



1. General description

LEONARDO™ EVOLUTION is the new range of precision air conditioners developed by UNIFLAIR™, conceived and designed specifically to meet the air-conditioning needs of call centers and Internet providers, data-processing centers and, more in general, any technological environment characterized by high levels of heat value to dissipate.

To guarantee the proper operation of the equipment in such installations, it becomes essential to keep the temperature and humidity conditions constant throughout the year; that is why we speak of controlling the ambient conditions, not just cooling.

The air-conditioning systems intended for the purposes of "comfort" are designed specifically to guarantee the well-being of the people in the room and are generally incapable of ensuring that the ambient conditions required by technologically sophisticated equipment can be kept constant, especially in the presence of much higher specific heat loads.

In precision air-conditioning applications, on the other hand, there are four main objectives to pursue, which prompt important design decisions that distinguish precision air-conditioners from those intended to ensure personal comfort, i.e.

- air temperature control ($\pm 0.5^\circ\text{C}$)
- air humidity control ($\pm 5\%$)
- high airflow rate
- year-round operation (24 hours a day, 365 days a year)

In the air-conditioning of large technical rooms used for telephone and Internet applications, the density of the heat load (per unit of surface area) is very high, even as much as 6-10 times the density of the heat load in comparable areas used as commercial offices, for instance. Standard air-conditioning equipment designed for ensuring comfort are unable to cope with such densities and types of heat load, especially as concerns the total absence of any latent load characteristic of technological applications.

Air temperature control

The air-conditioners in the new LEONARDO™ EVOLUTION range are capable of controlling the air temperature in the air-conditioned room with the utmost precision, adapting their cooling or heating capacity to the heat load in the room by means of sophisticated microprocessor control PID algorithms.

They are also able to react promptly to any sudden change in the entity of the heat load, restricting to a minimum any oscillation in the ambient temperature with respect to the set point.

Air humidity control

The sophisticated equipment contained in the rooms requiring precision air-conditioning must be suitably protected both from any condensation inside the room and from any static electricity discharges. To achieve this objective, it is essential to control the humidity level in the room very accurately. In fact, an excessively high humidity level can lead to condensation forming inside the electronic equipment, whereas if the humidity is too low there is a danger of a build-up of static electricity [R.H. <30%]. Both situations are potentially harmful to the electronic equipment.

High airflow rate

The air-conditioners in the new LEONARDO™ EVOLUTION range are the outcome of an accurate fluid dynamics study that has enabled the airflow in the appliance to be optimized, thus ensuring high specific airflow rates to guarantee the greatest possible sensible-heat factor, SHR (the ratio of space sensible heat to space total heat).

In fact, the rooms occupied by the equipment used for telephone or Internet transmissions, or large-scale EDP centers, demand high airflows to cope with the ambient heat load without having to resort to excessively low air delivery temperatures, thus guaranteeing a uniform conditioning of all parts of the room.

The high density of the heat load characteristic of such applications, together with the lower thermal inertia of the system, calls for the number of recirculations per hour to be about 10 times greater than in a normal air-conditioning application for the purposes of personal comfort in order to prevent troublesome temperature fluctuations.

Year-round operation (24 hours a day, 365 days a year)

The air-conditioners in the new LEONARDO™ EVOLUTION range are designed to function all year round without interruption and all the technical and process decisions have been made with a view to achieving a very high degree of reliability for the equipment.

The sophisticated research behind their design has combined an accurate selection of the components involved with an innovative production process and the assurance of absolute reliability and a great energy efficiency, a fundamental aspect when a constant control of the ambient conditions is needed.

