Air Handling Units

LG
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Company Profile

Ever since manufacturing Korea's first homegrown air conditioner in 1968, LG has remained at the forefront of air conditioning innovation. For eight of the last 10 years, LG has been the world's top selling manufacturer of residential air conditioning solutions. And in 2008, LG became the first company to sell a cumulative total of more than 100 million air conditioners.

Building on its success and technological leadership in the residential air condition g sector, LG has moved into system air conditioning as well. The company's range of high-performance system air conditioning products provides effective temperature control to large scale building and facilities. Over time, LG has evolved into the total HVAC and energy solution provider, investing in new technologies and adding chillers, VRF systems, and Improve indoor air quality through AHU-VRF solution building management systems (BMS) into its comprehensive product portfolio.

Along with a wide range of innovative solutions LG delivers unrivalled customer service. The company produces top notch air conditioning professionals at its SAC academies of which there are more than 100 worldwide. These centers of excellence provide detailed product workshops and training programs that offer invaluable hands –on experience. LG also provides useful tools for HVAC system engineers and installers, including its timesaving LG Air Conditioner Technical Solutions (LATS) software.

Additionally, LG operates several state-of-the-art R & D facilities all across the planet. One such facility is the Energy Lab, a purpose – built R & D and testing center in northern France. Helping to keep the company ahead of the competition, the scientists and engineers at the Energy Lab study the effects of different environmental conditions on LG's products. This in-depth research and analysis enables LG to tailor its solutions to the specific environmental demands of each individual market.

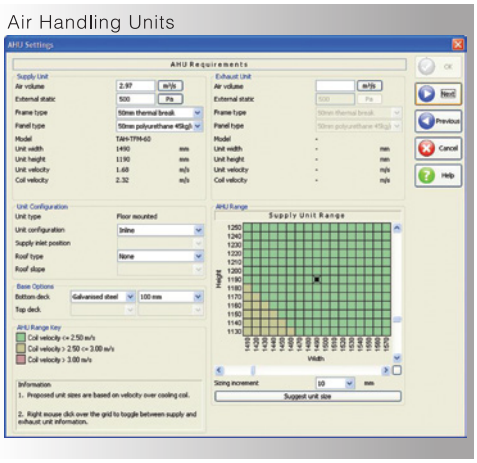
With 10 manufacturing plants throughout the world, LG produces in excess of 17 million reliable compressors and 16 million first-class HVAC solutions per year. Combining the best technologies with the best ideas, LG's highly quality products are now enjoyed by consumers in over 100 countries.

Selection Program

LG WinTADS software has been custom built to accommodate most of the possible requirments from the customer with a very user friendly input panel on linear windows. The selection program, built with standard models of TAH series, includes 30 different sizes for floor mounted Air Handling Units, 15 sizes for Ceiling Hung units and 9 sizes for Kitchen Ventilation (Ecology) units.

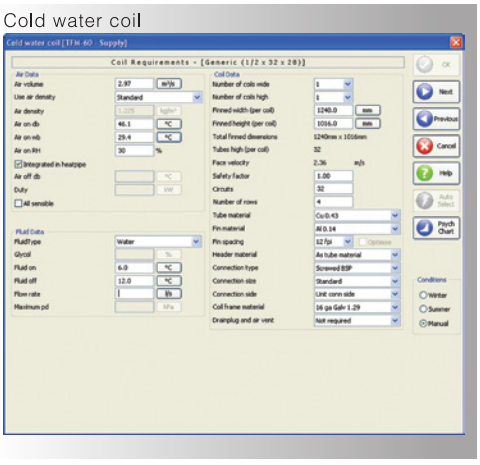
In addition to the standard models, the selection program has a built-in feature which allows us to select unit dimensions on a grid of height vs width, the scale of the grid being 10 mm, practically this means that we can meet any combination of sizes for our units as per the Customer's site requirements.

Air Handling Units



Cooler batteries can be selected with one of these options: water, glycol or refrigerants such as R22, R407C, R410a and R134a. The system has been designed to operate using the SI units of measurement. But the user is free to toggle between the Imperial system and Metric system for each input data at their convenience.

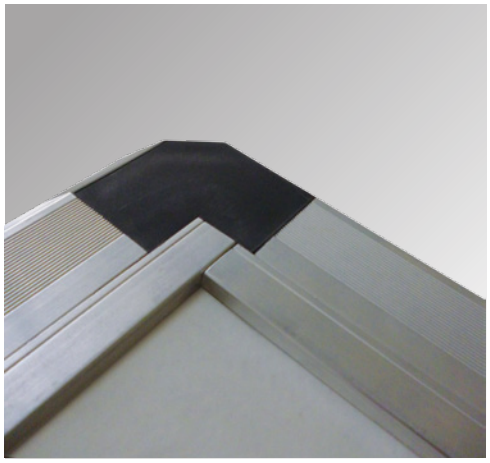
Cold water coil



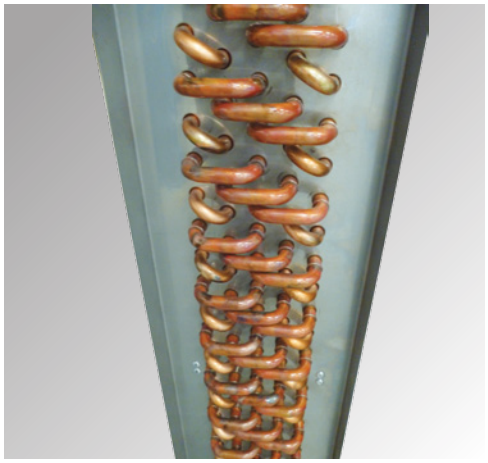
The output of the program provides a very detailed specification and performance of each component chosen and produces a complete technical submittal comprising of all the technical information required for the customer.

Design Flexibility

LG WinTADS offers an incredible flexibility to the user by customizing the unit dimensions in multiples of 10mm on the width and height meeting all aspects of customer's requirement. The selection program provides us with tremendous options in choosing the components and its arrangement, thereby satisfying the system designer and architectural layout.



Screw less snap fix panels are offered for contemporary looks at very low air leakage rates. For retrofit and revamp requirements, we offer complete solutions of building up compact units so that the units can move comfortably through the passage constraints.



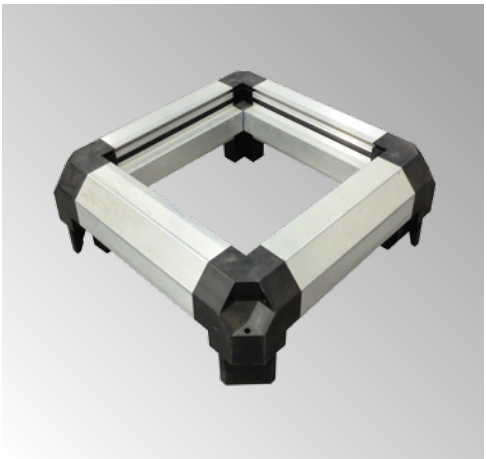
The cooler batteries are offered with a flexibility of choosing either ½"OD (12.5mm) or 5/8"OD (15.8mm) copper tubes depending on the capacities and water side pressure drops. Cooler batteries have an option of choosing water, glycol and refrigerants such as R22, R407C, R410a and R134a.

Complete range of construction materials are available including plain galvanized steel, pre-painted galvanized steel, aluminium and stainless steel. Trosten WinTADS covers a multitude of environments including the most corrosive atmosphere and offers complete range of components ensures to provide the environment with quality indoor air. Units can also be designed to suit indoor and out conditions with variable sized inlet and discharge openings.

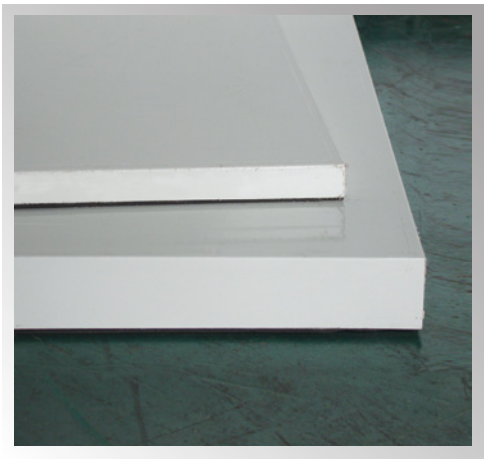
Casing Construction

TAH series Air Handling Units are of modular construction using pentapost, extruded aluminium profiles with excellent rigidity. Thermal efficiencies, i.e., thermal transmittance and thermal bridging are addressed by our unique thermal break casing design meeting the European standard EN 1886. Aluminium profiles are offered with options of anodized finish for anti corrosion and screw less snap fixing type for low air leakage rates.

Panels are secured to the unit frame work with fasteners, exerting pressure evenly onto the panel and the gasket attached to the frame to ensure better air tight casing construction.



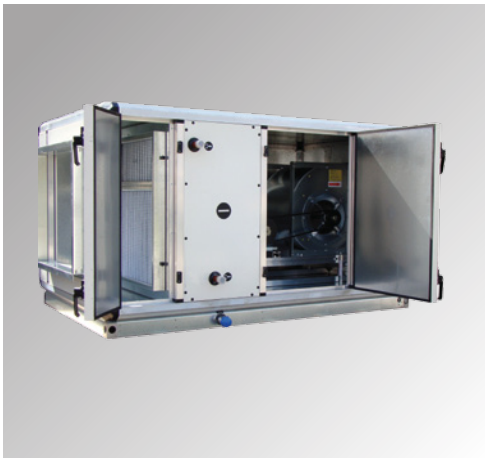
Panels are of double wall construction either injected with polyurethane foam insulation of 48 kg/cu.m density or with high density Rockwool insulation providing a rigid, sturdy and easily cleanable enclosure. The double wall construction keeps the insulation out of air stream and contributes towards improved IAQ.



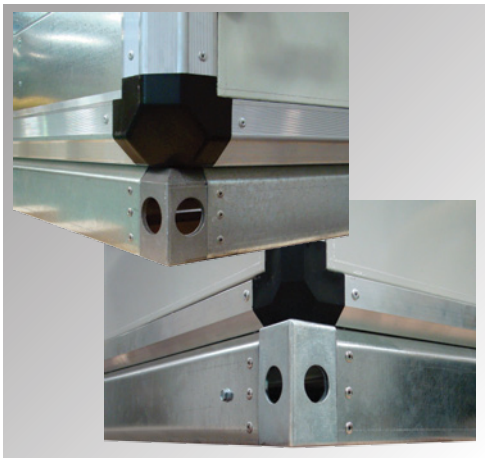
Polyol used for PUF insulation are blended with environment friendly CFC & HFC free agents, self extinguishable as per ASTM D 3014 standard and the foam insulation conforms to Class “O” of ISO 1182.2 standards. Thermal conductivity “K” factor is 0.02 W/m°K.

Casing Construction

Panels are offered in 25mm and 50mm thickness chosen as per the given specification and application. The outer skin and inner skin of the casing comes with a variety of options in choosing sheet thickness and material (Galvanized Steel / Aluminium / SS) as per the requirement.



The outer surface of the panel is generally offered with pre-coated polyester, having excellent corrosion resistance, applied over galvanized steel sheet and further protected with vinyl guard film towards scratch protection. All plain galvanized steel sheets used shall have a minimum zinc coating of 270 GSM (G90) for anti corrosion.



Base frames are made out of sendzimir galvanized steel sheets with either die cast aluminium joints or heavy duty steel joints with lifting holes. Hot dip galvanized channel frames are also provided, especially for larger dimension units.

For hygiene applications, food grade gaskets are provided as a standard feature conforming to BS EN-71 Part 3: 1995 standard.

Acoustics

LG WinTADS selection software calculates the sound levels transmitted from the unit into the outlet ducting, inlet ducting and the radiated sound levels for each octave band based on the specific working condition and as per the tests carried out conforming to EN ISO 3744:2009 standards.

Fan sound is a major component of the unit noise levels and to minimize the sound generation, fans need to correctly sized and selected to operate at or near peak efficiency. Oversized fans can generate much higher sound power levels than necessary. Undersized fans can also result in higher sound power levels because of increased fan speed and the higher tip velocity of the air leaving the fan blades.

Sound performance data is derived from testing performed in accordance with AMCA standard 300. The effects of various components, casework and unit configurations are taken into account while deriving the sound levels in octave band.

