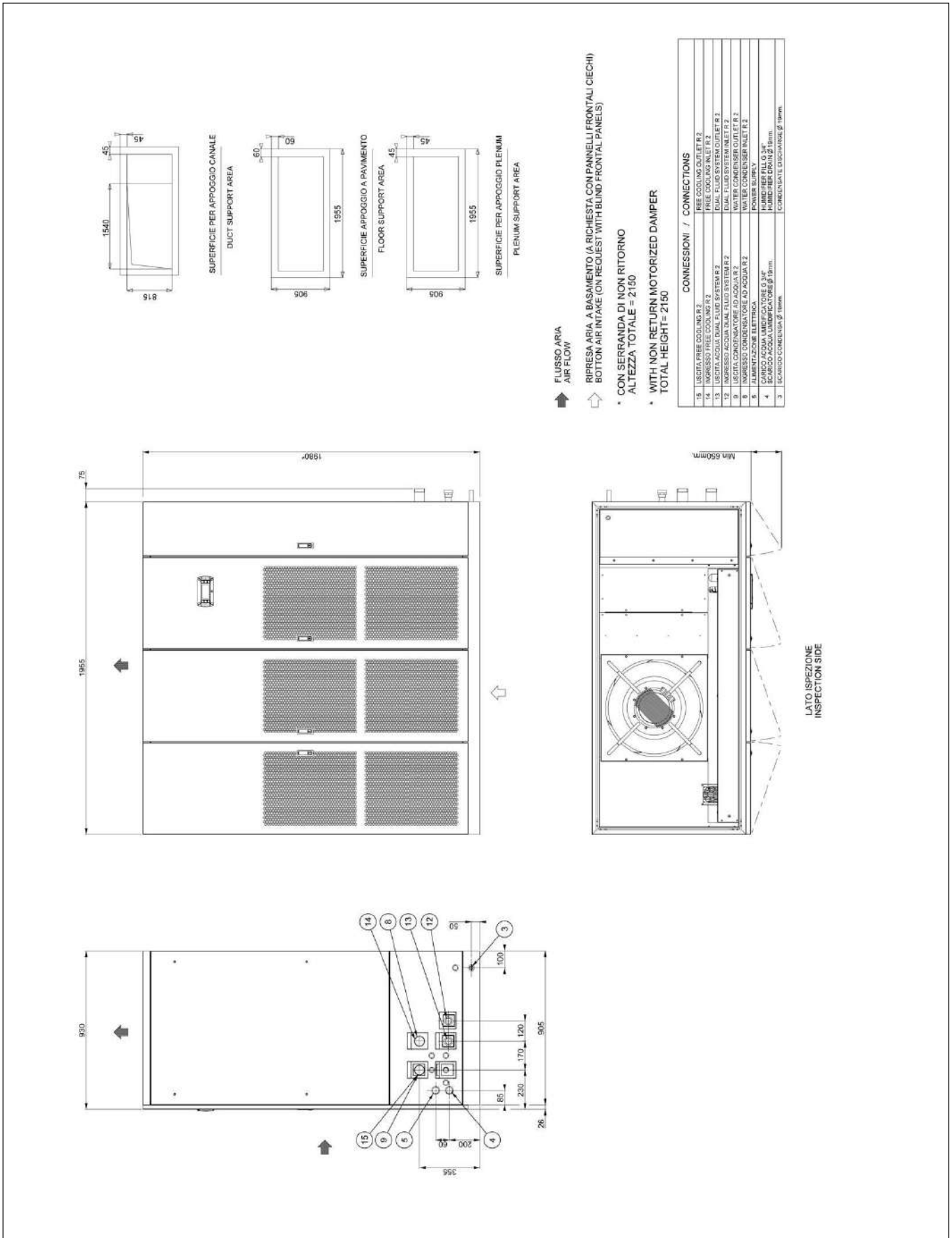


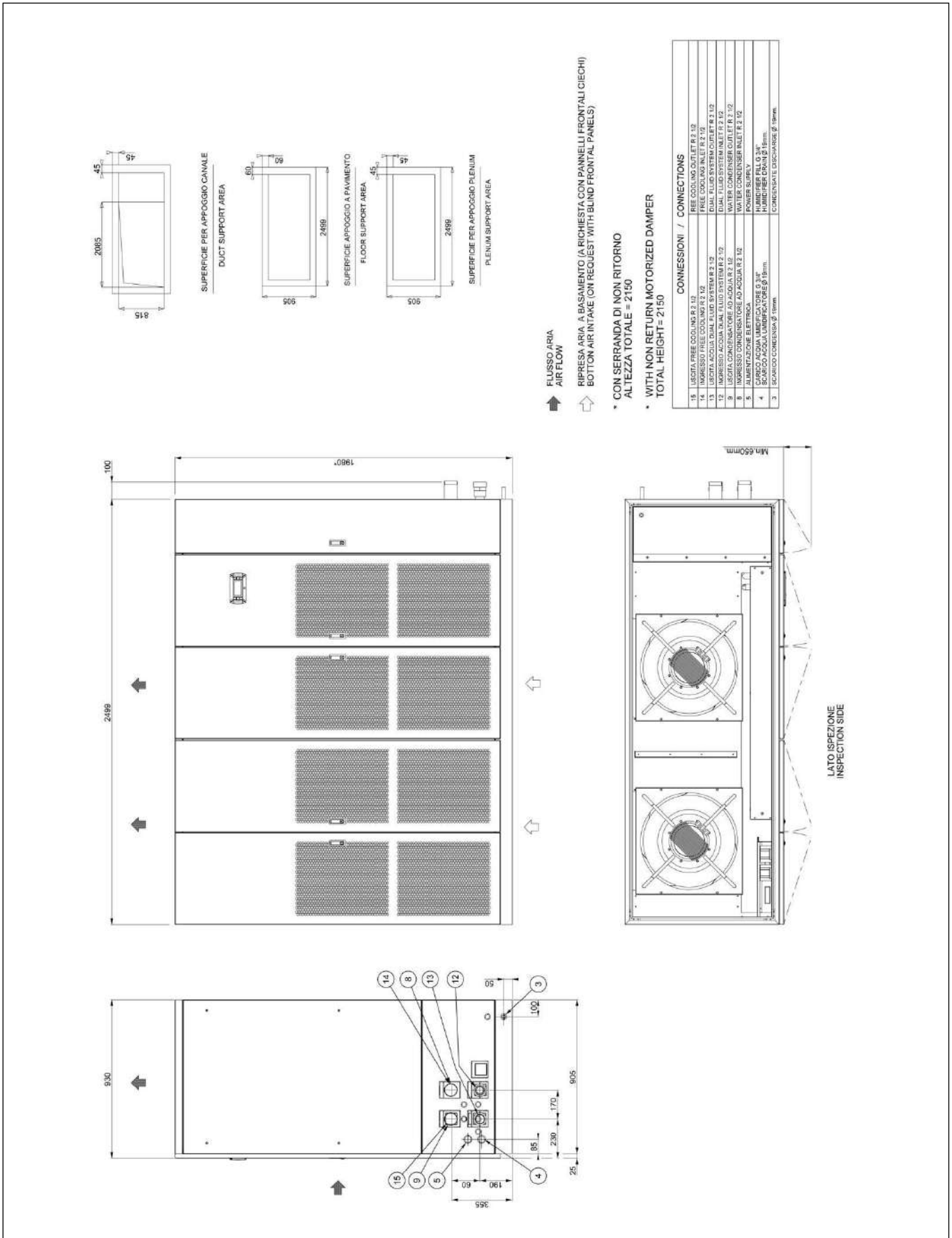


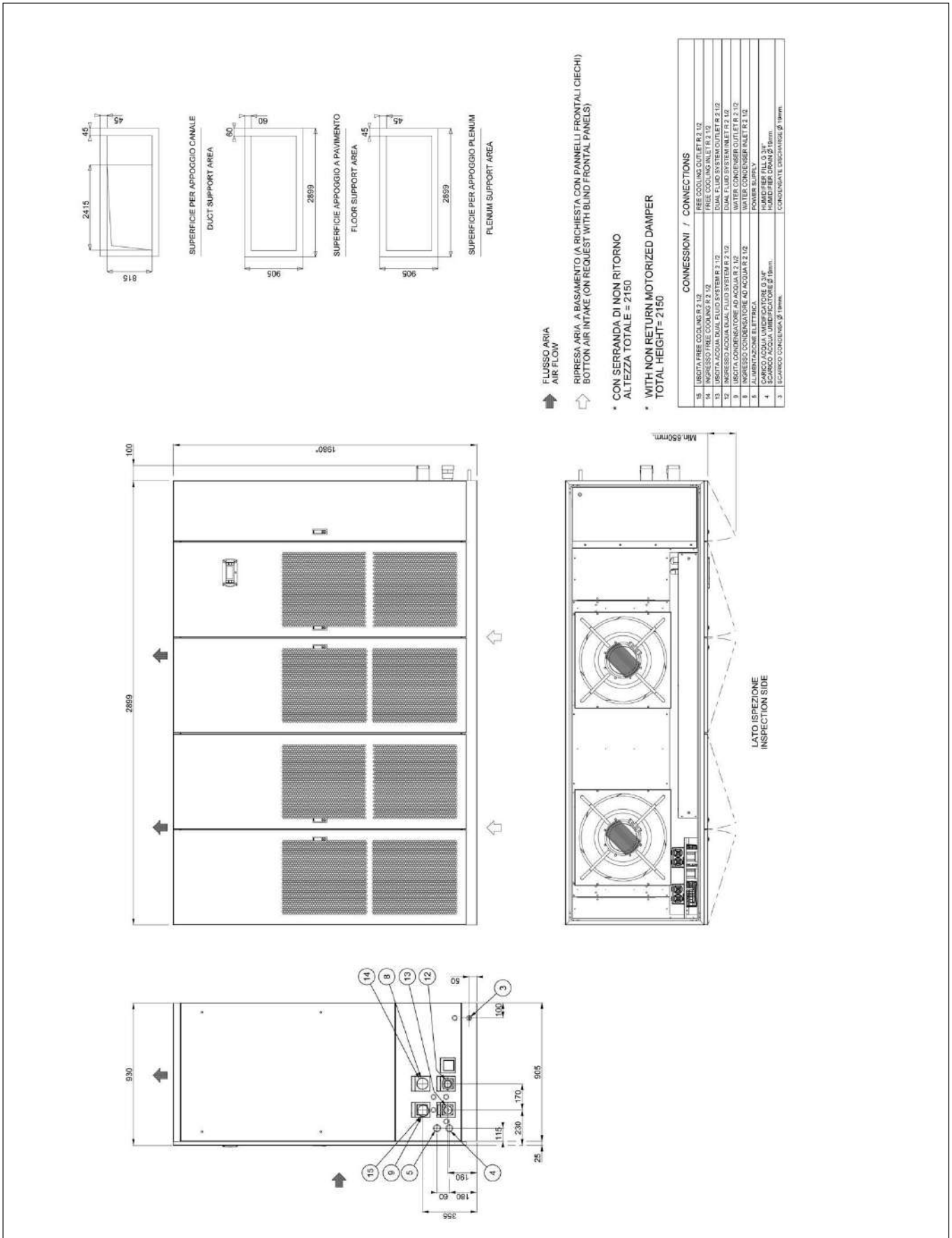






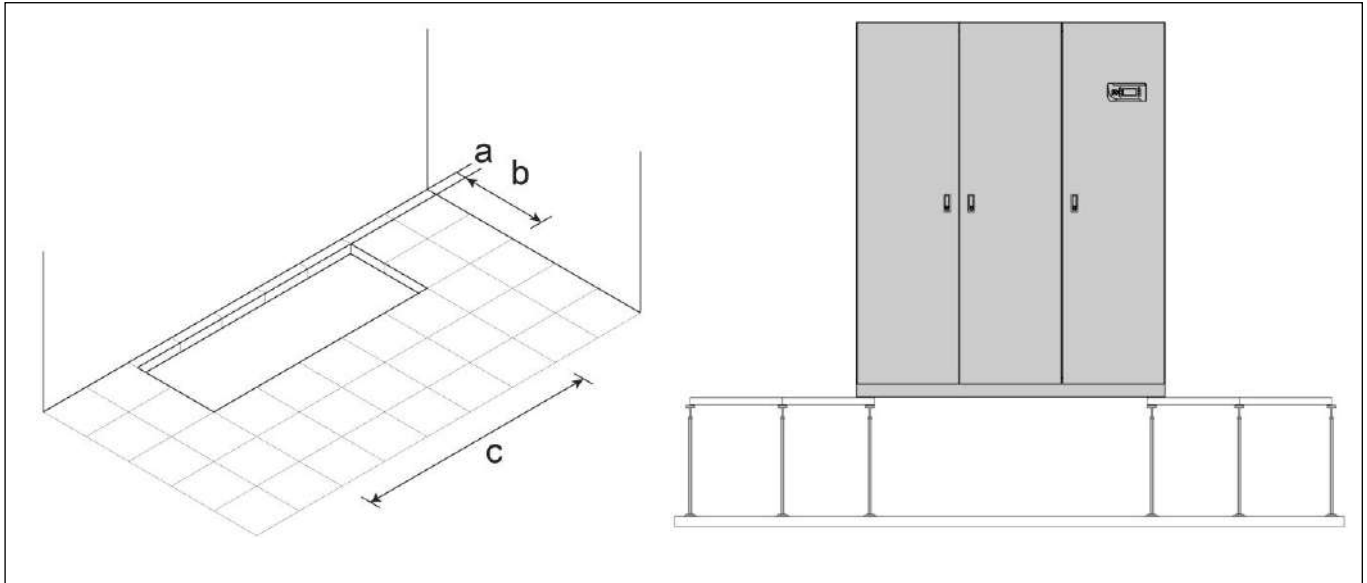






HOLE IN THE RAISED FLOOR FOR DOWNFLOW VERSION

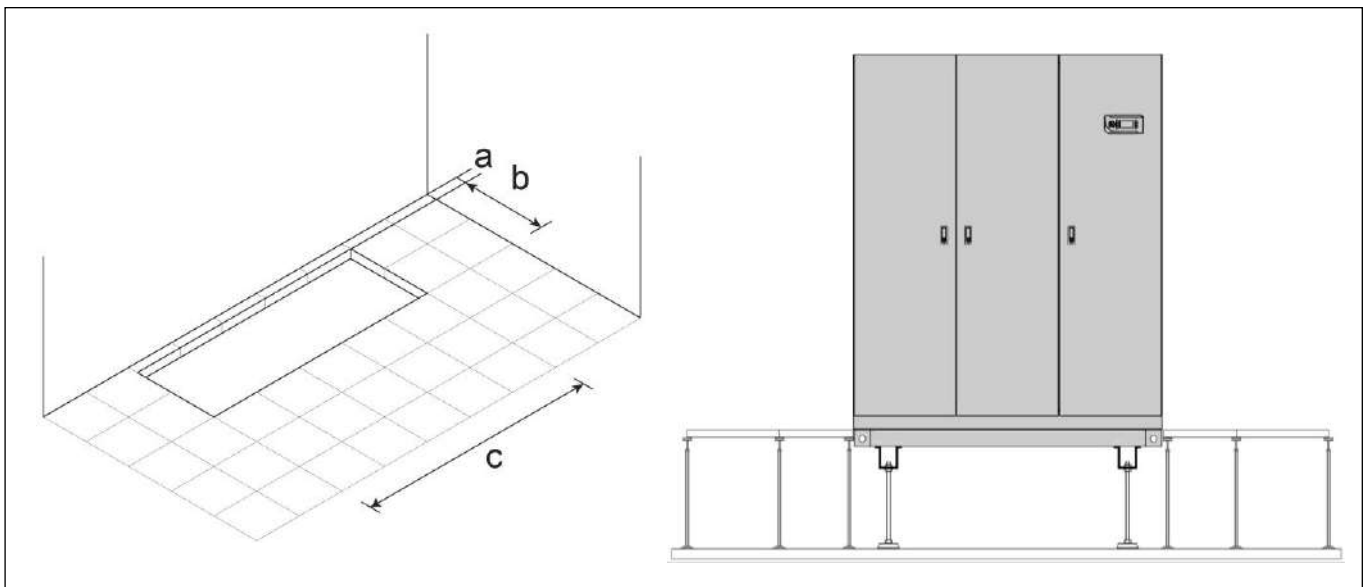
HOLE IN THE RAISED FLOOR WITHOUT FLOOR STAND



Foresee a hole in the floor with the following dimensions:

| SIZE | | E1 | E2 | E3 | E4L | E5L | E7L | E8L | E9L |
|------|----|-----|-----|-----|------|------|------|------|------|
| a | mm | 95 | 95 | 95 | 110 | 110 | 110 | 110 | 110 |
| b | mm | 560 | 560 | 660 | 785 | 785 | 785 | 785 | 785 |
| c | mm | 560 | 695 | 995 | 1510 | 1835 | 2400 | 2780 | 3180 |

HOLE IN THE RAISED FLOOR WITH FLOOR STAND (OPTION)

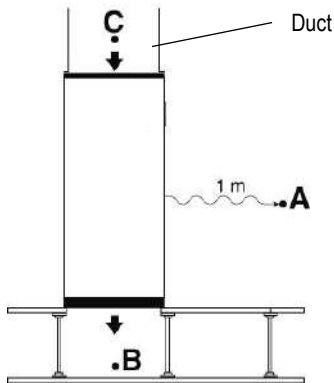


Foresee a hole in the floor with the following dimensions:

| SIZE | | E1 | E2 | E3 | E4L | E5L | E7L | E8L | E9L |
|------|----|-----|-----|------|------|------|------|------|------|
| a | mm | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| b | mm | 670 | 670 | 770 | 925 | 925 | 925 | 925 | 925 |
| c | mm | 670 | 805 | 1105 | 1650 | 1975 | 2520 | 2920 | 3320 |