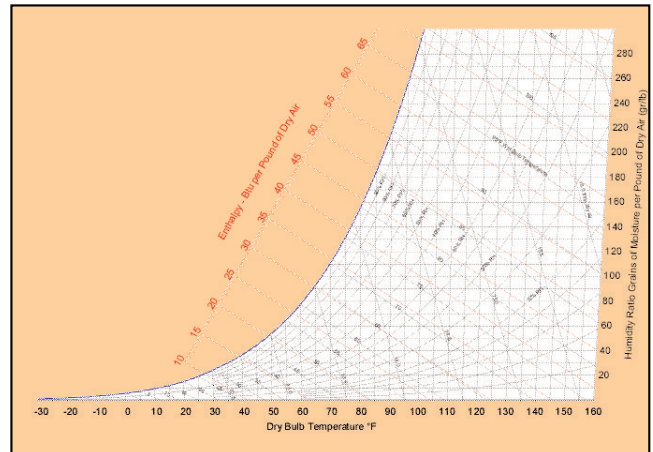
These results are achieved not only by an appropriate selection of the components (also thanks to the many years of experience acquired in the field of precision air-conditioning for technological environments), but also through an original design of the software used to control the equipment.

The software is based on the event prediction principle, which enables action to be taken in advance on the strength of analyses on the trends of the room's temperature and humidity parameters, guaranteeing precision and optimizing the energy consumption.

The LEONARDO™ EVOLUTION range offers a complete set of solutions with:

- air- or water-cooled direct expansion versions (**DX**)
- chilled water versions (**CW**)
- twin cool versions (**TC**), characterized by a chilled water section and a water- or air-cooled, refrigerant fluid direct expansion section
- energy saving versions (**ES**), that exploit water cooled by the outside environment to cool the air to send into the room being conditioned.

The variety of power ratings and cooling and airflow configurations in the new range enables even the most sophisticated plant requirements to be met.



2. Principal features

- High sensible cooling capacity and high SHR (i.e. the sensible to total cooling capacity ratio). This characteristic is particularly important in technological applications, where the heat load is all sensible and distinguishes this type of equipment from similar equipment designed for comfort-providing applications.

- Sturdy industrial design and semi-automatic assembly using top-quality and highly reliable components.

The new design of the LEONARDO™ EVOLUTION range is the evolution of a configuration specifically studied by UNIFLAIR™ and amply tested in the field. This is a guarantee of reliable and durable operation.

- Low running costs, achieved by means of sophisticated design and co-design methods, combined with an accurate selection of the components.

- The whole LEONARDO™ EVOLUTION range is "environment friendly" because it uses materials that can be recycled, particularly for the plastics and the thermal insulation.

- Compact air-conditioning units (in a self-contained package): all the component parts are contained inside the unit, for the operation of which all you need is:

- electrical wiring to the mains switchboard;

- hydraulic connections for draining off condensation, the humidifier (versions D and H) and the (optional) hot water reheat

- connections to the chiller (in the CW units);

- connections to the remote condenser (in the air-cooled DX and TC units) or to the dry-cooler (in the water-cooled DX and TC units and in the ES units).

- **Full frontal accessibility for all versions.** This feature enables you to access all the main components of the machine from the front for installation purposes and routine servicing.

Thanks to this feature, the machines can be installed side by side, or in between cabinets for other technical applications (racks).

- Metal structural framework and inside parts made with cold-dip zinc-plated sheet steel framework.

These profiles are connected together by means of structural rivets designed to ensure a sturdy assembly and capable of withstanding severe transport and handling conditions.

- Inside panels for shutting off the compartments affected by the airflow, made with cold-dip zinc-plated steel sheet metal profiles

- a reduction in the sound pressure level transmitted through the paneling;

- airtightness even without any outside panels, so that the units can operate with the doors open;

- the opportunity to inspect the elements inside without interfering with the operation of the unit and, more important, with the unit in operation.

- **Outside panels coated with RAL 7037 grey epoxy-polyester paint**, which guarantees the long-term durability of their original features.

The front panels are attached to the framework by means of rapid-coupling "fasteners".

The standard panels are lined on the inside with heat- and sound-proofing insulation to class 1 according to the Ministerial Decree (DM) of 26.06.84, to class HF-1 according to the UL94, to class M1 according to the Arrêté Ministériel of 30.06.1983.

On request, sandwich panels are available, lined internally with heat-insulating material; in this case, the fire reaction class of the panel as a whole is to class 0 according to the DM of 26.06.84, or class A1 according to the DIN 4102 standard.