Rockwool

Octave Band	125	250	500	1000	2000	4000	8000	Hz
Sound Reduction	10.4	22.3	27.9	31.3	34.1	37.0	43.5	dB

50 mm panel, 1.0 mm inner & 0.9 mm outer steel sheet.

Polyurethane Foam

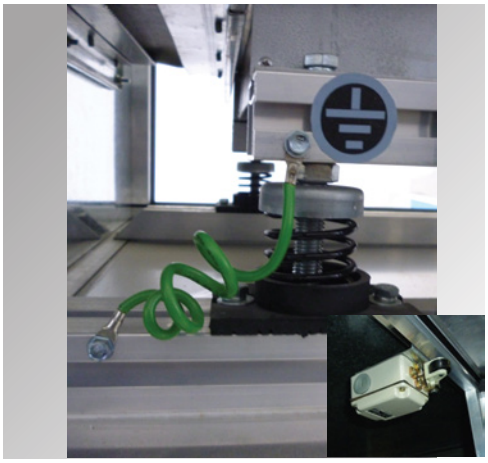
Octave Band	125	250	500	1000	2000	4000	8000	Hz
Sound Reduction	7.7	14.3	12.3	13.8	21.9	35.0	40.5	dB

50 mm panel, 0.7 mm inner & 0.7 mm outer steel sheet.

Safety

Air Handling Units must not be put into operation before all electrical and mechanical safety devices have been installed. All unprotected openings should be equipped with protective screen. For any service work or inspection need to be carried out, all safety isolating switches of the unit should be tripped before the access doors are opened and before restarting, all safety devices must be reset.

Fan guard is fixed at the access opening of fan section to restrict the access to the fan / motor assembly for additional safety. It is strongly recommended to prevent the access to the fan section while the unit is in operation. View port on the access doors enable visual inspection of the fan motor drive and UV lamp status.



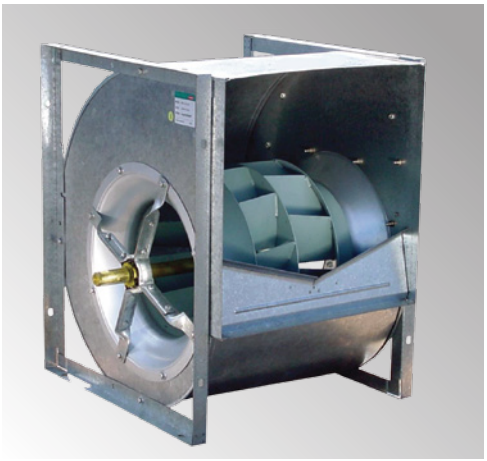
Fan motor assembly isolated by anti-vibrators and flexible connectors shall be earthed to the casing. Further, the casing is earthed as a part of field wiring to ensure complete safety. Fan section access doors shall be incorporated with safety “cut-off” switches electrically interlocked with the fan motor. No sharp edges, all projected screws shall be covered with nylon caps.

Electrical heaters should be provided with separate power supply, safety thermostat and need to be interlocked with an air flow switch. Hot water coils need to handled with utmost care while the using the purge connections for the risk of water hammer or steam discharge. Adequate space need to be provided in the front of the electric heater and electric control panels in accordance to the local electrical safety regulations.

Fans

LG units are housed with centrifugal, double inlet, double width (DIDW) fans with blades of forward curved, backward inclined, airfoil, plenum or twin fans. The performance of the fans have been tested and measured in accordance to AMCA standard 210. Similarly, the noise levels of the fans have been tested and measured in accordance with AMCA standard 300.

Fans are designed in accordance to the specified operating class of AMCA standard 99-2408-69 performance class limits for centrifugal fans. Further, all backward inclined, airfoil and most of the forward curve fans are sized in accordance to AMCA standard 99-0098-76 R20.

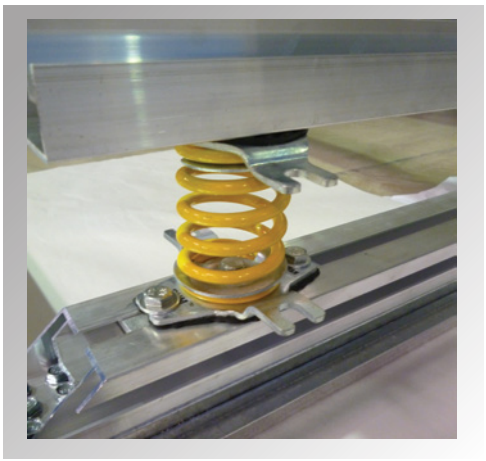


Wheels of forward curved fans are manufactured in galvanized steel construction, backward inclined and airfoil wheels in cold rolled steel sheet with polyester coated finish. Shafts are manufactured from C45 grade carbon steel and then coated for anti corrosion after assembly.

The drives are selected for 150% of the maximum motor horse power of the units. Sheaves are of fixed pitch type and dynamically balanced. Adjustable pitch pulleys are provided upon request. V-belts are of anti-static and oil resistant type.

Fans

Bearings used are of either deep groove ball bearing type with an adaptor sleeve or spherical roller bearing type sealed at both sides for different applications. All the bearings are lubricated for life and maintenance free under normal operating conditions. All the fan bearings have a minimum life time of 200,000 hours at L50 life and upon request, we can provide heavy duty bearings suitable for continuous operation of 200,000 hours at L10 life.



Fan and motor assemblies are mounted on a common extruded aluminium base located inside the air handling casing which in turn is mounted on anti vibration mounts designed for 93% isolation.

All the wheels are statically and dynamically balanced according to ISO 1940 and AMCA 204 – G2.5 standards. Clean room application fans with balancing grade of G1.0 can be provided upon request.

Fire retardant fabrics are used as flexible connectors between the fan outlet and the unit casing for vibration free operation.

Motors

All fan motors are mounted inside the unit casing. The appropriate motor size will be selected by LG WinTADS selection software.

Electric motors are of IEC standard in squirrel cage, totally enclosed fan cooled (TEFC), B3 foot mounted, IP 55 degree of protection and class F insulation. Motors conform to IEC 34, IEC 72, BS 5000, BS 3979, BS 4999 standards and carry CE mark.

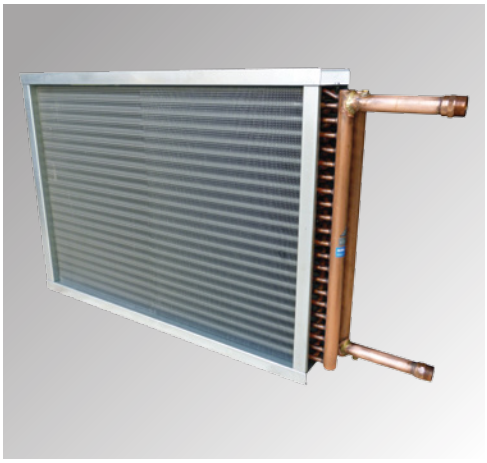
Motor efficiencies available include EFF2 (IE1) standard efficiency, EFF1 (IE2) high efficiency and Premium Efficiency (IE3), offered based on the requirement. On request, the motors can be offered upto 660Volts, 50/60Hz AC supply. Motors of explosion proof construction can also be offered.

Motors are suitable for VFD operation, 5:1 ratio for constant torque applications, as higher grade and type of copper materials, lamination etc., are used and the motors undergo vacuum impregnated insulation treatment, thereby increasing the insulation strength on the overhangs of the motors so that harmonic distortions are minimized. Speed variations of 40 to 100% are recommended.

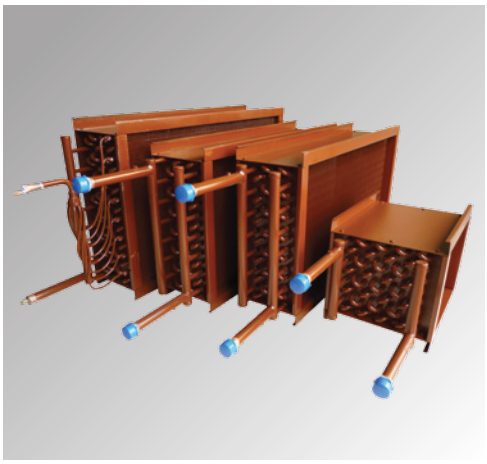
Please refer to page nos. 71 to 76 for motor ratings and cable sizing.

Coils

LG WinTADS offers wide range of application flexibility in selecting the coils using different pitches of 12.5mm OD (1/2”) or 15.8mm OD (5/8”) copper tubes with cooling medium as water (chilled water / hot water), glycol, steam or refrigerants of R22, R134a, R410a & R407c. Various configurations of coil arrangements like draw-through, blow through and multi-zone are also offered.



Coils are designed to maximize the utilization of the available unit cross section area with the connections clearly labeled on the outside of the units. Cartridge type coil mounted on steel channels shall ease the access for removability.



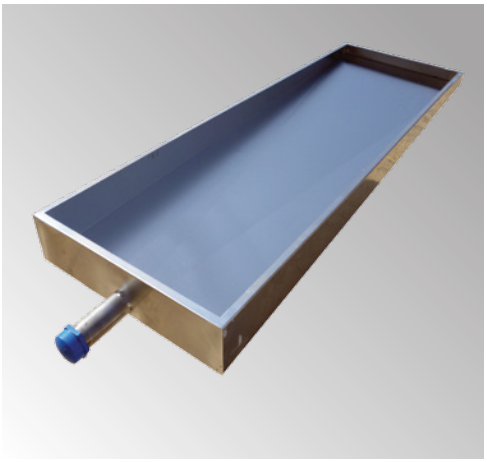
Coils are constructed out of corrugated aluminium fins and seamless copper tubes as standard. Anti corrosion coated coils or copper fins are provided upon request. The fins are of sine wave design and shall have collars drawn, belled and firmly bonded to the copper tubes by mechanical expansion of the tubes.

Casing shall be 1.5mm thick galvanized steel or stainless steel (optional) with formed end supports on the top and bottom. The bottom channel is provided with drain holes to ensure proper condensate drainage.

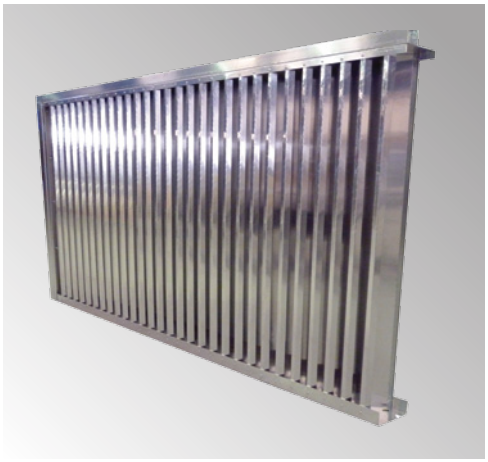
Coils

Headers shall be of extra heavy seamless copper tubing with tube holes intruded to provide the maximum brazing surface for added strength. Header end caps are heavy gauge, die formed copper. Connections for water coils shall be of threaded hexagonal brass / copper fittings as standard for the ease of plumbing while erection.

Drain pans are made out of stainless steel – SS304 construction with dual slope to facilitate immediate discharge of condensate. Specially designed drain pan with all round edges allow complete cleaning and avoid microbial growth as per ASHRAE 62-1999. Drain pans can be offered in SS316 construction upon request. Intermediate drain pans are provided for stacked coils to drain the condensate to the main drain pan without flooding the lower coils or passing the condensate through the airstream of the lower coil.



Moisture eliminators are provided in PVC construction for coil face velocities exceeding 2.5 m/s as standard. Aluminium and stainless steel construction are provided upon request.



Cupro-nickel tubes and headers can be provided for special applications upon request where high acid or sand content tends to be corrosive or erosive. Each coil is factory pressure tested at 375 psig air pressure under water for water / steam coils and 450 psig for refrigerant coils for trouble free operations. Vent and drain plugs are provided for all water coils.