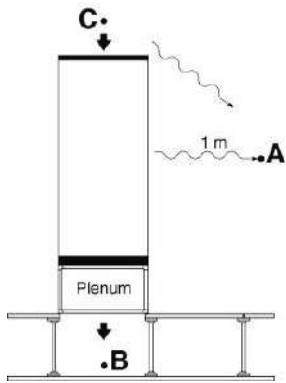
EXAMPLE FOR MACHINES NOISE EMISSION CALCULATION

UNDER MACHINE WITH DUCT ON AIR INTAKE



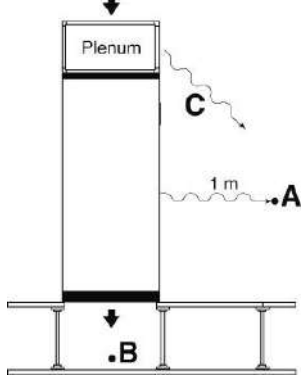
- Lp A = Front side Under catalogue value
- Lp B = Air delivery Under catalogue value
- Lp C = Air intake Under catalogue value
- The points B and C do not influence the point A

UNDER MACHINE WITH PLENUM ON AIR DELIVERY



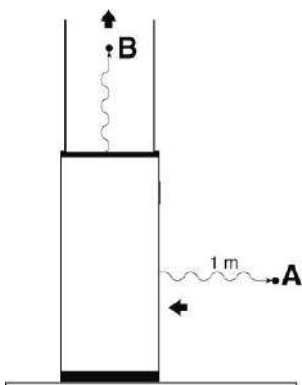
- Lp A = Front side Under catalogue value
- Lp B = Air delivery Under catalogue value – plenum noise reduction
- Lp C = Air intake Under catalogue value
- $Lp A+C = 10 \log_{10} \left(10^{\frac{LpA}{10}} + 10^{\frac{LpC}{10}} \right)$
- The point B do not influence the point A

UNDER MACHINE WITH PLENUM ON AIR INTAKE



- Lp A = Front side Under catalogue value
- Lp B = Air delivery Under catalogue value
- Lp C = Air intake Under catalogue value – plenum noise reduction
- $Lp A+C = 10 \log_{10} \left(10^{\frac{LpA}{10}} + 10^{\frac{LpC}{10}} \right)$
- The point B do not influence the point A

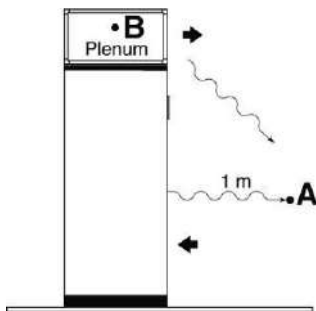
OVER MACHINE WITH DUCT



- Lp A = Air intake Over catalogue value
- Lp B = Air delivery Over catalogue value
- The point B do not influence the point A

EXAMPLE FOR MACHINES NOISE EMISSION CALCULATION

OVER MACHINE WITH PLENUM ON AIR DELIVERY

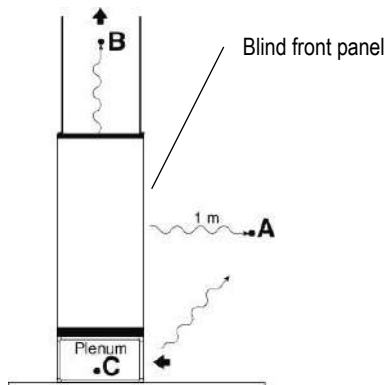


Lp A = Air intake Over catalogue value

Lp B = Air delivery Over catalogue value – plenum noise reduction

$$Lp A+B = 10 \log_{10} \left(10^{\frac{LpA}{10}} + 10^{\frac{LpC}{10}} \right)$$

OVER MACHINE WITH DUCT AND PLENUM ON AIR DELIVERY



Lp A = Radiated Over catalogue value

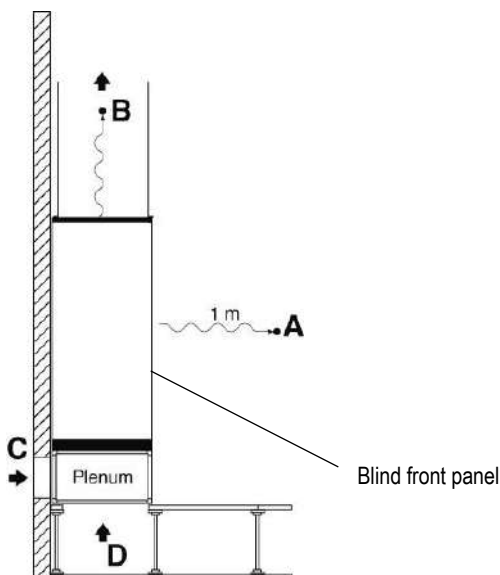
Lp B = Air delivery Over catalogue value

Lp C = Lp A + 6dB(A) – plenum noise reduction

$$Lp A+C = 10 \log_{10} \left(10^{\frac{LpA}{10}} + 10^{\frac{LpC}{10}} \right)$$

The point B do not influence the point A+C

OVER MACHINE WITH DUCT AND PLENUM ON AIR DELIVERY



Lp A = Radiated Over catalogue value

Lp B = Air delivery Over catalogue value

Lp C = Lp D = Lp A + 6 dB(A) – plenum noise reduction

The points B, C and D do not influence the point A

IMPORTANT

The declared noise levels are intended in free field conditions.

The noise pressure level of an installed unit is affected by the room acoustic characteristics.

Please consider an average noise increase of +4/+6 dB(A).

VALVE PRESSURE DROP CALCULATION AS FUNCTION OF WATER FLOW RATE

Flow coefficient k_v defines the water flow (between 5°C and 40°C) expressed in m³/h that cross a valve with a pressure drop of 1bar (100kPa).

With this data is possible to calculate the localized pressure drop as function of the water flow rate.

$$\Delta P = (Q / k_v)^2$$

ΔP (bar) = localized pressure drop of valve;

Q (m³/h) = water flow rate – it varies according to the desired operating condition;

k_v (m³/h) = valve flow coefficient.

The formula allows to calculate the value of the localized pressure drop (in bar).

The pressure drops values showed on the documentation are supplied in kPa.