- Versatile fan section, with two options available:

- **Aluminium single-inlet centrifugal fans with backward curved blades** (version "R") with a low moment of inertia and innovative vane profile.

The directly-coupled electric motor is of the three-phase (or single-phase in outside-rotor type protection grade IP10, offering the opportunity for speed adjustment by means of an auto-transformer and complete with thermal protection (klixon) inside the electric motor winding.

The fan wheel is statically and dynamically balanced with lifelong-lubricated sealed bearings.

The fan is mounted on a bearing that restricts the transmission of vibrations to the body of the appliance.

The fan speed can be selected to adapt the airflow to the head required by the aeraulic system.

Increasing the turning speed to obtain greater heads naturally means an increase in the sound pressure level produced by the machine and must be taken into account in the acoustic assessment of the installation.

The control system adopted has been specifically designed to guarantee a straightforward usage and quick and easy adjustment.

Using this type of fan with a highly-reactive fan wheel instead of the one with forward curved blades enables you to reach higher useful static pressures (up to 350 Pa) AS A STANDARD FEATURE.

The assembly of the whole fan section has been designed to facilitate all the servicing operations.

Aluminium single-inlet centrifugal fans with backward curved blades with EC (electronically commutated) direct current motors (version "V") with a low moment of inertia and innovative vane profile.

The directly-coupled EC motor is of the three-phase (or single-phase in the small size units) outside-rotor type, protection grade IP54, offering the opportunity for speed adjustment by means of a 0-10Vdc signal given by and integrated the microprocessor control

The fan wheel is statically and dynamically balanced with lifelong-lubricated sealed bearings.

The fan is mounted on a bearing that restricts the transmission of vibrations to the body of the appliance.

The fan speed can be selected to adapt the airflow to the head required by the aeraulic system.

EC fans grants power consumption lower than any other available type of fan and low noise level

Increasing the turning speed to obtain greater heads naturally means an increase in the sound pressure level produced by the machine and must be taken into account in the acoustic assessment of the installation.

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- Heat exchanger designed with an ample front surface area in order to ensure a low air flow velocity through the exchanger so as to prevent the entrainment of droplets of condensation, reduce the air's load losses and ensure a more efficient heat exchange during both the cooling and the dehumidifying processes.

The exchanger is composed of copper tubes mechanically expanded on aluminium fins, complete with a hydrophilic treatment to reduce the surface tension between the water and the metal surface, thus favoring film-wise condensation.

The exchanger is situated upstream from the fans to ensure unhindered air distribution and is complete with a stainless steel condensate tray with a flexible conduit for its drainage and an incorporated trap.

In the DX versions, the exchanger may have one or two circuits, depending on the number of cooling circuits: if it has two, the circuits are interconnected to ensure that the heat exchanging surface of the exchanger is used to maximum advantage whichever cooling circuit is in use at the time.

The UNIFLAIR™ heat exchanger is designed to ensure a high SHR.

• **Air filters** of the box type, made of self-extinguishing, artificial-fiber cellular material. The frame containing the filter material is made of metal.

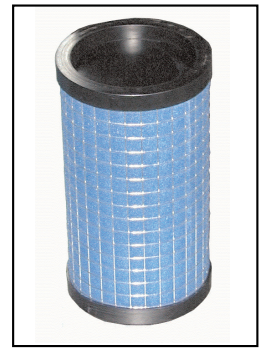
The pleated arrangement of the filters extends the surface area, ensuring a high filtering efficiency and a low load loss.

The filtering rate is to **EU4** (standard) or, on request, to EU5 (according to EUROVENT 4/5), in which case the filters are mounted inside the equipment, upstream from the heat exchanger.

It is very easy to access and remove the filters in all the machine configurations.

Filtering rates of **up to EU8** (according to EUROVENT 4/5) are available on request; in this case the filters are mounted on the plenum or on a base frame outside the machine.