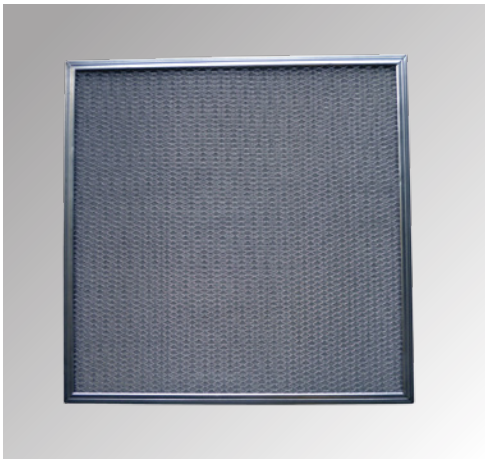
Please refer to page no. 63 for coil sizing.

Filters

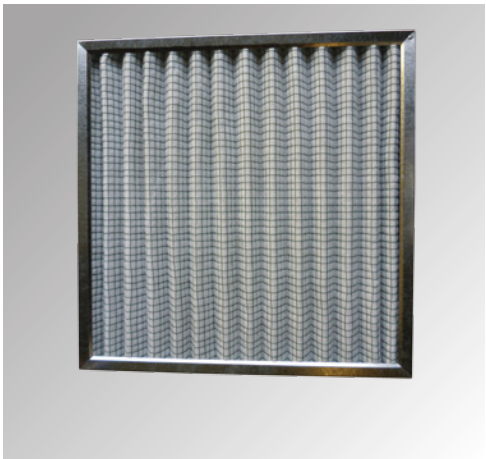
Metallic Filters

Metallic washable filters are made out of fine galvanized steel wire mesh for use in heavy duty industrial and kitchen air ventilation applications. Filters having excellent dust holding capacities and ability to perform in high moisture conditions are specially made to handle the grease content exhausted out of kitchen hoods. The Metallic filters shall be with multiple layered and pleated galvanized steel wire mesh formed into compact maze of dirt catching surfaces.

Technical specifications : Metallic Filters
Filter class: G2 as per EN 779 Standard
Initial resistance: 22 Pa
Final resistance: 130 Pa
Mean resistance: 75 Pa
Rated velocity: 2.5 m/s
Average arrestance: 75-80%
Maximum operating temp: 420 Deg C.



Technical specifications : Synthetic Panel Filters
Filter class: G4 as per EN 779 Standard
Initial resistance: 90 Pa
Final resistance: 250 Pa
Mean resistance: 170 Pa
Rated velocity: 2.5 m/s
Average arrestance: ≤90%
Maximum operating temp: 70 Deg C.



Synthetic Panel Filters

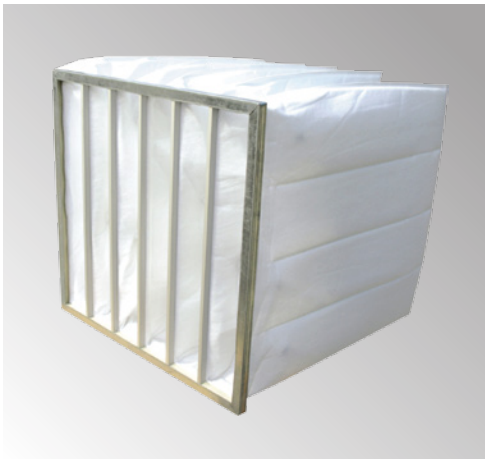
The 2" / 4" deep pleat shall have consistent pleat spacing and durable execution. Pleated Filters feature a self supporting media pack in a two piece frame - pleat stabilizers on the air leaving side in combination with pleat support straps on the air entering side ensure pleat consistency providing excellent dust holding capacity and low pressure resistance. The pleated media shall be made from a controlled and repeatable special blend of size-specific virgin fibers. Also available, G3 class filters upon request.

Filters

Soft Bag Filters

Soft bag filters shall be made of ultra fine synthetic fiber media consisting of a unique blend of coarse and fine synthetic fibers specially designed and interwoven to provide a low initial resistance and high air cleaning performance. The coarse fibers arrest larger and heavier particles in the air stream while the fine fibers remove the smaller particulate matter and give the filter its high efficiency classification. The media is color coded for identification as per Filter class. Also available, F5 and F9 class filters upon request.

Technical specifications: Soft Bag Filters
Filter class: F7 as per EN 779 Standard
Initial resistance: 80 Pa
Final resistance: 250 Pa
Mean resistance: 165 Pa
Rated velocity: 2.5 m/s
Average arrestance: 98%
Efficiency: 80-85%.
Maximum operating temp: 70 Deg C.



Technical specifications: Rigid Bag Filters
Filter class: F9 as per EN 779 standard
Initial resistance: 210 Pa
Final resistance: 450 Pa
Mean resistance: 330 Pa
Rated: 2.5 m/s
Efficiency: $\geq$95%
Maximum operating temp: 70 Deg C.

Rigid Bag Filters

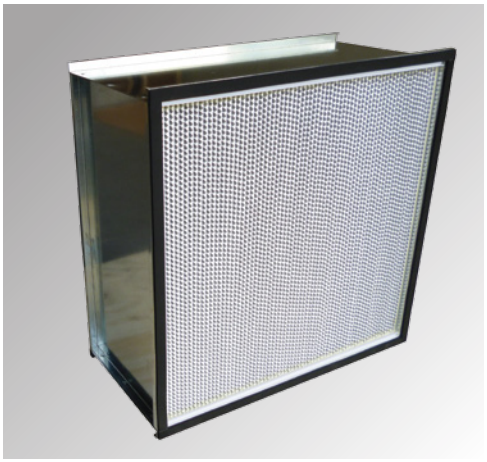
Rigid bag filters are constructed of pleated media pack with hot melt separators which ensure that they deliver the desired air quality when used in variable air volume systems and subjected to repeated fan shutdown, high relative humidity and intermittent exposure to water. The hot melt separators maintain uniform spacing between pleats to allow optimal flow of air into and through the filter. They also ensure large effective media area for low resistance and high dust holding capacity.

Filters

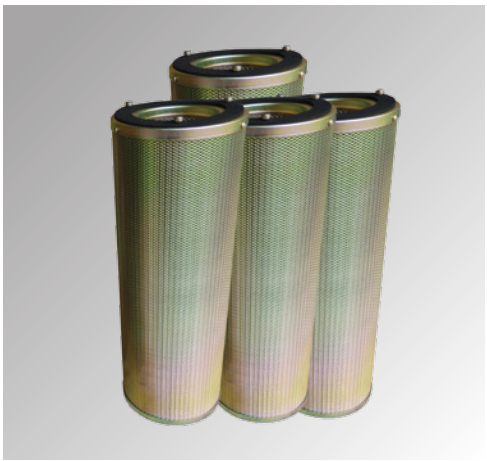
Absolute Filters

HEPA Filters shall have metal cell sides, heavy duty filter designed for both constant air volume and variable air volume systems. These filters shall consist of pleated media pack enclosed in an electro galvanized steel housing; the media shall be made of ultra fine fiber glass formed in to a series of pleats.Corrugated Aluminum separators maintain uniform spacing between each pleat to allow unrestricted air flow. Bar braces shall be installed on both the sides of the filter for extra reinforcement of the media pack. H10, H11, H13 and H14 class filters are available upon request.

Technical specifications: Absolute Filters
Filter class: H12 as per EN 1822
Efficiency: 99.5% at 0.3 micron
Initial resistance: 250 Pa
Final resistance: 750 Pa
Mean resistance: 500 Pa
Cell sides: Galvanized steel
Filter media: Ultra-fine Glass Fiber media
Separators: Aluminum
Maximum operating temp : 120 Deg C.



Technical specifications: Carbon Filters
Frame material: Galvanized steel frame
Carbon filter size: 145 dia x 600 mm long
Volume per canister: 5.9 l
Capacity per 24x24: 3200 m3/hr having 16 canisters
Carbon content: 3 kgs per canister = 48 kgs per cell
Average resistance: 150 Pa
Dwell time (contact time): 0.1 sec
Refillable type: Yes



Carbon Filters

Canister delivery system shall consist of multiple individual canisters in metal execution. Canister shall be assembled in a galvanized sheet metal holding frame to fit standard dimension filter sections. The individual canister seals and holds in the frame due to its unique seal and bayonet style clamping mechanism. Canisters shall be factory pre-filled with user specific media. Each canister shall be vibration filled in order to ensure that the media is uniformly packed.

Filters

MERV rating

Minimum Efficiency Reporting Value (MERV) – ASHRAE 52.2.1999 standard on "Method of Testing General Ventilation Air-Cleaning Devices for Removal by Particle Size" provides a methodology for determining filter efficiency at removing various sizes of particles as the filters become loaded. There are three ranges of particle sizes that define the MERV value.

ASHRAE standard 52.2 replaces ASHRAE 52.1 method and please refer to the table of ASHRAE 52.2 showing the MERV ratings and particle size range.

MERV Rating	ASHRAE 52.2 Standards			ASHRAE 52.1 Standards		EN779 / EN1822 Standards
	Range 1	Range 2	Range 3	Arrestance %	Dustspot Efficiency %	
	0.3 to 1.0 µm	1.0 to 3.0 µm	3.0 to 10.0 µm			
MERV 1			<20%	<65%	<20%	G1
MERV 2			<20%	65 - 70%	<20%	G2
MERV 3			<20%	70 - 75%	<20%	G2
MERV 4			<20%	75 - 80%	<20%	G2
MERV 5			20 - 35%	80 - 85%	<20%	G3
MERV 6			35 - 50%	85 - 90%	<20%	G3
MERV 7			50 - 70%	>90%	25 - 30%	G4
MERV 8			70 - 85%	>90%	30 - 35%	G4
MERV 9		<50%	≥85%		40 - 45%	F5
MERV 10		50 - 65%	≥85%		50 - 55%	F5
MERV 11		65 - 80%	≥85%		60 - 65%	F6
MERV 12		80 - 90%	≥90%		70 - 75%	F6
MERV 13	<75%	≥90%	≥90%		80 - 90%	F7
MERV 14	75 - 85%	≥90%	≥90%		90 - 95%	F8
MERV 15	85 - 95%	≥90%	≥90%		>95%	F9
MERV 16	≥95%	≥95%	≥90%		85% DOP 95% DOP	H10 H11

The Standard only lists arrestance efficiencies for MERV values upto 16. Higher ratings of MERV 17 to MERV 20 correspond to HEPA (High Efficiency Particulate) and ULPA (Ultra-low Particulate) filters. These filters are suited for Clean room & Pharmaceutical manufacturing applications.

Electrical Heaters

Electric heaters are used to control the temperature of the supply air precisely. Electric heater sections are provided with finned tubular heaters of stainless steel tubes and fins with mechanical bonding for optimum heat transfer. These heating elements have a strong outer sheath to help protect the heater from physical stress and use high quality alloys to allow efficient heat transfer from resistance coil to the heating medium. Further, finned tubular heaters are factory configured to almost any shape and size to accommodate in the cross section of the Air Handling Units.

Heaters are available in 240V, 480V and 600V, 3 phase electrical characteristics. The heaters offer very negligible air side pressure drop ranging from 0.25Pa to 1.0Pa, depending on the air velocity and the number of rows of heating elements.

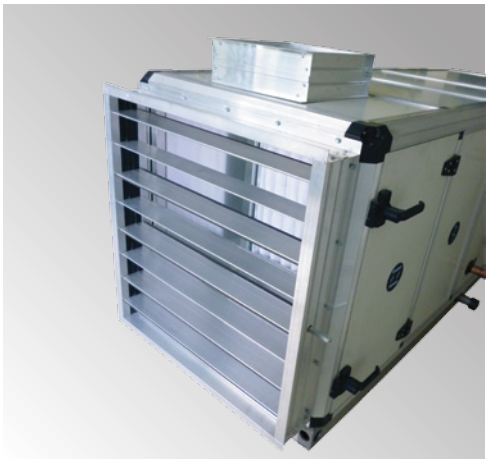
A variety of diameters are available to adjust the watt densities and design the electric heaters for best performance and long life. Finned tubular electric heaters have increased heat transfer surface area, safe to operate having minimal risk of fire or electric shock, durable and easy to maintain. The operating temperature of the finned element shall change with respect to the air velocity, air temperature and the watts per square inch of the finned element.

