Air Handling Units NB

NB

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Systemair

Examples of applications

Different types of plant – same basic requirements

All buildings are there to create a "climate shell", regardless of whether the aim is cleaner air or a cooler or warmer climate than the external surroundings.

Here are a few examples where Systemair's air handling units have been used and the conditions and requirements that applied.

Topvex

TA F Maxi TR TX SR SX TIME

SIMPLE PROJECT IMPLEMENTATION

Simple project implementation for expansion of existing premises or new buildings. Simplifies selection and planning and includes smart solutions for easier installation.

TIME DV NB

FLEXIBLE SOLUTIONS

Flexible solutions with heat recovery and intelligent control functions that are easily adapted to suit current needs, different recovery systems and configurations.

TIME DV NB

LARGE VOLUMES OF AIR

When choosing central plants, you will usually need units capable of handling large volumes of air and sometimes the option of communicating with an integrated control system.

Topvex

TA F Maxi TR TX

COMPACT SOLUTIONS

Changed needs when upgrading or renovating a building usually mean new requirements for air handling. Extreme space-saving solutions and connections for units that can also be split for easier transport and handling at the construction site are able to satisfy all new demands.

Topvex

TA Maxi TR TX SR SX TIME DV

COMMUNICATION

Integrated control systems. The nature and complexity of requirements for controlling units and functions vary depending on the size of a project. Our factory-integrated solutions with various levels of equipment can handle everything from the simplest requirements to the toughest demands.

Offices

Office buildings generally require good ventilation during the day as well as heat recovery and reheating of supply air depending on external conditions. Ventilation systems with demand control should be considered for offices where staffing levels vary. As a rule, offices develop an excess of heat produced by people, lighting, solar radiation, computer equipment, etc. In many cases there is a need to cool the air and prevent uncomfortably high temperatures. In larger buildings that accumulate heat energy easily, you should consider employing night cooling. If the office is in a city environment, a higher filtration class should be used. In an office environment, there is also considerable need to reduce the noise generated by the ventilation system.

Schools/day nurseries

A school environment means a lot of people present at certain times of the day, i.e. generally there are relatively large variations. This means that it should be possible to use demand control for the ventilation system. Normally, heat recovery is warranted. There will be short periods during the year when cooling may be required. However if there is effective sunscreening, then air conditioning is rarely required. High demand for low noise levels. At day nurseries, activities, such as cooking, that create odours are common, so there is often a need for supply air and extract air to be kept separate. There must be heat recovery in the form of a plate heat exchanger, for example.

Shops

As a rule, the number of people in a shop changes constantly throughout the day, making a control-on-demand ventilation system the sensible option. Recirculating air in combination with carbon dioxide control (CO_2) and heat recovery can be one optimised solution for these types of premises.
When there are few people present, CO_2 levels will be low and an increased amount of return air can be mixed into the system. As the number of people present increases, the amount of return air is reduced and replaced with fresh outdoor air.
If heating is required at night-time, the premises are warmed up using 100% recirculating air.

Industry

Industrial premises will often have high airflows if the work carried out there generates high levels of air pollution. If the pollutants are also aggressive, there may be requirements that affect the choice of material used. Systemair offers products for different environmental classes that can cope with tough environments. Filtration of processed air can be adapted to suit specific demands.

Hotels

The requirements for ventilation in hotels are characterised by demands relating to fire protection, demand control and low noise levels. The choice of air handling unit will probably be affected by these demands. What is important here is good functions for speed control and quiet operation.
In addition to quiet air handling units with demand control, Systemair can also supply fans and dampers for fire protection.

Healthcare premises

Healthcare premises can encompass numerous activities, everything from operating theatres to wards. The activity determines the requirements. Operating theatres will have stringent demands for cleanliness and ventilation. Wards require low noise levels. If several areas are served by the same system, the unit must have demand control and possibly even sub-systems.
Systemair's range of air handling units can satisfy all requirements relating to healthcare premises, whether these have to do with air cleanliness, noise levels or demand control.

Introduction

The air handling unit (AHU) is one of the most essential and critical units to be considered when designing an air conditioning system.

This air conditioner is designated by us and other industry manufacturers as an air handling unit. The latter designation is popular within the company and has been used routinely in all previous editions of the NB catalogue. We will also use it in this catalogue to refer to our well-known, popular and efficient NB air handling unit.

The importance of the air handling unit in the system is readily understood, as it modifies the air conditions for final treatment of air conditioned environments and is placed downstream of all other installed equipment.

Both the construction layout and the physical location of the installed air handling unit means that it is extremely difficult to adjust at a later date to conditions much different from those established during the original selection process. For this reason, the equipment must be carefully and precisely selected.

The front surface, and therefore the width and height of the equipment, is defined on the basis of the air flow rate.

The type of fan and the motor can be selected on the basis of the designed static pressure.

The characteristics of the cooling and heating units can be defined on the basis of the estimated cooling and/or heating power.

Various additional sections can be added to obtain an apparatus defined by three dimensions and with a series of specific components.

This catalogue presents Systemair HVAC Spain's standardised range of NB air handling units, which includes equipment for air flows between 500 and 87,000 m3/h, with static pressures of up to 200 Pascals.

Special care has been taken in the preparation of the catalogue to ensure a user-friendly document. Only a little effort is needed to obtain a rather precise overview of the air handling unit required, with clear, concise information on the most important characteristics. Based on our experience, these are key data for the start of any project.

Additional information can be used to identify each of the characteristics to be taken into account in the precise, complete definition of each apparatus.

Example NB Unit.

Modular air handling units NB

NB is probably the most flexible unit on the market when it comes to design. As we do not have standard unit combinations, units can be adapted to suit customer requirements.

Keywords

- Available in 15 different sizes
- Handles airflows of 500-90.000 m³/h
- For use with low, intermediate or high air pressure systems.
- Heating and cooling units
- Extensive range of filters
- Heat recovery sections
- Two different types of air humidifier

Unit housing

The unit housing is made from aluzinc 185 sheet steel and sandwiched panels. The outside of the unit housing has a stove-enamelled surface in our characteristic new grey colour. Panels are available in two different versions:

- 25 mm – which is the standard version. The panels are attached directly to the framework.
- 50 mm – which satisfies demands when more effective heat insulation is required. These panels are attached to a frame made from 70x70 mm profiled aluminium sections.

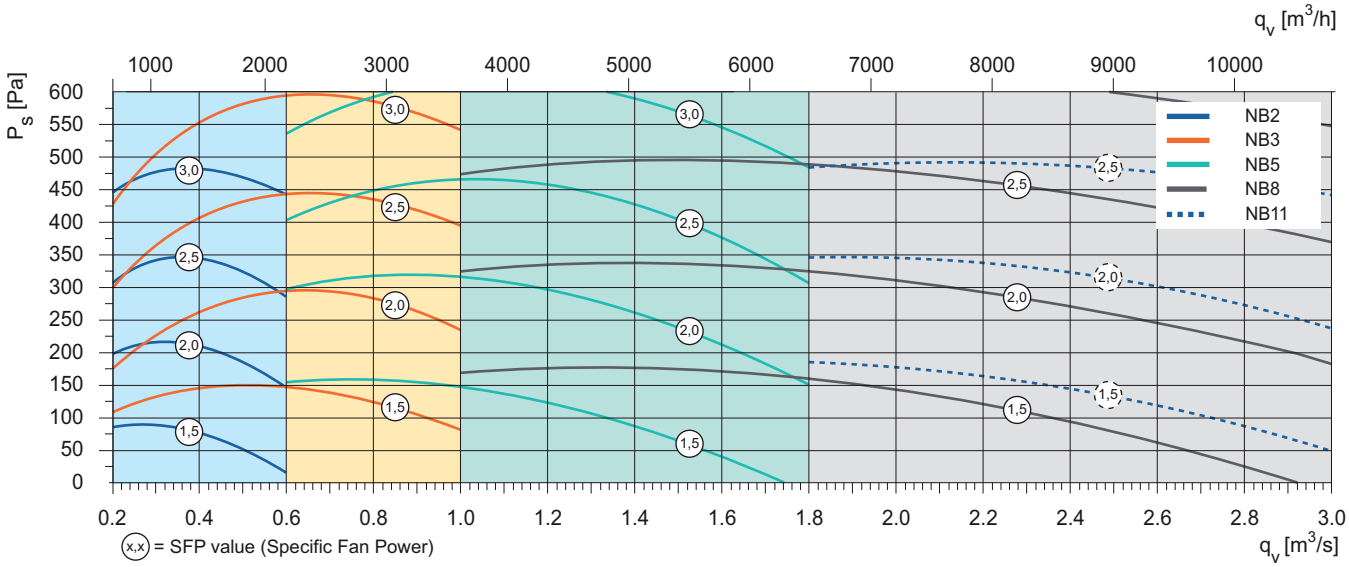
All panels are filled with injected polyurethane insulation foam, which has excellent heat and sound-insulating properties. Rockwool panels are optional as well.

Range and software

Detailed information on NB units you can get with the product selection software. Both are easy to use and are available from your nearest Systemair office.

WORKING RANGE

2, 3, 5, 8



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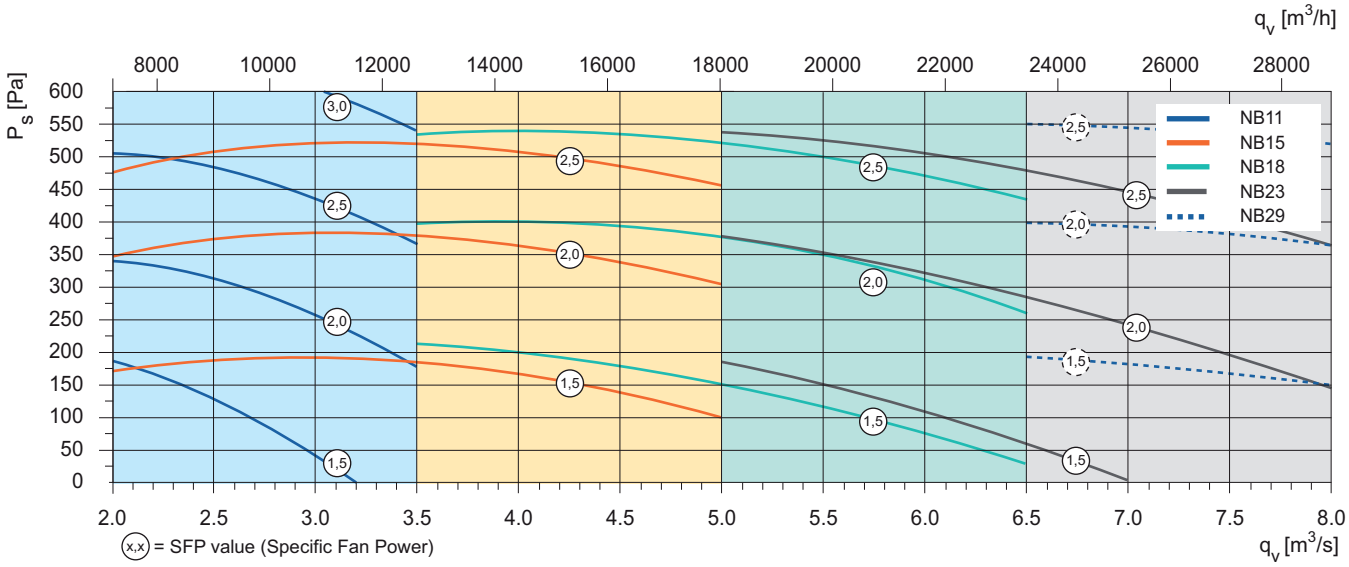

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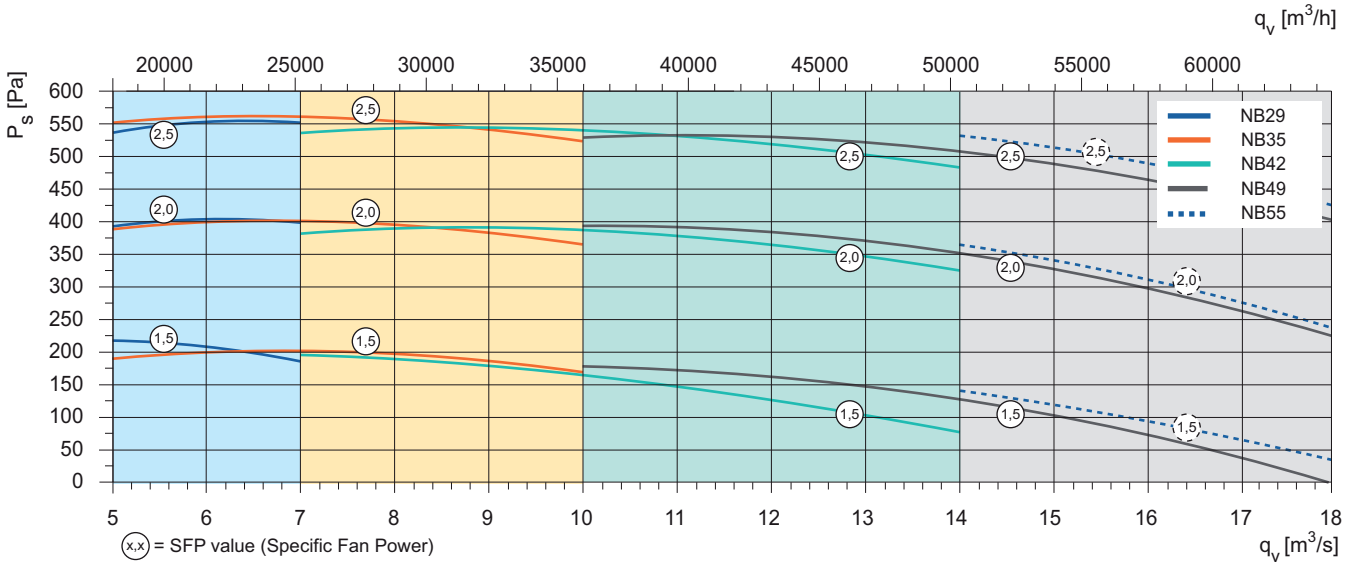