The air-conditioner can be fitted with a high-capacity (optional) filter on the return air ducts, which is connected to the outside by means of a flexible conduit; a small booster fan is provided except for TUCR-TUCV units with suction from the rear and in TDCR-TDCV units.



• **Low airflow and clogged filter alarm sensors** consisting of two pressure switches for controlling the operating conditions of the fans and the build-up of dirt on the air filters inside the unit.

• Latest-generation hermetic scroll compressors (air- and water-cooled DX versions, TC versions, ES versions), characterized by a high COP (coefficient of performance) and consequently also a high energy efficiency. Scroll compressors are characterized by:

- low noise levels
- low vibration levels, facilitated also by their assembly on vibration absorbers
- a high MTBF (Mean Time Between Failures)
- a low in-rush current
- incorporated overheating protection
- oil level control for functional checks (in some versions)
- assembly inside a dedicated technical compartment separate from the airflow (optional for upflow versions) for easy monitoring of the air-conditioner's operation without having to suspend the operation of the appliance.

• **Hydraulic circuit** (CW versions)

The piping for the hydraulic circuit is coated entirely with closed-cell insulating material to class 1 according to the DM of 26.06.84, class 1 according to the BS 476 part 7, ASTM E 162-87, low fumes opacity measured according to ASTM 662-79. The unit can be fitted with a two-way or three-way valve, as preferred, with a remote control servomotor.

• **Refrigerating circuits** (air- and water-cooled DX versions, TC versions, ES versions)

The LEONARDO EVOLUTION™ direct expansion range offers the opportunity to choose between three different refrigerating circuit configurations on the same power rating options:

- a single-circuit unit with one compressor;
- a single circuit unit with two compressors (tandem);
- a dual-circuit unit with a compressor for each circuit;

Each circuit is composed of:

- a fluid intake complete with a rotalock on-off cock and safety valve;
- a dehydrating filter and flow sensor. The former enables the refrigerating circuit to be kept free of humidity (thus increasing the life of all the circuit's components), while the latter enables a rapid check on whether the system is charged with refrigerant correctly and whether it contains any humidity;
- Electronic expansion valve controlled by the microprocessor with special software created and tested by UNIFLAIR™. This enables you to adjust the flow of refrigerant fluid through the evaporator, controlling the real evaporator superheating in relation to variations in the ambient conditions in the room being air-conditioned. Improving in this way precision of cooling and the energy efficiency of the cooling cycle.
- high-pressure pressure switches with manual resetting devices;
- needle valves for the refrigerant charge and for pressure control;
- outside connections complete with check valves (in the air-cooled DX versions)

• **Refrigerant R407C (standard) or R22 (optional)**; R134a on request. The whole LEONARDO™ EVOLUTION range is "ozone friendly" in terms of both the refrigerant fluids it uses and the foaming agents used for the insulating material. In the water-cooled units, the refrigerant circuit is pre-charged with refrigerant; in the units with a remote condensers, on the other hand, the circuit is saturated with dry nitrogen and the unit must therefore be emptied and charged with refrigerant by the installer. Guidelines are available for calculating the piping and estimating the amount of refrigerant required.

• Internal water-cooled condenser (for water-cooled DX and TC versions and for ES versions), of the braze welded plate type, made of AISI 304 stainless steel.

• Remote air-cooled condenser (for air-cooled DX and TC versions). These condensers are characterized by a single- or dual-circuit exchanger with aluminium finned copper tubes, complete with low-speed axial-flow fans to reduce the sound pressure level.

The frame is made of embossed aluminium with excellent weather-resistant characteristics.

Special surface treatments on the coil are available on request and enable the resistance to aggressive atmospheric conditions to be further increased.

The remote condenser is complete with an electric power and control board, fully wired and tested at the factory.

The fan management may be of the standard modulating type with phase cutting regulation, for proper operation during the winter season down to temperatures of -20°C and wind speeds perpendicular to the coil below 2.5 m/s.

