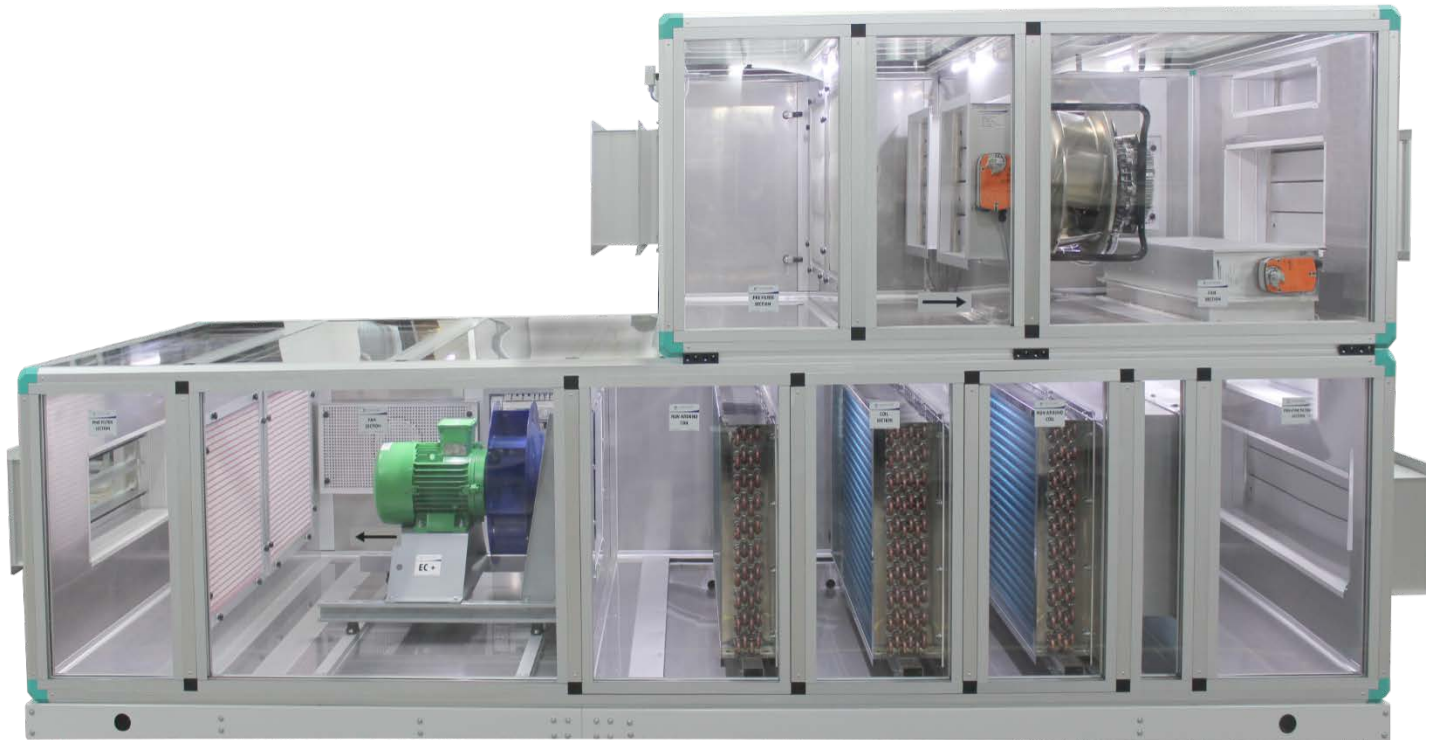


AIR HANDLING UNITS



THE LEADERS IN COOLING

Blue Star is India's largest central air conditioning and commercial refrigeration company, with over seven decades of experience in providing expert cooling solutions. It has offices across India, UAE, Malaysia, Qatar and Oman, 5 modern manufacturing facilities, around 2500 employees and a turnover of over USD \$530 million. Alliances and partnerships with leaders in global technology have further enhanced Blue Star's capability in providing advanced cooling solutions for diverse needs.

Blue Star offers a range of air conditioning products that encompasses Screw Chillers, Scroll Chillers, Air Handling Units, Fan Coil Units, Packaged Air Conditioners, Ducted Splits and VRF Systems apart from room air conditioners such as Split, Window, Verticool and Cassette Air Conditioners. Refrigeration products include Water Coolers, Deep Freezers and Water-Cooling solutions specifically designed to cater to the unique requirements of India, Middle East, Africa, SAARC, ASEAN and Pacific Islands markets.

A wide range of models is available in each product category to ensure that the air conditioning system design is implemented without any compromise. All the products are energy efficient and come with a host of distinctive features. Every Blue Star product is a result of robust R&D, a strong understanding of design and superior manufacturing processes. These core attributes have made Blue Star the preferred cooling solution provider.



GLOBAL PRESENCE

Blue Star's international business consists of AC&R product exports to the Middle East, Africa, SAARC, ASEAN and Pacific Islands regions, with steady progress also being made in developing the other international markets. In addition, the Company also participates in international projects managed by the Company's joint ventures in Qatar, Oman and Malaysia.

New opportunities are being identified for AC&R products, MEP projects, after-sales service as well as system integration and agency businesses in global markets.

CUTTING-EDGE R&D

Blue Star's innovations are bourn out of the high-end R&D establishment that has been painstakingly put together over decades with the brightest brains and the latest equipment in place.

Recognized by the Department of Science and Industrial Research (DSIR) – Ministry of Science and Technology, Government of India, Blue Star's R&D has enabled the Company to file more than 25 patents and win many prestigious innovation awards.



WORLD CLASS TESTING FACILITIES

Blue Star's infrastructure for conducting various performance tests on new products is one of the largest in India, ensuring that every product and technology is tested vigorously before being productionised. Blue Star has 6 Psychrometric, 2 condensing and 2 Environmental test labs.

Blue Star's R&D labs at Thane and Dadra have been certified by Intertek, Sweden to carry out safety tests for HVAC products as per the International Electro technical Commission Standards. Intertek is a global leader in safety testing and certification for regulatory approval.

Also, the National Accreditation Board for Testing and Calibration Laboratories (NABL) has conferred Certificate of Accreditation to Blue Star Laboratories located at Thane and Wada, India in accordance with the Standard ISO 17025: 2005. NABL is a signatory member of APLAC and International Laboratory Accreditation Cooperation (ILAC).

Products designed are also subject to various reliability tests before they are cleared for manufacturing. These include endurance, vibration and shock tests along with life cycle and ageing tests to rigorously test design reliability. All Blue Star products are designed to perform under tropical conditions such as high ambient, high humidity, extreme voltage condition and fluctuations.



ADVANCED PSYCHROMETRIC TEST LAB

Blue Star factories have a modern Psychrometric Test Lab that can simulate and test products under various conditions. All machines manufactured at our factories are rigorously tested for various parameters before dispatch. Customers too can witness actual performance tests conducted on the products before dispatch of their machines, making Blue Star one of the few companies in the air conditioning industry offering this facility.



WORLD CLASS MANUFACTURING

Blue Star's manufacturing strength is spread across five state-of-the-art manufacturing facilities. Blue Star's commercial and residential AC units are manufactured at the modern factories at Wada, Dadra and Himachal Pradesh. Set up to International Standards, the products manufactured at these ISO 9001-2008 certified factories are exported to various countries across the globe.

The factories are highly productive, automated and flexible. They are also efficient in manufacturing the setup of heat exchange coils and advanced chillers. In addition, these factories have modern sheet metal fabrication units with Amada punching and bending machines.



Wada, Maharashtra



Dadra

ENSURING AN EXCELLENT FINISH

Blue Star's production facilities use raw materials that are of the highest quality, including corrosion resistant, galvanized steel for enhanced life and rust protection. The equipment used to process the steel includes CNC machines such as the Amada punch press, hydraulic press, specialized microprocessor-based protection and resistance welders. All these machines ensure superior quality in cabinet fabrication to tight tolerances.

All products are powder coated by specialized process equipment from Nordson of the USA on fully conveyORIZED lines. They are fitted with electro-mechanical oscillators that ensure an even powder coating. A 'smart spray' mechanism senses movement of the conveyor and geometry of the component to adjust the powder flow.

Blue Star is equipped with a high-tech coil manufacturing setup using imported Burr Oak machines that can manufacture high efficiency plain coils as well as enhanced split fins for superior heat transfer. The copper tubes are then processed by a bank of PLC-Controlled Burr Oak machines that ensure perfect bonding between the copper tubes and fins for superior performance. The coils are then tested for fine leaks with ultra-sensitive electronic leak detectors to enhance reliability.

The entire AHU range is manufactured with robust manufacturing practices and quality processes laid down by Blue Star. And is subject to QC testing at the factory for all critical parameters such as CFM and static pressure, casing leak, current, voltage and vibration.



CERTIFIED FOR EXCELLENCE

Blue Star's production processes and QC have resulted in international recognition of the quality and reliability of Blue Star products and their performance.

ISO 9001-2015 Quality Management System Standard Certification for Design, Development & Manufacturing of Air Conditioning and Refrigeration Equipment.



Eurovent Certification for Air Handling Units – Mechanical and Performance Characteristics.**CERTIFICATE
N° 18.04.009****Air Handling Unit / Centrales de traitement d'air****Range Name / Nom de Gamme :
EDSA**

Granted on April 19, 2018 - Date 1ère admission 19 avril 2018

This document is valid at the date of issue - Check the current validity on:
Document valable à la date d'émission - Vérifier la validité en cours sur :
www.eurovent-certification.com

Participant/Titulaire

Blue Star Limited
Kasturi Buildings, Mohan T Advani Chowk - Jamshedji Tata Road
400 020 Mumbai , India

This product performance certificate is issued by Eurovent Certita Certification according to the certification rules:

Ce certificat de performance produit est délivré par Eurovent Certita Certification dans les conditions fixées par le référentiel :

ECP AHU - « Air Handling Unit » in force at established date.

ECP AHU – « Centrales de traitement d'air » en vigueur à date d'édition.

Pursuant to the decision notified by Eurovent Certita Certification, the right to use the mark ECP shall be granted to the beneficiary company for the above Range in the conditions defined by the certification program mentioned.

