ISOVER
SAINT-GOBAIN

CLIMAVER® STAR
For outdoor use

SAINT-GOBAIN

Introduction and Contents

ISOVER offers innovative and sustainable solutions for thermal and acoustic insulation and fire protection for the HVAC Markets.
Within its continuous innovation process and in line with all the technical requirements of an HVAC system, ISOVER has launched CLIMAVER® STAR, the first mineral wool self-supporting duct that is valid and resistant in outdoor environments and that requires no subsequent sheet metal coating as mechanical protection.
As well as guaranteeing energy efficiency in HVAC installations, this new outdoor solution minimises the operations required on them and allows for a weather-proof duct to be installed in just one step.
Insofar as energy efficiency in HVAC installations, it meets all the necessary requirements thanks to the thermal insulation it provides and to its Class D air tightness that limits installation leakage as much as possible.
It also has all the same benefits and easy installation as the other panels in the CLIMAVER® Range, as the work method and the tools are the same as for CLIMAVER® APTA (40mm), which means it adapts very easily to all types of installation and their singularities.

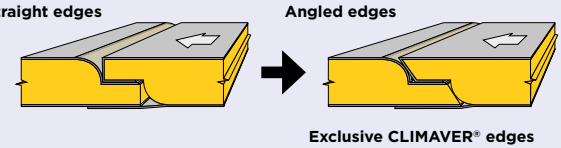
1. Description

CLIMAVER® STAR is a rigid, non-hydrophilic mineral wool panel used to make self-supporting air distribution ducts for direct use outdoors. Its thermal conductivity at 10 ˚C is 0.032 W/m·K and it is 40 mm thick, thus complying with stringent building regulations on building exteriors.
It is coated on both sides by strong facings. Its outer side has an exclusive laminated and impermeable embossed aluminium coating with an absolute vapour barrier and ultraviolet protection, which is adhered to the mineral wool panel using an adhesive system that is resistant to outdoor environments. This exclusive outer coating has been tested in a climatic chamber to simulate its ageing and has successfully passed several impact, piercing and static load tests, proving to be a totally resistant and durable coating.

Its inner side has Neto coating with great acoustic absorption. The textile structure of this Neto fabric provides complete permeability to sound waves, helping achieve better acoustic attenuation in the installation. This is very important, as CLIMAVER® STAR is a solution designed for outdoors, which is where the HVAC units, the most significant sources of noise in an installation, are located.

Furthermore, this inner coating is resistant to all existing cleaning systems in the market. This includes brushing and compressed air cleaning, guaranteeing the absence of holes where dirt might accumulate.

CLIMAVER® STAR has the new angled edging of the entire CLIMAVER® range, which means that the cross connection of the ducts is made by joining the male and female, double-density angled edges before sealing the joint with staples and CLIMAVER® STAR tape.



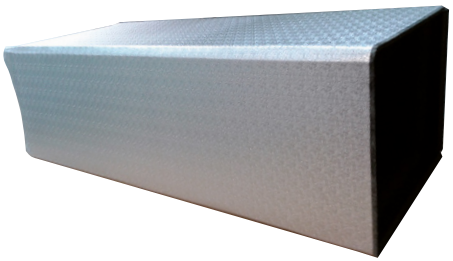
Advantages of the exclusive angled edging of CLIMAVER®:

- More precise connection.
- Increased performance.
- Optimised air tightness.
- Fewer load losses.
- Duct continuity.
- Improved appearance.

2. Dimensions

CLIMAVER® STAR is supplied in panel format with the following measurements.

Thickness (mm)	Length (m)	Width (m)	m²/ pallet	m²/truck load
40	3.00	1.21	65.34	1,568.13



3. Technical characteristics according to regulations

The table below includes all the technical characteristics referred to in the standards of reference: EN 13403, 13501-1, EN ISO 354, EN 12086, UN 12237.

Symbol	Parameter	Icon	Units	Value	Standard
λ_D	Declared thermal conductivity according to temperature		W/m·K (°C)	0.032 (10) 0.033 (20) 0.036 (40) 0.039 (60)	EN 12667 EN 12939
–	Reaction to fire		Euroclass	B-s1, d0	EN 13501-1 EN 15715
MU	Mineral wool: water-vapour diffusion resistance, μ		–	1	EN 12086
Z	Facing: water-vapour diffusion resistance		m^2·h·Pa/mg	150	EN 12086
MV	The vapour diffusion-equivalent air layer thickness, Sd		m	100	EN 12086
DS	Dimensional stability, Δε		%	<1	EN 1604
–	Air Tightness		Class	D	UNE-EN 13403 EN 12237
–	Pressure resistance		Pa	±800	UNE-EN 13403

Working conditions: Air speed up to 18 m/s and circulating air temperature up to 90ºC.