For lower temperatures, down to -40°C, a customized version is available with a high-resilience steel fluid receiver and flooding valve, both designed to fit within the overall dimensions of the equipment; in this case the phase cutting regulation is inside air conditioning LEONARDO

• Remote dry-cooler with water/glycol mixture (water-cooled DX, water-cooled TC and ES versions)

Characterized by an exchanger with copper tubes and aluminium fins, with low-speed axial-flow fans to reduce the impact of ambient noise.

The frame is made of embossed aluminium with excellent weather-resistant characteristics.

Special surface treatments on the coil are available on request and enable the resistance to aggressive atmospheric conditions to be further increased.

The dry-cooler is complete with an electric power and control board, fully wired and tested at the factory.

The equipment is complete with a system that optimizes the fans' operation during the winter season, fully exploiting the additional free cooling capacity. (in energy saving unit)

• **Electric heating with aluminium-finned heating elements** (in the units with electrical heaters), complete with safety thermostat for manual resetting to cut off the power supply and trigger the alarm in the event of overheating.

For each version, there are two heating power levels available, i.e. standard and boosted. In a smaller model there is a single heating power and there is a

modulating heating power in a boosted. In both cases, this power is distributed in three stages, thus spreading the load in a balanced manner on the three power phases of the mains supply to avoid electric balancing problems and achieve a lower electrical energy consumption. In fact, the presence of the three stages ensures an excellent temperature regulation according to the needs of the room being conditioned.

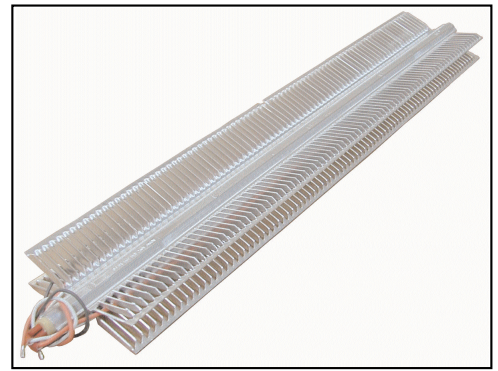
Both from the energetic and from the functional standpoints, the three-stage solution unquestionably behaves far better than the single-stage or two-stage systems.

The finned heating elements are characterized by a high efficiency in order to keep a lower power density on the surfaces, thereby restricting any overheating of the elements and thus increasing their durability.

Thanks to the low surface temperature of the heating elements, the air ionization effects are also limited.

This heating system serves a dual purpose:

- heating the air in order to reach and maintain the set point;
- reheating in the dehumidifying phase, so as to restore the air temperature to the set point. As a result, the installed heating capacity is sufficient to maintain the dry bulb temperature in the room during operation in dehumidifier mode.



• **Heating with a hot-water coil.** This system is proposed as an alternative to, or in combination with the electric heating system.

It is characterized by a hot water coil made with copper tubes and aluminium fins in a single array, tested to 30 bar.

The reheat coil is complete with a valve for venting air from the hydraulic circuit (positioned at the highest point and accessible from the front) and a three-way modulating regulator valve with a servomotor controlled directly by the unit's microprocessor control.

When it is used in combination with the electric heating, this system takes priority over the latter. It serves a dual purpose:

- heating the air to bring it up to the set point;
- reheating during the dehumidifying phase to make the two regulations (temperature and relative humidity) independent of each other. The installed heating capacity is capable of maintaining the dry bulb temperature in the room during operation in dehumidifier mode.

• **Hot-gas reheating.** In the original UNIFLAIR version, this reheating system is proposed as an alternative to hot-water heating and is only available in the DX, TC, ES versions.

It exploits a part of the heat released to the condenser to reheat the air destined for the room being conditioned, thereby achieving a worthwhile energy saving.

It is characterized by a coil of copper tubing with aluminium fins and is situated downstream from the evaporator coil.

During the dehumidifying phase, when the temperature of the air can drop to below the set point, this system enables the temperature and relative humidity to be regulated separately.

Accurate temperature regulation is naturally the responsibility of the unit's microprocessor control, which governs an on-off valve feeding the reheat coil.

When it is used in combination with electric heating, this system takes priority over the latter.