En vertu de la décision notifiée par Eurovent Certita Certification, le droit d'usage de la marque ECP, est accordé à la société qui en est bénéficiaire pour la gamme visée ci-dessus, dans les conditions définies par le programme de certification mentionné.

Unless withdrawn or suspended, this certificate remains valid as long as the requirements for the certification program framework are met. The validity of the certificate is to be verified on www.eurovent-certification.com

Sauf retrait ou suspension, ce certificat demeure valide tant que les conditions du référentiel du programme de certification sont respectées. La validité du certificat est à vérifier sur le site Internet www.eurovent-certification.com

**THIS CERTIFICATE HAS BEEN ISSUED ON 13/10/2022
THIS CERTIFICATE IS VALID UNTIL 31/12/2022**

***CE CERTIFICAT A ÉTÉ EMIS LE 13/10/2022
CE CERTIFICAT EST VALIDE JUSQU'AU 31/12/2022***

Paris, 13 octobre 2022



Organisme accrédité n° 5-0517 Certification Produits et Services selon la norme NF EN ISO/CEI 17065:2012
Portée disponible sur www.cofrac.fr
Accreditation #5-0517 Products and Services Certification according to NF EN ISO/CEI 17065:2012 –
Scope available on www.cofrac.fr
COFRAC est signataire des accords MLA d'EA et MLA d'IAF,
COFRAC is signatory of EA MLA and IAF MLA,
List of EA members is available on www.eurovent-certification.com/ea-members
List of IAF members is available on www.iaf.ru/Articles/IAF_MEMBERS_SIGNATOIRES/4

MANAGING BOARD MEMBER / MEMBRE DIRECTOIRE



CERTIFICATE
N° 18.04.009



Appendix / Annexe

Granted on April 19, 2018 - Date 1ère admission 19 avril 2018

This document is valid at the date of issue - Check the current validity on:
Document valable à la date d'émission - Vérifier la validité en cours sur :
www.eurovent-certification.com

List of certified products and characteristics is displayed on:
La liste des références et caractéristiques certifiées est disponible sur le site :
www.eurovent-certification.com

This product performance certificate is valid for the following trade names:
Ce certificat de performance produit est valide pour les marques commerciales suivantes:
[Trade Name / Marque Commerciale](#)

BLUE STAR

This product performance certificate is valid for the following manufacturing places:
Ce certificat de performance produit est valide pour les sites de production suivants:
[Manufacturing Place / Site de Production](#)

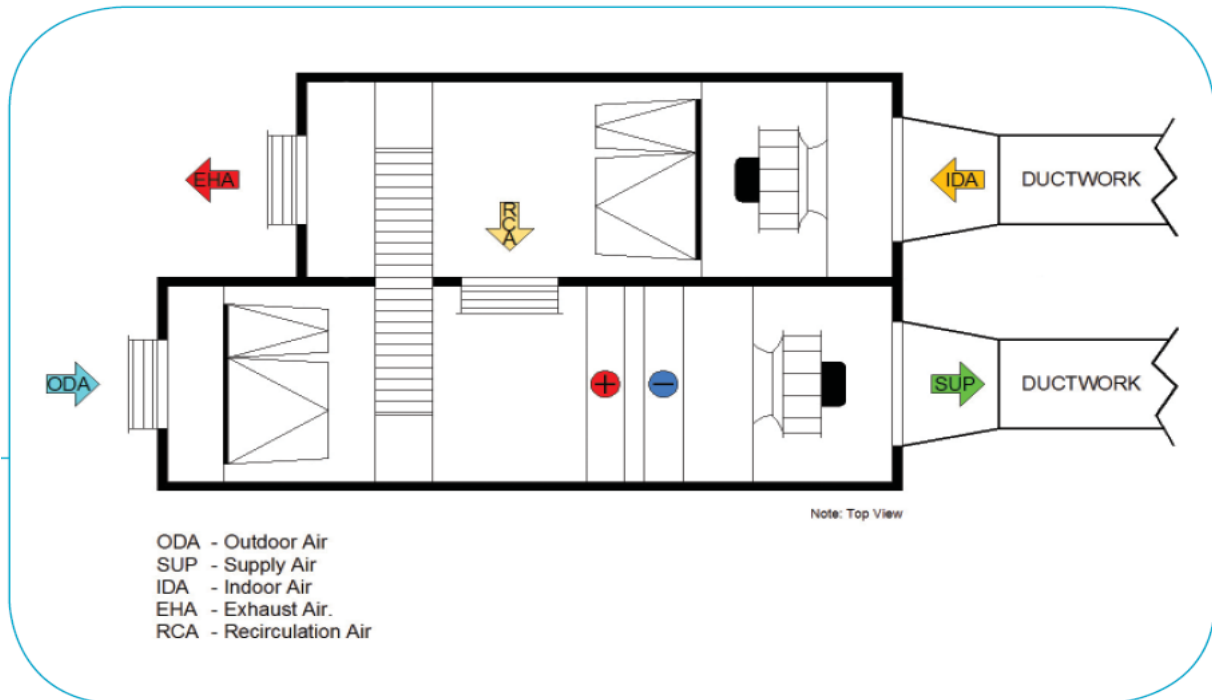
GREATER NOIDA, India

This product performance certificate is valid for the following software:
Ce certificat de performance produit est valide pour les logiciels de sélection suivants:
[Software / Logiciel de sélection](#)

BLUESTAR AHU 5.0.3

BLUE STAR AIR HANDLING UNITS

Air Handling Units are devices which can carry out air conditioning processes such as Ventilation, Cooling, Heating, Humidification, Dehumidification, Filtration, Heat recovery, etc. Blue Star Double Skin AHUs are engineered and manufactured with innovative technology to deliver an energy efficient Air Handler with Optimum design, Superior quality and Reliable performance. A typical Air handling Unit schematic is shown below.



Blue Star EDSA series Air Handling Units are Eurovent Certified according to EN 1886 and EN 13053. Our AHUs are designed to meet the Indoor Air Quality requirement as per ASHRAE 62. We have a wide range of AHUs for use in various applications from small offices to larger industrial applications. Common to all items in the range is that the system and components have been developed to satisfy stringent demands of low energy consumption. Heat exchangers, motors and fan units have all undergone extensive testing, both in laboratory and out in the field, in order to comply with current and future demands for low energy consumption.



AHU FEATURES

- Suitable for both indoor and outdoor installation.
- EDSA units are Eurovent Certified & NDSA series are non-certified.
- Eurovent Certified Selection Software.
- Heating, Cooling, Humidification, De-humidification, Extensive range of Filters and Various Heat Recovery sections.
- Available in 41 different models with Air Flow Rate range of 1,000 to 76,000 CFM.
- EDSA series are available in 50 mm panels, whereas NDSA series are available in both 25 mm and 50 mm.
- Component Flexibility.
- Modular Construction.
- Energy Efficient.
- Easy for installation and Better Serviceability.
- Low Noise and Vibrations.
- High Indoor Air Quality.
- Can handle Static Pressures up to 2300 Pa.
- Factory Acceptance Test and Performance Test.

COMPONENTS OF AHU

- **Fans:** A variety of fans can be offered based on the requirement - Belt driven DIDW centrifugal forward curved/Backward curved fans, Centrifugal plug fans, EC fans.
- **Motors:** IP 55 Class F insulated Motors with IE2, IE3, IE4 efficiency.
- **Supply and Extract Filters:** Units are offered with high quality and low pressure drop filters of different particulate efficiency.
- **Heat transfer coils:** Copper tube aluminum finned heat transfer coils available in multiple rows deep and are designed to give certified performance output for cooling, heating and recovery applications.
- **Tightness and Corners:** Framework of airtight, elegant and sturdy extruded aluminum hollow profile with polyamide thermal break profile having glass filled nylon corners and spacers.
- **Dampers:** Low-leakage extruded aluminum/GI dampers suitable for manual or motorized operations.
- **Base Frame:** Made of strong galvanized steel with lifting provision, as an option we have aluminum base frame.
- **Inspection doors/handles:** Adequate sized inspection doors are provided in each section fitted with high quality comfortable handles.
- **Heat Exchangers:** High quality and energy efficient heat exchangers are available – Heat Recovery Wheels, Plate Heat Exchangers, Heat Pipes or Run around Coils.



AHU APPLICATIONS

Blue Star AHUs are designed in modules which can be configured for different applications to make up the heart of any air conditioning system. The flexibility makes it possible to optimize the air handling unit for specific requirement.

- **Comfort Solutions:** Simple project implementation for expansion of existing premises or new buildings. Simplifies selection plus planning and includes smart solutions for easier installation.
- **Compact Solutions:** Extreme space saving solutions and new connections for units that can also be split. Completely adaptable to satisfy all new demands. Compact air handling units are easier to transport and handle at the construction site.
- **Flexible Solutions:** Flexible solutions with heat recovery and intelligent control functions that are easily adapted to suit current needs of different recovery system and configurations.
- **Industrial Solutions:** Air humidifiers can be installed in air handling units which makes the units suitable for air cooling, water spray humidifier and scrubber applications.
- **Clean Room Solutions:** Clean rooms can encompass numerous applications, everything from operating theaters to laboratories. Our air handling units can satisfy all requirements relating to healthcare, whether these have to do with air cleanliness, noise levels or demand control.



CHARACTERISTICS OF BLUE STAR AHUs

Mechanical & Thermal performance of AHU housing is tested in Eurovent accredited laboratory as per EN 1886 with the following results.