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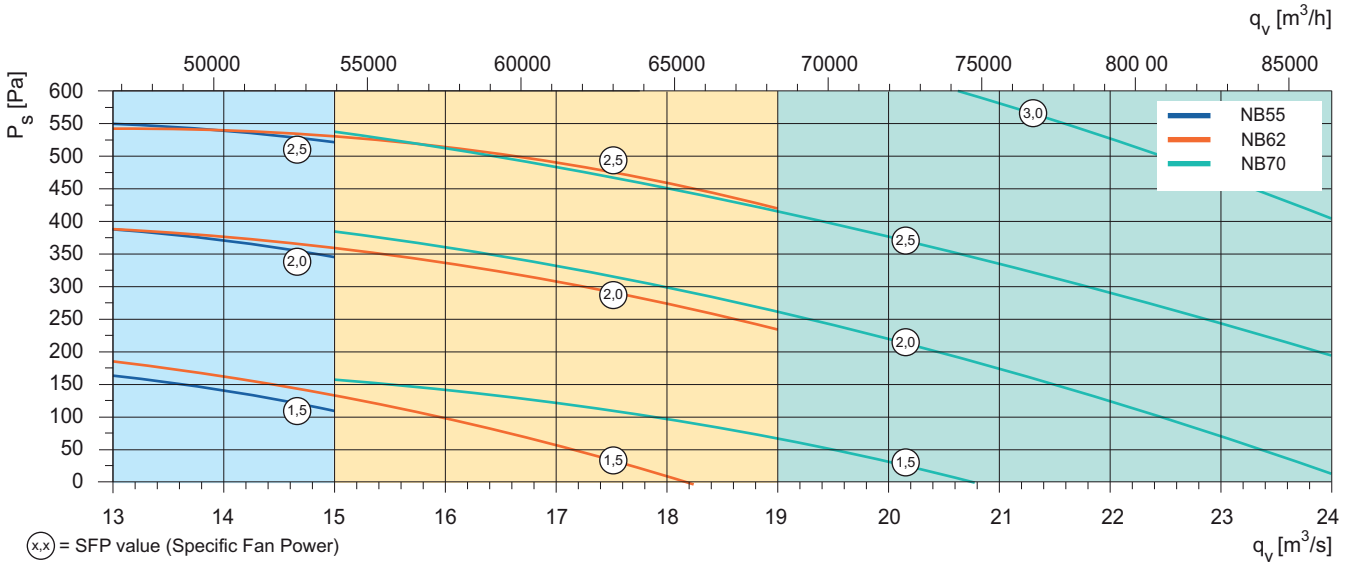
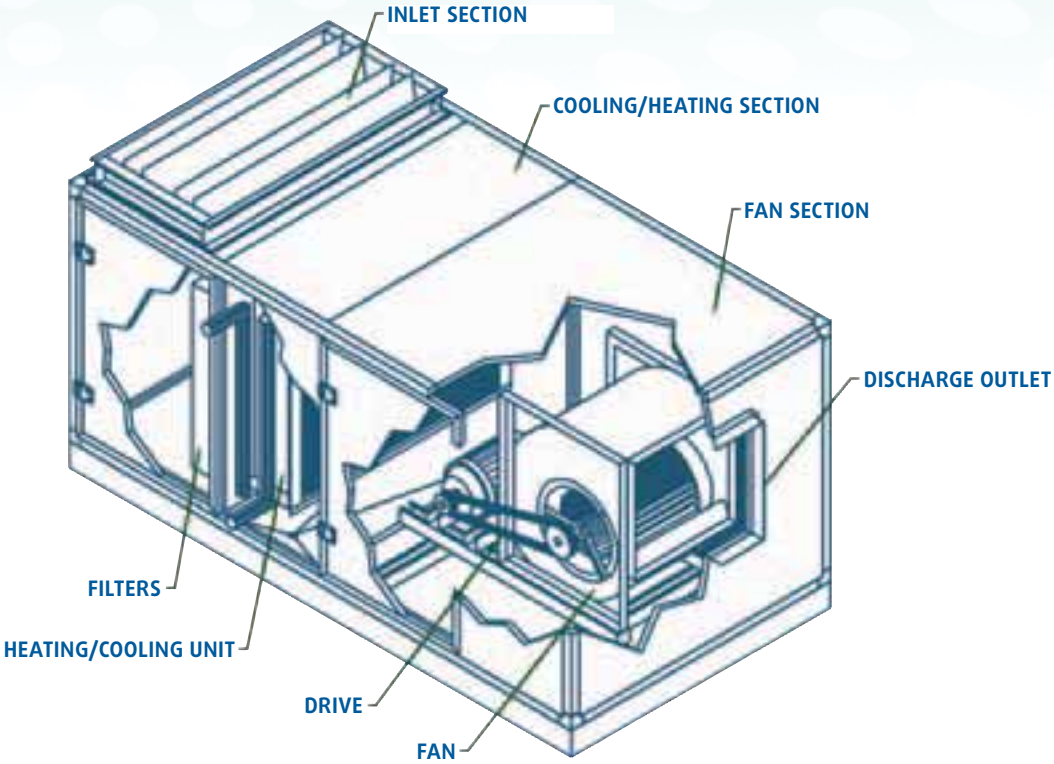


Description of the series

Systemair HVAC Spain's standardised Normabloc Air Handling Unit range consists of 15 models designated NB-2 to NB-70. Under normal air handling conditions, flow rates between 500 and 67,000 m³/h can be handled, with rates as high as 87,000 m3/h when the unit is used exclusively for hot-air heating.



The use of three types of double-inlet centrifugal fans allows the equipment to be selected for use in low-, medium- or high-pressure air systems, depending on the project characteristics.

Several options are also available for the heat exchangers.

The heating units installed can use different heating fluids such as:

- Hot water; Superheated water; Steam; Electricity, etc.

The most commonly used cooling media are:

- Chilled water; Glycol water; Direct expansion of coolants, etc.

An extensive range of air filters can handle a variety of filtering needs, from simple impurity filtering to absolute filtering, within the limits established by the manufacturer for the filtering media.

The use of two types of standardised humidifiers allows the media to be freely selected. Furthermore, additional sections can be used to mount any type of humidifier available on the market.

A set of 19 well-differentiated sections complete the assembly to allow the intake of outside air, mix it with returned air, filter it, heat it, cool it, humidify it, recover heat, provide access to the equipment interior, etc.

Once completed, the air handling unit features a smooth, exterior line with a solid, sturdy, aesthetically pleasing look that fits with the surroundings.

Descripton of the Air Handling Unit

Casing

The metal enclosure that covers all the components contained in the Normabloc air handling units is sturdy and has no protruding items to disturb the overall look of the unit.

Air handling units with a smaller cross-section (NB-2 to NB-18) have a frame composed of an aluminium section that outlines the equipment edges perfectly, resulting in a solid, robust and attractive overall look.

These aluminium extruded sections are joined by injection-moulded fibreglass-reinforced plastic angle cleats.

In air handling units with a larger cross-section (NB-23 to NB-70), the assembly includes a frame composed of a specially shaped section of extra-thick steel with high bending strength, due to the pleats in frame. These pleats create the housing of the closing panels, leaving an outer bevelled edge.

In these larger sizes, the sections are joined together by angle cleats manufactured of die-cast aluminium. The assembly is anchored by slot screws, obtaining a solid, sturdy structure.

The frame enclosure is based on the use of NB sandwich panels comprising two pieces of galvanised sheet one inside the other.

The inner rack is manufactured of galvanised steel sheet, whereas the exterior rack of the same material has a baked-on pre-enamel finish in the characteristic aluzinc of Systemair HVAC Spain. The space created by the connection of the two racks is filled with an injected polyurethane foam insulation to ensure excellent thermal and sound insulation that prevents heat transfer, noise transmission and potential condensation.

The injection-moulding process is done with the panel introduced in a press with hot plates, which promotes polymerisation and avoids panel deformation due to the expansive strength of the polymer.

This method results in a mechanical stiffness well above that of other panels filled with other type of insulation (even when the panels have thicker sheets), as the adhesion of the chemical foam to the metal sheet significantly increases the mechanical strength.

This type of insulation has become extremely popular and is the unquestionable market leader in Spain and other European Union countries.

Polyurethane foam was introduced many years ago for the insulation of air handling units. Anyway we use rock wool or fiber glass upon request.

The construction approach used in our Normabloc air handling unit has become a market leader since its introduction in the late 1970s.

The NB panels are manufactured in two nominal thicknesses:

- 25 mm, which is the standardised panel, and
- 50 mm, which meets specific needs requiring greater heat insulation.

The 25-mm thick NB panels are mounted on the two structures mentioned above.

The 50-mm thick NB panels are mounted on a frame composed of an aluminium profile of 70 x 70 mm, which outlines the equipment edges precisely. Due to its width, the 50 mm NB panel is flush with the extruded aluminium frame, providing an overall solid, robust, attractive appearance.

The frame sections are joined by angle cleats manufactured of die-cast aluminium.

Corner detail.

The above solution is applicable to all NB models with a 50-mm panel (NB-2 to NB-70).

Regardless of the type of structure, all NB panels on the access side can be easily dismounted, thereby facilitating access to the internal parts of the air handling unit by the maintenance staff.

By special order, the NB panels can be constructed with a different shape for specific needs.

All internal components of the air handling units are secured to the structure and the NB panels by butts of galvanised sheet. These butts have various shapes, based on the specific component.

The finished equipment can have a bedplate composed of channel sections or feet. Based on the project needs, it can also be set on shock absorbers when vibration must be avoided.

The enclosure described contains all the air handling unit sections, which can include some or all of the ones described below:

Inlet section

This section is composed of a standardised section with an air inlet to the air handling unit.

This opening can:

- Use a volume control damper, that can be equipped for manual operation or for subsequent automation.
- Be protected by an air shutter.
- The combination of the previous two.
- Be equipped with a simple inlet consisting of a straight flange for easier duct connection;

In addition, a cover to prevent water from entering when the equipment is placed outdoors can be provided.

Mixing section

This has similar features as the above and two openings, each of which contain a control damper.

These dampers can be supplied with an extruded aluminium section construction. There are two models of aluminium section, one with an airfoil blade.

The operating mechanisms for all dampers are installed in the channel frame. This allows air to circulate freely and facilitates installation in closed ducts. The mechanisms and fasteners are made of corrosion-resistant materials.

Hinges detail.

The operating mechanism of the dampers may be manual or equipped for motor-driven operation. In the latter case, upon request and depending on the damper size, these controls can be supplied interconnected so they can be operated by a single servo drive.

Window detail.

Free cooling section

This section requires a return fan and a supply fan. These fans must have three dampers in between, with the dampers used to regulate the volumes of exhaust, return and outside air.

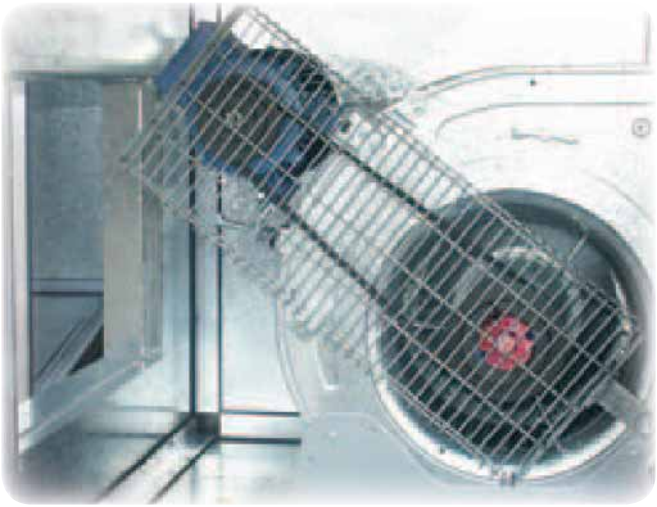
Therefore, in order to meet their purpose the dampers must be motor-driven.

When the enthalpy of the outside air is less than the enthalpy of the recirculated air, i.e., during spring and autumn, the mixture of outside air and recirculated air is controlled to achieve free cooling.

Consequently, the relative opening of the dampers is determined by an enthalpy (or dry temperature) comparator, which sends the respective signal to the damper motors.

In order to ensure the minimum ventilation air required in cooling or heating seasons, the outside air inlet damper can be split into two sections (one motor-driven and another manual that remains fixed). The cross-section of the damper will be proportional to the minimum ventilation air flow.

This effect can also be achieved more economically by adjusting the stroke of the motor operating the outside air damper so it does not close completely.



Filter section

The following sections of filters are included in the NB Air Handling Unit standardised range:

- **Extended surface filters**, in which the filtering mat is mounted in zigzag fashion. As a result, the filtering area is larger, the air flow rate is low, and the service interval for replacement or cleaning is longer.

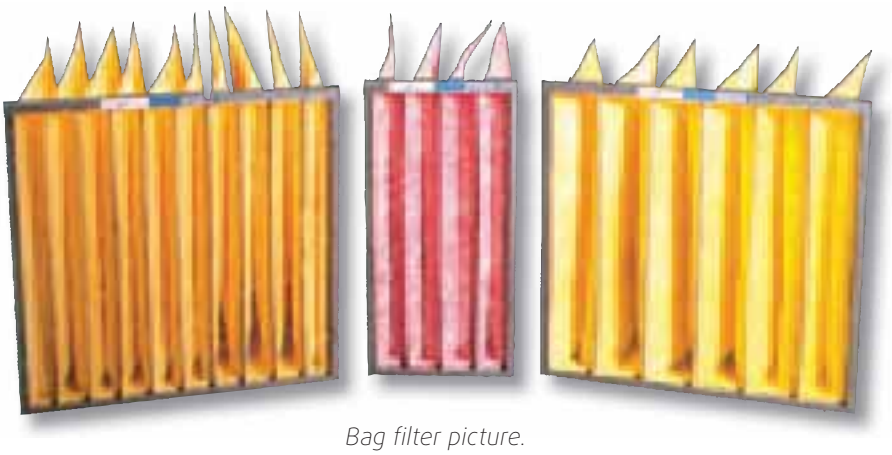
  The filtering efficiency is low; and therefore the unit can be used in systems for human comfort where the atmosphere has a low level of contamination.