Calculation of Electric Heater capacity in kW
IP system: Capacity (kW) = 1.08 x Air Flow Rate (cfm) x Air Temperature Rise (deg.F) / 3410
SI system: Capacity (kW) = 1.21 x Air Flow Rate (L/s) x Air Temperature Rise (deg.C) / 1000

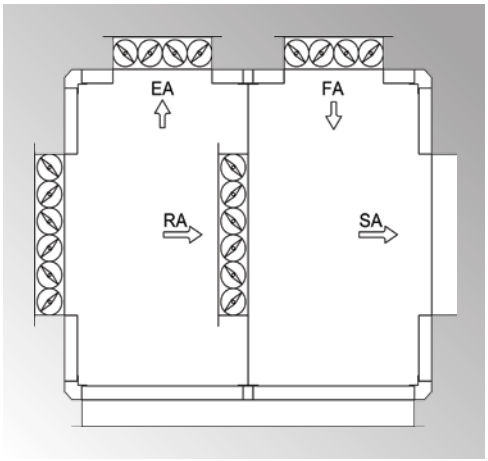
Mixing Boxes and Economizers

Mixing boxes and Economizer sections are offered with fresh air and return air inlets to mix the ambient fresh air and return air from the conditioned space. Fresh air and return air dampers are provided upon request.

The mixing box segment typically must be the first segment in the direction of airflow. Variable size openings and locations are offered to meet the plant requirements.



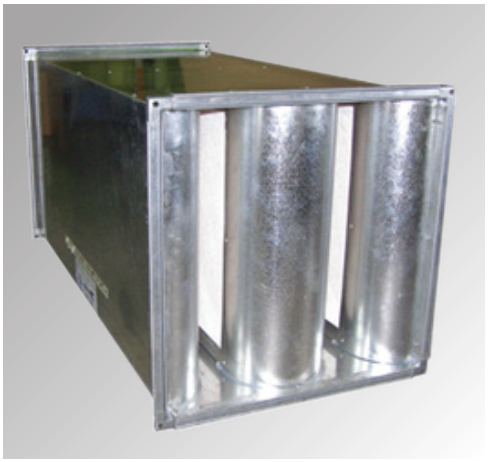
Based on the need of ventilation, Ecomomizers are offered which may be the first segment in the air stream or may be used in conjunction with other segments. Correctly setup economizers will constantly tract building pressurization as well as indoor and outdoor temperatures.



Inlet plenum sections are also offered to provide a proper means of air entry into the Air Handling Unit. Openings may be applied at top, bottom, front, left side or right side. The variable size opening option allows the opening to be properly aligned and sized for airflow convergence or divergence.

Sound Attenuators

Sound Attenuators can be offered as an integral part of the Air Handling Unit in both supply and return air streams for low noise application by absorbing the noise generated by fans. The length of the sound attenuator combined with the volume and velocity of the air moving through it determines the insertion loss or sound attenuation characteristics of the unit.



Sound attenuators are manufactured in square and rectangular sizes with round transitions to match the equipment internal dimensions. Attenuators are constructed out of 270 GSM zinc coated galvanized steel sheet to the standards of JIS 3302 / BS 2989 exterior sealed shell with sound absorbing baffles. The acoustic material is inorganic, incombustible, has a class 1 fire rating to BS 476 and non hygroscopic mineral fiber which is retained by means of galvanized perforated steel sheet.

Splitters are of vermin proof and non-combustible material. The interior partitions shall be fabricated from perforated sheets and shall have coved entrance shapes so as to provide the maximum aerodynamic efficiency and minimum self noise characteristics. Upon request, materials of aluminium / stainless steel casing and heavy gauge exterior casings for low “break-out” noise can also be offered.

The following table shows the acoustical characteristics of our standard sound attenuator lengths.

Length	Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
900 mm	8	11	16	21	32	26	18	14
1200 mm	9	13	19	27	39	33	21	16
1500 mm	10	16	22	32	47	39	24	18

Energy Recovery Components

Heat Recovery Wheels

Heat recovery wheels are of air to air rotary heat exchangers with energy recovery over 80%, provide improved IAQ, control humidity and save energy. By pre-conditioning the incoming fresh air, the heat recovery wheels with minimal cross contamination, deliver fresh air at conditions close to the room conditions and allow reduction in system capacity by 30 to 65%.

Sensible heat is transferred as the metallic substrate picks up and stores heat from the warmer air stream and gives it up to the cooler one. Latent heat is transferred as the desiccant coating on the metallic substrate absorbs moisture from the air stream that has the higher humidity ratio and releases the moisture in to the air stream that has the lower humidity ratio.

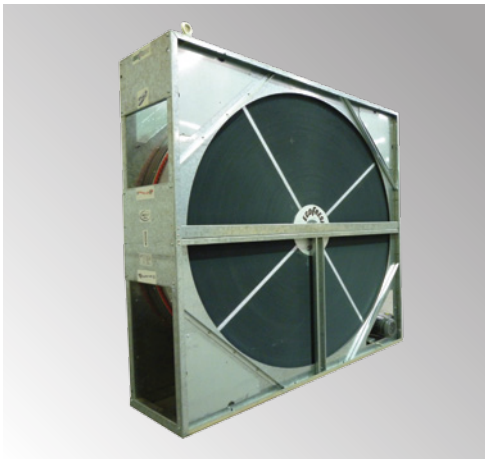


Plate Type Heat Exchangers

Plate type heat exchangers are ideal for sensible energy recovery. Being static, have no moving parts and provide highest reliability and safe operation. The exchange takes place across the plates forming the walls of the passages and efficiency values between 40% and 75%.

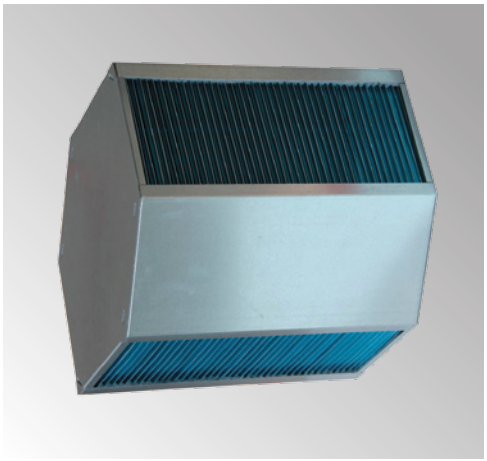


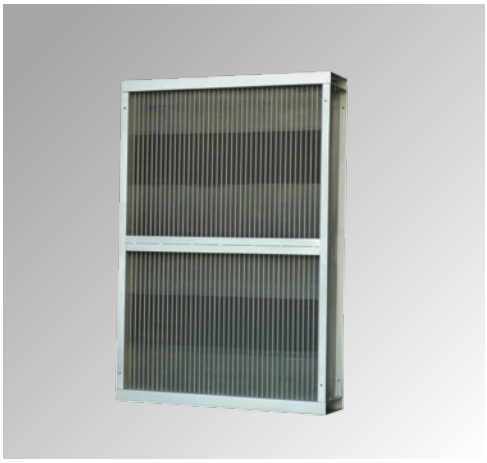
Plate type heat exchangers do not allow the passage of humidity from one flow to the other, but may use part of the latent heat contained in the humid exhaust air.

The direction of the air flow is not of particular importance. However, it is recommended for the exhaust to pass through the heat exchanger from top to bottom in cases in which the formation of condensation is expected.

Energy Recovery Components

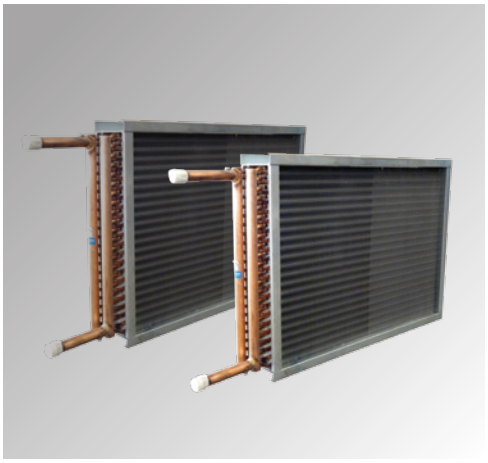
Heat Pipes

Heat pipes are energy efficient thermal superconductors with no moving parts and transfer large amounts of heat energy across a small temperature gradient. Heat pipes with zero cross contamination are used for energy recovery and dehumidification applications.



Heat Recovery heat pipe is used for reclaiming heat from exhaust air and returning it to the fresh-supply stream which in turn saves energy and cost. The running cost of the heat pipe heat recovery system is virtually nil and maintenance is minimal.

Dehumidification: Wrap around (horse shoe) heat pipe enhances the performances of a dehumidifier and improves the quality of the re-circulated air.



Run Around Coils

Run around coils have same construction of standard water coils, positioned within the supply and exhaust air streams, connected to each other by a pumped pipe work circuit for energy recovery. The pipe work is charged with a heat exchange fluid, normally water, which picks up heat from the exhaust air coil and give up heat to the supply air coil before returning again.

Thus heat from the exhaust air stream is transferred through the pipe work coil to the circulation fluid and then from the fluid through the pipe work coil to the supply air stream.

The use of this system is generally limited to demands where the air streams are separated and no other type of device can be utilized since the heat recovery efficiency is lower than other forms of air-to-air heat recovery. Gross efficiencies are usually in the range of 40% to 50%.

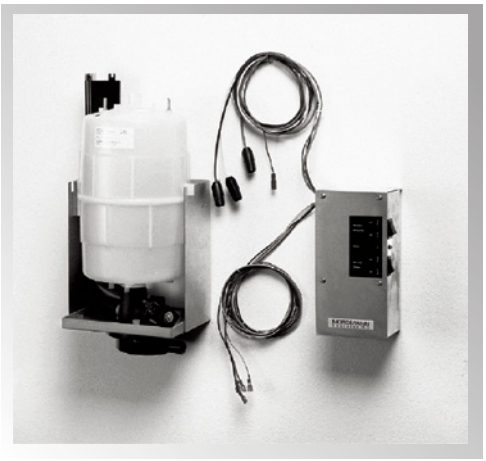
Humidifiers

Steam type and water type humidifiers are provided based on the specification and application.

Steam humidifiers could either be located externally or internally to add steam in the air handling system. Internal steam humidifiers are provided with steam generators integrated with immersion type electric heaters, containing tank and controls.

In external type steam humidifiers, the steam distribution tubes and hoses are brought inside the air handling system.

Water type humidifiers can also be offered in honeycomb and air washer configurations. Multifold droplet eliminators are provided as standard for water type humidifiers.



Calculation of humidifying efficiency for Water Humidifier:

$$\text{Humidifier Efficiency} = \frac{\text{Actual Moisture Content Change}}{\text{Theoretical Moisture Content Change}} = \frac{ET_{DB} - LT_{DB}}{ET_{DB} - LT_{WB}}$$

ET_{DB}	-	Entering Dry Bulb Temperature
LT_{DB}	-	Leaving Dry Bulb Temperature
LT_{WB}	-	Leaving Wet Bulb Temperature

Calculation of humidifier capacity (kg/h):

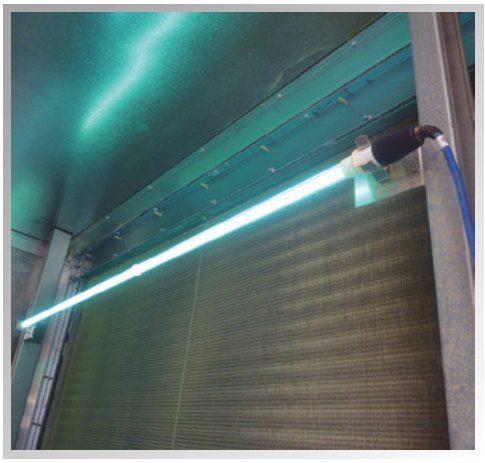
$$\text{Humidifier Capacity H (kg/h)} = \frac{\gamma \times V_f \times (X_i - X_o)}{1000}$$

H	-	Humidification load in kg/h
γ	-	Specific weight of the air in kg/m^3
V_f	-	Fresh air flow in m^3/h
X_i	-	Absolute humidity inside in g/kg
X_o	-	Absolute humidity outside in g/kg

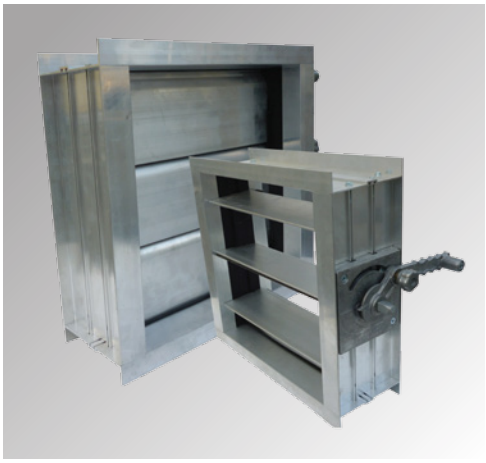
Accessories

UV lamps

Ultraviolet lamps are factory fitted in the air handling units, pre-engineered for placement to provide maximum effectiveness by neutralizing biological and chemical contents such as mold, bacteria, viruses, spores, allergens, VOCs and many other airborne contaminants. The UV lamps direct the UV energy onto the evaporator coil and drain pan, destroying and preventing mold and other microbial growth.



