Harmony
FIRE SAFETY, ENERGY SAVING

AESWOOL

PRODUCT BROCHURE

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Why To Choose AESWOOL

Environment Protection

Convenient Construction

Why To Choose AESWOOL ?

AESWOOL (Alkaline Earth Silicate Fiber) is an inorganic fiber material primarily composed of alkaline earth metal oxides (e.g., MgO, CaO) and SiO_2. By utilizing a unique spinning process combined with double-sided needle-punching technology, the production of fiber blankets eliminates the need for organic binders, while still achieving high tensile strength. Compared to traditional materials such as rock wool, AESWOOL is entirely composed of inorganic fibers, containing no organic substances. This feature ensures it is completely non-combustible in the presence of fire, with zero smoke emission. Additionally, its unique bio-solubility enables gradual decomposition in specific biological environments, thereby significantly reducing potential harm to both ecosystems and human health.

Low Bio-persistence Product

Alkaline Earth Silicate Fibers Are Categorized As "Non-Carcinogenic "

Alkaline earth silicate fibers are primarily composed of calcium oxide (CaO) and magnesium oxide (MgO), with these components collectively accounting for approximately 30% to 50% of the total composition. Such alkaline oxides exhibit significant solubility in water, leading to the rapid dissolution of the fibers in bodily fluids (e.g., pulmonary secretions), which in turn results in low biopersistence.

As noted by the International Agency for Research on Cancer (IARC), the biopersistence of fibers serves as a critical determinant of carcinogenic potential. Owing to their dissolution, **alkaline earth silicate fibers are categorized as "non-carcinogenic," distinguishing them from** asbestos. Additionally, AES fibers are explicitly exempted from carcinogen classification under Nota Q of the European Union Directive 97/69/EC.

Non-Combustibility Product

It is essential that the insulation you choose produces with zero smoke emission and no flames when exposed to high temperatures .

We carry out non combustibility tests and material classification according to IMO 2010 FTP Code Part 1 at FEFT

0 SMOKE EMISSION

0 FLAME AT HIGH TEMPERATURE

No.4　试验后的五个试样
Five specimens after the test

Excellent Tensile Strength

Fiber blankets with insufficient tensile strength prone to breakage or compression deformation during installation or when subjected to external forces (such as vibration and thermal stress). This can lead to the collapse of the fiber structure or the formation of gaps. Heat can be directly transferred through the cracks, reducing the overall thermal insulation effect of the fibers.

In high-temperature applications, if the material cracks due to insufficient mechanical strength, it will damage the integrity of the thermal insulation layer, accelerate the penetration of heat, and greatly increase the risk of fire. High tensile strength is a **key factor in ensuring the long-term stability of the thermal** insulation layer.

Density	Tensile streng (kpa)
48kg/m3，50mm	≥15kpa
60kg/m3，50mm	≥25kpa
70kg/m3，50mm	≥30kpa
96kg/m3，50mm	≥40kpa

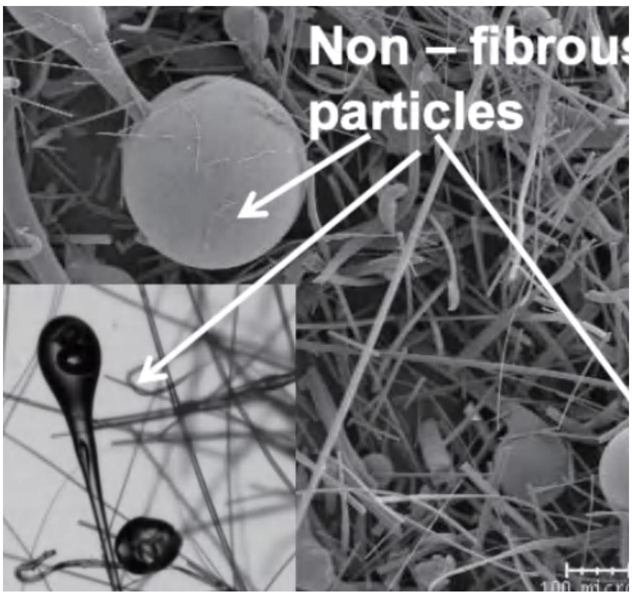
Low Slag Ball Content

Slag balls, generated during the production process, **refer to irregular spherical or block-shaped impurities** primarily composed of unmelted or incompletely **crystallized inorganic constituents.**

These slag balls typically exhibit higher thermal **conductivity than fibers, creating localized thermal** bridges that increase the material's overall heat transfer capacity and thereby degrade its thermal insulation performance.