• **Immersed-electrode humidifier** for modulating sterile steam production with the automatic regulation of the concentration of salts in the boiler to allow for the use of untreated water. You can consequently use water with varying degrees of hardness and without the need for any chemical treatment or demineralizing.

The humidifier has a steam cylinder, a steam distributor (installed immediately downstream from the exchanger), water intake and delivery valves and a maximum level sensor.

Proportional control of the humidifier's operation (achieved by controlling the electric current allowed to pass through the cylinder's electrodes) and the periodic flushing cycle (controlled by continuously monitoring the water's conductivity) guarantee a perfect efficiency of the system, a low energy consumption and a greater durability of the components.

The steam cylinder is installed outside the air flow to avoid any heat losses.

The air-conditioner's microprocessor control lets you know when the steam cylinder has to be changed because it has been exhausted; on request, the steam cylinder can be of a type that allows for inspection so that the electrodes can be routinely cleaned to remove any scale.

The steam production capacity is adjustable within a range of values that can be selected by hand.

Generally speaking, the value set at the factory amounts to 70% of the cylinder's maximum steam production capacity.

The microprocessor control is also designed to govern a dehumidifier installed outside the equipment, on the air distribution channel.

• **Switchboard** situated in a compartment separated from the air flow and made in compliance with the directive 73/23/EEC and related standards.

The main characteristics are as follows:

- a single-phase power supply 230/1ph/50Hz for the smaller chilled water units in cooling only version (TD./TU.C(R) 0600-0700)
- a three-phase power supply, 400V/3ph+N/50Hz for all the units except for TU./TD.C (R-V) 1000...2500 where the Neutrum is available in the case of the optional condensate drainage pump and/or booster fan for fresh air being requested.
- 24Vac low-voltage secondary circuit with isolation transformer;
- plastic insulating screen for protection from live components;
- general isolator with mechanical interlock;
- thermomagnetic circuit-breakers for protection;
- terminal board for no-voltage signal and control contacts.

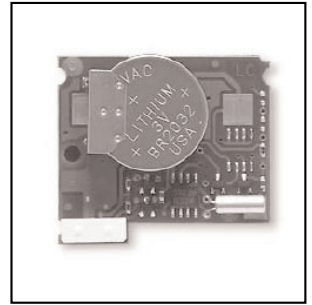
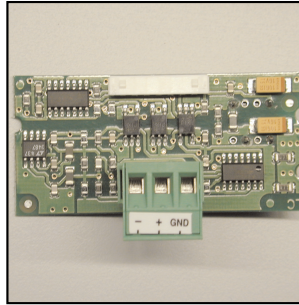
All the units undergo a safety test cycle to check the continuity of the protection circuit and the insulation resistance, and a voltage (dielectric strength) test.



3. Other optional accessories

The microprocessor control system can be supplied with the following optional cards:

- **RS485** serial adapter for data transfer to a central supervisor system with STD protocol or MODBUS protocol;
- **Clock card** for managing scheduling operations and for the operations counter functions
- **TCP/IP** interface board: connection air-conditioners to networks managed by BMS working with the SMNP or TCP/IP
- **LON** serial board: connection air-conditioners to networks managed by BMS working with the SMNP or TCP/IP
- **RS232** serial board for modem



- **TWO-WAY PRESSURE-REGULATING VALVE** for regulating the condensing water flow rate (only on water-cooled DX and TC units).
- System for regulating the condensing pressure complete with three-way flooding valve on the units (only on water-cooled DX and TC units).
- Optional **REPHASING CONDENSER** are available in the all units in exception to CW units with EC centrifugal fans and small size units (0600-0700)
- **CONDENSATE DRAINAGE** pump (versions C and with electrical heaters)
- **HUMIDIFIER CONDENSATE DRAINAGE PUMP** (versions D), suitable for eliminating the hot water coming from the humidifier.
- **EXTERNAL SENSORS** for high ambient temperature or high temperature and humidity alarm signals.
- **DELIVERY TEMPERATURE THRESHOLD SENSOR** (only on CW units), which governs the opening of the three-way valve to keep the air temperature at the conditioner's outlets above a threshold value.
- **FIRE AND/OR SMOKE DETECTOR.**
- **WATER LEAK DETECTOR** comprising a control module installed on the electric switchboard and an external sensor. To check several points, you can connect a number of **ADDITIONAL LEAK DETECTOR SENSORS** or **SENSOR STRIP PROBE**