Mechanical Strength: D1

Air Leakage: L1

Filter Bypass leakage: F9

Thermal Transmittance: T3

Thermal Bridging: TB2

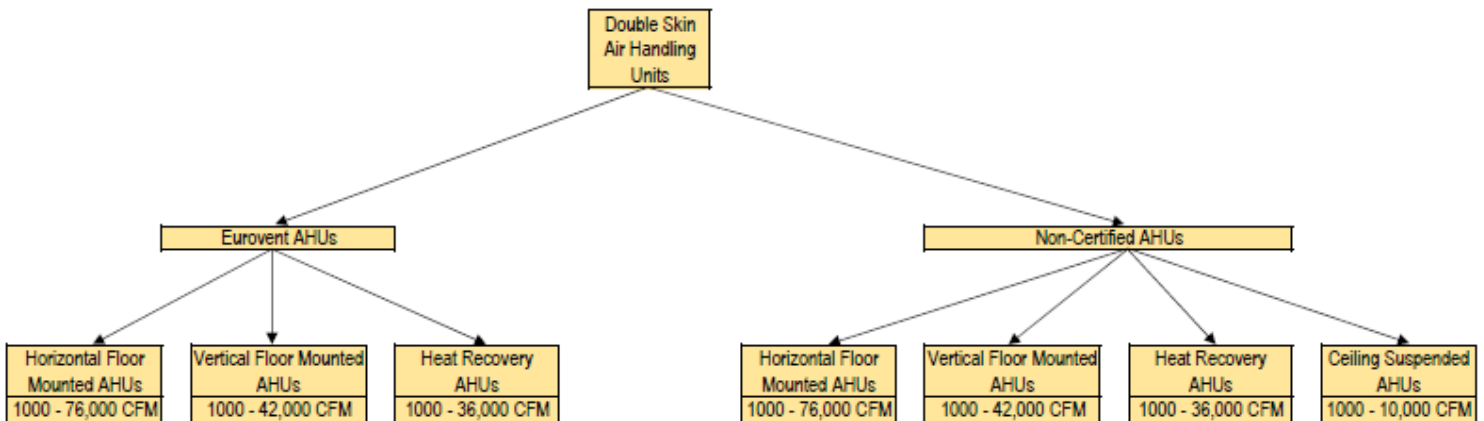
Acoustic Insulation: @ 15 dbA reduction.



The performance of AHU is tested in a Eurovent accredited laboratory in accordance with EN 13053. Tests are carried out for Air Flow Rate – Static Pressure data – Power consumption, Heat Recovery, Cooling duty, Heating duty and air side & water side pressure drops.

BLUE STAR AHU RANGE

Blue Star's AHUs come in variety of forms to suit any installation, ensuring freedom and flexibility in design. The range includes Eurovent and Non-Certified AHUs.



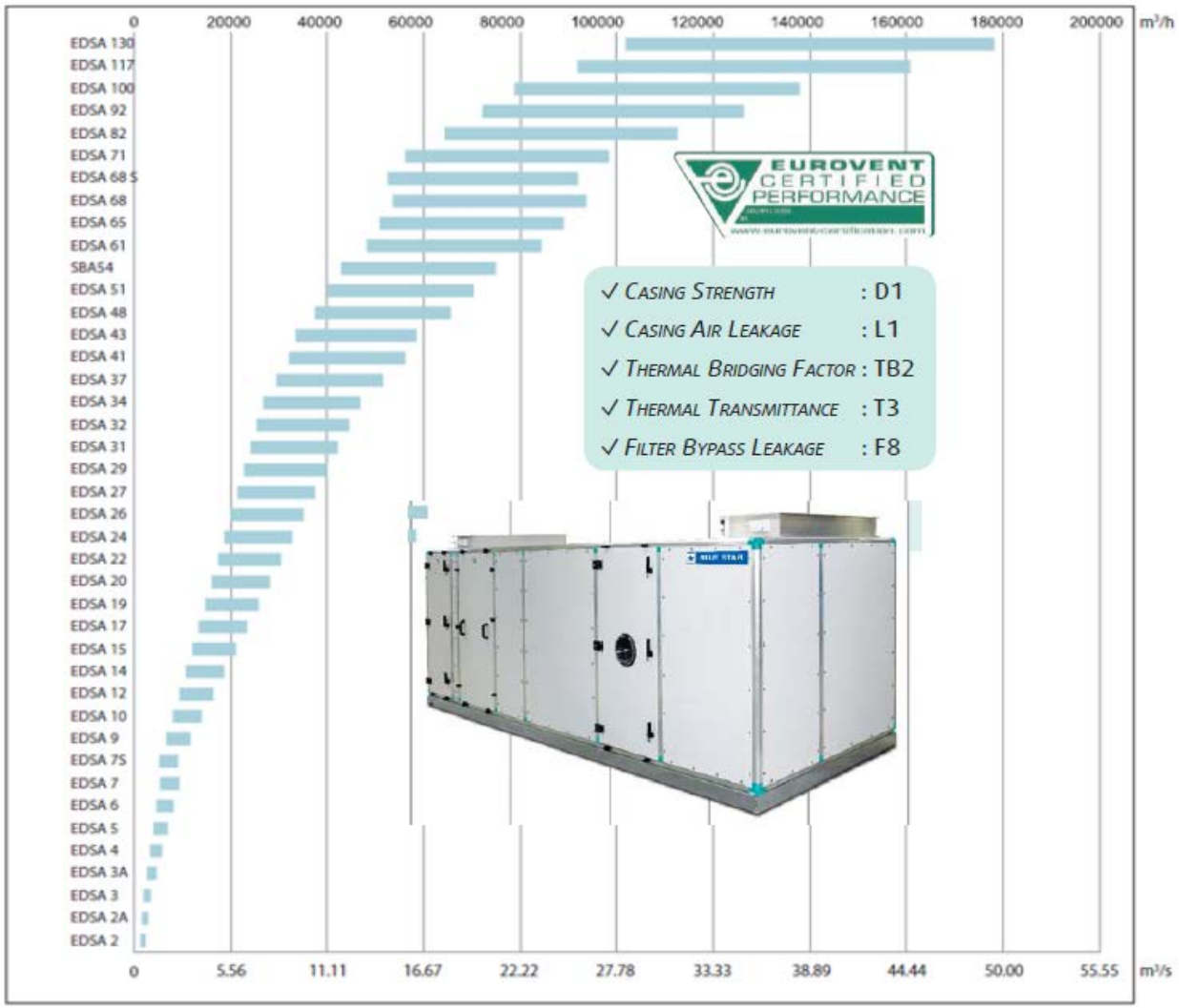
AHU NOMENCLATURES

EDSA- Eurovent Certified Double Skin Air Handling Unit

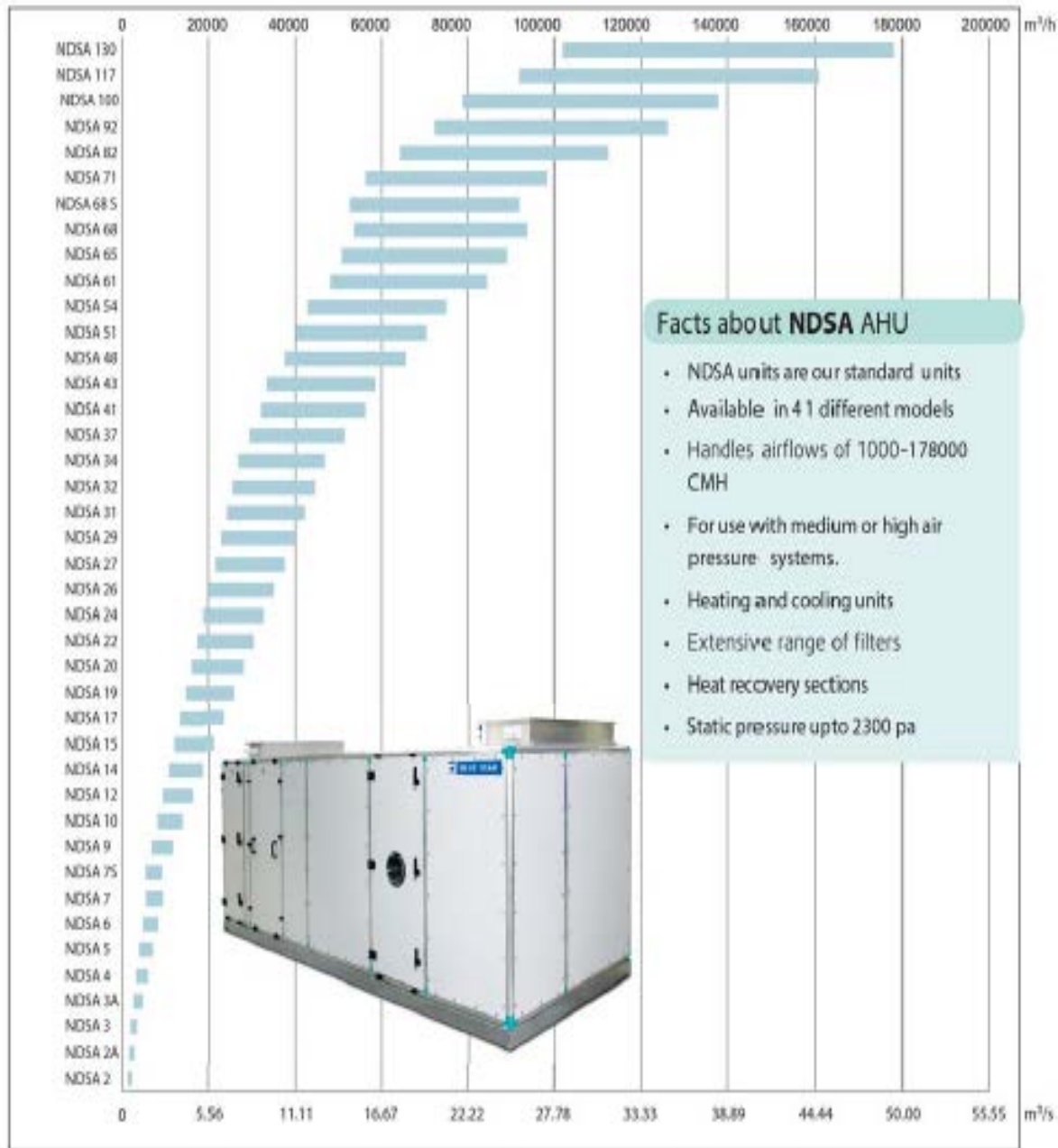
NDSA- Non - Certified Double Skin Air Handling Unit

DCW/XS – Double Skin Ceiling Suspended Water Coil/DX Coil Standard Air Handling Unit

QUICK SELECTION OF EDSA AHUs



NDSA Standard Units



Facts about NDSA AHU

- NDSA units are our standard units
- Available in 41 different models
- Handles airflows of 1000-178000 CMH
- For use with medium or high air pressure systems.
- Heating and cooling units
- Extensive range of filters
- Heat recovery sections
- Static pressure upto 2300 pa

MECHANICAL PERFORMANCE OF AHU CASING – EN 1886

Casing Strength

Air Handling unit casings are categorized in to classes according to below table.