Is possible to change from one unit to another through the following conversion.

$$1 \text{ bar} = 100\text{kPa}$$

CALCULATION EXAMPLE OF CONDENSING CONTROL VALVE PRESSURE DROP IN FUNCTION OF CONDENSER WATER FLOW RATE.

Model 068 M2 D E7L – Nom Cooling Capacity

Example at nominal conditions. Characteristics referred to entering air at 26°C-40%UR; water to the condenser 30-36°C

Condenser water flow rate: 14,8 m³/h

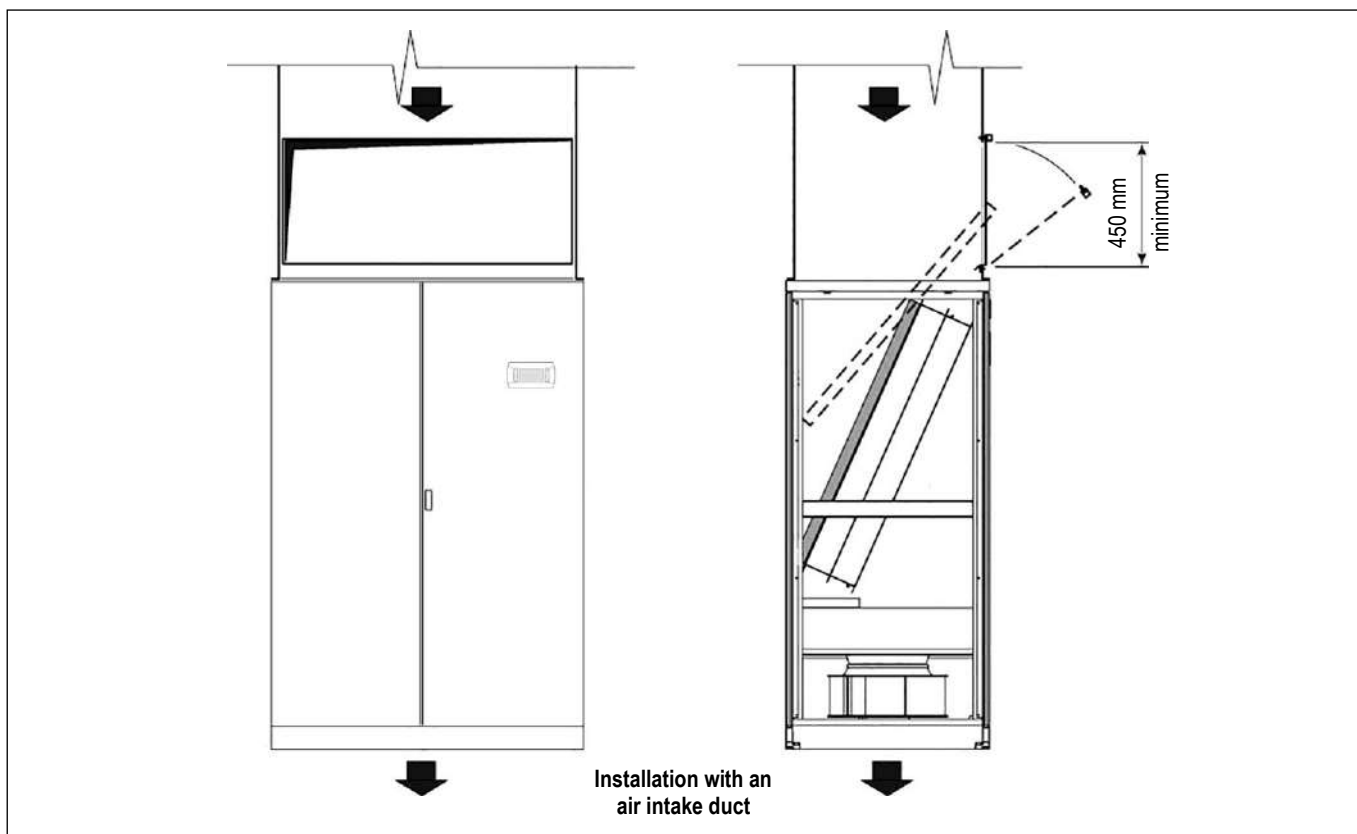
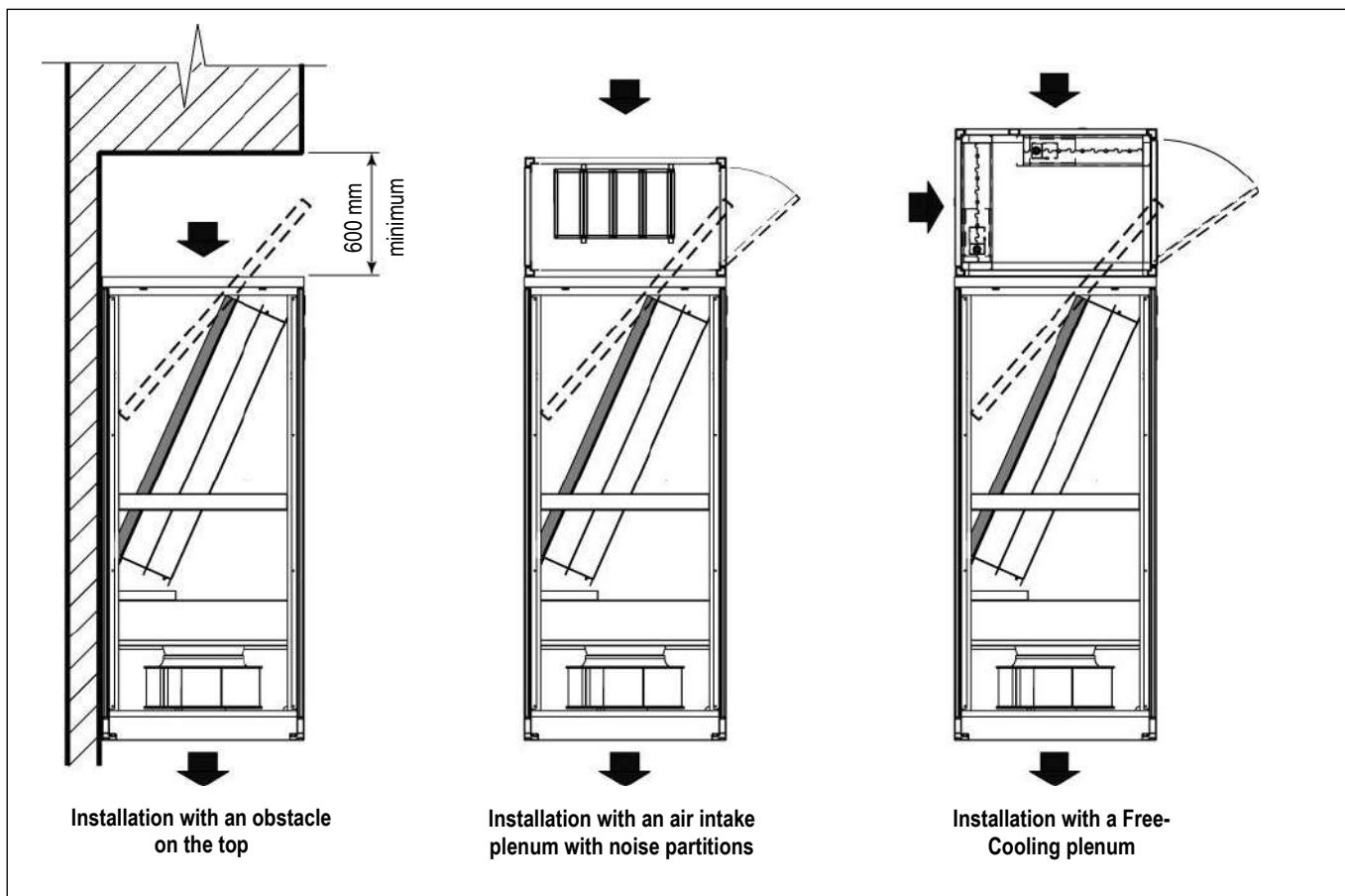
Condenser pressure drop 22 kPa