Ultra Violet lamps use Quartz (lamps)and are filled with Mercury vapour. UV lamps improve energy savings and reduce maintenance by keeping the coil clean. UV lamps can be installed either upstream or downstream of the cooling coil. UV lamps are also available with reflectors for better efficiency.



Volume Control Dampers

Volume control dampers are square or rectangular type with opposed blade operation designed for low leakage to control the air flow rate by offering resistance to flow of air.

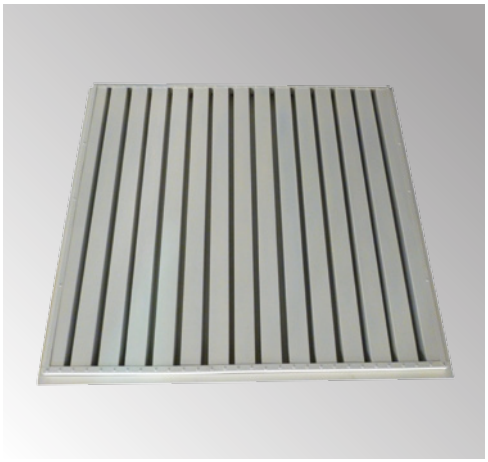
Dampers are constructed out of extruded aluminium profile frame with blades of extruded aluminium airfoil design, operated with nylon gears and handles for smooth and quiet operation. Links are provided for either manual or motorized operation.

Accessories

Sand Trap Louvers

Sand trap louvers are provided for fresh air intake and are designed to separate large size sand particles at low air velocities thus avoiding excessive dust loading on conventional secondary stage filters. At low velocities, sand trap louvers give excellent performance for air filtration and moderate pressure drops.

Sand trap louvers are constructed out of aluminium in general and powder coated for corrosion resistance. Stainless steel construction can be offered upon request.



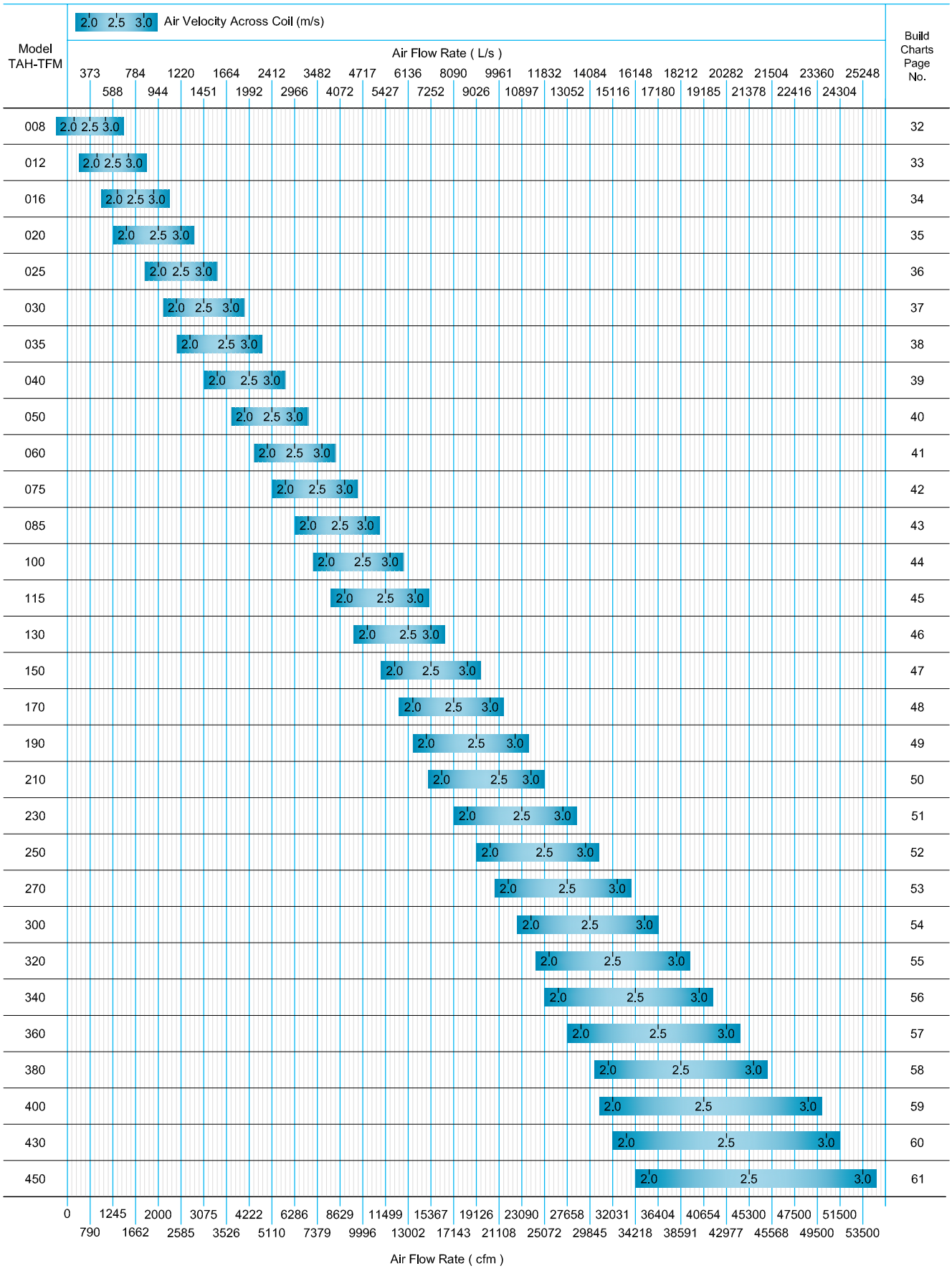
Supply Air Grilles

Exposed type air handling units having direct discharge into the conditioned space are provided with linear grilles, of double deflection type, designed to provide full flexibility in volume and air pattern control. The grilles are constructed from extruded aluminium profiles and finished with powder coating.

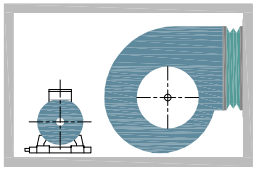
Return Air Louvers

Return air louvers are provided for exposed type installations with non ducted return air. The grilles are constructed from extruded aluminium profiles, fixed at 35 degree deflection and finished with powder coating.

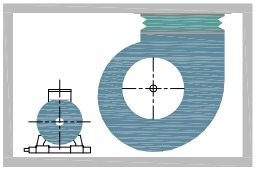
Quick Selection Chart



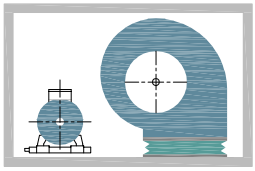
Fan Orientation



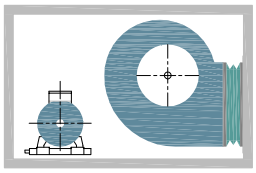
Position - A



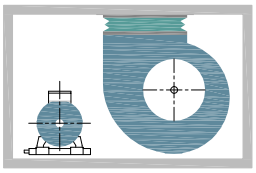
Position - B



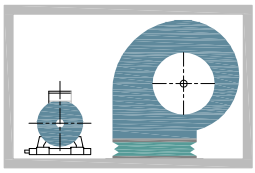
Position - C



Position - D



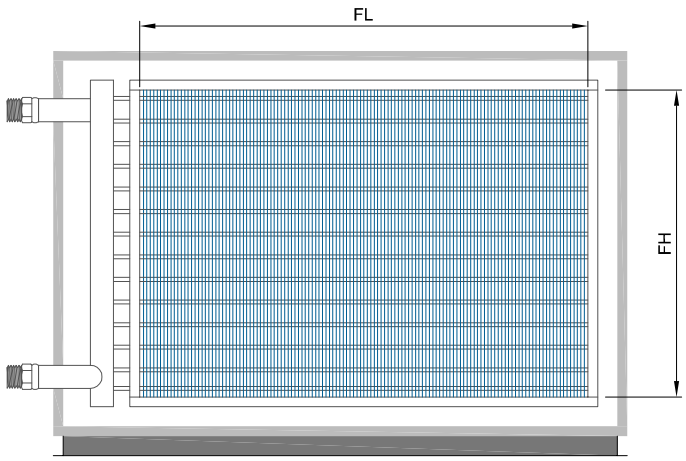
Position - E



Position - F

Fan Dia	Position	Motor Frame Sizes					Fan Outlet	
		≤112	132	160-180	200	225	Height	Width
		Section Length L (mm)					mm	mm
7-7	A - F	857					228	259
9-9	A - F	1007					262	298
10-10	A - F	1007					289	331
12-12	A - F	1007					341	395
15-15	A - F	1157					404	471
18-18	A - F	1307	1307				478	557
160	A - F	857					205	205
180	A - F	857					229	229
200	A - F	857	1007				256	256
225	A - F	1007	1007				288	288
250	A - F	1007	1007				322	322
280	A - F	1007	1007				360	360
315	A - F	1007	1157				404	404
355	A - F	1157	1157				452	452
400	A, D	1157	1157				506	506
	B, C, E, F	1307	1307					
450	A, D	1307	1307	1457			568	568
	B, C, E, F	1307	1457	1607				
500	A, D	1307	1457	1457			638	638
	B, C, E, F	1457	1607	1757				
560	A, D	1457	1457	1607			714	714
	B, C, E, F	1607	1607	1757				
630	A, D	1607	1607	1757			800	800
	B, C, E, F	1757	1757	1907				
710	A, D		1757	1907	2057	2057	898	898
	B, C, E, F		1907	2057	2207	2207		
800	A, D		1907	2057	2207	2207	1006	1006
	B, C, E, F		2057	2207	2357	2357		
900	A, D		2057	2207	2357	2357	1130	1130
	B, C, E, F		2207	2357	2507	2507		
1000	A, D		2057	2207	2357	2357	1266	1266
	B, C, E, F		2357	2507	2657	2657		
1120	A, D		2357	2507	2657	2657	1422	1422
	B, C, E, F		2807	2957	3107	3107		