UPFLOW UNITS

- **BASE FRAME (height 200mm)** with removable front panel, ready-punched holes on the side to allow for the connections to be made even without a raised floor. The inside walls are lined with standard sound-proofing material or with panels to class A1 ⁽¹⁾.
- **BASE FRAME (height 500mm) WITH MOTORIZED DAMPER** insulated with standard sound-proofing material or with panels to class A1 ⁽¹⁾. Normally used in combination with an air intake from below.
- **BASE FRAME (height 500mm) WITH HIGH-EFFICIENCY FILTERS** insulated with standard sound-proofing material or with panels to class A1 ⁽¹⁾, with high-efficiency air filters ranging from class EU6 to class EU8. The filters are accessible from the front.
- **DELIVERY PLENUM (height 500mm)** for connecting the top of the unit to a false ceiling or to the air delivery channel. The inside walls are lined with standard sound-proofing material or with panels to class A1 ⁽¹⁾. The plenum is also available in a version with melamine resin filter plates (class 1 according to the DM of 26.06.84, class B1 according to the DIN 4102, classes 94 V-0 and 94 HF-1 according to the UL94, class M1 according to the NF P92-501). On request, there is also a version available for installing high-efficiency air filters ranging from class EU6 to class EU8. The filters are accessible from the front.
- **DELIVERY PLENUM (height 500mm) WITH FRONT GRILLE** with a double array of slats, coated with standard sound-proofing material or with panels to class A1 ⁽¹⁾.
- **GRAVITY OVERPRESSURE DAMPER** to prevent a reverse flow of air when the unit is not in operation, in installations with several air-conditioners installed in the same room.
- **MAIN FRAME** for assembly on a raised floor. The frame is adjustable in height (± 25 mm) from 200 mm to 600 mm and is provided complete with vibration absorber feet.

DOWNFLOW UNITS

- **AIR INTAKE PLENUM (height 500mm) WITH MOTORIZED DAMPER** insulated with standard sound-proofing material or with panels to class A1 ⁽¹⁾, for installation on the delivery line of downflow units. The damper is controlled by the air-conditioner fan's remote control and serves the purpose of preventing the reverse flow of the air when the unit is not in operation, in installations with several air-conditioners installed in the same room.
- **AIR INTAKE PLENUM (height 500mm)** for mounting between the top of the unit and the air return channel or false ceiling. The inside walls are lined with standard sound-proofing material or with panels to class A1 ⁽¹⁾. Available with melamine resin filter plates (to class 1 according to the DM of 26.06.84, class B1 according to the DIN 4102, classes 94 V-0 and 94 HF-1 according to the UL94, class M1 according to the NF P92-501). On request, there is also a version available for installing high-efficiency air filters ranging from class EU6 to class EU8. The filters are accessible from the front.
- **BASE FRAME (height 500mm) WITH FRONT DELIVERY GRILLE** insulated with standard sound-proofing material or with panels to class A1 ⁽¹⁾, for installing on the delivery line of downflow units. The base frame is fitted with an internal deflector to guide the air flow to the machine's outlet.
- **MAIN FRAME** for assembly on a raised floor. The frame is adjustable in height (± 25 mm) from 200 mm to 600 mm and is provided complete with vibration absorber feet.
- **MAIN FRAME** for assembly on a raised floor and complete with a deflector for guiding the air flow to the conditioner's outlet.

⁽¹⁾ The sound-proofing material indicated as "standard" is to class 1 according to the Ministerial Decree of 26.06.84 and class B1 according to the DIN 4102; the panels indicated as class "A1" are to class 0 according to the DM of 26.06.84 and class A1 according to the DIN 4102.