Plate filter.

- **Bag filters**, which can be flexible or stiff and have a medium or high filtering efficiency, depending on the class. The bag filters have an individual frame and airtight seals. They are particularly recommended for installations requiring extra-pure air.

  The bag filters are generally preceded by a prefilter section of lower efficiency (e.g., extended surface filters). This approach extends the service life of the bag filters, which are more costly and must be replaced, as they cannot be regenerated.

- **Absolute filters**, with an efficiency of almost 100% as indicated by the name. They are equipped with an individual frame and airtight gaskets.



Bag filter picture.

Similar to the other filters, which must contain a prefilter section upstream, the prefilters should be high efficacy filters to ensure a longer service life. They are costly and cannot be re-used.

Hepa filters

Cooling/heating section

The cooling and heating units are composed of the enclosure described above, which contains the tube-and-fin heat transfer unit, mounted on a special joint cover.

For air cooling processes, units composed of copper pipes and aluminium fins (Cu/Al) are normally used.

At the bottom, the cooling section has a stainless steel pan for collecting condensation and a small hose to drain the condensation toward the outside. The pan is slightly tilted for easier drainage, in order to prevent the proliferation of harmful bacteria such as Legionella pneumophila.

Direct expansion units are also used for cooling. These units can be equipped with one or two manifolds.

Water cooling/heating coils

For heating processes, the same type of copper/aluminium units used for cooling is normally used.

If the air might contain corrosive chemicals, copper tube and fin (Cu/Cu) units should be used to improve the corrosion resistance of the equipment. This type of unit is more expensive than the copper/aluminium unit.

In facilities where the heating fluid is at high temperature and pressure (e.g., steam, superheated water or special thermal fluids), units composed of steel tubes and fins (Fe/Fe), which have a much higher strength, should be used. This type of unit is more expensive than the copper/aluminium unit.

Electrical heating units can also be installed upon request, depending on the customer's needs.

Germicide section

We can analyse the use of a germicide section to improve the quality of the air supply only upon request.

An adequately designed germicide section should ensure that all bacteria flowing through the system are subjected to the bactericidal radiation necessary for its disposal.

The emitters should be installed in areas prone to bacterial growth, such as cooling units, drip pans and other moist areas, in other words, in any parts that have adequate conditions for bacteria development.

The use of this equipment will improve the air quality of the treated environments, as well as the heat exchanger efficiency of the units, minimising the need for cleaning and maintenance of the units and the drip pan.

If the specified exposure times are used, these emitters can attack microbes on surfaces or suspended in the air that are growing, circulating or being distributed in the air handling units, and which are largely responsible for allergies and other air-borne diseases.

Access section

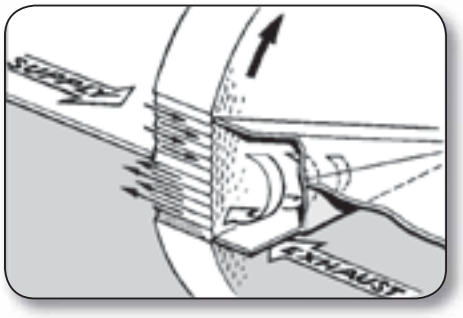
This section, which has a hinged access door and is equipped with an enclosure and handle, is sandwiched in the air handling unit configuration to allow access to the lower parts that require surveillance or regular maintenance.

It may also be used to hold any type of auxiliary component, such as a perforated jet humidifier for direct humidification with steam, or other types of components.

Recovery section

Rotating regenerative air-to-air recovery unit, specially designed to transfer sensitive (temperature) and latent (humidity) heat from the exhaust air to the supply air.

The supply air stops in one of the halves of the heat recovery unit, while the exhaust air circulates in counterflow through the other half.



When the impeller turns, the small air flowing channels comprising the impeller are alternately in contact with clean air and with return air, transmitting heat and moisture from one circuit to the other.

Static recovery unit with air-to-air crossflow designed to transfer sensitive (temperature) heat; in this type of heat recovery unit, the supply air is completely separate from the exhaust air, in order to prevent any type of contamination from one air stream to the other.

Heat transfer takes place through the plate separating the two streams.

Two adjacent plates form a small duct for exhaust or supply air.

The plate-to-plate distance varies, depending on the size and efficiency requirements.

Recovery unit composed of a dual unit in a closed air-to-air circuit. Designed to transfer sensitive (temperature) heat, using units manufactured with copper pipes and aluminium fins (Cu/Al).

The method is simple and economic, as the return air flows through one of the units, heating the water that circulates inside and is then exhausted.

Example run around coil.

The outside air flows through the other unit, which heats the air while it cools the circulating water, with the latter heated again in the return circuit, creating a continuous sensitive-heat recovery cycle in the air.

In order to ensure proper system operation in winter, facilities with an extremely low outside air temperature must use glycol water.

Benefits achieved from the installation of any of these heat recovery systems:

- Reduced heating plant power, minimising equipment sizes in terms of boilers, fuel tank, circulating pumps, heat pipes and heating units.
- Reduced cooling plant size (compressors and condensers or cooling towers), circulating pumps, pipe grid and cooling units. Savings in operating power consumption for heat and cold generation.

Any of the recovery systems mentioned in this section can be installed upon request only, as they are not included in the NB standardised range.

Humidifier section

Two different types of air humidifiers can be installed in our air handling units. In both cases, the units are adiabatic humidifiers.

Panel humidifier, composed of a standardised enclosure, including a stainless steel drip pan at the bottom.

The enclosure houses the humidifier panel, which has crosswise corrugated channels to ensure minimum air resistance as well as a large contact surface between the air and water, thereby releasing moisture into the circulating air.

The top of the panel contains a water manifold, to which the water is pumped through the pipework from the drip pan by means of a small submersible electrical pump.

Water is distributed vertically by gravity, coating the entire inner panel surface with an extremely fine film. As the air flows by the panel horizontally through the spaces provided, turbulent flow conditions are established, thereby resulting in efficient transfer of heat and moisture.

The humidifier panel is manufactured of two different types of material:

- **Fibreglass**. Mixed with structural additives for stiffening.

  Fibreglass is the material we recommend for the construction of equipment with materials accepted by current regulations, as it helps prevent the appearance of Legionella.
- **Cellulose**. With chemical additives, allowing it to absorb water without affecting its stiffness.

Fiber glass

Cellulose.

Usage is not advisable, since current regulations recommend that materials promoting the development of bacteria and fungi be avoided (e.g., leather, wood, fibre cement, concrete or cellulose derivatives).

Legionella is an aerobic (oxygen-requiring) bacterium that causes two critical forms of disease in humans:

- One form is known as "Legionnaire's disease" and affects the lungs, causing high fever. It is serious and can be fatal in many cases.
- The other, milder form is known as "Pontiac fever".

These bacteria are found naturally in aquatic media and enter the human population through the public water mains.

The conditions required for proliferation are:

- Presence of a substrate acting as a food source (e.g., grime, algae, microorganisms, iron oxides, calcium, magnesium or silicon salts)
- Appropriate temperature.

The bacterium is carried through the air in water droplets. Droplets between 1 and 5 microns (aerosols) provide the necessary conditions for human infection.

Infection takes place through the airways.

Ways to prevent infection:

- Water treatment with disinfectants to ensure quality.
- Periodic testing of the physical, chemical and biological parameters of the water.
- Periodic cleaning and disinfection of the installation to ensure safe operation.

Air scrubber, composed of an enclosure with a large drip pan at the bottom.

The tray contains enough water to create steady state conditions in the scrubber system and is equipped with hoses to connect the circulating pump (supplied when requested by the client) and water supply, drain and overflow fittings.

The inside contains a distribution branch with water spray nozzles. Two distribution branches are used to increase the efficiency of the humidifier.

A drop separator with blades designed to hold drops in the air is installed on the air outlet side, ensuring that no drops are carried to other sections.

In order to prevent leaks of water, the entire section is watertight and has an access door equipped with a sighthole for visual inspection.

This type of air scrubber can be manufactured entirely of reinforced polyester (both the enclosure and the drip pan) to prevent corrosion.

The equipment that includes the air scrubber comes with a bedplate composed of steel channel sections which are used to support the entire air handling unit.

The air scrubbers are installed exclusively by special order, as they are not included in the NB standardised range.

Fan section

This section is composed of a double inlet cone centrifugal fan with an anchor bedplate, drive and electric motor or plug-fan.

If centrifugal fan motor assembly is mounted on Silentbloc bushings and the discharge outlet is joined to the opening in the enclosure by means of a flexible synthetic seal.

This allows the unit to run without external transmission of the small vibrations normally caused by fan motor assemblies.

The standardised NB air handling units can contain three different types of fans:

Two of them have forward-facing impeller blades and are used in facilities designed to run with low-pressure air flow. These fans are identified with the AT and ADH codes.

The third, which has backward curved blades and is designated RDH, is used for facilities with medium- or high-pressure air flow.

The three types of fans are carefully manufactured, which ensures perfect operation, as perfect static and dynamic balance.

The motor-fan drive is composed of pulleys and V-belts.

The air discharge outlet of the fan section has a straight tab for easier connection to the duct system.

In some cases where the noise level of the facility should be minimised, the inside of the panel is covered with a sheet of perforated plate equipped with pleats, that contains a fibreglass insulating layer with neoprene film on the exposed side to prevent particle creep.

This assembly is secured to the standardised panel by tubular rivets, obtaining a fan section that can absorb most of the noise generated by the fan motor, in this case radiated sound pressure.

Silencer section

The baffles of the silencer section are constructed of natural galvanized steel sheet, with a peak at the air inlet end to decrease the head loss. The baffles are also filled with a sound-insulating material composed of fibreglass with an appropriate density. This material is also heat-resistant and its outer face is protected against air erosion.

There are two options:

- **PA**. The sound insulation is protected against erosion due to air flow by a flame-retardant protective layer.

  This is the most common approach in ventilation and air conditioning systems.

- **PAM**. Equal to PA, but with an additional polyester-film coating (Melinex).

  Used for applications with acidic, alkaline or oily gases, as it can be steam-cleaned.

  Recommended for hospitals, since bacterial colony formation is not possible.

These two models can be constructed with four lengths of baffle.

Special sections

In addition to the standardised sections, other special sections that meet specific requirements can be analysed by special order and included in the air handling unit assembly designed expressly for the conditions of your project.

Example belt driven fans.

Quick selection tips

IMPORTANT INFORMATION

1. These fast selection criteria are included to help the user choose the equipment for the design specifications. Nevertheless, this selection method is not precise enough to indicate the equipment that best fits your requirements. If more precise information is necessary, please use our computer-aided selection program (available on CD-ROM) or talk to our Sales Department.
2. The dimensions and weights used in the following pages correspond to equipment constructed with 25-mm thick NB Panel.
3. Remember: the following formula must be used to determine the air velocity (m/s):

$$\text{Air velocity} = \frac{\text{Flow rate } m^3/s}{\text{Afo } m^2} = m/s$$

4. The data used to determine the number of rows of the units are based on the following values:

Cooling:	inlet air	26,4ºC, 48,4% RH.
	outlet air	13,0ºC, 92,0% RH.
Heating:	inlet air	18,0ºC
	outlet air	30,0ºC.

5. The fan features refer to operation in facilities with free inlet and channelled supply outlet, and do not take into account any air flow fittings.
6. The absolute fan power consumption does not include losses attributable to the drive.

A diagram is included so the size of the right air handling unit can be quickly selected for each case (see next page). Based on the air flow rate and air velocity through the heat exchanger units, the diagram indicates the most adequate unit, as well as the relationship with the nearest units in terms of size.

The most common practice is to define the air velocity through a cooling unit at 2.7 m/s, and 3.5 m/s for heating only. These are approximate values only. For further information, refer to the section on heating and cooling units provided below.

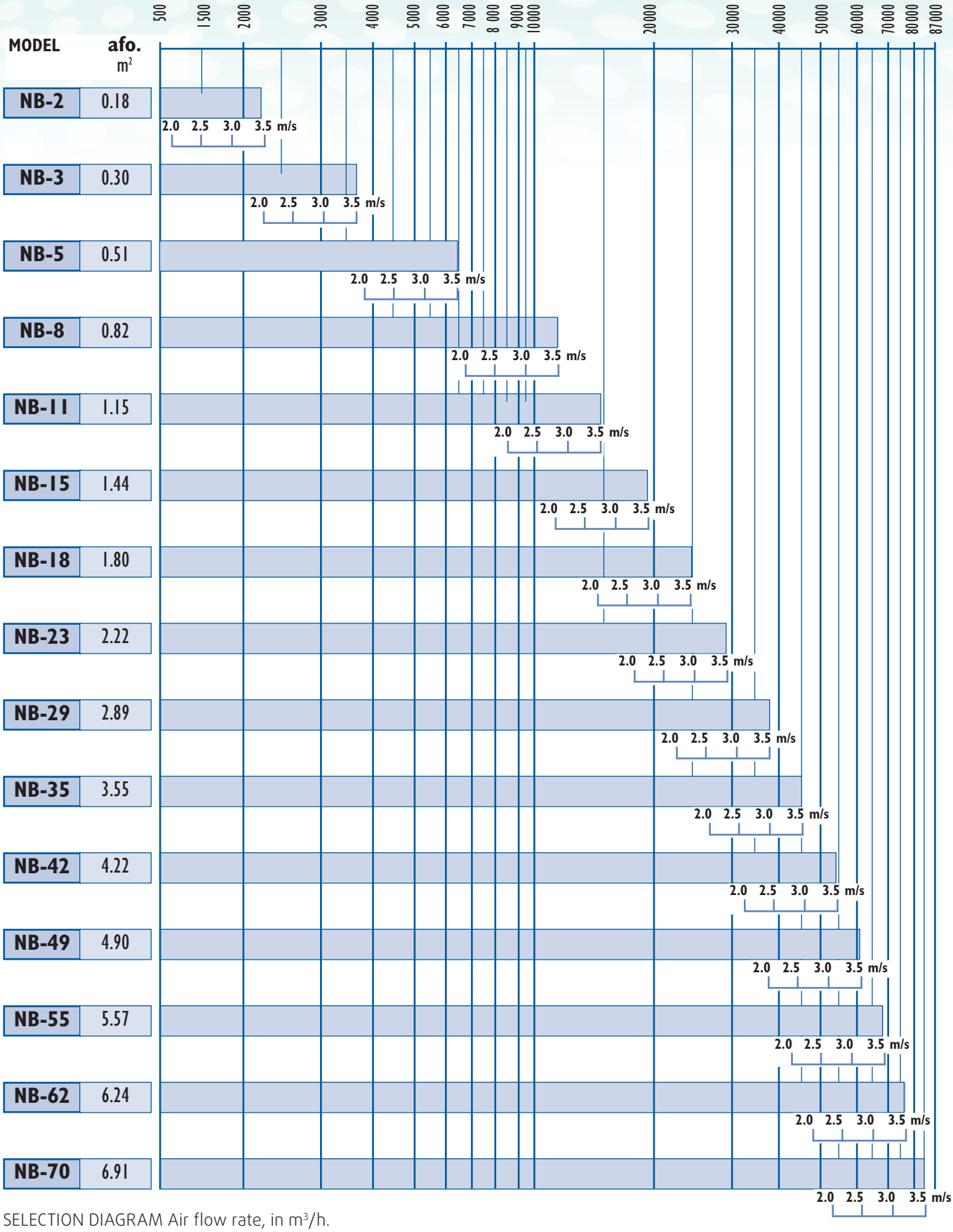
There are two pages with the most relevant data on this model for the selection of each air handling unit model in this standardised range.