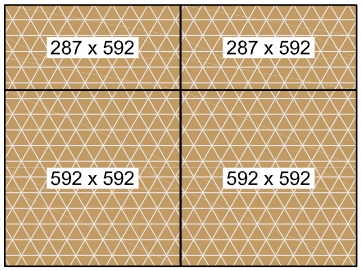
Coil Sizing



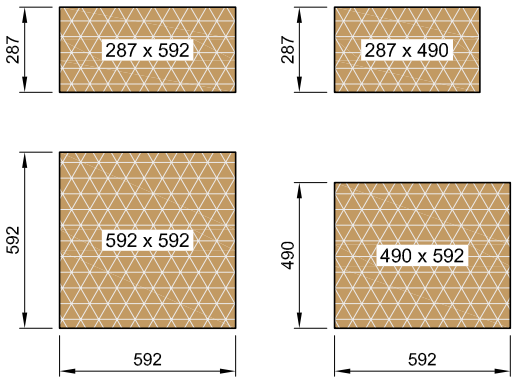
Model	Air Flow Rate		Coil Size 1/2"			Coil Size 5/8"			Coil Face Area	
			FH	FL	Tubes / Row	FH	FL	Tubes / Row		
TAH-TFM	cfm	L/s	mm	mm	Nos.	mm	mm	Nos.	ft^2	m^2
008	790	373	445	330	14	457	330	12	1.58	0.15
012	1245	588	445	520	14	457	520	12	2.49	0.23
016	1662	784	572	540	18	610	540	16	3.32	0.31
020	2000	944	572	650	18	610	650	16	4.00	0.37
025	2585	1220	572	840	18	610	840	16	5.17	0.48
030	3075	1451	762	750	24	838	750	22	6.15	0.57
035	3526	1664	762	860	24	838	860	22	7.05	0.66
040	4222	1992	826	950	26	991	950	26	8.44	0.78
050	5110	2412	826	1150	26	838	1150	22	10.22	0.95
060	6286	2966	1016	1150	32	1067	1150	28	12.57	1.17
075	7379	3482	1016	1350	32	1067	1350	28	14.76	1.37
085	8629	4072	1206	1330	40	1372	1330	36	17.26	1.60
100	9996	4717	1397	1330	44	1448	1330	38	19.99	1.86
115	11499	5427	1397	1530	44	1448	1530	38	23.00	2.14
130	13002	6136	1397	1730	44	1448	1730	38	26.00	2.42
150	15367	7252	1651	1730	52	1600	1730	42	30.73	2.86
170	17143	8090	1651	1930	52	1600	1930	42	34.29	3.19
190	19126	9026	1842	1930	58	1905	1930	50	38.25	3.56
210	21108	9961	1842	2130	58	1905	2130	50	42.22	3.92
230	23090	10897	1842	2330	58	1905	2330	50	46.18	4.29
250	25072	11832	1842	2530	58	1905	2530	50	50.14	4.66
270	27658	13052	2032	2530	64	2057	2530	54	55.32	5.14
300	29845	14084	2032	2730	64	2057	2730	54	59.69	5.55
320	32031	15116	2032	2930	64	2057	2930	54	64.06	5.95
340	34218	16148	2032	3130	64	2057	3130	54	68.44	6.36
360	36404	17180	2032	3330	64	2057	3330	54	72.81	6.77
380	38591	18212	2032	3530	64	2057	3530	54	77.18	7.17
400	40654	19185	2159	3500	68	2210	3500	58	81.31	7.56
430	42977	20282	2159	3700	68	2210	3700	58	85.95	7.99
450	45300	21378	2159	3900	68	2210	3900	58	90.60	8.42

Note: Air flow rate at coil face velocity of 2.5 m/s

Filter Grid



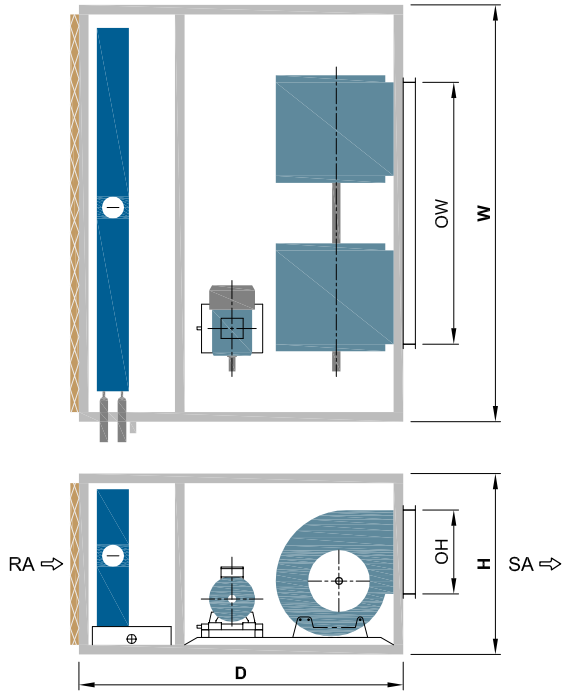
Illustrated Model : TAH-050 TFM



Standard Filter Sizes

Model	Air Flow Rate		Filter Grid				Filter Face Area	
			592 x 592	287 x 592	490 x 592	287 x 490		
TAH-TFM	cfm	L/s	mm	mm	mm	mm	ft²	m²
008	790	373				1	1.52	0.14
012	1245	588			1		3.12	0.29
016	1662	784	1				3.77	0.35
020	2000	944	1				3.77	0.35
025	2585	1220	1	1			5.60	0.52
030	3075	1451	1	1			5.60	0.52
035	3526	1664	1	2			7.42	0.69
040	4222	1992	1	2			7.42	0.69
050	5110	2412	2	2			11.19	1.04
060	6286	2966	2	2			11.19	1.04
075	7379	3482	2		2		13.77	1.28
085	8629	4072	4	2			18.72	1.74
100	9996	4717	4	2			18.72	1.74
115	11499	5427	4	4			22.38	2.08
130	13002	6136	6	3			28.08	2.61
150	15367	7252	6		3		31.96	2.97
170	17143	8090	6		3		31.96	2.97
190	19126	9026	9	3			39.38	3.66
210	21108	9961	9	3			39.38	3.66
230	23090	10897	12				45.19	4.20
250	25072	11832	9	3	3		48.74	4.53
270	27658	13052	12	4			52.51	4.88
300	29845	14084	12	7			58.00	5.39
320	32031	15116	15	5			65.64	6.10
340	34218	16148	15	5			65.64	6.10
360	36404	17180	15	8			71.12	6.61
380	38591	18212	15	5	3		75.00	6.97
400	40654	19185	15	5	3		75.00	6.97
430	42977	20282	18	6			78.76	7.32
450	45300	21378	18	9			84.25	7.83

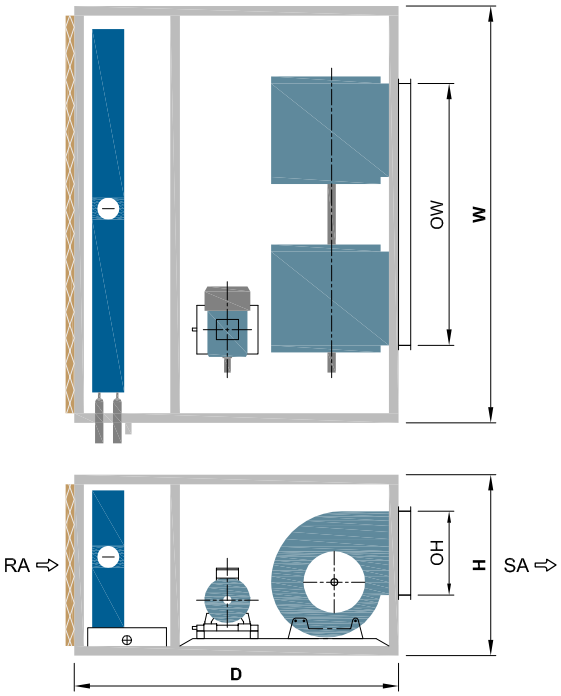
25mm Panel



Model	Air Flow Rate		Unit Dimensions			Coil Size		Fan Size	Motor Power	Fan Outlet Dim		Filter Face Area		Unit Weight
			W	D	H	FH	FL			OH	OW			
TCS	cfm	L/s	mm	mm	mm	mm	mm		kW	mm	mm	ft²	m²	kgs
010	1000	472	800	1120	550	381	483	07/07	0.55	228	259	3.39	0.32	130
015	1500	708	1050	1200	550	381	737	09/09	1.1	262	298	4.59	0.43	165
020	2000	944	1140	1300	550	445	838	10/10	1.1	262	298	5.02	0.47	190
025	2500	1180	1530	1200	550	381	1219	07/07 Twin	2.2	228	702	6.88	0.64	235
030	3000	1416	1760	1200	550	381	1448	09/09 Twin	2.2	262	840	7.98	0.74	270
035	3500	1653	2020	1200	550	381	1702	09/09 Twin	2.2	262	840	9.22	0.86	300
040	4000	1889	1780	1300	680	508	1473	10/10 Twin	2.2	262	840	10.44	0.97	320
045	4500	2125	1970	1300	680	508	1651	10/10 Twin	3.0	289	926	11.61	1.08	350
050	5000	2361	2140	1300	680	508	1829	12/09 Twin	3.0	341	807	12.66	1.18	390
055	5500	2597	1910	1300	810	635	1600	12/12 Twin	4.0	341	1114	13.79	1.28	415
060	6000	2833	2070	1300	810	635	1753	12/12 Twin	4.0	341	1114	15.00	1.39	440
065	6500	3069	2220	1300	810	635	1905	12/12 Twin	4.0	341	1114	16.13	1.50	465
070	7000	3305	2370	1460	810	635	2057	15/15 Twin	4.0	404	1326	17.27	1.61	520
075	7500	3541	2520	1460	810	635	2210	15/15 Twin	4.0	404	1326	18.41	1.71	545
080	8000	3777	2650	1460	810	635	2337	15/15 Twin	5.5	404	1326	19.39	1.80	620

Notes: Units selected for 250 Pa ESP & 480 Pa TSP
Air flow rate at coil face velocity of 2.5 m/s
Unit weight calculated with 4 row deep coil

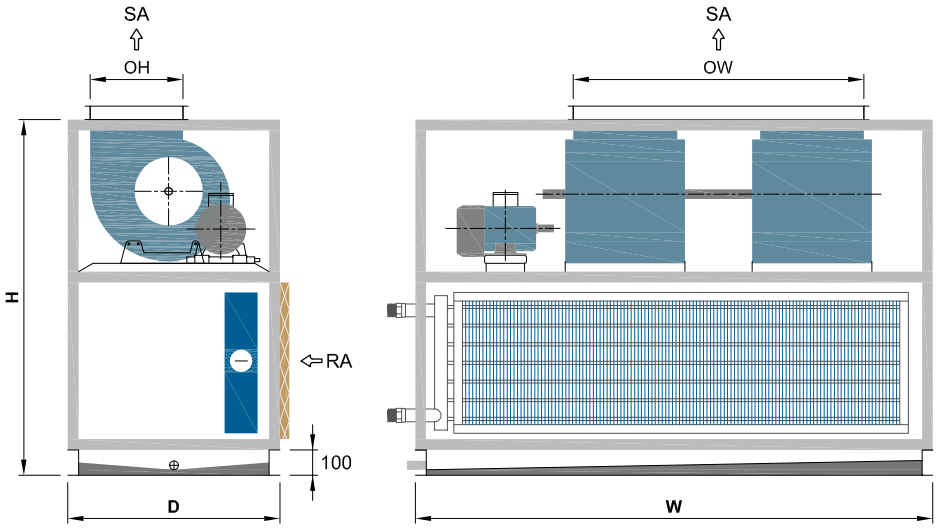
50mm Panel



Model	Air Flow Rate		Unit Dimensions			Coil Size		Fan Size	Motor Power	Fan Outlet Dim		Filter Face Area		Unit Weight
			W	D	H	FH	FL			OH	OW			
TAH-TCS	cfm	L/s	mm	mm	mm	mm	mm		kW	mm	mm	ft²	m²	kgs
010	1000	472	850	1180	600	381	483	07/07	0.55	228	259	3.39	0.32	160
015	1500	708	1100	1260	600	381	737	09/09	1.1	262	298	4.59	0.43	200
020	2000	944	1190	1360	600	445	838	10/10	1.1	262	298	5.02	0.47	230
025	2500	1180	1580	1260	600	381	1219	07/07 Twin	2.2	228	702	6.88	0.64	275
030	3000	1416	1810	1260	600	381	1448	09/09 Twin	2.2	262	840	7.98	0.74	315
035	3500	1653	2070	1260	600	381	1702	09/09 Twin	2.2	262	840	9.22	0.86	350
040	4000	1889	1830	1360	730	508	1473	10/10 Twin	2.2	262	840	10.44	0.97	375
045	4500	2125	2020	1360	730	508	1651	10/10 Twin	3.0	289	926	11.61	1.08	400
050	5000	2361	2190	1360	730	508	1829	12/09 Twin	3.0	341	807	12.66	1.18	445
055	5500	2597	1960	1360	860	635	1600	12/12 Twin	4.0	341	1114	13.79	1.28	465
060	6000	2833	2120	1360	860	635	1753	12/12 Twin	4.0	341	1114	15.00	1.39	490
065	6500	3069	2270	1360	860	635	1905	12/12 Twin	4.0	341	1114	16.13	1.50	520
070	7000	3305	2420	1520	860	635	2057	15/15 Twin	4.0	404	1326	17.27	1.61	580
075	7500	3541	2570	1520	860	635	2210	15/15 Twin	4.0	404	1326	18.41	1.71	605
080	8000	3777	2700	1520	860	635	2337	15/15 Twin	5.5	404	1326	19.39	1.80	685