Casing Class	Maximum relative deflection (mm/m)
D1	4
D2	10
D3	Exceeding 10

Note: Leakage test shall be done after casing strength test.

Class D1 and D2 casings shall be designed and selected so that the maximum deflection of any span of the panels or/and frames does not exceed the limits in above table. The casings of class D1, D2 and D3 have to withstand the maximum fan pressure (not shock pressure) at the selected design fan speed. No permanent deformation (hysteresis maximum ± 2 mm/m frame/panel span) of the structural parts (structures and supports) or damage of the casing may occur.

Test Criteria	Kind of casing	
	Model (M)	Box Real Unit (RU)
Deflection	± 1000 Pa	Normal operating conditions at selected design fan speed.
Withstand maximum fan pressure	± 2500 Pa	Maximum fan pressure at selected design fan speed.

Casing Air Leakage

Air leakage tests shall be done after the strength test. Leakage test shall be performed at both negative pressure (-400 Pa) and positive pressure (700 Pa).

Testing under negative pressure

Leakage class of casing	Maximum Leakage rate (f400) in $l \times s^{-1} \times m^{-2}$	Filter Class (EN 779)
L1	0.15	Superior to F9
L2	0.44	F8 to F9
L3	1.32	G1 to F7

Unless otherwise specified, the applicable rate shall be a function if the efficiency of the air filters within the air handling unit. Where there is more than one stage of air filtration, the classifications shall be based on the efficiency of the highest grade of filter.

In the case of units tested at a pressure deviating from 400 Pa, the measured leakage rate shall be converted in to a value at reference pressure, using the following formula:

$$f_{400} = f_m (400/\text{test pressure})^{0.65}$$

where:

- f_m is the measured leakage rate at the actual test pressure.
- f_{400} is the converted leakage rate at 400 Pa.

Testing under positive pressure

Leakage class of casing	Maximum Leakage rate (f700) in $l \times s^{-1} \times m^{-2}$
L1	0.22
L2	0.63
L3	1.90

In the case of units tested at a pressure deviating from 700 Pa, the measured leakage rate shall be converted in to a value at reference pressure, using the following formula:

$$f_{700} = f_m (700/\text{test pressure})^{0.65}$$

where:

- f_m is the measured leakage rate at the actual test pressure.
- f_{700} is the converted leakage rate at 700 Pa.

Filter Bypass Leakage

Air bypass around filter cells will decrease the effective efficiency of the filter, especially a high efficiency one, because the bypass air is not filtered. In addition, any inward leakage through the casing downstream of the filter has the same effect. Therefore, for filters located upstream of the fan, the air tightness and area of the casing between the filter and the fan are factors that can affect the filter bypass leakage rate.

Below table gives the acceptable filter bypass leakage rate, related to different filter classes, as percentages of the specified or nominal air flow rate of the air handling unit to be tested. If the filter is upstream of the fan, leakage of the sections between the filter and fan are deemed to be included in specified value. In case of downstream filters, the specified values are for the bypass around the filter only.

Filter Class	G1 to F5	F6	F7	F8	F9
Maximum filter bypass leakage rate k in % of the volume flow rate	6	4	2	1	0.5

The acceptable filter bypass leakage rate q_{va} is specified by the formula:

$$q_{va} = k \times q_{vnom} / 100$$

where:

- q_{vnom} is the air flow rate of the filter section.
- k is the filter bypass leakage rate, in percent of specified or nominal air flow rate.

If two or more filter sections are provided within the air handling unit, the filter bypass leakage shall be tested separately for each filter.

THERMAL PERFORMANCE OF AHU CASING – EN 1886

This test procedures provides the means for classifying the thermal transmittance of an air handling unit using a test enclosure with standard construction features. The test is also used to provide a measure of thermal bridging associated with the structural design.

Thermal Transmittance

The thermal transmittance U ($W \times m^{-2} \times K^{-1}$) shall be determined when the steady state temperature difference of 20K. Under these conditions, the U values shall be classified in accordance with below table. The area used for the purpose of calculating U value shall be that of the external surface area of the casing (without a base frame and a canopy).

Class	Thermal transmittance (U) in $W \times m^{-2} \times K^{-1}$
T1	$U \leq 0.5$
T2	$0.5 < U \leq 1.0$
T3	$1.0 < U \leq 1.4$
T4	$1.4 < U \leq 2.0$
T5	No requirements

Thermal transmittance is calculated using below formula.

$$U = P_{el} / A \times \Delta t_{air}$$

where:

P_{el} is the electrical power input for heater and circulating fans.

A is the external surface area.

Δt_{air} is the air to air temperature difference. $\Delta t_{air} = t_i - t_a$

t_i is the mean internal air temperature.

t_a is the mean external air temperature.

Thermal Bridging

Under the test conditions, when the mean temperature difference between internal and external temperature is established at 20 K, the lowest values of temperature difference between any point on the external surface and the mean internal air temperature shall be established. The ratio between the lowest temperature difference and the mean air to air temperature difference determine the thermal bridging factor.

Determine the thermal bridging factor k_b as follows,

$$k_b = \Delta t_{min} / \Delta t_{air}$$

where:

Δt_{min} is the least temperature difference, $\Delta t_{min} = t_i - t_{smax}$

Δt_{air} is the air to air temperature difference $\Delta t_{air} = t_i - t_a$

t_i is the mean internal air temperature.

t_a is the mean external air temperature.

t_{smax} is the maximum external surface temperature.

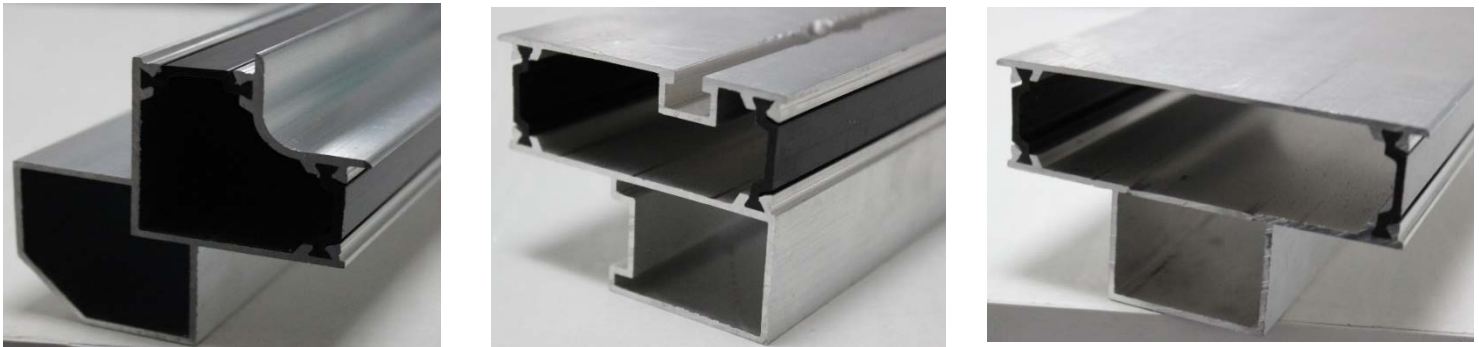
The thermal bridging factor k_b of the casing shall be graded in accordance with below table.

Class	Thermal bridging factor (k_b)
TB1	$0.75 < k_b < 1.00$
TB2	$0.60 \leq k_b < 0.75$
TB3	$0.45 \leq k_b < 0.60$
TB4	$0.30 \leq k_b < 0.45$
TB5	No requirements

BLUE STAR AHU TECHNICAL SPECIFICATIONS – EN 1886					
Mechanical Strength (mm x m-1)	D1	D2		D3	
	4	10		>10	
Casing Air Leakage ($l \times s^{-1} \times m^{-2}$)	L1 (f400)	L2 (f400)		L3 (f400)	
	0.15	0.44		1,32	
	L1 (f700)	L2 (f700)		L3 (f700)	
	0.22	0.63		1,90	
Filter Bypass Leakage (%k)	F9	F8	F7	F6	G1-F5
	0.5	1	2	4	6
Thermal Transmittance ($W \times m^{-2} \times K^{-1}$)	T1	T2	T3	T4	T5
	$U < 0,5$	$0.5 < U \leq 1.0$	$1.0 < U \leq 1.4$	$1.4 < U \leq 2.0$	$2.0 < U$
Thermal Bridging	TB1	TB2	TB3	TB4	TB5
	$0.75 < k_b < 1.00$	$0.60 \leq k_b < 0.75$	$0.45 \leq k_b < 0.60$	$0.30 \leq k_b < 0.45$	$k_b < 0.3$

AHU CASING/CABINET CONSTRUCTION

Housing of Blue Star AHUs are made of double skin construction complying with **Eurovent Standard** for mechanical characteristics as per **EN 1886**. The metal enclosure that covers all the components contained in the AHU is sturdy and has no protruding parts to disturb the overall look of the unit. Air handling units have a frame composed of an extruded aluminum section that outlines the equipment edges perfectly, resulting in a solid, robust and attractive overall look. These aluminum extruded sections are with or without Polyamide Thermal break profile. EDSA series AHUs are with Thermal Break profile, whereas it is optional for NDSA series AHUs.



The sections joined by injection-molded glass reinforced plastic angle cleats. In the larger sizes, the sections are joined together by angle cleats made from engineered plastics. The assembly is anchored by slot screws, obtaining a solid, sturdy structure.



The unit enclosure is made up of sandwich panels comprising two pieces of sheets one inside the other. Outer Casing of AHU is made of 0.6 mm thick Pre-coated GSS with 40-micron PVC protection film and Inner Casing is made of 0.6 mm thick Plain GSS/Aluzinc, as Standard for both EDSA and NDSA series AHUs.