Valve flow coefficient k_v : 25,0 m³/h

Condensing control valve pressure drop: $\Delta P = (Q / k_v)^2 = (14,8 / 25)^2 = 0,350 \text{ (bar)} * 100 \text{ (kPa / bar)} = 35,0 \text{ kPa}$

Pressure drop (condenser + valve) = 22 + 35,0 = 57,0 kPa

**AIR FILTERS REPLACEMENT
FOR UNDER VERSION MACHINES SIZE E4L – E5L – E7L – E8L – E9L**

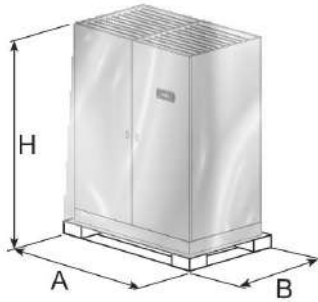


SHIPMENT: PACKING DIMENSIONS

Values referred to basic machine. The presence of some accessories increases the weight of machine.

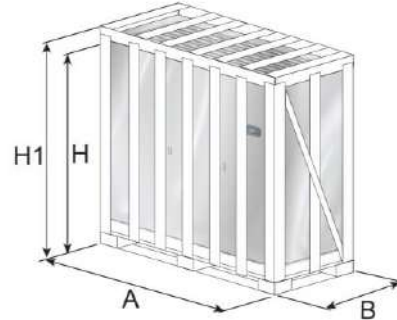
The machines are shipped on pallet and covered with shrink wrap.
On request packing on pallet covered with shrink wrap and wooden cage.

STANDARD PACKING DIMENSIONS



| Size | A (mm) | B (mm) | H (mm) |
|------|--------|--------|--------|
| E1 | 750 | 750 | 2080 |
| E2 | 900 | 750 | 2080 |
| E3 | 1200 | 910 | 2080 |
| E4L | 1750 | 1050 | 2130 |
| E5L | 2050 | 1050 | 2130 |
| E7L | 2650 | 1050 | 2130 |
| E8L | 3000 | 1050 | 2130 |
| E9L | 3510 | 1050 | 2130 |

OPTIONAL 9973: WOODEN CAGE PACKING DIMENSIONS



| Size | A (mm) | B (mm) | H (mm) | H1 (*) (mm) |
|------|--------|--------|--------|-------------|
| E1 | 790 | 790 | 2150 | 2350 |
| E2 | 940 | 790 | 2150 | 2350 |
| E3 | 1240 | 950 | 2150 | 2350 |
| E4L | 1790 | 1090 | 2200 | 2350 |
| E5L | 2090 | 1090 | 2200 | 2350 |
| E7L | 2690 | 1090 | 2200 | 2350 |
| E8L | 3040 | 1090 | 2200 | 2350 |
| E9L | 3550 | 1090 | 2200 | 2350 |

H1 (*) = Packing height with optional A531 on/off damper

SHIPMENT: SHIPPING WEIGHT

STANDARD PACKING

| Model | 012 M1 S | 018 M1 S | 022 M1 S | 030 M1 S | 047 M1 S | 042 M2 D | 068 M2 D | 094 M2 D | 120 M4 D | 150 M4 D |
|--------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Size | E1 | E2 | E3 | E4L | E5L | E5L | E7L | E8L | E9L | E9L |
| Weight UNDER | kg 254 | 305,2 | 366 | 526 | 631,5 | 661,5 | 838,5 | 1021,5 | 1171 | 1196 |
| Weight OVER | kg 244 | 295,2 | 346 | 516 | 621,5 | 651,5 | 783,5 | 961,5 | -- | -- |