Thickness (mm)	Weighted acoustic absorption coefficient, AW, α_ω	Acoustic absorption class	Designation code
EN 823	EN ISO 354 - EN ISO 11654	UNE EN ISO 11654	EN 14303
40	0.90 (1)	A	MW-EN 14303-T5-MV1

Acoustic trials with plenum: CTA 140003/REV. (1) Weighted acoustic absorption coefficient AW,α_w without plenum 0.70 (40 mm thickness) CTA 140053/REV-2.

4. Working conditions

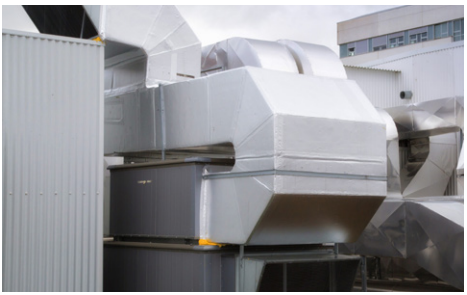
According to EN-13403, the use of CLIMAVER® STAR ducts is not recommended in the following cases:

- Air circulation at temperatures > 90 °C.
- Transport of corrosive solids or liquids
- Vertical ducts over a height of more than two storeys, with no attachment profiles
- Underground ducts.
- Ducts with a side measuring more than 1600 mm.

Exclusive laminated embossed aluminium coating

5. Certification

CLIMAVER® STAR is CE and EUCEB certified.



6. Energy efficiency in outdoor installations

6.1. CLIMAVER® STAR guarantees thermal insulation

CLIMAVER® STAR guarantees thermal insulation in order to decrease energy losses due to heat transfer and air tightness in order to limit air leakage.

a) For a material with thermal conductivity of reference at 10 °C of 0.040 W/(m · K):

Indoors (mm)	Outdoors (mm)
30	50

b) For a material with thermal conductivity different to the above, determining the minimum thickness by applying the following equation for flat surfaces is considered valid:

$$d = d_{ref}\left(\frac{\lambda}{\lambda_{ref}}\right)$$

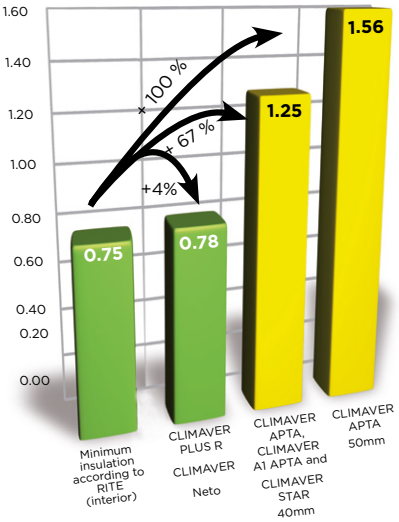
In the case of the CLIMAVER® range, the conductivity of the material at 10 °C is 0.032 W/m · K.

Applying the formula gives the following minimum thickness of reference:

$$d = d_{ref}\left(\frac{\lambda}{\lambda_{ref}}\right) = 50 \text{ mm } \left(\frac{0.032}{0.040}\right) = 40 \text{ mm}$$

CLIMAVER® STAR is 40 mm thick and, therefore, has great features for both cold and hot air.

Thermal Resistance R (m² · K)/W



6.2. CLIMAVER® STAR air tightness: The best guarantee of air tightness

A Class B duct with 300 Pa of static pressure available at the outlet of the AHU will have around 0.37 L/(s · m²) in air leakage.

In a duct network carrying a flow of 5400 m³/h (1.5 m³/s) and a surface area of 200 m², the leakage would represent 74 L, i.e. 5% of the flow.

Where the HVAC air is 16 °C and the room temperature 25 °C, the energy losses equivalent to this air leakage for 12 hours would almost reach 10 kWh.

Class D CLIMAVER® STAR, guaranteeing the highest air tightness.