When exposed to high temperatures—such as in a firescenario—slag balls are prone to phase transformation or decomposition. This phenomenon increases the material's thermal shrinkage rate and reduces the stability of the fiber structure.

Moreover, slag balls disrupt the uniformity of the fiber **network, leading to non-uniform pore distribution (e.g., localized macropores or dense regions). This structural** irregularity negatively impacts the material' s acoustic, filtration, and permeability characteristics.



	Slag ball rate (45 um)	Slag ball rate (212 um)
AESWOOL	≤35%	≤8%

Low Linear Shrinkage Rate

A minimal linear shrinkage rate effectively mitigates the formation of cracks induced by fibrous matrix contraction, thereby precluding heat leakage and flame penetration. Under elevated-temperature conditions, this characteristic ensures enhanced structural stability of the fiber matrix, preserving fire-resistance integrity and averting failure of the fire barrier caused by linear shrinkage of fiber.

Linear shrinkage at the joint after A60 test in FEFTC

before

after

Material Tpye	Tensile strength (kpa)
AESWOOL	< 3%
ROCKWOOL	5%-8%
Ceramic fiber wool	4%-6%

Excellent □ermal insulation performance

- Fibers with a typical diameter of 3-5 micrometers form abundant micron-sized pores (porosity >90%), where these isolated air voids effectively suppress convective heat transfer.
- The unique needle-punching process creates a randomly oriented 3D fiber network that effectively prolongs heat transfer pathways.
- The low shot content in AES fiber products prevents the formation of thermal bridges thereby reducing localized heat conduction pathways.

The thermal conductivity at ambient temperature conditions

Density kg/m³	THERMAL CONDUC TIVITY W/(M*K)	PRODUCTS FORM	U-VALUE (W/m²K)						
			THICKNESS						
			25	30	40	45	50	55	60
48	0.034	Roll	1.36	1.13	0.85	0.76	0.68	0.57	0.56
60	0.033	Roll	1.32	1.10	0.83	0.73	0.66	0.60	0.55
70	0.033	Roll	1.32	1.10	0.83	0.73	0.66	0.60	0.55
96	0.033	Roll	1.32	1.10	0.83	0.73	0.66	0.60	0.55

AESWOOL Marine Blanket for your ships

Completely Inorganic Materials

Compared to rock wool products, our advanced needle-punching technology produces completely inorganic materials that are non-combustible when exposed to fire, with zero smoke emission.

High tensile strength

Long, uniformly distributed fibers ensure structural stability; Resists fiber shedding, requiring only single-sided facing protection.

Thermal Insulation Performance

Low shot content for superior thermal insulation performance.

AESWOOL Marine Blanket for your ships

Fireproof

Low linear shrinkage at high temperatures ensures fire risk elimination for vessels.

Non-Carcinogenic

The material's low biopersistence ensures the health of construction crews and occupants in enclosed cabin spaces, while minimizing potential hazards to both human health and the ecosystem.

The flexible material properties

The flexible material properties enable easy on-site installation, delivering higher construction efficiency and superior material utilization rates compared to alternative products.