As Standard, NDSA series are with 25 mm thick panels and EDSA series are with 50 mm thick panels. Insulation between the skins is machine injected CFC free Polyurethane foam having density 38 +/-2 kg/m³ and thermal conductivity of 0.022W/m K. Please refer below Summary table for Standard Casing Specification.

Series	Outer Skin		Inner Skin		Thermal Break Profile	Panel Thickness	Insulation	
	Material	Thickness	Material	Thickness			Material	Density
EDSA	Pre-coated GSS	0.6 mm	Aluzinc	0.6 mm	Yes	50 mm	PUF	38+/-2 kg/m ³
NDSA	Pre-coated GSS	0.6 mm	Aluzinc	0.6 mm	No	25 mm	PUF	38+/-2 kg/m ³



Cabinet construction of AHU reduces the sound level significantly. And it is maintenance friendly through easy access to all the components. Panels can be removed from all the sections without compromising the rigidity of AHU, which is ensured by Aluminum frame. The panels are screwed to the structure using soft food grade gasket to make it leak proof. Air tight access doors/panels with die cast Zinc hinges are provided for access to various sections for maintenance. Access doors are with double wall Inspection Window of 200 mm diameter and robust glass filled Nylon handles operational from both sides with optional locking arrangement. Each section is provided with duly wired Marine Lights and on/off switch mounted on wall of the unit.

The entire housing of the AHU is mounted on Rolled formed GSS channel frame work with provision for handling the units at site.

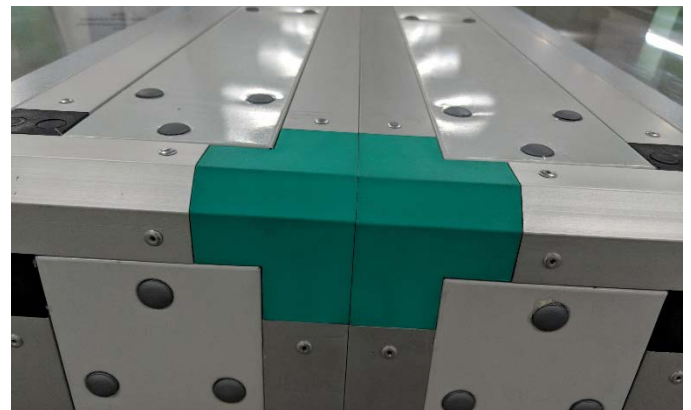
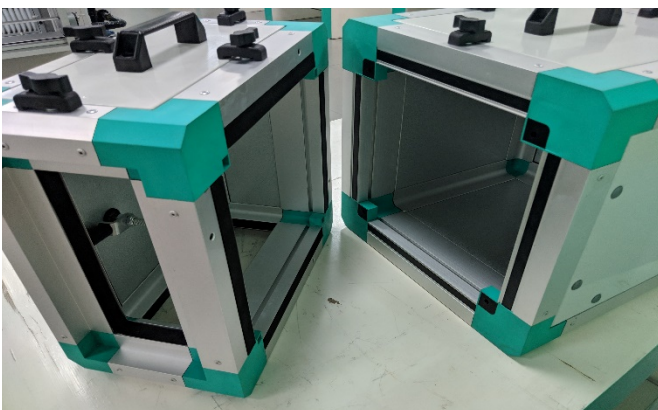
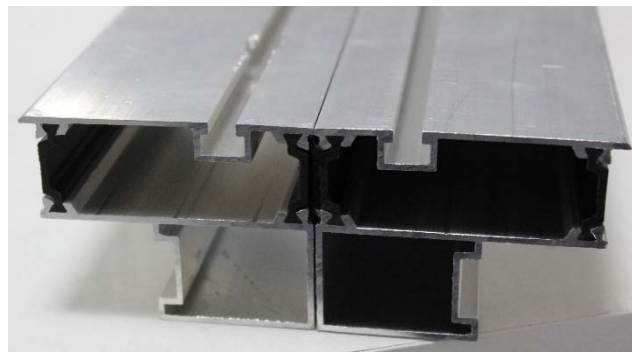
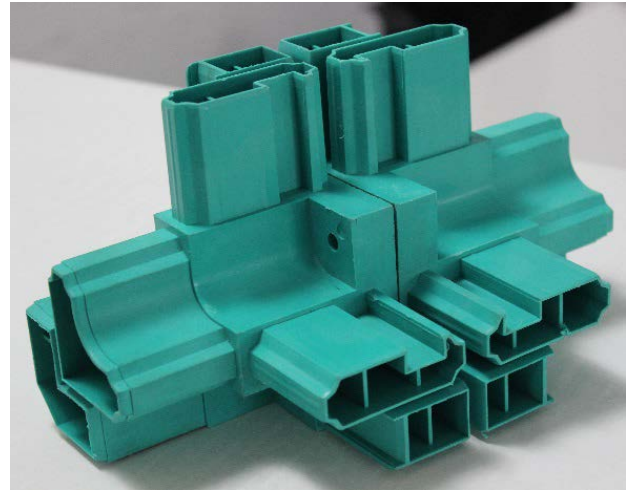
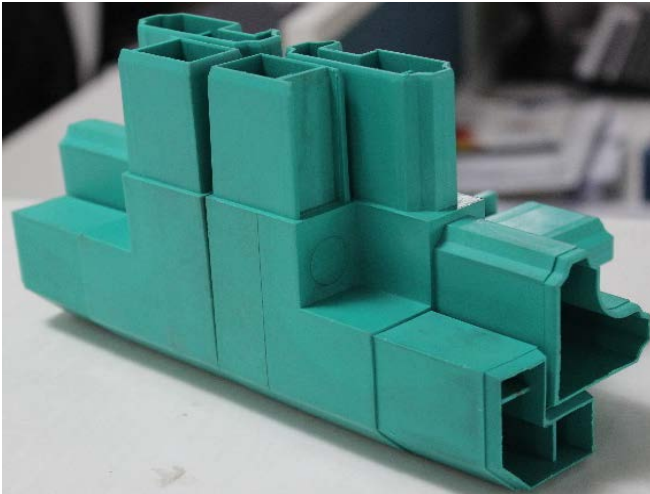
Drain pan is constructed of 18G 304 Stainless Steel with dual slope to facilitate immediate discharge of condensate. Specially designed drain pan with all round edges allow complete cleaning and avoid microbial growth as per **ASHRAE 62-1992** standard. The drain pan is insulated externally with 19 mm thick Nitrile Rubber and extended at least 300 mm beyond the coil. Necessary arrangements are provided to slide the coil in the drain pan.

Casing/Cabinet Optional features

- Outer Skin: 0.8/1.0 mm Pre-coated GSS, 0.8 mm Aluzinc and 0.6/0.8/1.0/1.2 Stainless Steel.
- Inner Skin: 0.8/1.0/1.2 mm Plain GSS, 0.6/0.8/1.0 Pre-coated GSS, 0.8 mm Aluzinc, 0.8/1.0/1.2 mm Aluminum and 0.6/0.8/1.0/1.2 Stainless Steel.
- Panel Insulation Material & Density: Fiberglass (48 kg/m³) and Rockwool (96 kg/m³ & 144 kg/m³).
- Thermal Break Profile for NDSA series AHUs.
- 50 mm thick panels for NDSA series AHUs.
- Drain Pan: 0.8/1.0 mm Stainless Steel and 1.6 mm Aluminum.

MODULAR JOINING

Our newly developed section joiners are with Ultra low leakage, maintains Thermal Bridging. AHUs in modules are easy to handle during transportation as well as installation.



AIR INLET SECTION/MIXING SECTION/FREE COOLING SECTION

AHUs can be supplied with Air Inlet Section, Mixing Box Section or Free Cooling section as per requirement. Air inlet section is used when the AHU is with 100% Fresh Air or 100% Return Air, section will be with Damper, with Flange for duct connection or with Louver. Dampers are constructed from high quality airfoil design Aluminum/GI extrusion and are suitable for manual or motorized operation. In Mixing section, a certain amount of Fresh Air is mixed with the Return Air, fulfilling the fresh air requirement of the conditioned space. Both FA and RA opening are with Control dampers. Free Cooling sections are used to regulate the volumes of Fresh Air, Return Air and Exhaust Air. When the enthalpy of the outside air is less than the enthalpy of re circulated air, the mixture of outside air and re circulated air is controlled to achieve free cooling. Damper Motors/Actuators and linkages to be done at site by the Contractor.



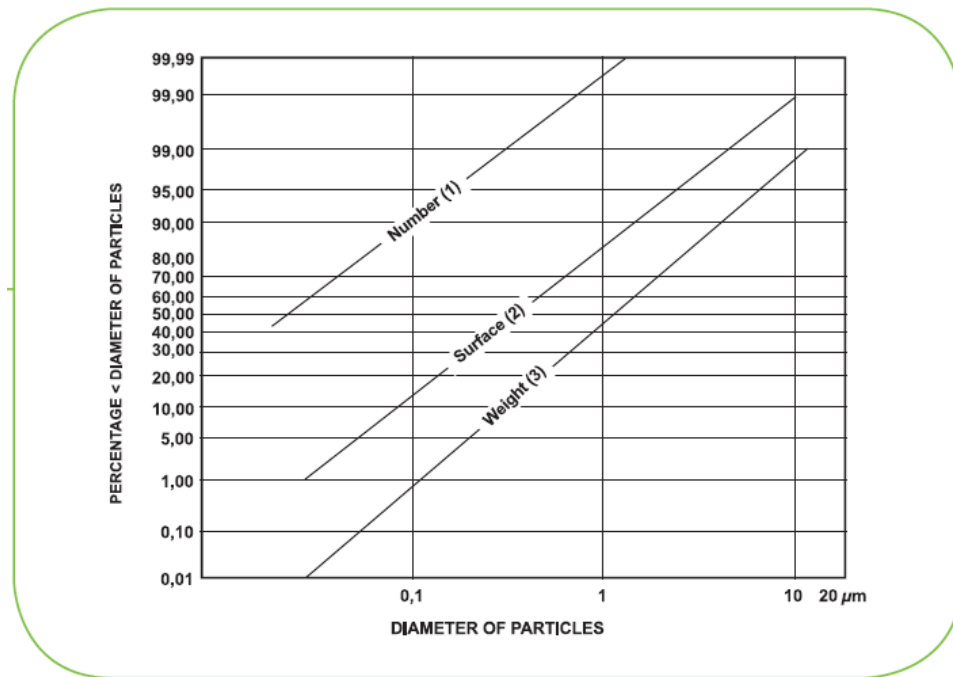
COMPONENTS OF BLUE STAR AIR HANDLING UNIT

FILTER SECTION

Filter plays a major role in maintaining good indoor air quality. Air contains numerous foreign substances caused by natural processes (wind erosion, sea evaporation, volcanic eruptions, etc.) and by human activity (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.