Notes: Units selected for 250 Pa ESP & 480 Pa TSP
Air flow rate at coil face velocity of 2.5 m/s
Unit weight calculated with 4 row deep coil

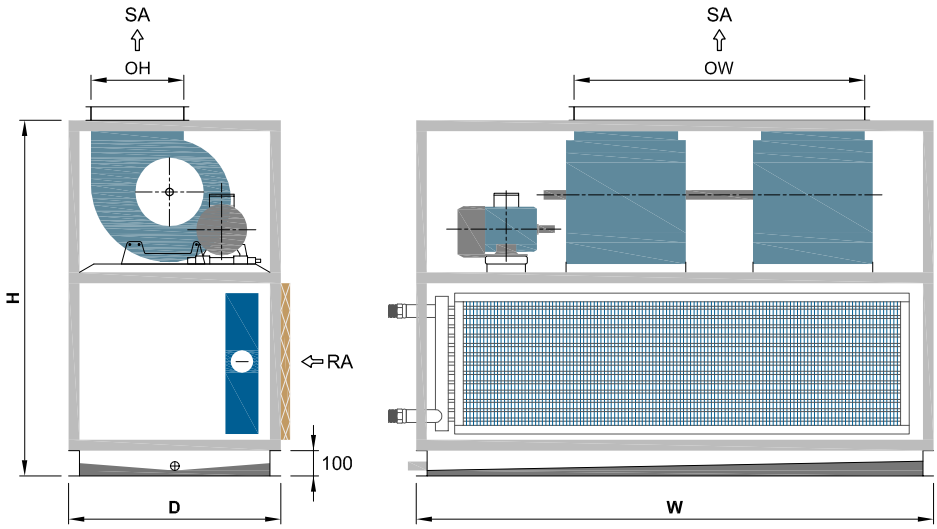
25mm Panel



Model	Air Flow Rate		Unit Dimensions			Coil Size		Fan Size	Motor Power	Fan Outlet Dim		Filter Face Area		Unit Weight
			W	D	H	FH	FL			OH	OW			
TFM	cfm	L/s	mm	mm	mm	mm	mm		kW	mm	mm	ft²	m²	kgs
010	1000	472	900	600	1070	381	483	07/07	0.55	228	259	4.49	0.42	130
015	1500	708	1050	600	1140	381	737	09/09	1.1	262	298	5.34	0.50	160
020	2000	944	1140	700	1260	445	838	10/10	1.1	262	298	5.85	0.54	195
025	2500	1180	1530	600	1070	381	1219	07/07 Twin	2.2	228	702	8.06	0.75	230
030	3000	1416	1760	700	1140	381	1448	09/09 Twin	2.2	262	840	9.36	0.87	275
035	3500	1653	2020	700	1140	381	1702	09/09 Twin	2.2	262	840	10.83	1.01	305
040	4000	1889	1780	700	1320	508	1473	10/10 Twin	2.2	262	840	9.47	0.88	325
045	4500	2125	1970	700	1320	508	1651	10/10 Twin	3.0	289	926	11.33	1.05	350
050	5000	2361	2140	800	1380	508	1829	12/09 Twin	3.0	341	807	12.37	1.15	405
055	5500	2597	1910	800	1510	635	1600	12/12 Twin	4.0	341	1114	12.64	1.17	425
060	6000	2833	2070	800	1510	635	1753	12/12 Twin	4.0	341	1114	16.29	1.51	450
065	6500	3069	2220	800	1510	635	1905	12/12 Twin	4.0	341	1114	14.81	1.38	480
070	7000	3305	2370	900	1580	635	2057	15/15 Twin	4.0	404	1326	16.20	1.51	535
075	7500	3541	2520	900	1580	635	2210	15/15 Twin	4.0	404	1326	17.27	1.61	560
080	8000	3777	2650	900	1580	635	2337	15/15 Twin	5.5	404	1326	18.20	1.69	635

Notes: Units selected for 250 Pa ESP & 480 Pa TSP
Air flow rate at coil face velocity of 2.5 m/s
Unit weight calculated with 4 row deep coil

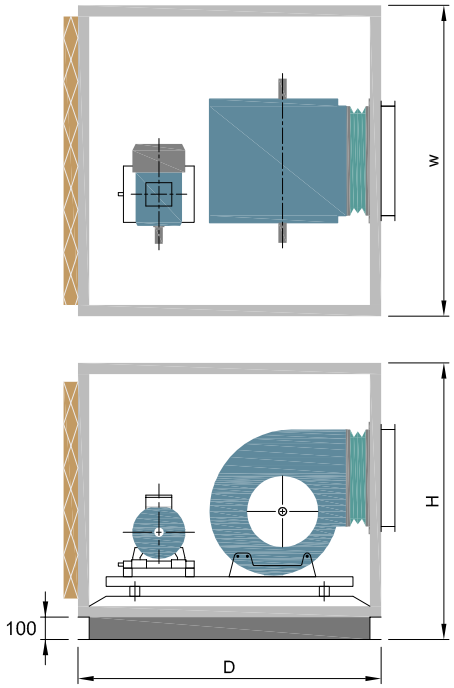
50mm Panel



Model	Air Flow Rate		Unit Dimensions			Coil Size		Fan Size	Motor Power	Fan Outlet Dim		Filter Face Area		Unit Weight
			W	D	H	FH	FL			OH	OW			
TAH-TFM	cfm	L/s	mm	mm	mm	mm	mm		kW	mm	mm	ft²	m²	kgs
010	1000	472	950	660	1120	381	483	07/07	0.55	228	259	4.49	0.42	160
015	1500	708	1100	660	1190	381	737	09/09	1.1	262	298	5.34	0.50	195
020	2000	944	1190	760	1310	445	838	10/10	1.1	262	298	5.85	0.54	235
025	2500	1180	1580	660	1120	381	1219	07/07 Twin	2.2	228	702	8.06	0.75	265
030	3000	1416	1810	760	1190	381	1448	09/09 Twin	2.2	262	840	9.36	0.87	320
035	3500	1653	2070	760	1190	381	1702	09/09 Twin	2.2	262	840	10.83	1.01	355
040	4000	1889	1830	760	1370	508	1473	10/10 Twin	2.2	262	840	9.47	0.88	375
045	4500	2125	2020	760	1370	508	1651	10/10 Twin	3.0	289	926	11.33	1.05	400
050	5000	2361	2190	860	1430	508	1829	12/09 Twin	3.0	341	807	12.37	1.15	460
055	5500	2597	1960	860	1560	635	1600	12/12 Twin	4.0	341	1114	12.64	1.17	480
060	6000	2833	2120	860	1560	635	1753	12/12 Twin	4.0	341	1114	16.29	1.51	510
065	6500	3069	2270	860	1560	635	1905	12/12 Twin	4.0	341	1114	14.81	1.38	540
070	7000	3305	2420	960	1630	635	2057	15/15 Twin	4.0	404	1326	16.20	1.51	600
075	7500	3541	2570	960	1630	635	2210	15/15 Twin	4.0	404	1326	17.27	1.61	625
080	8000	3777	2700	960	1630	635	2337	15/15 Twin	5.5	404	1326	18.20	1.69	705

Notes: Units selected for 250 Pa ESP & 480 Pa TSP
Air flow rate at coil face velocity of 2.5 m/s
Unit weight calculated with 4 row deep coil

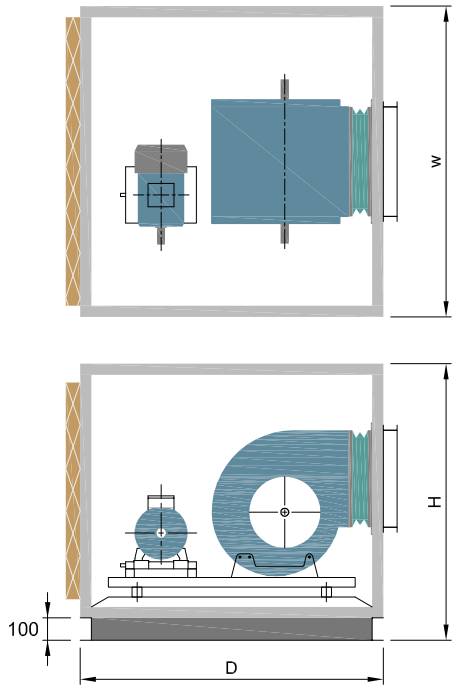
25mm Panel



Model	Air Flow Rate		Unit Dimensions			Fan Size	Motor Power	Filter Grid				Filter Face Area		Unit Weight
			W	D	H			592 x 592	287 x 592	287 x 490	490 x 592			
TFM	cfm	L/s	mm	mm	mm		kW	mm	mm	mm	mm	ft²	m²	kgs
010	1000	472	650	960	690	180	0.55			1		1.52	0.14	90
015	1500	708	800	960	720	200	0.75				1	3.12	0.29	100
020	2000	944	800	1110	770	225	1.1				1	3.12	0.29	115
025	2500	1180	850	1110	900	250	1.1	1				3.77	0.35	125
030	3000	1416	1100	1110	950	280	1.5	1	1			5.60	0.52	155
035	3500	1652	1100	1260	950	315	1.5	1	1			5.60	0.52	175
040	4000	1888	1300	1260	1030	355	1.5	1			1	6.89	0.64	205
060	6000	2832	1400	1410	1200	400	2.2	2	2			11.19	1.04	240
080	8000	3775	1400	1410	1200	450	3.0	2	2			11.19	1.04	260
100	10000	4719	1700	1410	1500	500	4.0	4	2			18.72	1.74	330
120	12000	5663	1700	1710	1500	560	4.0	4	2			18.72	1.74	395
150	15000	7079	2000	1860	1550	630	5.5	6				22.60	2.10	525
180	18000	8495	2200	2010	1700	710	7.5	6	3			28.08	2.61	660
200	20000	9438	2300	2010	1700	710	7.5	6	5			31.74	2.95	670
220	22000	10382	2400	2160	2000	800	7.5	9				33.89	3.15	845
250	25000	11798	2400	2160	2000	800	11.0	9	3			39.38	3.66	905
270	27000	12742	2700	2310	2150	900	11.0	12				45.19	4.20	1050
300	30000	14158	2700	2310	2150	900	11.0	12				45.19	4.20	1050
320	32000	15101	2900	2310	2150	900	11.0	12	3			50.68	4.71	1075
350	35000	16517	3000	2460	2300	1000	15.0	12	3			50.68	4.71	1275

Note: Units selected for 300 Pa TSP

50mm Panel



Model	Air Flow Rate		Unit Dimensions			Fan Size	Motor Power	Filter Grid				Filter Face Area		Unit Weight
			W	D	H			592 x 592	287 x 592	287 x 490	490 x 592			
TAH-TFM	cfm	L/s	mm	mm	mm		kW	mm	mm	mm	mm	ft²	m²	kgs
010	1000	472	700	1020	740	180	0.55			1		1.52	0.14	110
015	1500	708	850	1020	770	200	0.75				1	3.12	0.29	125
020	2000	944	850	1170	820	225	1.1				1	3.12	0.29	135
025	2500	1180	900	1170	950	250	1.1	1				3.77	0.35	150
030	3000	1416	1150	1170	1000	280	1.5	1	1			5.60	0.52	185
035	3500	1652	1150	1320	1000	315	1.5	1	1			5.60	0.52	205
040	4000	1888	1350	1320	1080	355	1.5	1			1	6.89	0.64	235
060	6000	2832	1450	1470	1250	400	2.2	2	2			11.19	1.04	280
080	8000	3775	1450	1470	1250	450	3.0	2	2			11.19	1.04	295
100	10000	4719	1750	1470	1550	500	4.0	4	2			18.72	1.74	375
120	12000	5663	1750	1770	1550	560	4.0	4	2			18.72	1.74	445
150	15000	7079	2050	1920	1600	630	5.5	6				22.60	2.10	585
180	18000	8495	2250	2070	1750	710	7.5	6	3			28.08	2.61	720
200	20000	9438	2350	2070	1750	710	7.5	6	5			31.74	2.95	735
220	22000	10382	2450	2220	2050	800	7.5	9				33.89	3.15	915
250	25000	11798	2450	2220	2050	800	11.0	9	3			39.38	3.66	975
270	27000	12742	2750	2370	2200	900	11.0	12				45.19	4.20	1135
300	30000	14158	2750	2370	2200	900	11.0	12				45.19	4.20	1135
320	32000	15101	2950	2370	2200	900	11.0	12	3			50.68	4.71	1160
350	35000	16517	3050	2520	2350	1000	15.0	12	3			50.68	4.71	1370

Note: Units selected for 300 Pa TSP

Mechanical Specification

Air Handling Units

General

Supply and install as indicated in the schedule of equipment, Air Handling Units (AHUs) / Fresh Air Handling Units (FAHUs), each capable of the duty as mentioned in the schedule of equipment. The space available for the unit to be physically verified at the site and dimensions of the units shall be selected to fit into the spaces available. Where necessary the units may be built on site, subject to acceptance of the finished units for warranty purposes by the original supplier and their local agent.