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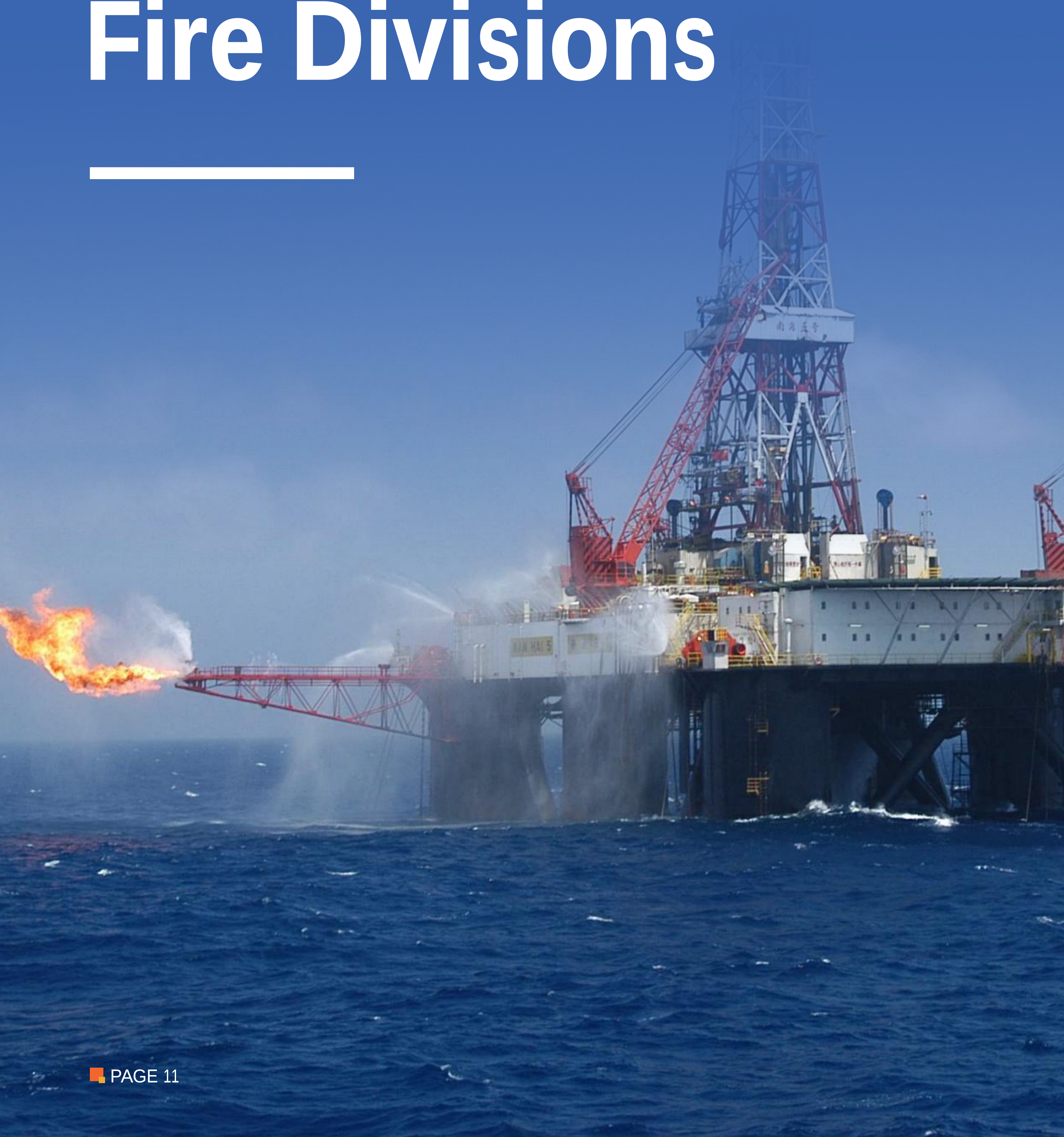
02