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 in atmospheric dust can be measured in several ways. Traditionally, a variety of measurement methods had 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 United 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 –

Coarse filters, Group F – Fine filters). Later in 1998 the first version of United Standard **EN 1822** unifying the classification criteria for HEPA and ULPA absolute filters was published. The initial efficiency of these filters with atmospheric dust was greater than 98%.



The standard range for Filters in Blue Star AHU includes three air filtering sections which combined with the wide variety of filtering materials covering an extensive range of possibilities in filtering efficiency. The media is thermally bonded with progressive density to have high dust holding capacity and low initial pressure drop. All Filters are in accordance with **ASHRAE 52.2** and **EN 779** standards. All filters are easily accessible for maintenance.

PRE-FILTERS

Blue Star AHUs are supplied with non-woven synthetic media pre-filters.

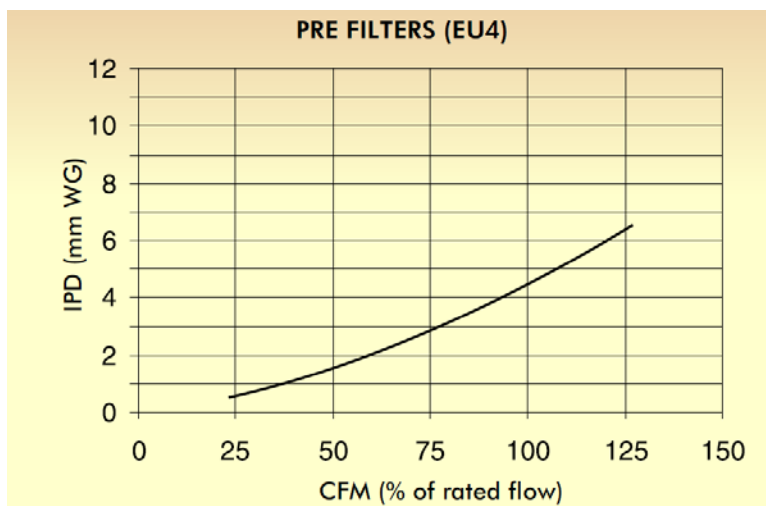
Efficiency: **G4 (EU4)** – 90% @ 10 microns.

Filter Thickness: 50 mm standard. 100 mm is optional.

Frame Material: Aluminum as standard. SS/GI/MS are optional.

Media Supporter: Aluminum Mesh/HDPE Mesh as standard. GI Mesh/GI Rod are optional.

Filters are tested as per **ASHRAE 52.1** and **EN-779**.



FINE-FILTERS

Variety of Fine Filters are available. All are with Non-woven synthetic media as standard.

Bag Filters are available in Box type & Flange type.

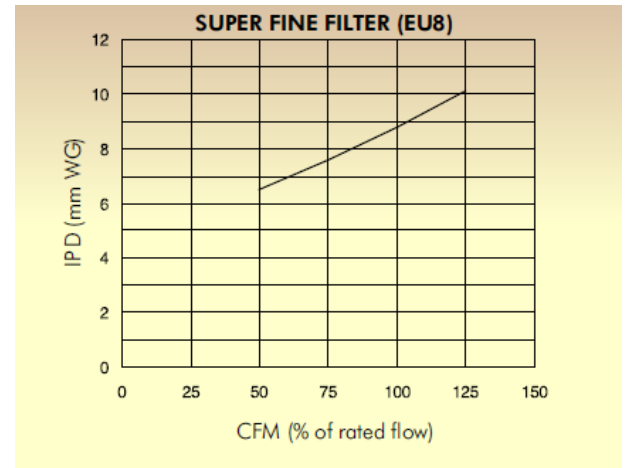
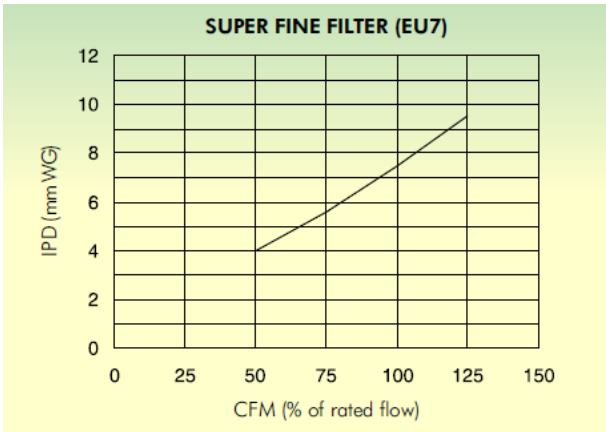
Efficiency: **F7 (EU4)**–99% @ 3 microns, **F8 (EU8)**– 70% @ 0.3 microns & **F9 (EU9)** – 75% @ 0.3 microns.

Filter Depth: 300 mm standard. 500 mm is optional.

Frame Material: Anodized Aluminum as standard. SS/GI/MS are optional.

Media Supporter: Aluminum Mesh/HDPE Mesh/GI Mesh as standard. GI Rod/Aluminum foil/Hotmelt are optional.

Filters are tested as per **ASHRAE 52.1** and **EN-779**.



HEPA-FILTERS

Filter Media – Micro Fiber Glass Paper (Deep pleated panel type) as standard.

Bag Filters are available in Box type, Flange type & Channel type.

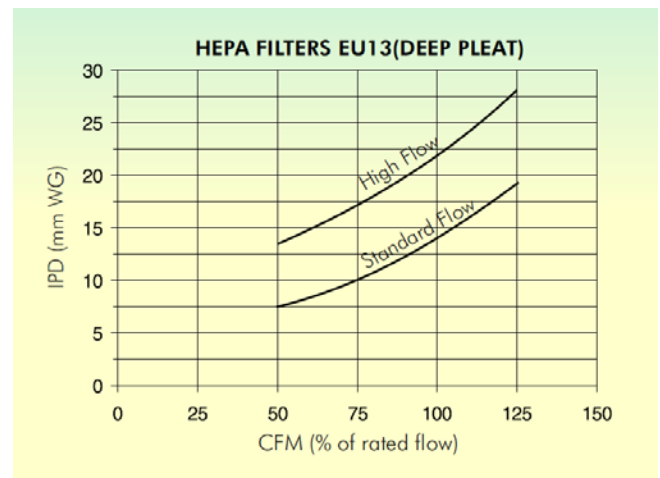
Efficiency: **H13 (EU13)**- 99.97% @ 0.3 microns. H14 are also available.

Filter Depth: 300 mm standard.

Frame Material: Aluminum as standard.

Media Supporter: Aluminum Foil as standard.

Filters are tested as per **EN 1822-4/5**.



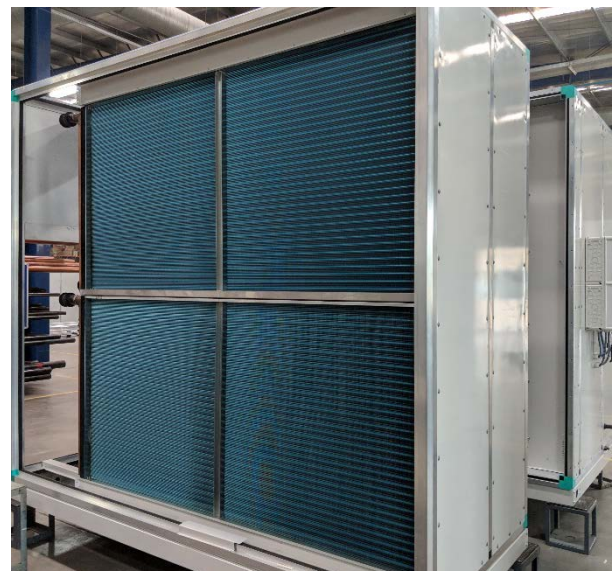
Classification of filter in accordance with EN779				Filters can also be classified as follows	
Class		Ability to separate synthetic dust, A_m	Mean value of the collecting efficiency, E_m	Eurovent 4/5	ASHRAE
G 1		$50 \leq A_m < 65$	-	-	-
G 2		$65 \leq A_m < 80$	-	-	-
G 3		$80 \leq A_m < 90$	-	EU3	G85
G 4		$90 \leq A_m$	-	EU3	G90
F 5		-	$40 \leq E_m < 60$	EU5	F45
F 6		-	$60 \leq E_m < 80$	EU6	F65
F 7		-	$80 \leq E_m < 90$	EU7	F85
F 8		-	$90 \leq E_m < 95$	EU8	F95
F 9		-	$95 \leq E_m$	-	-

Filter Section Optional features

- Magnehelic Manometer.
- Differential pressure switches.
- Inspection Window and Marine light.
- Stainless Steel frames for filters.
- Fire retardant media for pre-filter.
- Mini pleat fine filters.
- High Efficiency ULPA Filters.

COIL SECTION

Coils are critical component of Air Handling Unit, which are used for Cooling, Heating and Mechanical de-humidification processes. Their performance has strong bearing on the ultimate indoor environmental conditions, which in turn, has significant impact on the Indoor Air Quality. We are manufacturing Chilled/Hot Water coils and Refrigerant Direct Expansion coils for our AHUs. Performance of Coil is in accordance with **EN 1216** standard with a maximum tolerance of 5%. Also, Capacity of the coil, water pressure drop and selection procedure are in accordance with **ARI standard 410**.