Example:

An air handling unit is needed for an air flow of 19,200 m3/h:

On the selection diagram, start with the scale in m3/h and vertically locate the point where this flowrate has the velocity of 2.7 m/s, in this case the one that corresponds is the NB-23 Air Handling Unit.

Normabloc Air Handling Unit Selection (NB)



SELECTION DIAGRAM Air flow rate, in m³/h.

Selection in a sample project

Horizontal air handling unit, composed of the following sections:

- Air mixture.
- Extended surface filters.
- Cooling unit based on chilled water.
- Hot-water heating unit.
- Low-pressure fan section.

Technical data:

- Air flow rate: 19,200 m3/h;
- Available static pressure: 45 mm w.g.;
- Cooling power: 99,100 -kcal/h;
- Chilled water temperature: 7ºC;
- Temp. difference of chilled water: 5ºC;
- Conditions of inlet air: 26.4ºC BS, 48% RH;
- Conditions of outlet air: 13ºC BS, 92% RH;
- Temperature rise of motor: approx. 1ºC;
- Heating power: 69,120 kcal/h;
- Hot water temperature: 85ºC;
- Temp. difference of heated water: 15ºC;
- Conditions of inlet air: 18.0ºC BS;
- Conditions of outlet air: 30.0ºC BS.

NB Air Handling Unit Selection (Normabloc)

Using the quick selection table, the appropriate model for a flow rate of air of 19,200 m³/h and an air velocity of 2.7 m/s is the NB-23 with a front surface (afo) of 2.22 m².

Step 1:

To determine the air velocity through the unit:

First, divide the flow rate of air expressed in 600 m³/h by 3600 seconds to obtain the flow rate of air in m³/s:

19.200 / 3.600 = 5,33 m³/s

Divide this flow rate, in m³/s, by the afo for the NB-23 air handling unit, in m², to obtain the air velocity in m/s:

Air velocity through heating/cooling unit= 5,33/2,22 = **2,4 m/s**

Step 2:

To determine the number of rows and depth of each cooling and heating unit, with an air velocity of 2.4 m/s:

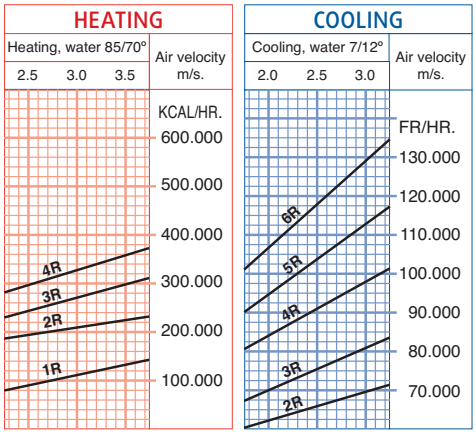
Cooling, water at 7-12ºC, 99100 -kcal/h = 4R

Heating, water 85/70ºC, 69120 kcal/h = 1R

Pressure drops					in mm w.g.
Section	Air velocity, m/s				
	2.50	2.75	3.00	3.25	3.50
E	2	2	3	3	4
M	2	2	3	3	4
FC	2	2	3	3	4
F	9	11	13	15	18
FB	19	23	27		
FA	56	58	60		
S-234 (700 mm)	2	2	3	3	4
S-334 (1050 mm)	2	3	3	4	5
S-434 (1400 mm)	3	3	4	4	5
S-534 (1750 mm)	3	4	4	5	6
HP	11	13	15		
HL	8	9	10		
BF 2R	5	6			
BF 3R	7	8			
BF 4R	9	10	NOTUSED		
BF 5R	10	12			
BF 6R	12	14			
BC 1R	3	3	4	4	5
BC 2R	4	5	6	7	7
BC 3R	6	7	8	9	10
BC 4R	7	8	9	11	12

Code	Section
E	Air inlet
M	Air mixture
FC	Free Cooling
F	Extended surface filters
FB	Bag filters
FA	Absolute filters
BF	Cooling unit
BC	Heating unit
A	Access
HP	Panel humidifier
HL	Air scrubber humidifier
V	Fan
S	Silencer

Determination of the number of rows in the unit



Step 3:

Determine the static pressure of the air handling unit by adding the various pressure drops for the unit for an air velocity of 2.4 m/s:

• Air mixing section (**M**)	2 mm w.g.
• Extended surface filter section (**F**)	9 mm w.g.
• Heating unit (**BC**) 1R	3 mm w.g.
• Cooling unit (**BF**) 4R	9 mm w.g.
Total sum for the air handling unit	23 mm w.g.
• Available static pressure	45 mm w.g.
Total static pressure	**68 mm w.g.**

Step 4:

Determine the operating conditions of the fan, in this case for low speed, ADH 560 model, on the respective curves:

The pressures indicated on the curves are "total pressures". Therefore, the dynamic pressure (Pd) for 19,200 m³/h of air flow must be added to the static pressure obtained earlier:

Total pressure (Pd + Pe) = 6,5 mm + 68 rnm **= 74,5 mm w.g. Total pressure increase (Pt)74,5 mm w.g. = 74,5 x 9,80665 = 730,6 = approx. 731 Pa**

The following values are obtained from the intersection of the air flowrate and total pressure:

Revolutions: 750 r.p.m.Input power:
6,0 kwSound power: 87 dBEfficiency:
66 %Air outlet velocity: 10,2 m/s

The input power can then be used to calculate the motor output:

Motor output = 6,0 kw. x 1,2 **= 7,2 kw (10=HP)**

SECTION WEIGHTS			
Sections	**Kg**	**Sections**	**Kg**
E	26	**HP**	100
M	33	**HL**	190
FC	56	**V** (w/o motor)	53
F	22	**BF 2R**	46
FB	40	**BF 3R**	51
FA	55	**BF 4R**	55
A (Each 175-mm clear)	11	**BF 5R**	59
S-234 (700 mm)	32	**BF 6R**	63
S-334 (1050 mm)	37	**BC 1R**	29
S-434 (1400 mm)	42	**BC 2R**	33
S-534 (1750 mm)	47	**BC 3R**	38
		BC 4R	42
Bedplate - weight per metre			**16**

MOTOR WEIGHTS			
Power (HP)	**Kg**	**Power (HP)**	**Kg**
0,33	5	1,5	16
0,5	5	2	16
0,75	9	3	30
1	9		

Step 5:

Determine the dimensions and weight of the air handling unit:

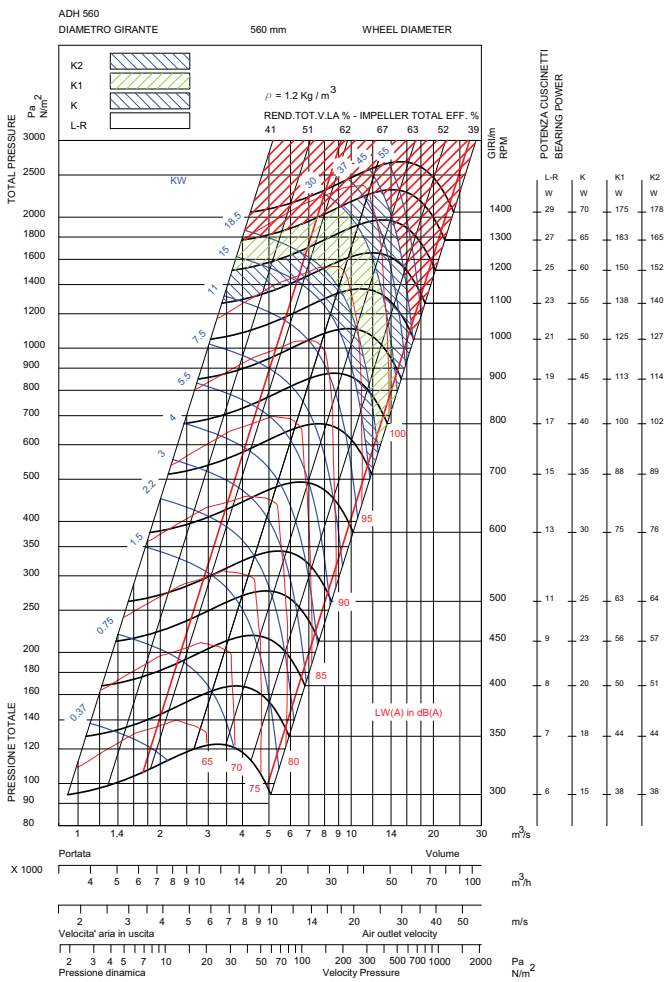
Section	**Dimensions**	**Weights**
M	920 mm	202 kg
F	175 mm	39 kg
BC (1 R)	175 mm	78 kg
BF (4 R)	525 mm	180 kg
V (without motor)	1.445 mm	342 kg
10 HP motor		52 kg
TOTAL	3.240 mm	893 kg

The air handling unit will have the following dimensions and weight:

Length	**3.240 mm**
Width	**2.190 mm**
Height	**1.490 mm**
Weight	**893 kg**

The air outlet mouth air are 721 x 721 mm.

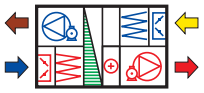
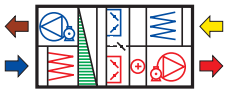
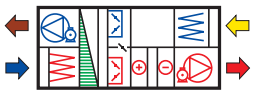
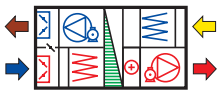
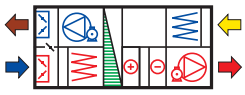
The air inlets are 800 x 1700 x 672 x 1900 mm.



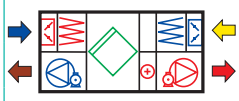
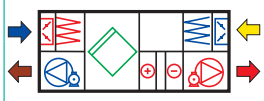
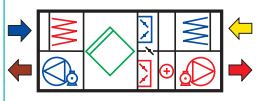
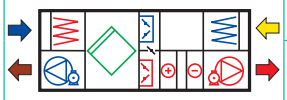
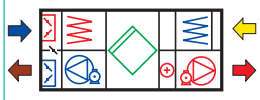
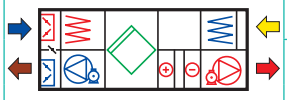
UNIT VERSIONS WITH CENTRIFUGAL FANS

In order to facilitate the work of designing an air handling unit based on the numerous options available, we have provided specifications for the most common unit combinations. These examples should help to speed up the process of designing your preferred unit with the right functions. Choose the unit version that best matches your preferences and then add or remove functions as required.

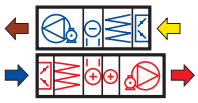
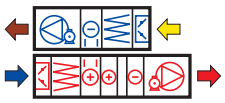
= outdoor air = supply air = extract air = exhaust air