Fire Testing Of Fire Divisions



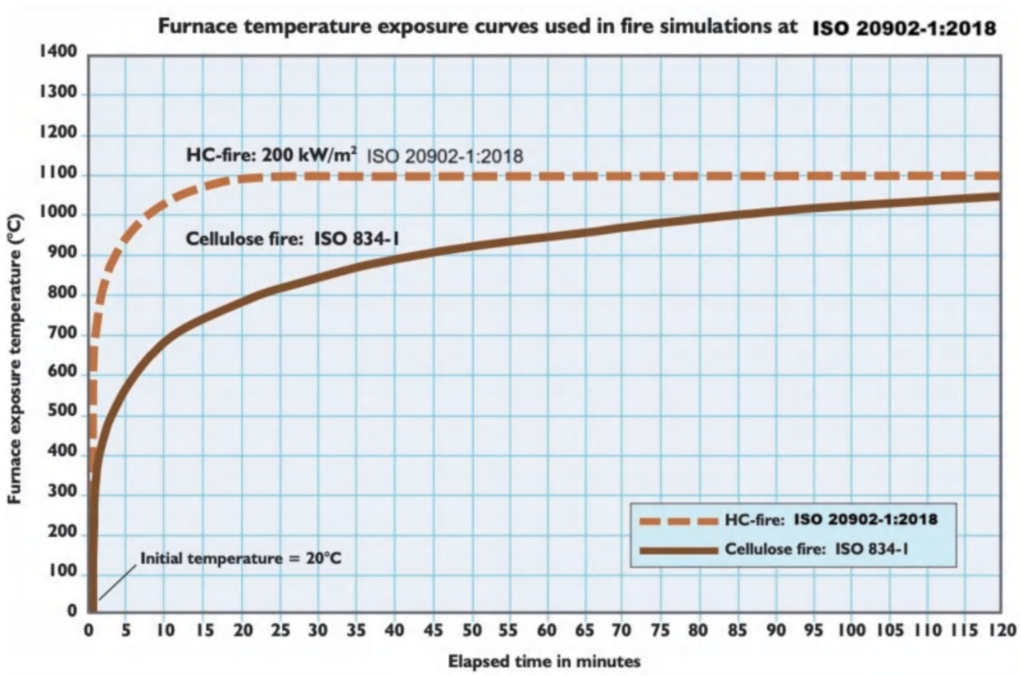
Fire testing of fire divisions

Fire divisions are tested using fire test furnaces. The fire division is fitted into a restraint frame which is then fixed as either a wall (bulkhead) or roof (deck) on a fire test furnace. Classification of fire divisions are classed as H, A, B, or F depending on the degree of fire protection performance required. The furnace is heated in accordance with a temperature/time fire curve relationship.

A-class according to ISO 834-1 and H-class according to ISO 20902-1:2018

A bulkhead fire test furnace

A deck fire test furnace



Graph showing the differences between the IMO FTP code temperature / time curve used for A -Class fire tests and H-Class division fire testing.

A-Class Division

Cellulose fire curves are used for fire testing these A-Class Fire Divisions.

Insulation performance, where it is required, is the time in minutes that the fire division satisfies a specified temperature rise limit on the unexposed face.The average (140°C) and maximum (180 °C) temperature rise limits are applied during the fire test.

The table below summarises the performance requirements of STEEL and Aluminium construction.

Fire division class	Integrity (min.)	Insulation(min.)
A-0	60	0
A-15	60	15
A-30	60	30
A-60	60	60

Fire divisions manufactured from aluminiumAluminium is a non-combustible material but has lower strength at high-temperature than steel. SOLAS II-2 regulations require A-Class aluminium fire resisting bulkheads to be insulated on both faces so that the temperature of the bulkhead does not rise above a level where stability may be lost leading to loss of integrity of the fire division. Compared with steel fire separations, aluminum fire separations shall have an **additional requirement that the structural temperature rise shall not exceed 200 °C**

Average Temp.	Maximum Temp.	Core Temp.
140°C	180°C	200°C

H-Class Division

Hydrocarbon fire curves are used for fire testing these H-Class, Fire Divisions.

The hydrocarbon fire temperature /time curve is significantly more severe in rate of temperature rise and final temperature achieved than the cellulosic fire curve used in the IMO 2010 FTP code. For H-Class fire divisions the fire test is carried out in accordance with the IMO FTP code part 3 with the exception that the hydrocarbon fire temperature/timeCurve is used to heat the furnace instead of the cellulosic fire curve. The Commonly accepted classification rules for the division are also different as shown below.

However, H-class also requirements for the average temperature rise and maximum temperature rise on the unexposed side are the same as A-Class fire divisions, namely that the average temperature rise shall not exceed 140°C, and the maximum temperature rise shall not exceed 180°C.