Both Water and Gas coils are constructed of 12.7 mm outer diameter Copper tubes having minimum wall thickness of 0.4 mm with waffle/ripple Aluminum fins having 0.15 mm thickness firmly bonded to Copper tubes assembled in 1.5 mm thick Zinc coated Steel frame. Mechanical expansion of tubes assures tight bonding between tubes and fins for better heat transfer. Fin spacing is 10 to 12 fins per inch (4 to 5 fins per cm). Coils are provided with Copper header and MS adaptor.

Coils are pitched in the unit casing for proper drainage. Cooling coil section is provided with insulated drain pan in order to hold and remove the condensate formed during dehumidification. Coils are assembled in slide rails for easy removal for maintenance. AHUs will be supplied with Manual Air Vent at high point in the cooling/heating coil and drain plug in the bottom of the coil.

Coils are designed based on the maximum utilization of cross sectional area to achieve the most efficient heat transfer. Recommended maximum air face velocity across cooling coil is 2.5 m/s. whenever an application requires face velocity higher than recommended value or when the humidity is high, there are chances of moisture carryover. To prevent the same, our AHUs can be supplied with Droplet Eliminator made of PVC, which avoid the moisture carryover. In such AHUs, drain pan will be extended to cover the bottom of Droplet Eliminator for the collection of condensates.

Water Coils are factory tested at 300 psig air pressure under water and Dx coils are tested at 450 psig.



Coil Section Optional features

- Tubes: Plain Copper tubes with 0.35/0.5 mm wall thickness & 5/8-inch OD Plain SS tube with 0.5 mm thick wall.
- Fins: Pre-coated Aluminum fins with 0.15 mm thickness & Copper Fins with 0.15 mm thickness.
- Heresite coating for coil.
- 1.6 mm thick Stainless-Steel Coil frame – SS304/316/316-L
- Droplet Eliminator – PVC, Powder coated GI or SS.

HUMIDIFIER SECTION

Blue star AHUs can be supplied with two different types of Humidifiers such as Panel Humidifiers and Water Spray Humidifiers. In both cases, the units are adiabatic humidifiers. This section is available with NDSA series AHUs only.



Panel Humidifiers

Panel Humidifiers are composed of an enclosure with humidifier panel, Stainless Steel drip pan at bottom, water manifold at the top and submersible electrical pump. Water is pumped through pipes by using pump and is distributed vertically downwards by gravity. As the air flows by the panel horizontally through the spaces provided, turbulent flow conditions are established and thereby resulting in efficient heat and moisture transfer. Humidifier panels are made of two different types of materials.

1. Cellulose – Humikool – with Chemical additives allowing it to absorb water without affecting its stiffness.
2. Fiberglass – Hu-Cell – with structural additives for stiffening.

Cellulose Humidifiers panels can be supplied with 3 different thicknesses,

- a. 150 mm thick with Saturation Efficiency of 75%
- b. 200 mm thick with Saturation Efficiency of 92% and
- c. 300 mm thick with Saturation Efficiency of 95.5%

End plates are made of GI as standard and SS can be given as optional. Standard drain pan is 1.6 mm thick Aluminum sheet and 0.8/1.0/1.2 mm thick Stainless-steel drain pan is optional.

Water Spray Humidifiers / Air Scrubbers

Blue Star AHUs can be equipped with Water spray humidifiers which mainly serve for Adiabatic cooling, humidifying and air washing. This section houses Spray nozzles, heat exchanger media, water collecting tank and droplet eliminator to prevent entrainment of water particles. System require a water circulating pump (not in our scope of supply) which re circulate water at a rate higher than the evaporation rate. Water tank is equipped with drain connection, overflow outlet, water feed with float valve and suction connection with screen.

ELECTRIC HEATER SECTION

AHUs can be supplied with Electric Heater having Capacity as indicated in the schedule. Heaters can be either strip or tubular type. Electric heaters are in accordance with IEC standard. Heating elements are constructed from 80/20 Nickel chrome resistance wire, which is connected to terminal pins and centered in Stainless Steel grade 304L sheath metal tubes.

Step Controls and Thyristor controls are optional features.

UVC EMITTERS

The specified product will be packaged with a plan and drawing for the installation of the lamp assemblies as supplied by manufacturer's installation manual indicating orientation (upstream, downstream or both sides of the coil) of the installation. Each UV-C lamp will be attached to a reflector that will reflect the UV-C energy in order to effectively irradiate the HVAC coil surface and drain pan. The reflector will be built from a high UV reflectivity material capable of withstanding air velocities of up to 2000 ft/min. without excessive noise, wobble, or vibration. The electronic power supply will be mounted on a rigid surface outside of the AHU in an adequate enclosure protecting it from moisture and humidity.

FAN SECTION

Fan

Blue Star Air Handling Units are supplied with highly energy efficient Double Inlet Double Width belt driven Centrifugal Fans, as standard. They are tested and certified for air and sound performance as per **AMCA 210-85**. All Impellers and fan shafts are statically and dynamically trim balanced to **ISO 1940** and **AMCA 204/3 – G4.5 standard**. Centrifugal fan Impellers can be Forward Curved, Backward curved or Airfoil profiles depending on the requirements. Forward curved fans are used for low static requirement and backward curved or backward curved airfoil fans are used for high static and high efficiency requirements.

Fan casing is made of Galvanized Steel. Impellers of Forward curved, Backward curved and Airfoil fans are manufactured from Galvanized Steel, heavy gauge sheet steel and Mild steel respectively. Impellers are mounted on a solid shaft made of C40 Carbon Steel with corrosion protection coating, supported to housing with angle iron frame and heavy-duty ball bearings/pillow block bearings. Fan and Motor assembly are mounted on a common extruded Aluminum base mounted on deep section extruded Aluminum or heavy gauge GSS channel inside AHU housing on anti-vibration mounts. The mounts can be either spring or turret depending on the fan frame size. Fan outlet is connected to casing with fire retardant fabric flexible connection for ensuring low noise operation. Wire guards are provided at fan section access door.



Motor and Drive

Fan Motors are Totally Enclosed Fan Cooled (TEFC), Energy Efficient (IE-2), IP 55 protected and class F Insulated Squirrel Cage Induction Motors. Motors are specially designed for quiet operation. Motors are mounted inside the AHU casing on slide rails for easy belt tensioning. Complete Fan-Motor drive assembly is mounted on floating sub-base with Anti-vibration mounts. Motor rating and operating characteristics are in accordance with IEC 60034-1 and IEC 60085. As standard, all fans are belt driven with a set of fixed pitch pulleys and matching belts. Belts are oil-resistant type.

Fan Section Optional features

- Plug Fans with AC Motor.
- EC Fans with Motor.
- Air Flow Switches.
- Premium and Super Premium highly efficient Motors – IE3 and IE4.
- Flame Proof Motors.
- Built in thermistor for thermal protection.
- VFD Compatible Motors.
- Dual Speed Motors.
- Variable Pitch Pulley.
- Standby Motors with manual change over.



HEAT RECOVERY SECTION

The increased supply of Outdoor air needed for ventilation to achieve acceptable Indoor Air Quality levels recommended in **ASHRAE standard 62** significantly increases the cooling and heating loads that the HVAC Equipment needs to handle, resulting in higher initial and operating cost. To compensate the same, we are designing our AHUs/FAHUs with Heat Recovery system to reduce the energy consumption associated with the treatment of the supply air. We can define Heat Recovery in brief as the process where the energy held by the expelled air is transferred to fresh air, it is essential that the fresh air doesn't mix with the dirty air removed from space. As compared to an Air Handling Unit without Heat Recovery, an AHU equipped with Heat recovery at suitable condition has smaller

exchanger in the AHU and hence lower Capacity Chiller/Condensing unit/Boiler, means lower power consumption. Blue Star FAHUs can be supplied with following Air to Air Heat Recovery sections/combinations.

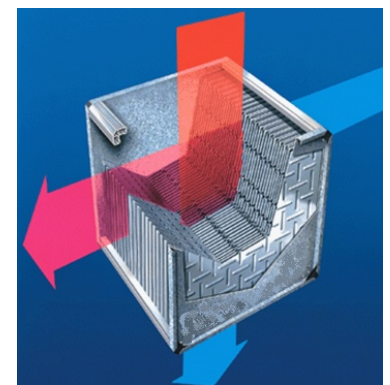
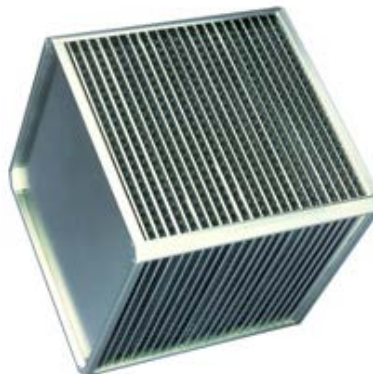
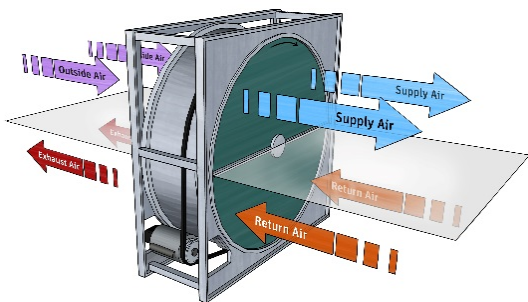
1. Double Wheel Energy Recovery – Total Energy and Sensible Energy Wheels.
2. Total Energy Wheel with or without Horse Shoe Heat Pipe.
3. Fixed Plate Heat Exchanger with or without Horse Shoe Heat Pipe.
4. Heat Pipe for Heat Recovery with or without Horse Shoe Heat Pipe.
5. Run Around Coil.