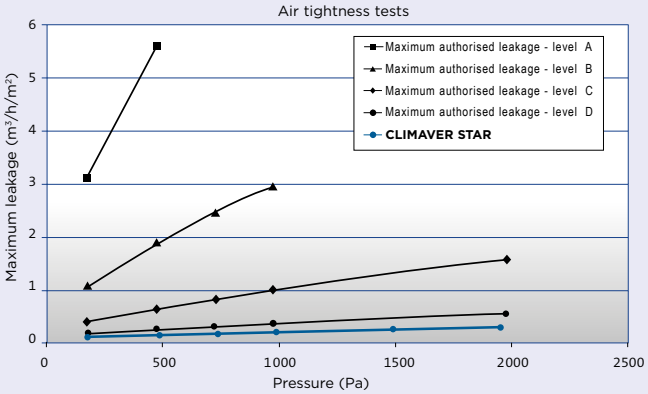
Air tightness rating and air leakage factor

Air tightness rating	Leakage factor (f_{max}) L/s · m²
A	0.027 x Ps $^{(065)}$
B	0.009 x Ps $^{(065)}$
C	0.003 x Ps $^{(065)}$
D	0.001 x Ps $^{(065)}$

Energy losses represented by leakage, by air tightness rating and according to example

Air tightness rating	Authorised leakage	% of the total flow represented by leakage	Equivalent energy losses (12 hours)	Savings
-	L/(s·m²)	%	kWh	%
B	0.37	5	10	0
D	0.004	0.5	1	90

As with the other solutions in the CLIMAVER® range, it ensures the increased air tightness of the installed ducts, minimising air leakage as much as possible to a differential static pressure of 2000 Pa.



To optimise the energy efficiency of an HVAC installation, install a Class D duct network instead of Class B to guarantee an air tightness that is 10 times higher.

7. Pressure losses equivalent to metallic ducts

The air circulating around a duct network receives the discharge energy from a fan. This energy must be sufficient to distribute the air to the rooms at the planned flow rate, temperature and speed, offsetting any pressure losses produced in the network. Correctly sizing the ducts consists of balancing the driving force (fan) with the pressure losses produced in the duct network.

The dynamic fluid process of the air in the ducts causes two types of pressure loss: frictional losses and localised pressure losses.

7.1. Frictional pressure losses

The abacus established for pressure loss in CLIMAVER® ducts is used, obtained from the ASHRAE Frictional Pressue loss Estimation Graph provided for cylindrical galvanised sheet metal ducts, with the necessary equivalent diameter correlation De (rectangular ducts with a cross section a x b), according to the formula:

$$D_e = 1.3 \cdot (a \times b)\ 0.625\ (a + b)\ 0.25$$

7.2. Localised load losses

These correspond to sections where the flow changes speed due to a change in direction or a variation in its volume.
In these cases, neither the Graph nor the Calculation Rule can be used, but instead coefficients for localised losses.

The values of these coefficients C in CLIMAVER® ducts are equivalent to those of galvanised sheet metal, and can be obtained from the ASHRAE Fundamentals Manual or from the CLIMAVER® Air Conditioning Manual.

8. CLIMAVER® STAR great acoustic features

8.1. Acoustic Quality of the Environment

Acoustic comfort is valued more and more every day. Noise is considered a disturbance that can be avoided. There are solutions to offer a suitable acoustic environment for personal wellbeing, so it is important for the law to establish certain minimum requirements to protect the end user from noise.

8.2. CLIMAVER® STAR: high acoustic absorption

Acoustic absorption is a characteristic of a material and corresponds to its capacity to absorb the sound energy and limit sound reverberation.

It is defined by the Sabine sound absorption coefficient αs and is obtained by measuring the acoustic absorption in a reverberating chamber in line with Standard EN ISO 354 for each frequency.

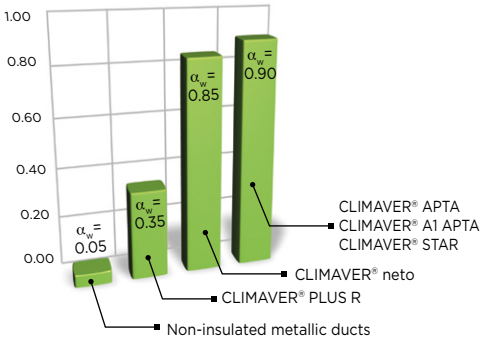
To adapt to the actual design of the HVAC duct networks that are normally installed, the Sabine alpha coefficient is determined with a plenum chamber, which is an air chamber that simulates the space around the duct. CLIMAVER® STAR offers the best acoustic absorption in the market, with overall coefficients of up to α_w = 0.9, ensuring optimum acoustic attenuation, with the noises from installations such as fans or the noise of passing air being attenuated and disappearing along the duct.

To estimate the acoustic attenuation provided by a duct by frequency, the values α_p are first established by octave bands based on the Sabine coefficients α_s obtained from the measurement according to Standard UNE-EN ISO 11654:1998.