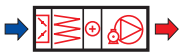
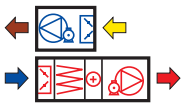
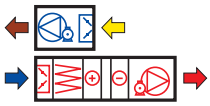
ROTATING HEAT EXCHANGER			SIZE														
			2	3	5	8	11	15	18	23	29	35	42	49	55	62	70
Panel 25		Width	760	760	1130	1130	1480	1480	1830	2190	2190	2190	2540	2890	3240	3590	3940
		Height[1]	1170	1520	1560	2260	2260	2960	2960	2980	3680	4380	4380	4380	4380	4380	4380
Panel 50		Width	810	810	1180	1180	1530	1530	1880	2230	2230	2230	2590	2920	3290	3620	3990
		Height[1]	1270	1620	1660	2360	2360	3060	3060	3060	3760	4460	4460	4460	4460	4460	4460
C1V 	Panel 25	Length	2860	2860	2880	2880	3230	3230	3580	3940	4290	4640	4640	4990	5340	5340	5340
		Weight[2]	481	576	813	1051	1289	1575	1852	2629	3105	3535	4891	5470	6030	6590	7150
	Panel 50	Length	2940	2940	2940	2940	3290	3290	3640	3990	4340	4690	4690	5040	5390	5390	5390
		Weight[2]	553	615	849	1098	1347	1644	1932	2693	3181	3622	5012	5605	6178	6751	7324
C2V 	Panel 25	Length	2860	3035	3230	3405	3755	3755	4105	4465	4815	5165	5165	5515	5865	5865	5865
		Weight[2]	549	658	917	1194	1453	1775	2074	2920	3450	3932	5321	5934	6529	7124	7719
	Panel 50	Length	2940	3115	3290	3465	3815	3815	4165	4515	4865	5215	5215	5565	5915	5915	5915
		Weight[2]	608	704	959	1248	1518	1861	2164	2992	3535	4029	5452	6080	6689	7298	7907
C3V 	Panel 25	Length	3035	3035	3230	3405	3930	3930	4280	4815	5165	5690	6215	6565	6915	6915	6915
		Weight[2]	519	622	878	1135	1392	1701	2000	2839	3353	3818	5282	5908	6512	7117	7722
	Panel 50	Length	3115	3115	3290	3465	3990	3990	4340	4865	5215	5740	6265	6615	6965	6965	6965
		Weight[2]	597	664	917	1186	1455	1776	2087	2908	3435	3912	5413	6053	6672	7291	7910
C4V 	Panel 25	Length	3210	3385	3755	3930	4455	4455	4805	5340	5690	6215	6740	7090	7440	7440	7440
		Weight[2]	593	711	990	1290	1569	1917	2240	3154	3726	4247	5747	6409	7051	7694	8337
	Panel 50	Length	3290	3465	3815	3990	4515	4515	4865	5390	5740	6265	6790	7140	7490	7490	7490
		Weight[2]	657	760	1036	1348	1639	2010	2337	3231	3818	4351	5888	6566	7224	7882	8540
C5V 	Panel 25	Length	3035	3035	3230	3405	3930	3930	4280	4815	5165	5690	6215	6565	6915	6915	6915
		Weight[2]	510	611	862	1114	1366	1670	1963	2787	3291	3747	5184	5798	6392	6985	7579
	Panel 50	Length	3115	3115	3290	3465	3990	3990	4340	4865	5215	5740	6265	6615	6965	6965	6965
		Weight[2]	586	652	900	1164	1428	1743	2048	2855	3372	3839	5313	5941	6549	7156	7763
C6V 	Panel 25	Length	3210	3385	3755	3930	4455	4455	4805	5340	5690	6215	6740	7090	7440	7440	7440
		Weight[2]	582	697	972	1266	1540	1882	2198	3095	3657	4168	5640	6290	6921	7551	8182
	Panel 50	Length	3290	3465	3815	3990	4515	4515	4865	5390	5740	6265	6790	7140	7490	7490	7490
		Weight[2]	644	746	1017	1323	1609	1973	2294	3172	3747	4271	5779	6445	7090	7736	8381

Dimensions in mm. Weights in kg.
[1] Does not include the height of the metal frame. [2] Does not include the weight of the metal frame.

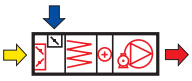
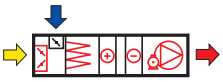
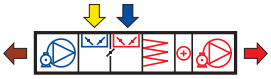
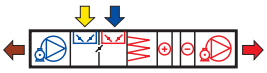
PLATE HEAT EXCHANGER			SIZE														
			2	3	5	8	11	15	18	23	29	35	42	49	55	62	70
Panel 25		Width	760	760	1130	1130	1480	1480	1830	2190	2190	2190	2540	2890	3240	3590	3940
		Height[1)]	1170	1520	1560	2260	2260	2960	2960	2980	3680	4380	4380	4380	4380	4380	4380
Panel 50		Width	810	810	1180	1180	1530	1530	1880	2230	2230	2230	2590	2920	3290	3620	3990
		Height[1)]	1270	1620	1660	2360	2360	3060	3060	3060	3760	4460	4460	4460	4460	4460	4460
Q1V 	Panel 25	Length	2860	3035	3055	3230	3930	4280	4630	5165	5690	6040	6565	7090	7440	7440	7440
		Weight[2)]	553	662	935	1209	1482	1811	2130	3023	3571	4065	5625	6291	6935	7579	8223
	Panel 50	Length	3080	3255	3255	3430	4130	4480	4830	5355	5880	6230	6755	7280	7630	7630	7630
		Weight[2)]	636	707	976	1263	1549	1891	2222	3097	3658	4165	5764	6446	7105	7764	8423
Q2V 	Panel 25	Length	3035	3385	3580	3755	4455	4805	5155	5690	6215	6565	7090	7615	7965	7965	7965
		Weight[2)]	631	757	1055	1373	1671	2041	2385	3358	3968	4522	6119	6824	7508	8193	8877
	Panel 50	Length	3115	3465	3640	3815	4515	4865	5215	5740	6265	6615	7140	7665	8015	8015	8015
		Weight[2)]	699	810	1103	1435	1746	2140	2489	3441	4065	4633	6270	6992	7692	8393	9093
Q3V 	Panel 25	Length	3035	3210	3405	3755	4630	4980	5330	6040	6565	7090	8140	8665	9015	9015	9015
		Weight[2)]	597	715	1010	1305	1601	1956	2300	3265	3856	4390	6075	6794	7489	8185	8880
	Panel 50	Length	3115	3290	3465	3815	4690	5040	5390	6090	6615	7140	8190	8715	9065	9065	9065
		Weight[2)]	687	764	1054	1364	1673	2042	2400	3345	3951	4499	6225	6961	7673	8385	9096
Q4V 	Panel 25	Length	3210	3560	3930	4280	5155	5505	5855	6565	7090	7615	8665	9190	9540	9540	9540
		Weight[2)]	682	817	1139	1483	1805	2205	2576	3627	4285	4884	6609	7370	8109	8848	9587
	Panel 50	Length	3290	3640	3990	4340	5215	5565	5915	6615	7140	7665	8715	9240	9590	9590	9590
		Weight[2)]	755	874	1191	1550	1885	2311	2688	3716	4390	5004	6771	7551	8308	9064	9820
Q5V 	Panel 25	Length	3035	3210	3405	3755	4630	4980	5330	6040	6565	7090	8140	8665	9015	9015	9015
		Weight[2)]	586	702	991	1281	1571	1920	2258	3205	3785	4309	5962	6668	7351	8033	8716
	Panel 50	Length	3115	3290	3465	3815	4690	5040	5390	6090	6615	7140	8190	8715	9065	9065	9065
		Weight[2)]	674	750	1035	1338	1642	2004	2355	3283	3878	4415	6110	6832	7531	8229	8928
Q6V 	Panel 25	Length	3210	3560	3930	4280	5155	5505	5855	6565	7090	7615	8665	9190	9540	9540	9540
		Weight[2)]	669	802	1118	1455	1771	2164	2528	3559	4206	4793	6486	7234	7959	8684	9409
	Panel 50	Length	3290	3640	3990	4340	5215	5565	5915	6615	7140	7665	8715	9240	9590	9590	9590
		Weight[2)]	741	858	1169	1521	1850	2269	2638	3647	4309	4911	6646	7412	8154	8896	9639

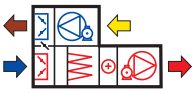
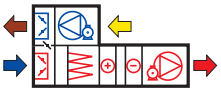
Dimensions in mm. Weights in kg.
[1)] Does not include the height of the metal frame. [2)] Does not include the weight of the metal frame.

LIQUID-COUPLED HEAT EXCHANGERS			SIZE														
			2	3	5	8	11	15	18	23	29	35	42	49	55	62	70
Panel 25		Width	760	760	1130	1130	1480	1480	1830	2190	2190	2190	2540	2890	3240	3590	3940
		Height[1)]	1170	1520	1560	2260	2260	2960	2960	2980	3680	4380	4380	4380	4380	4380	4380
Panel 50		Width	810	810	1180	1180	1530	1530	1880	2230	2230	2230	2590	2920	3290	3620	3990
		Height[1)]	1270	1620	1660	2360	2360	3060	3060	3060	3760	4460	4460	4460	4460	4460	4460
R1V 	Panel 25	Length	2160	2335	2530	2705	3055	3055	3230	3590	3765	3940	3940	4115	4290	4290	4290
		Weight[2)]	483	579	794	1045	1297	1488	1849	2706	3184	3666	4439	4975	5539	6103	6670
	Panel 50	Length	2240	2415	2590	2765	3115	3115	3290	3640	3815	3990	3990	4165	4340	4340	4340
		Weight[2)]	529	619	829	1091	1355	1653	1930	2775	3260	3756	4548	5098	5675	6252	6829
R2V 	Panel 25	Length	2685	2860	3055	3230	3580	3580	3755	4115	4290	4465	4465	4640	4815	4815	4815
		Weight[2)]	551	662	898	1187	1461	1688	2071	2997	3529	4062	4868	5439	6038	6637	7236
	Panel 50	Length	2765	2940	3115	3290	3640	3640	3815	4165	4340	4515	4515	4690	4865	4865	4865
		Weight[2)]	610	707	939	1241	1526	1865	2161	3071	3616	4162	4988	5572	6187	6802	7417

SUPPLY AIR UNITS			SIZE														
			2	3	5	8	11	15	18	23	29	35	42	49	55	62	70
Panel 25		Width	760	760	1130	1130	1480	1480	1830	2190	2190	2190	2540	2890	3240	3590	3940
		Height[1)]	585	760	780	1130	1130	1480	1480	1490	1840	2190	2190	2190	2190	2190	2190
Panel 50		Width	810	810	1180	1180	1530	1530	1880	2230	2230	2230	2590	2920	3290	3620	3990
		Height[1)]	635	810	830	1180	1180	1530	1530	1530	1880	2230	2230	2230	2230	2230	2230
S1V 	Panel 25	Length	1810	1985	2180	2355	2705	2705	2880	3240	3415	3590	3590	3765	3940	3940	3940
		Weight[2)]	207	243	338	449	570	700	827	1207	1424	1645	2024	2281	2552	2823	3064
	Panel 50	Length	1890	2065	2240	2415	2765	2765	2940	3290	3465	3640	3640	3815	3990	3990	3990
		Weight[2)]	221	265	360	471	592	722	849	1237	1454	1675	2054	2311	2582	2853	3124
S2V 	Panel 25	Length	2335	2510	2705	2880	3230	3230	3405	3765	3940	4115	4115	4290	4465	4465	4465
		Weight[2)]	276	326	441	592	735	903	1053	1499	1755	2028	2441	2733	3040	3347	3654
	Panel 50	Length	2415	2590	2765	2940	3290	3290	3465	3815	3990	4165	4165	4340	4515	4515	4515
		Weight[2)]	295	354	469	620	763	931	1081	1535	1808	2080	2494	2786	3093	3400	3707
			SIZE														
			2	3	5	8	11	15	18	23	29	35	42	49	55	62	70
Panel 25		Width	760	760	1130	1130	1480	1480	1830	2190	2190	2190	2540	2890	3240	3590	3940
		Height[1)]	1170	1520	1560	2260	2260	2960	2960	2980	3680	4380	4380	4380	4380	4380	4380
Panel 50		Width	810	810	1180	1180	1530	1530	1880	2230	2230	2230	2590	2920	3290	3620	3990
		Height[1)]	1270	1620	1660	2360	2360	3060	3060	3060	3760	4460	4460	4460	4460	4460	4460
S3V 	Panel 25	Length	1810	1985	2180	2355	2705	2705	2880	3240	3415	3590	3590	3765	3940	3940	3940
		Weight[2)]	333	393	555	740	946	1147	1362	1969	2311	2678	3359	3804	4271	4758	5192
	Panel 50	Length	1890	2065	2240	2415	2765	2765	2940	3290	3465	3640	3640	3815	3990	3990	3990
		Weight[2)]	357	430	592	777	983	1184	1399	2019	2381	2748	3428	3874	4347	4828	5309
S4V 	Panel 25	Length	2335	2510	2705	2880	3230	3230	3405	3765	3940	4115	4115	4290	4465	4465	4465
		Weight[2)]	402	476	658	883	1111	1350	1588	2261	2642	3061	3776	4256	4759	5282	5782
	Panel 50	Length	2415	2590	2765	2940	3290	3290	3465	3815	3990	4165	4165	4340	4515	4515	4515
		Weight[2)]	431	519	701	926	1154	1393	1631	2317	2735	3153	3868	4349	4858	5375	5892

Dimensions in mm. Weights in kg.
[1)] Does not include the height of the metal frame. [2)] Does not include the weight of the metal frame.

UNITS WITH MIXING SECTION			SIZE														
			2	3	5	8	11	15	18	23	29	35	42	49	55	62	70
Panel 25		Width	760	760	1130	1130	1480	1480	1830	2190	2190	2190	2540	2890	3240	3590	3940
		Height[1)]	585	760	780	1130	1130	1480	1480	1490	1840	2190	2190	2190	2190	2190	2190
Panel 50		Width	810	810	1180	1180	1530	1530	1880	2230	2230	2230	2590	2920	3290	3620	3990
		Height[1)]	635	810	830	1180	1180	1530	1530	1530	1880	2230	2230	2230	2230	2230	2230
M1V 	Panel 25	Length	1810	1985	2180	2355	2705	2705	2880	3240	3415	3765	3940	4115	4290	4290	4290
		Weight[2)]	215	254	361	467	606	729	862	1273	1469	1716	2135	2403	2685	2967	3234
	Panel 50	Length	1890	2065	2240	2415	2765	2765	2940	3290	3465	3815	3990	4165	4340	4340	4340
		Weight[2)]	229	276	383	489	628	751	884	1304	1514	1761	2180	2448	2730	3012	3294
M2V 	Panel 25	Length	2335	2510	2705	2880	3230	3230	3405	3765	3940	4290	4465	4640	4815	4815	4815
		Weight[2)]	283	341	472	610	765	920	1069	1564	1823	2115	2557	2852	3178	3497	3816
	Panel 50	Length	2415	2590	2765	2940	3290	3290	3465	3815	3990	4340	4515	4690	4865	4865	4865
		Weight[2)]	303	372	493	638	799	960	1116	1603	1868	2167	2620	2922	3241	3560	3879
M3V 	Panel 25	Length	2685	3210	3580	3930	4630	4630	4980	5690	6390	6740	7090	7790	8140	8140	8140
		Weight[2)]	339	416	512	734	960	1138	1347	2037	2403	2767	3513	4013	4495	4822	5149
	Panel 50	Length	2765	3290	3640	3990	4690	4690	5040	5740	6440	6790	7140	7840	8190	8190	8190
		Weight[2)]	362	445	606	766	1003	1188	1405	2087	2462	2835	3599	4111	4605	5177	5504
M4V 	Panel 25	Length	3150	3675	4025	4375	5075	5075	5425	6125	6825	7175	7525	8225	8575	8575	8575
		Weight[2)]	408	499	617	877	1124	1338	1569	2329	2748	3163	3942	4477	4944	5323	5650
	Panel 50	Length	3290	3815	4165	4515	5215	5215	5565	6265	6965	7315	7665	8365	8715	8715	8715
		Weight[2)]	436	533	715	916	1175	1396	1637	2410	2816	3241	4039	4586	5117	5464	5791