Rotating Heat Recovery Wheels (HRW)

Double Wheel Energy Recovery – with a Total Heat Recovery Wheel and a Sensible Heat Recovery Wheel: This system has two energy transfer stages between adjacent fresh air and extract/exhaust air, with air flowing at opposite directions, creating a counterflow heat exchange arrangement. In the first recovery phase, total energy exchange combining both latent and sensible energy transfer is achieved by virtue of revolving Enthalpy Wheel having an Aluminum backbone structure with a desiccant coating and a large internal surface area to transfer moisture and heat between the two airstreams having different temperatures and vapor pressures as the driving force for energy transfer. During the cooling season, this wheel pre-cools and dehumidifies the fresh air prior to entering the main cooling coil, reducing the cooling coil load. Cooling coil dehumidifies the air to a certain dew point. Leaving the Cooling coil, this dehumidified fresh air enters the second Sensible-only wheel where it absorbs heat from the extract/exhaust air stream and is reheated to a specified neutral dry bulb. During this, by releasing heat to the supply airstream, exhaust air is pre cooled prior to entering the first Enthalpy wheel, which further enhances cooling the fresh airstream.

Total Energy Recovery Wheel only: In this system, process is same as first recovery phase of the Double Wheel system, an Enthalpy Wheel is equipped to precool and dehumidify the air entering the conventional fresh air handling unit. Again, the cooling coil dehumidifies the air to a certain dew point, without reheating it to a neutral dry bulb temperature.

Blue Star supplies **Eurovent Certified HRWs** which are available in wide range of diameters from 500 mm to 2800 mm. These wheels are available in two series – MS 200 and MS 270. Both series have a selectivity of 3A° molecular sieve desiccant coated Aluminum substrate and this result in high latent recovery and control on cross contamination. Aluminum substrate eliminates any fire risks and result in high sensible recovery and high structural strength. Purge section provides strict separation of airstreams preventing carryover of bacteria, dust and pollutants from exhaust air to supply air. Purge section and sealing system limit cross contamination to 0.04% of the exhaust air concentration by volume. Effective non-contact labyrinth seal ensures no wear and tear and long life. Wheel edges are hardened as standard to suit marine and coastal application needs. Sectioned wheels capable of being assembled in the field are available as options for above 2000 mm dia. Control Packages can be given as option.



Fixed Plate Heat Exchanger (PHE)

Designed with air-to-air crossflow to transfer sensible heat. PHE consists of layers of plates which separates Supply and Exhaust airstreams. These plates are constructed of high quality, aircraft-grade Aluminum, automatically machine formed for quality and consistency. As an option, plates can be coated with Epoxy for additional corrosion resistance or constructed of Stainless Steel for pressure resistance. Plate edges are folded to positively seal all edges from air leakage and crimped to ensure plate stability & alignment and provided leading edge turbulence to enhance heat transfer. Plate spacing can be selected from very close to very open to match the required efficiency and air flow requirements and are ensured complete separation of airstreams with no cross contamination. PHE are washable using water and detergent. The housing is constructed of Galvanized Steel as standard; coating can be given as optional.

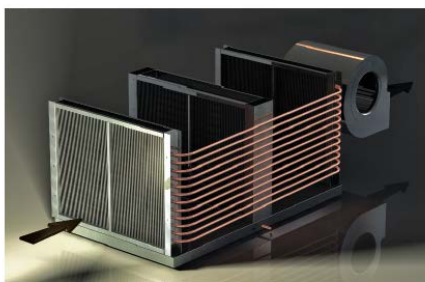
Heat Pipes

Heat pipes are one of the most effective passive method of transferring heat across small temperature gradients. A sealed Copper tube is evacuated and charged with a refrigerant which will absorb the heat from warm air stream (Evaporator section of Heat Pipe) and get boiled. Due to its elevated vapor pressure, the vapor moves rapidly to the cooler Condenser section of Heat pipe, carrying with it the absorbed heat. As the vapor reaches the condensing area of the heat pipe, heat is released to the cooler air and vapor condenses. The liquid returns by gravity to complete the cycle.

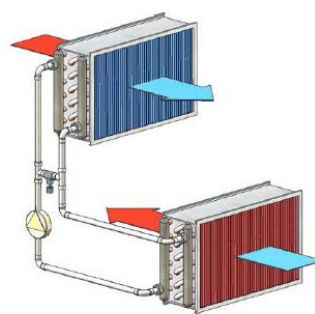
Heat Pipes for Energy Recovery (HR HP) will be of the straight type and included within the AHU. Heat pipes are suitable for Horizontal (side by side) and Vertical installations within the AHU, as per requirement. Heat pipe will straddle the airways in the supply and extract decks of the AHU and will incorporate a dividing plate to separate the two airstreams. The two airways can be adjacent to one another with minimum separation. The heat pipes will comprise a supply fin block directly coupled to an extract fin block and the two airstreams are arranged to be in counter flow as they pass through the heat pipe.

Heat Pipes for enhanced Dehumidification are of "wrap-around" (HSHP – Horse Shoe) type included in the AHU around the main Cooling coil. Heat pipe consists of a **Pre-cool** fin block upstream of the cooling coil linked to a **Reheat** fin block downstream of the cooling coil by means of wrap-around pipes.

Casing of our Heat pipes are constructed of Galvanized Sheet Steel with a minimum thickness of 1.2 mm. Tubes are made of refrigeration standard Seamless Copper C106 for heat exchanger use. Tube diameter will be minimum of 12 mm with grooved inner surface to enhance the internal surface area and prevent pooling of liquid. External fins are of Aluminum with a minimum thickness of 0.11 mm. Fins are of the continuous plate type to maximize the external surface area rather than individually finned tube pattern. Fins are wither rippled or louvered type to suit the application and spaced at such a distance as required by the condition specified. Copper fins, vinyl pre-coated Aluminum or Blygold/Heresite post coated aluminum etc. are optional.



Heat Pipe



Run Around Coil



Run Around Coil

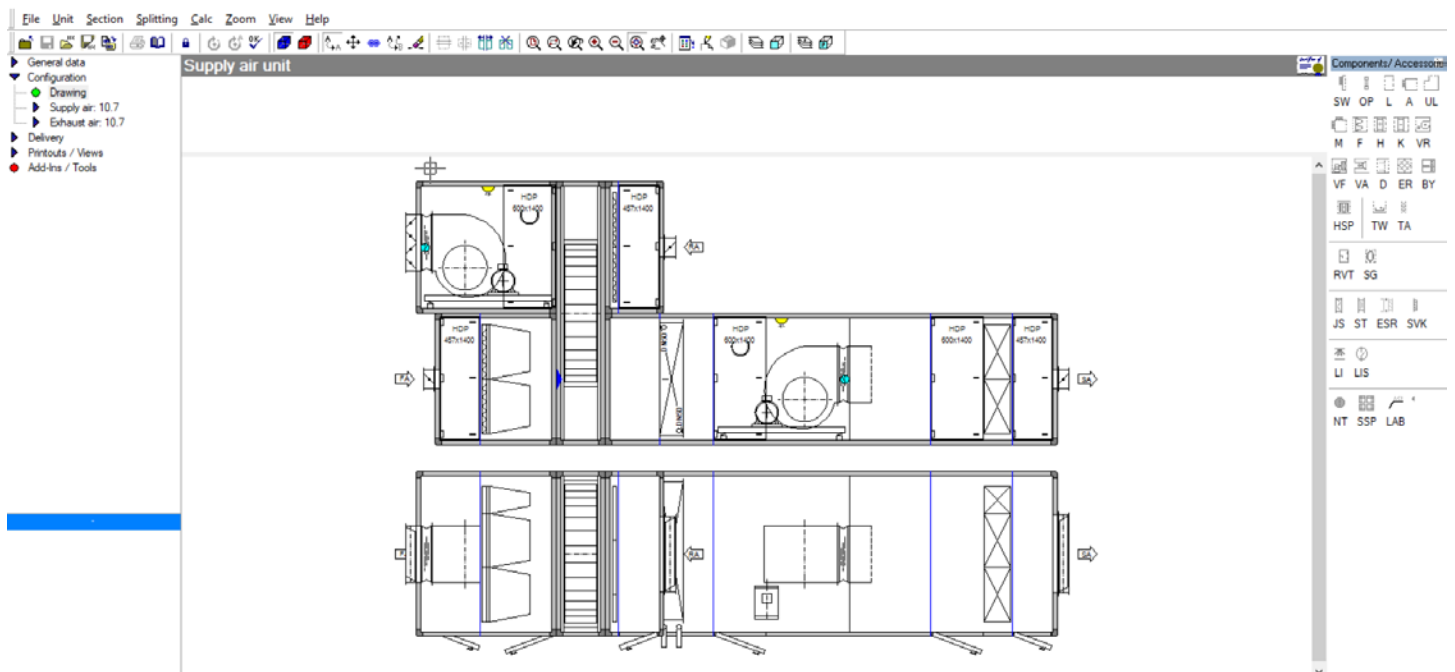
In this recovery system, the heat carried by one airflow is transferred to the other airflow indirectly, via a liquid medium. The heat transfer fluid is a water/glycol mixture (brine) in the pump circuit. Supply air and extract air heat exchangers can be arranged at entirely separate locations. They are merely connected by a hydraulic connection. As a result, they are suitable for applications in which no

leakages between the supply and extract air are desired or permitted for hygienic reasons: for example, in hospitals as well as in the food and pharmaceutical industries.

SELECTION TOOL

Blue Star DSA air handling unit Selection Program named **BluestarAHU** is tested and certified by **EUROVENT**.

- Customers can choose various construction/manufacturing options viz. sheet thickness, insulating material, fin material, manifold material etc.
- Customer can design unit sections based on required application viz. mixing sections, filtration level, recovery section, cooling/heating section, fan assembly sections, etc.
- It actually let customers to decide sectional possibilities in order to decide the dimensions of space required to place the unit.
- Divide the equipment in to modules in accordance with Project requirements.
- Obtain all technical information for the equipment selected, including the curves for the selected fan and its operating points.
- Estimate the cost of the selected equipment.
- Selection software is user friendly and highly intuitive.





For more information, please contact **BLUE STAR INTERNATIONAL FZCO**: Unit No. 3E-520, Building No. 3E (East Side), Dubai Airport Free Zone, Dubai, UAE, PO Box: 293719, Phone: +971 4 2306900. Email: exports@bluestarindia.com
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