OPTIONAL 9973: WOODEN CAGE PACKING

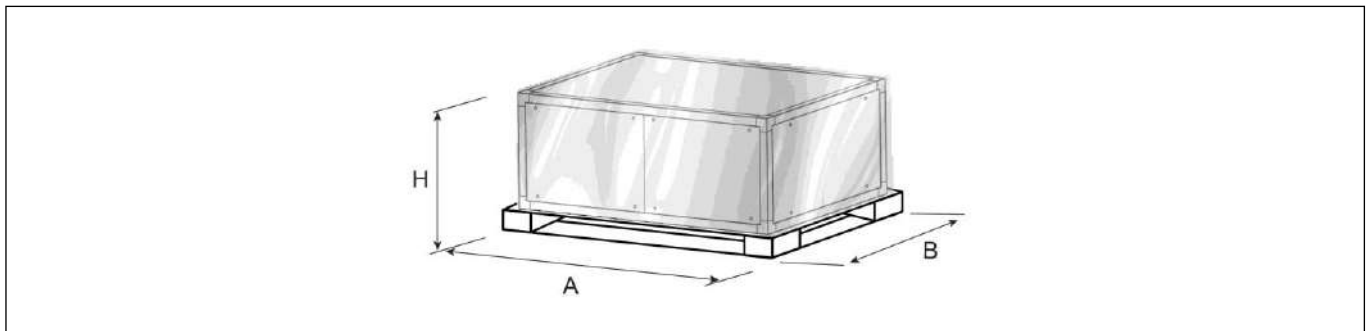
| Model | 012 M1 S | 018 M1 S | 022 M1 S | 030 M1 S | 047 M1 S | 042 M2 D | 068 M2 D | 094 M2 D | 120 M4 D | 150 M4 D |
|------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Size | E1 | E2 | E3 | E4L | E5L | E5L | E7L | E8L | E9L | E9L |
| Weight UNDER | kg 281 | 333,2 | 398 | 562 | 677,5 | 707,5 | 888,5 | 1079,5 | 1230 | 1255 |
| Weight UNDER (1) | kg 303 | 358,2 | 431 | 612 | 737,5 | 767,5 | 966,5 | 1167,5 | 1333 | 1358 |
| Weight OVER | kg 271 | 323,2 | 378 | 552 | 667,5 | 697,5 | 833,5 | 1019,5 | -- | -- |
| Weight OVER (1) | kg 293 | 348,2 | 411 | 602 | 727,5 | 757,5 | 911,5 | 1107,5 | -- | -- |

(1) Machine with optional A531 on/off damper

SHIPMENT: OPTIONALS PACKING DIMENSIONS AND SHIPPING WEIGHT

- P011 - EMPTY PLENUM
- P012 - EMPTY PLENUM CL.A1
- P031 - EMPTY INTAKE PLENUM
- P032 - EMPTY INTAKE PLENUM CL.A1
- P013 - PLENUM + 3 GRILLES
- P014 - PLENUM + 3 GRILLES CL.A1
- P015 - SILENCED PLENUM
- P016 - SILENCED PLENUM + 1 GRILLE
- P017 - PLENUM + FILTER EPM2.5 50%
- P018 - PLENUM + FILTER EPM1 50%
- P019 - PLENUM + FILTER EPM1 85%

The plenums are shipped on pallet and covered with shrink wrap.



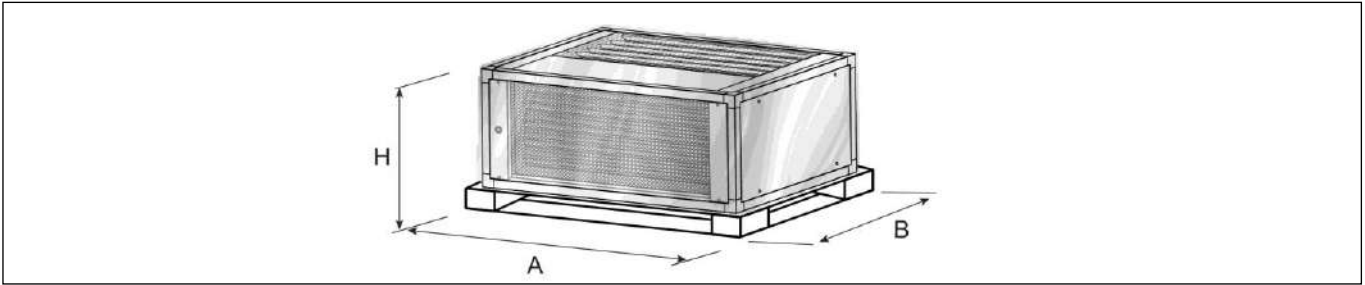
| Size | | E1 | E2 | E3 | E4L |
|--|----|-----|-----|------|------|
| DIMENSIONS | | | | | |
| A | mm | 750 | 900 | 1200 | 1750 |
| B | mm | 750 | 750 | 910 | 1050 |
| H | mm | 630 | 630 | 630 | 630 |
| SHIPPING WEIGHT | | | | | |
| P011 - Empty plenum "O" / "U" | kg | 31 | 34 | 41 | 69 |
| P012 - Empty plenum CL.A1 "O" / "U" | kg | 36 | 39 | 47 | 79 |
| P031 - Empty intake plenum "O" / "U" | kg | 31 | 34 | 41 | 69 |
| P032 - Empty intake plenum CL. A1 "O" / "U" | kg | 36 | 39 | 47 | 79 |
| P013 - Plenum + 3 grilles "O" / "U" | kg | 32 | 35 | 47 | 79 |
| P014 - Plenum + 3 grilles CL. A1 "O" / "U" | kg | 36 | 40 | 54 | 90 |
| P015 - Silenced plenum "O" / "U" | kg | 36 | 39 | 47 | 81 |
| P016 - Silenced plenum + 1 grille "O" / "U" | kg | 41 | 44 | 54 | 101 |
| P017 - P018 - P019 - Plenum + filter "O" / "U" | kg | 37 | 39 | 47 | 84 |

| Size | | E5L | E7L | E8L | E9L |
|--|----|------|------|------|------|
| DIMENSIONS | | | | | |
| A | mm | 2050 | 2650 | 3000 | 3510 |
| B | mm | 1050 | 1050 | 1050 | 1050 |
| H | mm | 630 | 630 | 630 | 630 |
| SHIPPING WEIGHT | | | | | |
| P011 - Empty plenum "O" / "U" | kg | 81 | 105 | 122 | 138 |
| P012 - Empty plenum CL.A1 "O" / "U" | kg | 92 | 119 | 137 | 158 |
| P031 - Empty intake plenum "O" / "U" | kg | 81 | 105 | 122 | 138 |
| P032 - Empty intake plenum CL. A1 "O" / "U" | kg | 92 | 119 | 137 | 158 |
| P013 - Plenum + 3 grilles "O" / "U" | kg | 99 | 135 | 146 | 178 |
| P014 - Plenum + 3 grilles CL. A1 "O" / "U" | kg | 110 | 151 | 170 | 192 |
| P015 - Silenced plenum "O" / "U" | kg | 102 | 130 | 152 | 170 |
| P016 - Silenced plenum + 1 grille "O" / "U" | kg | 115 | 155 | 182 | 200 |
| P017 - P018 - P019 - Plenum + filter "O" / "U" | kg | 106 | 135 | 152 | 170 |

"O" Over / "U" Under

P034: INTAKE FREE-COOLING PLENUM

The plenums are shipped on pallet and covered with shrink wrap.