			SIZE														
			2	3	5	8	11	15	18	23	29	35	42	49	55	62	70
Panel 25		Width	760	760	1130	1130	1480	1480	1830	2190	2190	2190	2540	2890	3240	3590	3940
		Height[1)]	1170	1520	1560	2260	2260	2960	2960	2980	3680	4380	4380	4380	4380	4380	4380
Panel 50		Width	810	810	1180	1180	1530	1530	1880	2230	2230	2230	2590	2920	3290	3620	3990
		Height[1)]	1270	1620	1660	2360	2360	3060	3060	3060	3760	4460	4460	4460	4460	4460	4460
M5V 	Panel 25	Length	1810	1985	2180	2355	2705	2705	2880	3240	3415	3765	3940	4115	4290	4290	4290
		Weight[2)]	339	416	512	734	960	1138	1347	2037	2403	2767	3513	4013	4495	4822	5149
	Panel 50	Length	1890	2065	2240	2415	2765	2765	2940	3290	3465	3815	3990	4165	4340	4340	4340
		Weight[2)]	362	445	606	766	1003	1188	1405	2087	2462	2835	3599	4111	4605	5177	5504
M6V 	Panel 25	Length	2335	2510	2705	2880	3230	3230	3405	3765	3940	4290	4465	4640	4815	4815	4815
		Weight[2)]	408	499	617	878	1124	1338	1569	2329	2748	3163	3942	4477	4944	5323	5650
	Panel 50	Length	2415	2590	2765	2940	3290	3290	3465	3815	3990	4340	4515	4690	4865	4865	4865
		Weight[2)]	436	534	715	916	1175	1396	1637	2170	2816	3241	4039	4586	5117	5464	5791

Dimensions in mm. Weights in kg.
[1)] Does not include the height of the metal frame. [2)] Does not include the weight of the metal frame.

Sections in detail

Air filters

The standardised range for the NB Air Handling Unit includes three air filtering sections which, combined with the wide variety of filtering materials, cover an extensive range of possibilities in filtering efficiency.

One of the purposes of the air handling unit is to ensure the purity of the room air.

Air filtering is related to the quantity, variety and size of the suspended impurities, the existence of contaminant gases or odours, and the desired filtering efficiency.

The various impurities that can exist in the air are discussed below.

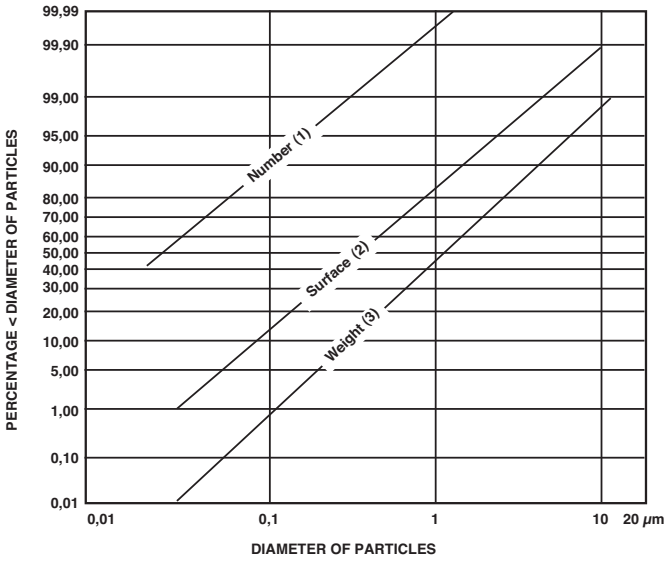
The air contains numerous foreign substances caused by natural processes (e.g., wind erosion, sea evaporation, soil movements, volcanic eruptions) and by human activity (e.g., combustion).

Atmospheric dust is a mixture of fog, combustion gases, fine dry particles and fibres. Air testing normally indicates the presence of soot and smoke, quartz, soil, residue from decomposed animals and vegetables, organic substances in the form of cotton and plant fibres, and metal fragments. The air also contains other organisms such as microorganisms, spores and pollen.

Particle size is expressed in microns (10-6 m). Air contains particles with a thickness of up to 0.01 microns and other particles with a thickness similar to fibres, leaves, etc. Dust is generally understood to mean particles under 100 microns.

The particle size distribution of particles in atmospheric dust can be measured in one of several ways. The following figure contains three curves representing the distribution of particles according to number, weight or spray surface.

The upper curve indicates (in % of total) the number of suspended particles in the air with a diameter below a certain reference number (e.g., 99.9% are below 1 micron)..



The middle curve shows the particle spray distribution on the surface; for example, the surface sprayed with particles under 1 micron, account for 30% of the total weight of the particles.

The lower curve indicates the distribution by weight of atmospheric dust; for example, particles below 1 micron account for 30% of the total weight of the particles.

Traditionally, a variety of measurement methods have been used to determine the efficiency of the different types of filters and no classification system combining the various criteria in use existed. The first version of the Unified Standard EN 779 was issued to unify the classification criteria for all filters with an initial efficiency with atmospheric dust less than or equal to 98%, (Group G: coarsedust filters; Group F: fine-dust filters).

Later, in 1998 the first version of Unified Standard EN-1822 unifying the classification criteria for HEPA and ULPA absolute filters was published. The initial efficiency of these filters with atmospheric dust is greater than 98%..

Extended surface filters

Characterised by a specific type of pleat which produces a larger filtering surface. The pleat design, as well as the alignment between the pleats, ensures uniform air circulation over the surface of the filtering media.

The extended surface filter is composed of a frame, filtering media in zigzag layout, and electrowelded mesh to hold the media.

Panel filters.

Its advantages with respect to flat filters are:

- Greater filtering surface;
- Reduced front air velocity;
- Greater efficiency;
- Greater dust retention capacity;
- Reduced front surface.

The filters correspond to Classes G1, G2, G3 and G4 of Group G (coarse-dust filters) and Class F5, F6 and F7 for Group F (fine-dust filters), as per UNE-EN 779.

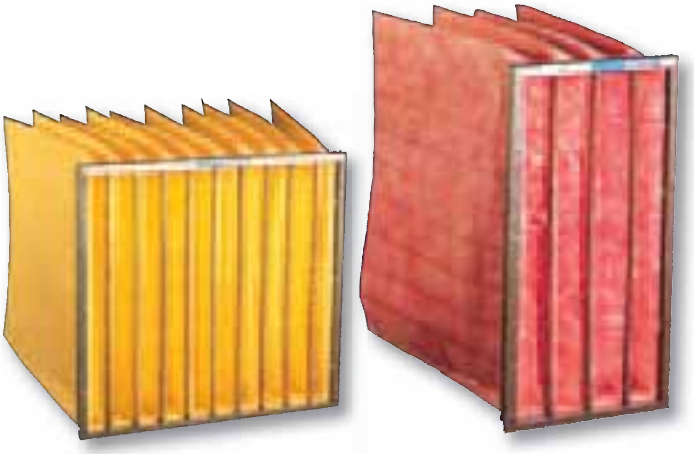
Flexible bag filters

Which allow a high filtering flow rate in relation to the front surface area. Constructed with fibreglass (greater efficiency) or synthetic fibre (lower efficiency) filtering media.

This equipment has the following advantages:

- Lower power requirement.
- Longer filter renewal interval.
- Lower energy costs.
- Lower maintenance.

These filters have a medium to high efficiency and correspond to Classes F5, F6, F7 and F8 of Group F (fine-dust filters) as per UNE-EN 779.



Bag filters.

Rigid bag filters

Same as above but allowing a high filtering flow in relation to the front surface area.

This equipment has the following advantages:

- Solid, sturdy construction for fast, easy installation.
- Compact, reduced-volume design.

They have a medium to high efficiency and correspond to Classes F5, F6, F7, F8 and F9 of Group F (fine-dust filters) as per UNE-EN 779.

Both the rigid and the flexible bag filters are specially recommended for:

- Hospitals.
- Pharmaceutical companies.
- Food industries.
- Computer rooms.
- Office buildings.

Likewise, both rigid bag filters and the flexible bag filters of Class F8 and F9 trap particles below 6 microns, which correspond to the smallest particles of those in temporary suspension that are visible under a microscopic.

Rigid filter.

Absolute filters

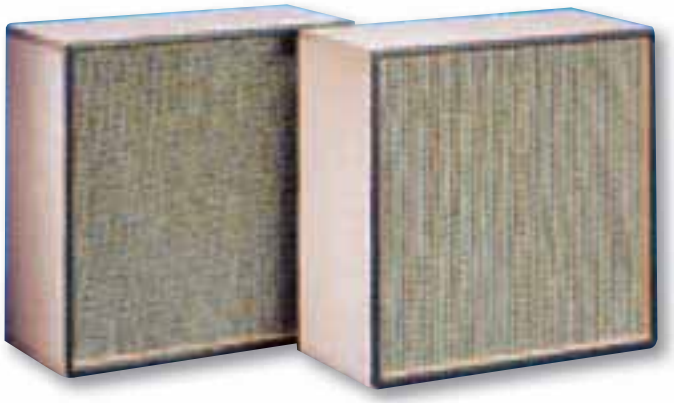
Require careful installation that guarantees complete air-tightness of all gaskets. They are designed to eliminate virtually even the smallest particles in the air, i.e., those in continuous suspension (the smallest of these are only visible using electronic microscopes).

They are specially recommended for:

- Hospitals.
- Food industries.
- Pharmaceutical companies.
- Clean rooms.
- Absolute filtering of air in environments with controlled contamination.

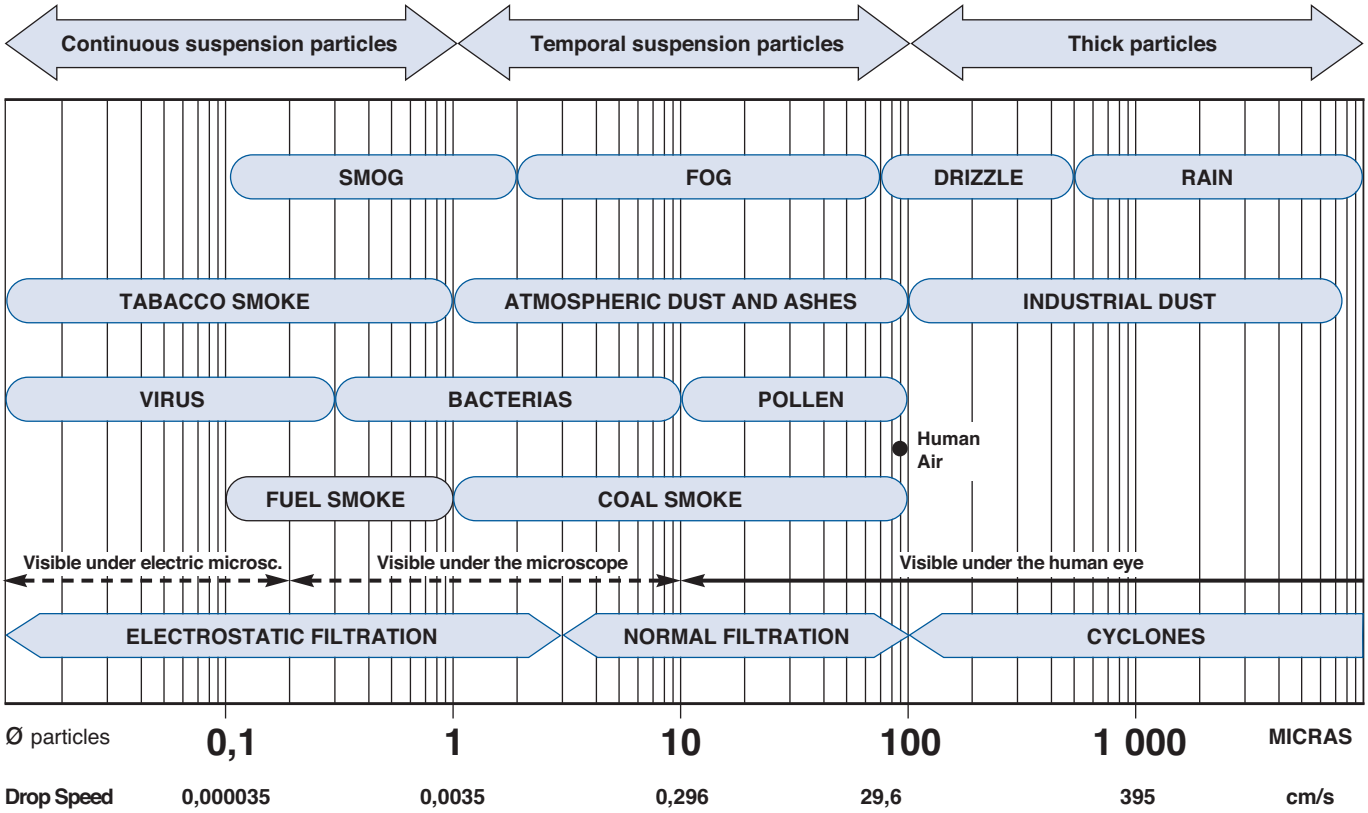
They should be installed immediately before the space requiring this virtually sterile air that these filters can supply.

They correspond to Classes H10, H11, H12, H13 and H14 of Group H: absolute filter, HEPA and ULPA, as per UNE-EN 1822.