The units shall be double skin construction, draw-thru type comprising of various sections such as mixing box (wherever the RA, FA is ducted), filter section, heat recovery components, cooling coil, electric heater and fan section as per the details shown either in the drawings or specified in the schedule of equipment.

Fresh air handling units with heat recovery systems shall be provided with heat recovery wheels / heat pipes as indicated in the schedule of quantity.

Quality Assurance

The equipment manufacturer shall strictly adhere to following standards & specification:

(1) ISO 9001:2008 certificate of the manufacturing facility required.

(2) Eurovent certification.

(3) The equipment manufacturer shall submit the mechanical performance report certified by Eurovent for the following characteristics.

Mechanical Characteristics	Class
Mechanical Strength	D1
Casing Air Leakage -400 Pa	L1
Filter by-pass Leakage	F9
Thermal Transmittance	T2
Thermal Bridging	TB2

The thermal transmittance factor and thermal bridge factor shall be relaxed to T3 and TB3 respectively for re-circulated Air Handling Units installed in conditioned plant rooms.

AHU panel insulation shall be injected polyurethane foam and be in accordance to fire retardant Class O of ISO 1182.2 standards.

Mechanical Specification

Unit Construction

The unit casings shall be of double skinned panels not less than 50mm thickness. Casing shall be assembled with self supporting modular panel elements with an integrated base frame made of zincated steel sections along upper sides of the units.

The frame work shall be of extruded aluminium, thermal break construction using polyamide profiles, without using gaskets for thermal bridging ensuring durability for all Fresh Air Handling Units and also for all the Air Handling Units installed in non-conditioned plant rooms.

Sheet metal thickness shall be not less than 0.8 mm for the inner skin, 0.8 mm for the outer skin and shall be made from 270 GSM zincated steel sheets. The outer skin shall be pre-painted galvanised steel sheet having 7 to 9 microns of primer coat and 20 to 25 microns of polyester coat on the outer surface. For additional protection, outer surface of the outer skin shall be provided with vinyl guard film for scratch protection. Inside and outside of panel walls shall be completely smooth.

All casing panels shall be insulated with injected CFC free polyurethane foam insulation and shall be in accordance to Class O of ISO 1182.2 standards. The insulation density shall be 48 Kg /m^3 and having thermal conductivity (K value) of 0.02 W/m K.

The base frame of the units shall be made from sendzimir galvanized sheet metal for size with largest dimensions upto 2500 mm, and hot dip galvanized U-profile for larger units.

The manufacturer shall guarantee that no condensation shall take place on the exterior of panels. In the event that any condensation problems appear after installation, the contractor shall undertake all remedial measures to rectify and to the satisfaction of the consultants. Any stacked or double height coils shall have separate drain pans to reduce carry over.Units installed outdoors shall be fitted with weather proof aluminium canopy.

Acoustical insulation through the panel:

Hz	125	250	500	1000	2000	4000	8000
dB	6.7	14.4	12.5	19.2	29	27.3	38.9

Mechanical Specification

Vibration Isolation

The Air Handling Unit shall have internal vibration isolation system by mounting fan, motor and drive assembly on spring isolators designed for 93% isolation. The fan discharge shall be connected to the air handling unit casing through canvas connection to prevent vibration transfer. In addition to the above the entire unit shall be mounted on additional vibration isolators.

Filter Section

Filter cells shall be of standard sizes and shall be obtained from reputed European manufacturers. The filters shall be sealed against the filter frame using a permanently elastic gasket to a standard compatible with the filter efficiency.

Pressure drop tapings shall be integrated into the frame to allow a manometer or filter monitor to be fitted. Filter materials shall be flame-retardant, incombustible, non-odorous and may offer no sustenance to vermin. Each filter section has to be provided with manometer.

The filter material shall be pleated to provide a large effective area. Filter section should be provided with an inspection door.

The contractor shall supply one set of all filters per AHU as spares for replacement after testing and commissioning and prior to handing over of the installation.

Panel Filter

The Panel filter material shall be synthetic media pleated to provide a large effective area and shall be supported by a wire mesh and frame. The filter cells shall be suitable for side withdrawal on the inspection side. The filter class shall be EU-4 as per Eurovent 4/5 or G4 as per EN 779.

Bag Filter

Bag filter material shall be synthetic media, of standard and readily available sizes. The filters shall be clamped against the frame using a cam locking bar. The filter class should be EU7 as per Eurovent 4/5 or G7 as per EN 779. Bag filters shall be provided for both Fresh Air Handling Units and Re-circulated Air Handling Units.

Mechanical Specification

Chilled Water Cooling Coil Section

Cooling coils shall be fabricated from ½" OD copper tubing of 0.41mm thickness expanded into 0.12mm thick Aluminium fins. Return bends shall be die formed. Headers shall be heavy section seamless copper tubing with a brass / copper male adaptor for the ease of piping. All joints shall be silver brazed. Fittings shall include plugged vent and drain taps for each section.

The coil shall be tested to 21 bar and designed to operate at 16 bar NP. Maximum coil face velocity shall not exceed 2.5 m/s. Droplet moisture eliminators shall be fitted to all fresh air handling unit cooling coils.

The cooling coils of all Fresh Air Handling Units and the Air Handling Units handling untreated fresh air shall be Heresite coated for anti-corrosion.

The coil shall be mounted on guide rails for side withdrawal. Header connection through the unit casing shall be sealed with plastic grommet.

Drainpan shall be of stainless steel – SS 304 construction and designed with all round edges allowing complete cleaning & avoiding microbial growth as per ASHRAE 62-1999. Drain pan shall have necessary slope to facilitate fast removal of condensate and arrangement to be provided to slide the coil. Any stacked or double height coils shall have separate drain pan to reduce carry over. Drain pans shall have drain connection to the service side.

Fan & Fan Motor

Fans shall be double inlet, double width, and backward curved centrifugal type with galvanized steel casings. Fans shall be tested in accordance with AMCA 300-85. Every individual fan shall be run before delivery to check bearing condition and vibration. Fan shafts shall be mounted in taper sleeve bearings designed for continuous operation and a mean useful life of 200,000 hours. Backward curved impeller should be coated with 60 micron epoxy painting of high quality.

Fans shall be designed in accordance with the specified operating class of AMCA standard 99-2408-69 – performance class limits for centrifugal fans. The impeller & fan shaft shall be statically and dynamically balanced to a balancing grade of G 2.5.

The fan shall be connected to the outlet opening by means of an airtight flexible connection. Fans shall not exceed a maximum outlet velocity of 12 m/sec.

Mechanical Specification

The degree of protection shall be IP55 with mounting method B3 and Class F insulation for the electric motors. Fan drive shall be rated at 150% of the maximum motor power of the units and shall be fitted with adjustable belt tension arrangement.

Belt guards or screen protection door in fan section shall be provided in accordance with CEN Standard. The fan motor shall be suitable for operating at 415V, 3Ph, 50Hz electrical power supply. The fan motor shall be wired to the safety isolation switch or connection box. The contractor shall select power input and speed of the fan subsequent to ascertaining system static pressure in accordance with pressure drop calculations to the approval of the engineer.

The fan motor shall meet the safety requirments of the CE and compatible with variable frequency drives. The motor shall be mounted on a common, torsionally rigid, galvanized steel base frame.

Heat Recovery Wheel (Enthalpy)

Fresh air handling units shall be provided with heat recovery wheel (enthalpy) wherever specified in the schedule of quantity.

Wheel matrix should be only from pure aluminium foil to allow for quick and efficient uptake of thermal energy, sufficient mass for optimum heat transfer, maximum sensible heat recovery during low rotational speed of 20 to 25 rpm.

The Desiccant for Enthalpy wheel should be water molecule selective and non-migratory.

The Desiccant should be molecular sieve and keep the cross contamination to absolute minimum and also ensure the exclusion of contaminants from the air streams, while transferring the water vapor molecule.

The desiccant should be of sufficient mass, and should be coated with non- masking porous binder adhesive on the aluminium substrate (matrix) so as to allow quick and easy uptake and release of water vapor. The weight of desiccant coating and the mass of aluminium foil shall be in a ratio so as to ensure equal recovery of both sensible and latent heat over the operating range.

The Rotor/Wheel matrix shall have equal sensible and latent recovery in the range of 75 to 80%.

Mechanical Specification

The Rotor honeycomb matrix foil should be so wound and adhered as to make a structurally very strong and rigid media unaffected by temperature and humidity changes.

The rotor shall be non-clogging aluminium media, having a multitude of narrow aluminium channels, thus ensuring a laminar flow and will allow particles up to 800 microns to pass through it.

The rotor should rotate at a speed lower than 20 to 25 rpm, ensuring long life of belts and reduce wear and tear of seals. The media shall be cleanable with compressed air or low pressure steam or light detergent, without degrading the latent recovery.

The recovery wheel cassette / casing shall be manufactured from tubular construction to provide a self supporting rigid structure, complete with access panels, purge sector, rotor, bearings, seals and drive mechanism complete with belts.

The rotor shall have a field adjustable purge mechanism to provide definite separation of air flow, minimizing the carryover of bacteria, dust and other pollutants, from the exhaust air to supply air. With proper adjustments the cross contamination shall be limited to less than 0.04% of the exhaust air concentration.

Heat Pipes (Wrap around Type)

FAHUs / AHUs shall be provided with wrap around type heat pipes wherever specified in the schedule of quantity.

Heat pipes shall be included within the FAHU / AHU and wrapped around the main cooling coil for enhanced dehumidification.

The external fins shall be of aluminium with a minimum thickness of 0.15mm. Fins shall be of the continuous plate type and louvered type. Tubes shall be of refrigeration standard seamless copper for heat exchanger use. Tube diameter shall be 12mm with a grooved inner surface and minimum root thickness of the tube shall be 0.35mm.

Casings shall be from galvanized sheet steel with a minimum thickness of 1.6mm. The casing shall incorporate tube plates and top and bottom plates around both precool and reheat heat pipe blocks.

The working fluid shall be refrigerant type classified as ASHRAE safety group AI. The refrigerant shall be R134a.

Mechanical Specification

The heat pipe circuits shall be factory charged and hermetically sealed with the calculated weight of refrigerant. There shall be a multitude of loops in the height of the heat pipe and each loop shall be individually charged. Heat pipes with header assemblies containing a single circuit are not suitable as a single leak will render the entire heat pipe inoperative.

Heat pipe performance shall be independently type tested and certified in line with the requirements of British Standards BS 5141 ptl / European Standards EN 305 & 306 / American Standards ARI 410 for testing and rating of heat exchangers. All software used to state the performance of heat pipes shall be based upon the results of these independent tests.

The heat pipe should have a third party independent test report conducted by a certified laboratory from U.S.A / Europe.

Fresh Air Intakes

Sand trap louvers of aluminium construction duly epoxy coated with bird screen and extruded aluminium, aerofoil construction dampers shall be provided at the intake section of the unit.

Fresh air dampers shall be of opposed blade louver type. Blades shall be made of extruded aluminium, aerofoil construction and shall be rattle-free.

Fresh air fans and fresh air intakes shall be per the requirements mentioned in the equipment schedule.

Safety Features

All the units must have safety features as under:

The fan access door shall be equipped with micro-switch inter locked with fan motor to enable switching off the fan motor automatically in the event of door opening. The fan access door shall be provided with a view port and further have wire mesh screen as an added safety feature bolted on to the unit frame.

Fan and motor base shall be properly earthed from the factory. All screws used for panel fixing and projecting inside the unit shall be covered with PVC caps to avoid human injury.

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