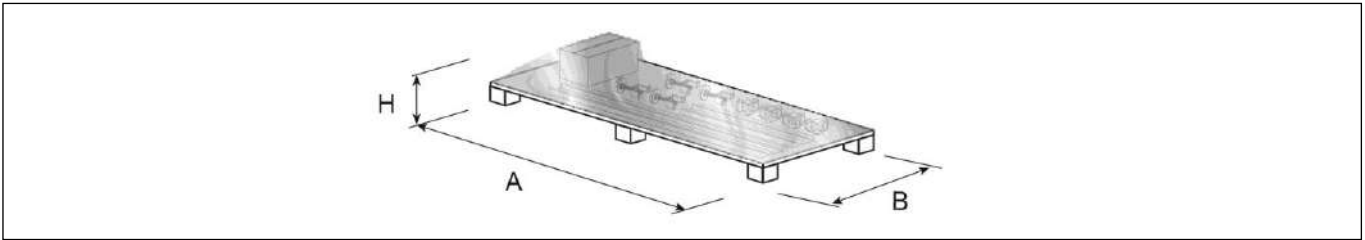


| Size | | E1 | E2 | E3 | E4L | E5L | E7L | E8L | E9L |
|---------------------------------------|----|-----|-----|------|------|------|------|------|------|
| DIMENSIONS | | | | | | | | | |
| A | mm | 750 | 900 | 1200 | 1750 | 2050 | 2650 | 3000 | 3510 |
| B | mm | 750 | 750 | 910 | 1050 | 1050 | 1050 | 1050 | 1050 |
| H | mm | 630 | 630 | 630 | 750 | 750 | 750 | 750 | 750 |
| SHIPPING WEIGHT | | | | | | | | | |
| P034 - Intake free-cooling plenum "U" | kg | 35 | 39 | 52 | 90 | 115 | 155 | 182 | 205 |
| P034 - Intake free-cooling plenum "O" | kg | 35 | 39 | 52 | 90 | 115 | 155 | 182 | 205 |

"O" Over / "U" Under

P041 / P042 / P043: SUPPORT FRAME

The support frames are shipped on pallet and covered with shrink wrap.



| Size | | E1 | E2 | E3 | E4L | E5L | E7L | E8L | E9L |
|------------------------|----|------|------|------|------|------|------|------|------|
| DIMENSIONS | | | | | | | | | |
| A | mm | 1200 | 1200 | 1200 | 1750 | 2050 | 2650 | 3000 | 3510 |
| B | mm | 900 | 900 | 900 | 900 | 900 | 900 | 900 | 900 |
| H | mm | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| SHIPPING WEIGHT | | | | | | | | | |
| | kg | 26 | 27 | 29 | 40 | 45 | 49 | 53 | 58 |

P183 / P184: KIT NETWORK ANALYZER / KIT NETWORK ANALYZER+OPTIONAL
P113 / P114: DUAL POWER SUPPLY KIT / DUAL POWER SUPPLY KIT+OPTIONAL

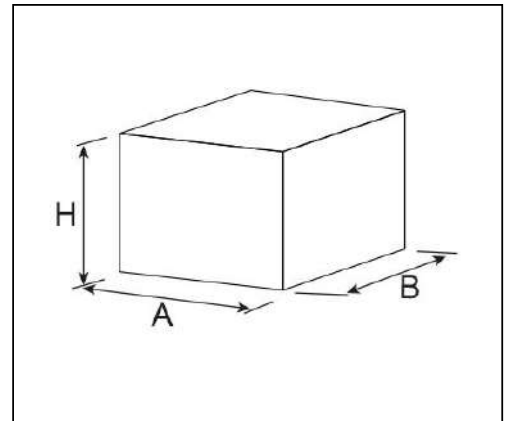
The optionals are shipped in a cardboard box.

P183 / P184 - KIT NETWORK ANALYZER / KIT NETWORK ANALYZER+OPTIONAL

| Size | | E1 | E2 | E3 | E4L | E5L | E7L | E8L | E9L |
|------------------------|----|-----|-----|-----|-----|-----|-----|-----|-----|
| DIMENSIONS | | | | | | | | | |
| A | mm | 410 | 410 | 410 | -- | -- | -- | -- | -- |
| B | mm | 410 | 410 | 410 | -- | -- | -- | -- | -- |
| H | mm | 210 | 210 | 210 | -- | -- | -- | -- | -- |
| SHIPPING WEIGHT | | | | | | | | | |
| | kg | 5 | 5 | 5 | -- | -- | -- | -- | -- |

P113 / P114 - DUAL POWER SUPPLY KIT / DUAL POWER SUPPLY KIT+OPTIONAL

| Size | | E1 | E2 | E3 | E4L | E5L | E7L | E8L | E9L |
|------------------------|----|-----|-----|-----|-----|-----|-----|-----|-----|
| DIMENSIONS | | | | | | | | | |
| A | mm | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 |
| B | mm | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 |
| H | mm | 210 | 210 | 210 | 210 | 210 | 210 | 210 | 210 |
| SHIPPING WEIGHT | | | | | | | | | |
| | kg | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |





for a greener tomorrow

Eco Changes is the Mitsubishi Electric Group's environmental statement, and expresses the Group's stance on environmental management. Through a wide range of businesses, we are helping contribute to the realization of a sustainable society.



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