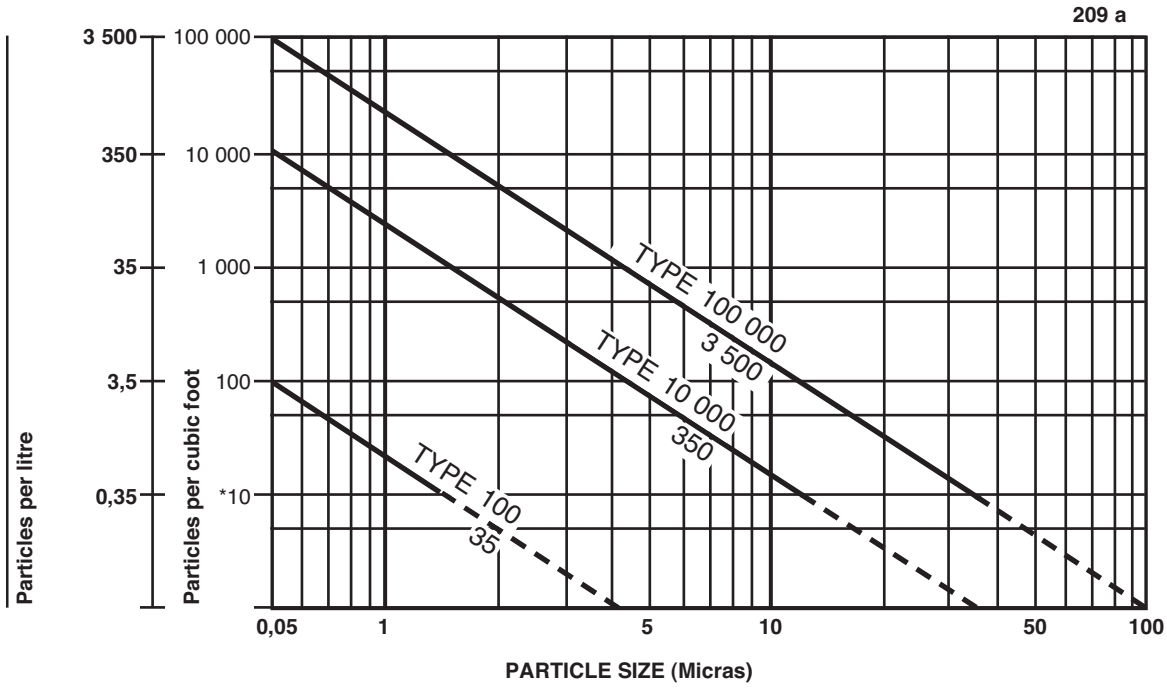


Absolute Hepa filters.

CHARACTERISTICS OF THE MAIN ATMOSPHERIC POLLUTANTS



AIR PURITY CONDITIONS IN CLEAN ROOMS



* Counts below 10 particles per cubic foot (0.35 per litre) are dubious.
Example: admissible particles for a Class 10,000 system:

10.000	per cubic foot, 0,5 microns.
1.200	per cubic foot, 1 micron.
70	per cubic foot, 1 micron.

Sections in detail

Heating/cooling units

Copper tube and aluminium fin heating/ cooling units

This class of heating/cooling unit is most commonly installed in air handling units, and is composed of a coil of copper pipes covered with thin aluminium fins to greatly increase the primary heat transfer surface of the tube, due to the large transfer surface of the fins.

The front air velocity surface (Afo) expressed in m^2 is determined by the dimensions (width x height) of the air handling unit internally.

Since the vertical spacing between the heating/cooling tube units used by Systemair HVAC Spain is 60 mm, each NB-70 air handling unit model has a specific number of tubes based on its working height, defined in the heating/cooling code as "T".

The maximum horizontal length of the finned coil is determined by the working width of the interior of the air handling unit and expressed in mm.

The depth of the heating/cooling unit is composed of a specific number of rows of tubes facing the direction of air flow. The number of rows is calculated according to the air flow conditions at the inlet and outlet of the unit, based on the cooling or heating energy used by the equipment.

The number of rows is defined by a number, followed by the letter "R".

Based on the above, a unit designated as 20T 3R 950 means:

20 T Height of 20 tubes, equal to 1200 mm;

3 R Depth of three tubes, at a distance of 30 mm;

950 Length of finned coil, in mm.

The standardised NB Air Handling Unit range uses the following heating/cooling units:

This range can be used with any cooling or heating fluid except steam, where the length of the finned coil is slightly lower, since collectors must be mounted on both sides of the unit instead of one side only, as normally done with other fluids.

Air Handling Unit Model	Quantity of tubes	Quantity of ranges	Lenght in mm
NB-2	6	1 to 10	500
NB-3	10	1 to 10	500
NB-5	10	1 to 10	850
NB-8	16	1 to 10	850
NB-11	16	1 to 10	1.200
NB-15	20	1 to 10	1.200
NB-18	20	1 to 10	1.500
NB-23	20	1 to 10	1.850
NB-29	26	1 to 10	1.850
NB-35	32	1 to 10	1.850
NB-42	32	1 to 10	2.200
NB-49	32	1 to 10	2.550
NB-55	32	1 to 10	2.900
NB-62	32	1 to 10	3.250
NB-70	32	1 to 10	3.600

Selection of the air velocity through the heating/cooling unit

Normally, the air velocity through the heating/cooling unit should not exceed 2.7 m/s (not including the drop separator), as this velocity is considered the maximum admissible to prevent entrainment of condensed water to other sections of the air handling unit or from the air supply system to the environments.

The heating/cooling unit will also provide good efficiency levels at lower velocities, however. As a result, since the pressure drop of the air flowing through the unit is lower, both the static pressure of the fan and the input power are also lower.

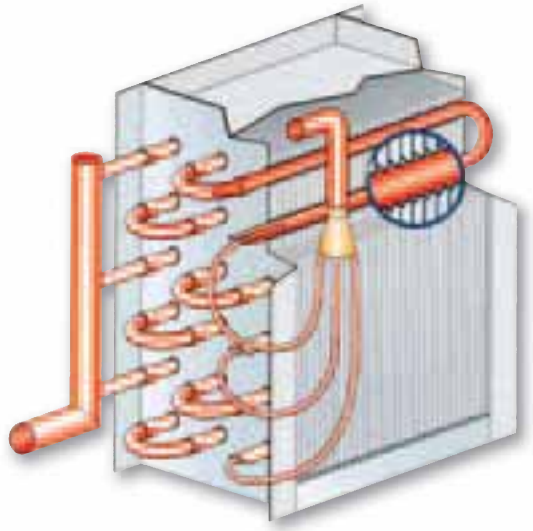
In terms of energy, this factor can save on power consumption over the years. Moreover, when the fan is selected, the rotating speed of the fan can be lowered to reduce the noise level.

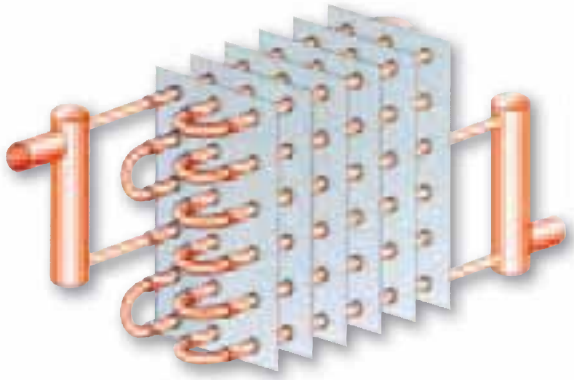
In some cases the above factors are critical and can be solved by selecting an air velocity through the heating/cooling unit below 2.7 m/s.

In the case of air handling units with heating units only (one or more), the air velocity may be above 2.7 m/s, although in terms of energy consumption and the above considerations, the circumstances are the same.

Generally the flow velocity is 3.5 m/s.

For heating, the use of units with steel pipe is recommended when utilising fluids at high temperature and pressure, as these pipes are much stronger than copper pipes, which could be deformed under these conditions due to excessive expansion of the metal.





Sections in detail

Humidifiers

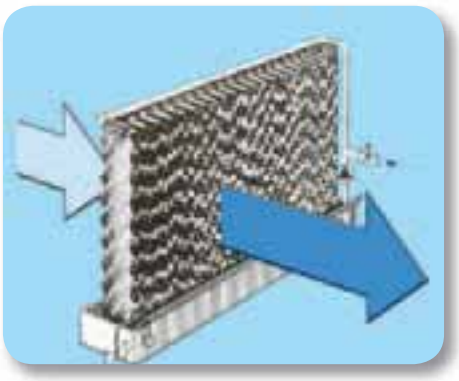
Panel humidifier

The evaporative humidifier, which is also used as an air cooler, can treat large air volumes to obtain cold, humid air at very low cost.

Common applications include localised cooling at job stations, ventilation and heat dissipation in machine rooms, laundries, large kitchens, warehouses, manufacturing plants, as well as providing moisture to print shops, textile plants and greenhouses.

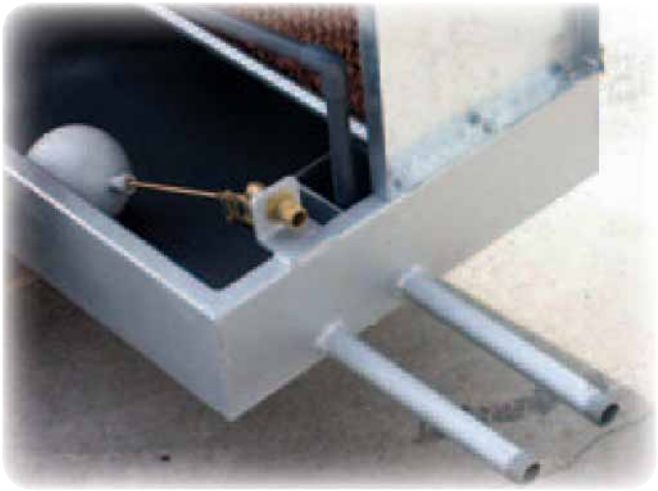
Its main advantage when included in a ventilation system is that it requires lower air flow in circulation due to its cooling effects. This is extremely important for human comfort.

The humidifier essentially consists of a component that is in close contact with water and is swept by an air current, producing rapid water evaporation. The water is added to the air and cooled by an evaporation process.



The humidification component contains multiple channelled plates joined together to form a block and arranged so the air flows horizontally and the water falls vertically over the plates.

Water is distributed at the top of the panel by a collector tube with water outlets.



Below the panel, there is a water pan with level control and a motorised pump to drain water to the discharge collector.

The evaporated water is replaced through a float valve.

Humidifier application

Humidification means that water vapour is added to the air.

The amount of humidification can be expressed as the moisture content (g of moisture per kg of dry air) or the relative humidity (moisture content under specific conditions of air with respect to the maximum saturation content at the same temperature).

When the air is heated, the amount of water vapour it can hold is increased.

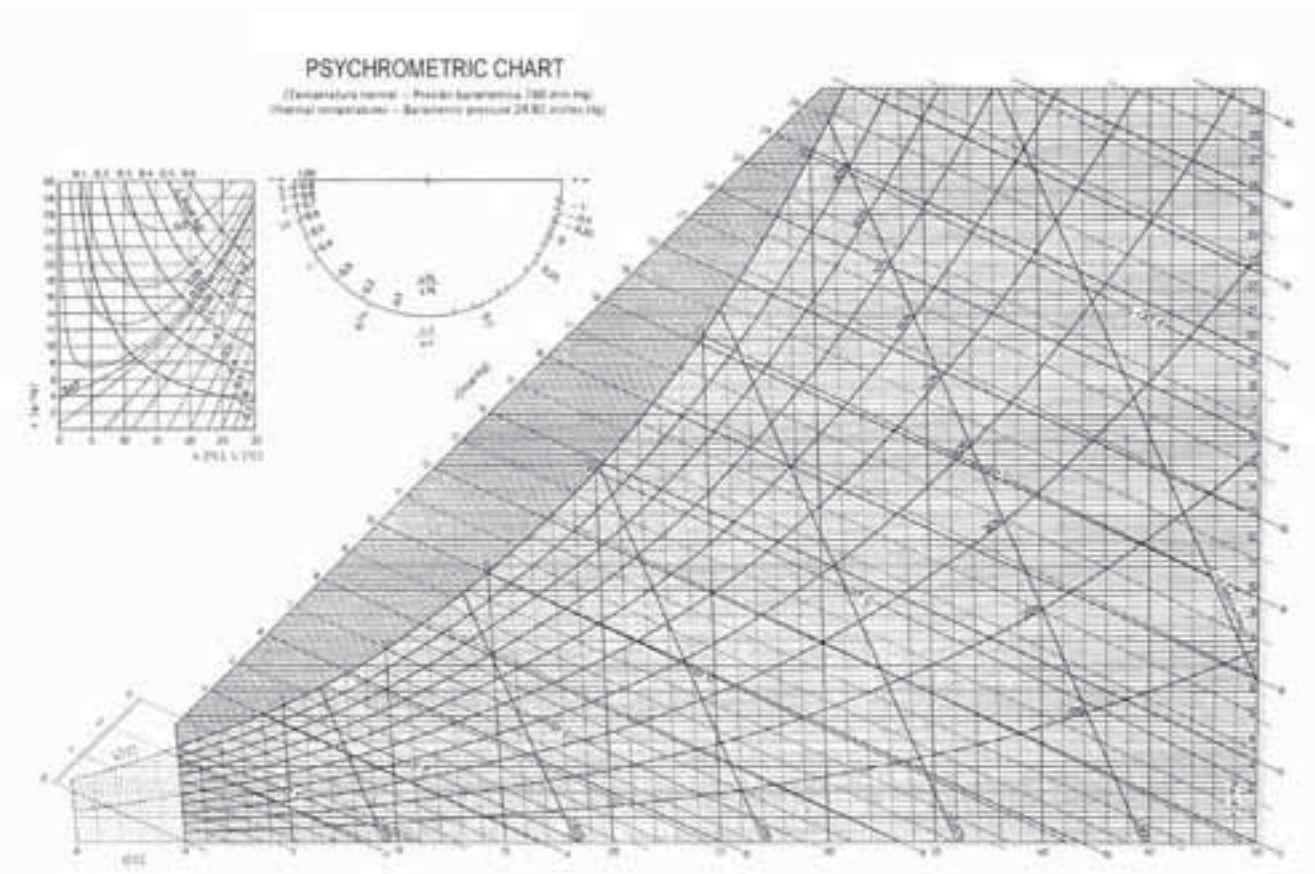
If no moisture is added to the air, the humidity level remains constant and the relative humidity decreases.