The attenuation is then determined on the straight ducts ΔL in dB/m per metre from the source of the noise, for example a fan, or air turbulence, etc. according to the formula indicated and for each octave band:

$$\Delta L = 1.05 \cdot \alpha_p^{1.4} \cdot P / S$$

Where: P: duct perimeter;
S: duct cross section
α_p: acoustic absorption coefficient by frequency



Acoustic absorption coefficient

The changes in direction (elbow joints) and the bypasses of the duct networks also buffer the sound of the source. There are empirical behaviour formulas and graphs that are used to estimate the sound attenuation produced.

	Frequency (Hz)					
	125	250	500	1000	2000	4000
Thickness d, mm	Practical acoustic absorption coefficient, α_p EN ISO 354 / EN ISO 11654					
40	0.40	0.70	0.85	0.85	0.90	1.00
Cross section, S mm²	Acoustic attenuation, in a straight duct, ΔL (DB/m)*					
200x200	5.82	12.75	16.73	16.73	18.12	21.00
300x400	3.40	7.43	9.76	9.76	10.57	12.25
400x700	2.29	5.01	6.57	6.57	7.12	8.25

*Estimated by the formula:

$\Delta L = 1.05 \cdot \alpha_p^{1.4} \cdot \frac{P}{S}$, (P=perimeter) for the sound power of a ventilator with a 20,000 m³/h flow, load loss 15 mm ca.

9. Other advantages of CLIMAVER® STAR

9.1. Fire safety: Euroclass B-s1,d0

CLIMAVER® STAR is rated B-s1,d0, which means it has the highest safety level in relation to emissions and smoke toxicity (s1), as well as to the production of flaming droplets or particles.

9.2. Pressure resistance

The CLIMAVER® range, tested at pressures of up to 2000 Pa without breakage, guarantees resistance to operating pressures of up to 800 Pa, as specified in Standard UNE-EN 13403.

9.3. Indoor air quality guarantee

Resistance to all HVAC duct cleaning methods. The Neto interior coating of the CLIMAVER® STAR ensures the necessary mechanical resistance for the hygienisation of HVAC systems according to Standard UNE 100012: 2005, including the most demanding cleaning tests such as brushing and compressed air, without causing any damage or requiring treatments after cleaning (encapsulation) that are otherwise often essential for products with interior linings.

9.4. No bacterial growth

The CLIMAVER® range, made of inorganic wool, does not encourage or feed the growth of microbes and bacteria. The CLIMAVER® ducts have passed the resistance to microbial growth requirements of European non-metallic duct standard EN 13403.

Inoculated mould does not spread, the structure is not damaged, and the joints do not open.

10. CLIMAVER® STAR: On-site efficiency

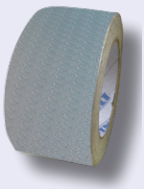
10.1. Easy and fast installation

CLIMAVER® STAR minimises the number of operations required on outdoor installations and allows for a self-supporting mineral wool duct that is weather resistant to be installed in just one step, which translates into easy and fast installation.

It is also very easy to install, as it uses the same work method as the other panels in CLIMAVER® range. The work tools are the same than for CLIMAVER® APTA (40mm).

These two accessories are required to install CLIMAVER® STAR:

Tape and adhesive CLIMAVER® STAR



Laminated embossed aluminium, i.e. made with the same coating as the panel, 75 mm wide, ensuring duct air tightness. It is used to seal the lengthways and exterior perimeter joints.

Solvent-free installation adhesive to seal the interior joints on figures. It is especially designed for outdoor installations.

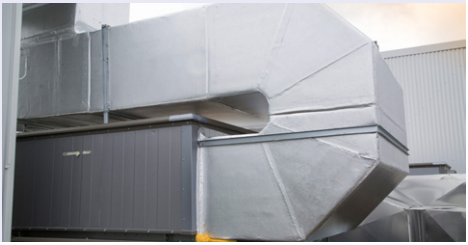
New Universal CLIMAVER® Tools.

11. Work of reference

HIGHER CONSERVATORY OF MUSIC. La Coruña

IKASTOLA ASTIGARRAGA. San Sebastian

SALBURUA CIVIC CENTRE. Vitoria



CARLOS III UNIVERSITY. Madrid

Notes

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CLIMAVER® STAR

under the stars

For outdoor use

ISOVER outside airduct solution.

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Saint-Gobain ISOVER
Les Miroirs
18 Avenue d´Alsace
92096 PARIS
LA DEFENSE

www.isover-technical-insulation.com

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@ISOVERes
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