In other words, the air will be drier, absorbing moisture from the objects with which it comes in contact (e.g., walls, furniture, products, etc. and more importantly, the body).

During the winter, adequate humidification slows evaporation from the body, increasing personal comfort, even at lower temperatures than normal.

Furniture, tools and sensitive equipment benefit from this situation, as it is extremely important to avoid static energy that is caused by low relative humidity and interferes with phone and electronic equipment.

Hospital environments must have adequately controlled relative humidity, since an excessively dry atmosphere may lead to bacteria growth and weaken the body's immune system.



In order to calculate the humidifier's efficiency, use the following formula to determine the saturation efficiency (SE):

$$ES = \frac{T_{se} - T_{ss}}{T_{se} - T_h} \times 100$$

Where:

- **T_{se}** = dry temperature of inlet air.
- **T_{ss}** = dry temperature of outlet air.
- **T_h** = wet-bulb temperature of air.

Based on the psychrometric chart (a diagram is shown on this page), air with inlet conditions of 38º C (T_{se}) and 21º C (T_h) is converted in the humidifier finding the process at the wet-bulb line of 21º C until reaching an outlet temperature of 24º C (T_{ss}).

The saturation efficiency will be:

$$ES = \frac{38 - 24}{38 - 21} \times 100 = 82{,}3\%$$

This percentage is reasonable, since the maximum level that can be expected from this type of humidifier is 90%, as shown in actual practice.

When this example is applied to a specific case in which an air flow of 30000 m³/h, is circulating and the moisture content of the air at the inlet (xe) is 8.6 g/kg and at the output (xs) is 14.4 g/kg, **then the amount of moisture added is**:

$$\frac{30.000 \times 1{,}2 \times (14{,}4 - 8{,}6)}{1.000} = 208{,}8 \text{ kg of water / hour}$$

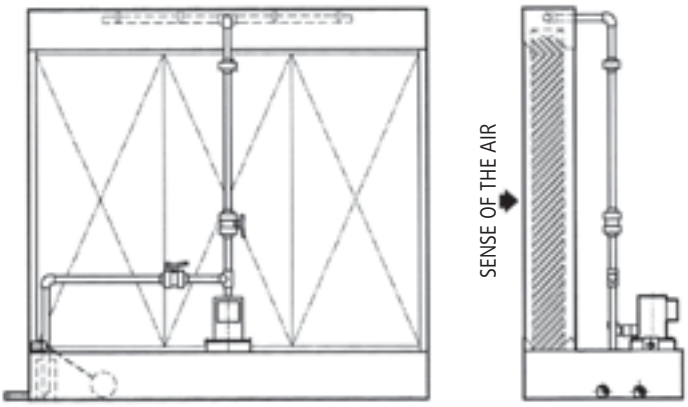
Air cooler application

The above example shows that this type of panel may be used as a cooling medium, since its behaviour is typical of an adiabatic cooling or constant enthalpy process.

Based on the above data, when heat dissipation of 200,000, kcal/h is needed in a space where the inside temperature should be maintained at no more than 29ºC, it is possible to calculate the air flow that should be introduced and therefore also removed from the local.

The air flow required will be:

$$\frac{200.000}{(29° C - 24° C) \times 0,3} = 133.333 \ m^3/h$$



Water spray humidifier

The same considerations used for the panel humidifier are applicable in the case of water spray humidifiers, also known as air scrubbers.

This is an air handling unit section which houses a series of water sprays which produce very small particles that come into contact with the circulating air flow and produce a high level of evaporation.

The bottom of this section contains a drip pan, from which water is sent back to the sprays, with only evaporated water added back to the system.

The system requires the use of a water circulation motor pump, which is not normally included in the supply of this section. A price quote may be provided, however, upon request.

To prevent the entrainment of water particles, this type of humidifier is always equipped with a drip separator at the air outlet as a safety measure.

The most appropriate air velocity in this type of humidifier is 2.7 m/s, and the water flow circulated by the spray bank is 0.8 l per m^3/h of air.

Water spraying can be done either in the same or the opposite direction of air flow, resulting in different saturation efficiencies.

The use of multiple units also increases efficiency, with the following experimental results obtained:

- One unit only, same direction as air flow 60% efficiency;
- One unit only, opposite direction as air flow 75% efficiency;
- Dual unit, same direction as air flow 84% efficiency;
- Dual unit, one in same and one in opposite direction 90% efficiency;
- Dual unit, opposite direction to air flow 95% efficiency.

Sections with a dual unit are longer, and when spraying is opposite to the direction of air flow, a drip separator is located at the inlet for the section.

The examples indicated earlier for the panel humidifier, are also useful for this type of humidifier.

Selection of the most appropiate fan is mainly influenced by the static pressure considered.

Depending on the type of air conditioning system, different static pressures are used (commonly known as low, medium or high).

Low pressures are considered to those up to 90 mm w.g, medium pressure is up to 180 mm w.g. and high pressure is up 300 mm w.g.

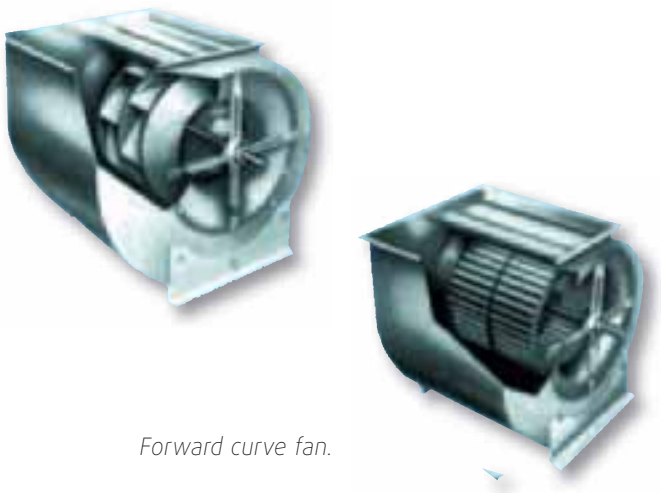
Sections in detail

Fans

Centrifugal

The NB series has three types of fans that cover all needs: the AT and ADH models for low pressures and the RDH model for medium and high pressures.

However, since the RDH model is a fan equipped with a rotor having backward curved blades (more efficient than the AT and ADH models, which have forward curved blades), it may also be used for low pressures. This will increase equipment performance, although the initial price of the air handling unit will be higher.



Forward curve fan.

Due to the efforts made to decrease energy costs, this fact should not be disregarded and the potential energy savings should be calculated, then compared with the depreciation schedule for the investment. In many cases, the result is highly satisfactory.

Once the fan model is selected, check the respective behaviour curve to obtain the unique characteristics.

Based on two essential factors (air flow and total static pressure), the following is obtained:

- Revolutions per minute
- Efficiency, in %
- Input power at the shaft, in kW;
- Mean sound power level of the octave bands, in dB;
- Air outlet velocity, in m/s;
- Dynamic pressure, in mm w.g.
- Peripheral velocity, in m/s.

In addition to the above, when the electric motor is selected, the input power at the shaft must be multiplied by the following coefficients:

Coefficient to be used

ADH	RDH					
1,25	1,25	0,75 kw	≤	Pot_{eje}	<	0,75 kw
1,20	1,15			Pot_{eje}	<	10 kw
1,15	1,12			Pot_{eje}	≥	10 kw

Once the new value is obtained, compare it to the standardised values from the electric motor manufacturers.

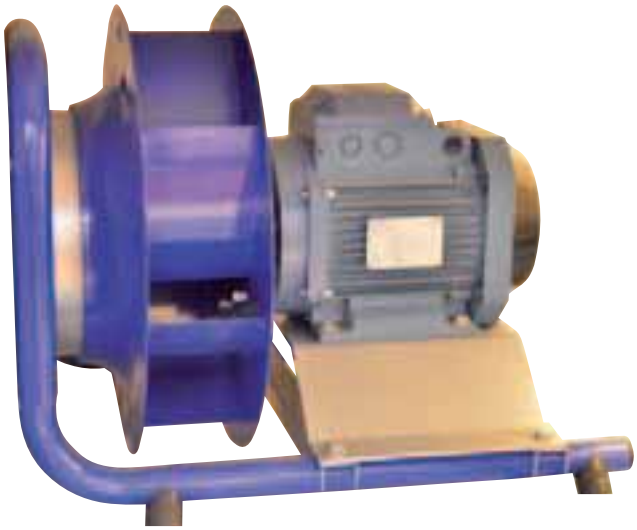
The energy of the electric motor used to operate the fan is dissipated in the circulating air, and therefore affects the cooling load of the cooling system.

In many cases, the air flow necessary for heating may be considerably less than for cooling. In this case, a two speed motor can be used. This changes the fan characteristics, minimising air flow during the winter season.

There are practically no limits for low-temperature operation in the fan section. In contrast, high temperatures can damage the motor. These temperature limits are clearly defined by electric motor manufacturers and must be respected to at all times.

Backward curve fan.

Plug Fan



Plug fan built into an acoustically insulated air handling unit.

A plug fan supplies air at the fan section outlet with a low and even air speed. In certain situations it can, therefore, be an advantage to position air handling components on the outlet side of the fan.

Single inlet plug fan with open outlet into the air handling unit. The fan impeller is fitted directly to the motor shaft. This fan type has low sound power levels in the lower frequencies.

Efficiency up to 75%.

The motor is supplied with a 1-speed motor. In order to regulate the fan speed to its actual operating point the motor must be fitted with a frequency converter.

The frequency converter can continuously control the fan speed and airflow. Power consumption can be greatly reduced by operating the fan at lower speed.

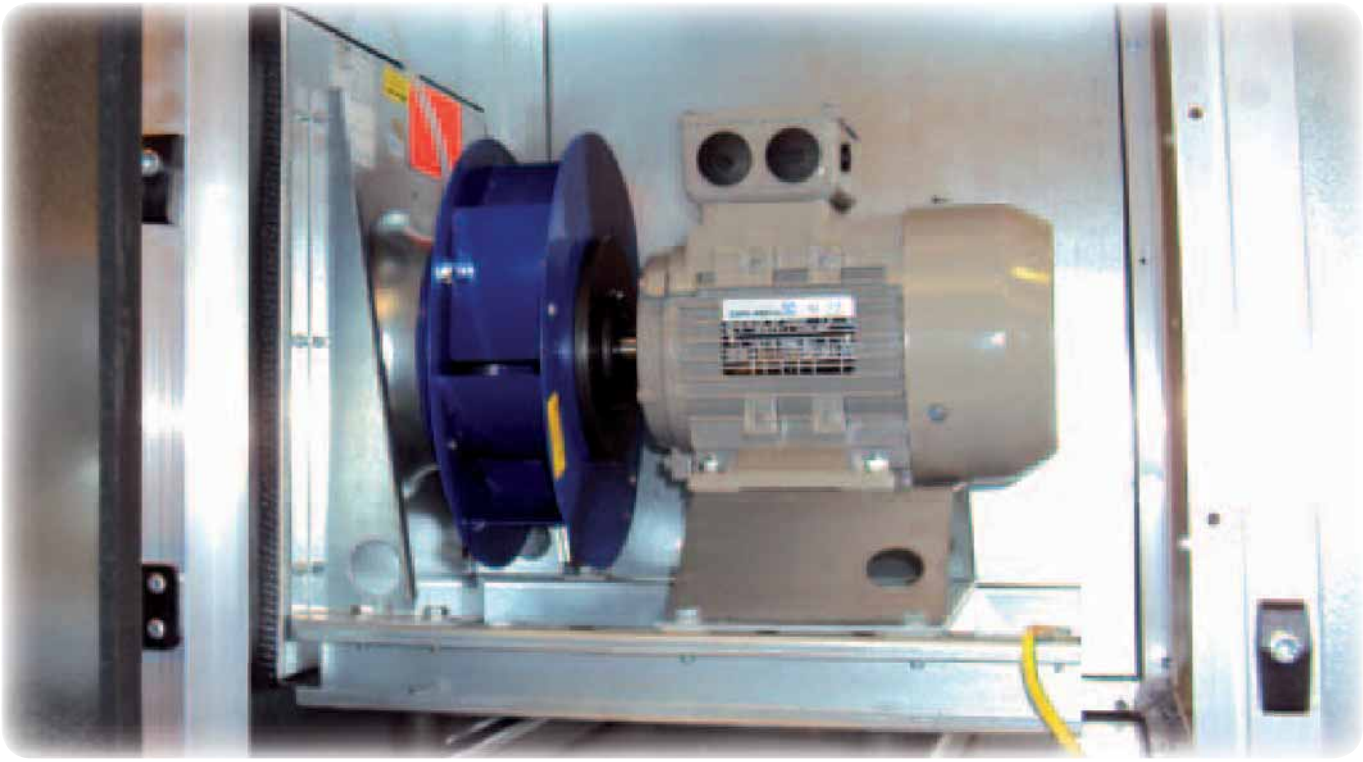
Operating temperatures:

Standard design: -10/+40 °C
Special design: -30/+60 °C.

All fans are fully balanced both statically and dynamically.

The fan and motor are built on a stable base frame that is connected to the unit casing with rubber vibration isolators. These are designed for high levels of vibration absorption.

The fan inlet is flexible connected to the unit casing. This ensures a good vibration absorption.



NB Selection Program

Our NB Selection Program runs under Windows® XP, Vista or W7, provided the equipment meets the following minimum requirements:

- Intel® Pentium® III or compatible processor;
- 1 GB of RAM;
- 500 MB of space on the hard disk;
- DVD drive;
- VGA 1024 x 768 Display;
- Mouse;
- Regional configuration and keyboard.

This program is specially designed to allow the selection of NB Air Handling Units and will help you to:

- Develop new projects according to your needs, readily making all the calculations necessary ;
- Divide the equipment into modules, in accordance with the project requirements;
- Easily save, retrieve and modify all your projects;
- Create a scale drawing of the equipment selected, allowing hard copies to be made;
- Obtain all technical information for the equipment selected, including the curves for the selected fan and its operating point;
- Estimate the cost of the equipment.

The NB Selection Program is user-friendly and highly intuitive.