Class	Integrity (min.)	Insulation (min.)
H-0	120	0
H-60	120	60
H-120	120	120

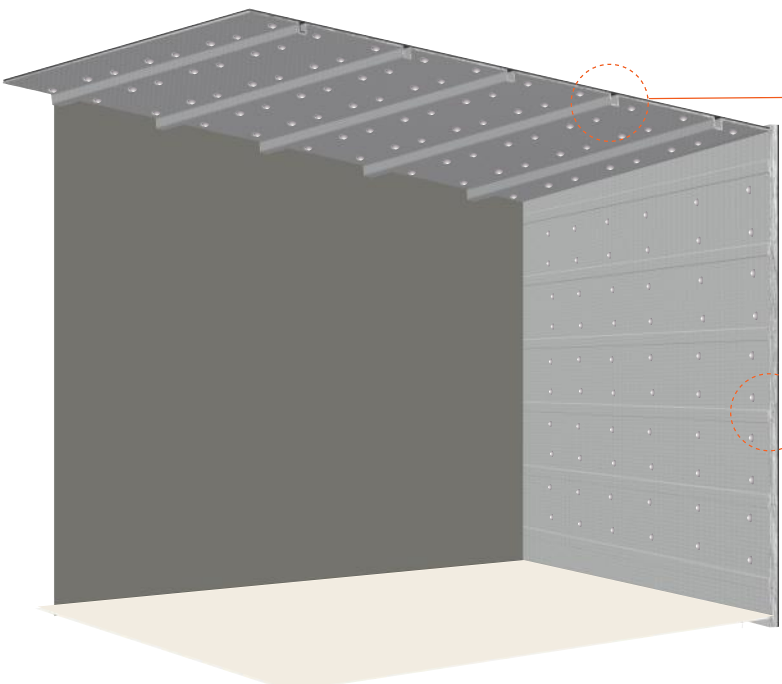
Fire Divisions For Steel Construction

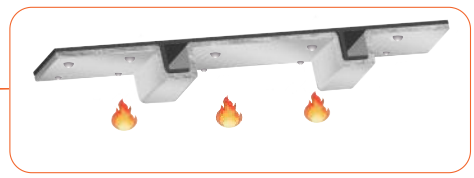
A-30 Class Steel Deck

	Ref	Type	Density(kg/m³)	Thickness (mm)	Weight (kg/m²)	U-Value [W/M2.K]
A-30 Class Steel Deck	Plate	AESWOOL	64	25	1.60	1.32
	Stiffer	AESWOOL	64	25	1.60	1.32

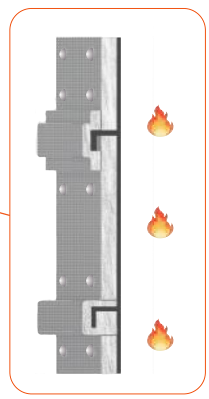
A-30 Class Steel Bulkhead

	Ref	Type	Density(kg/m³)	Thickness (mm)	Weight (kg/m²)	U-Value [W/M2.K]
A-30 Class Steel Bulkhead (Unrestricted)	Plate	AESWOOL	64	45	2.88	0.73
	Stiffer	AESWOOL	64	25	1.60	1.32





A-30 Class Steel Deck



A-30 Class Steel Bulkhead (Unrestricted)

Easy Handling

Fast Installation

Eco-Friendly

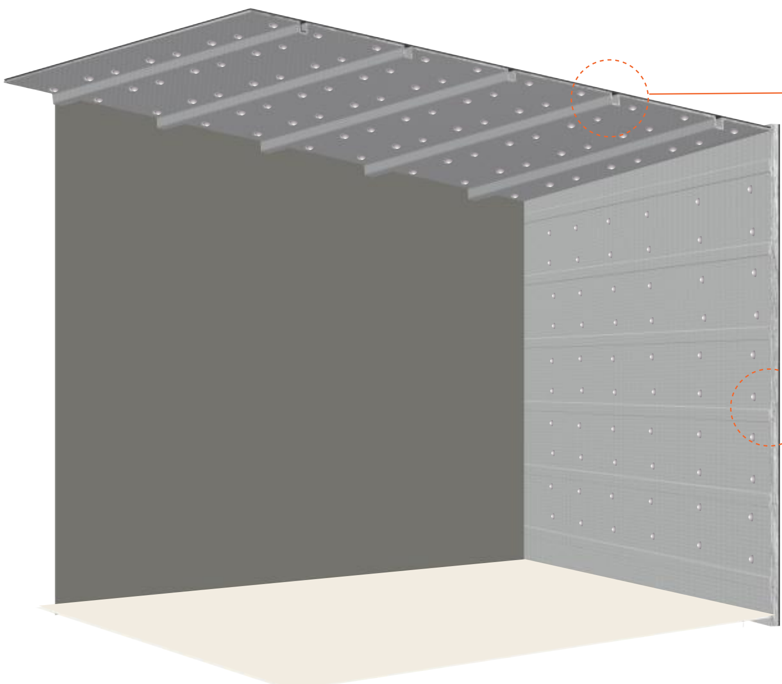
Inorganic Materials

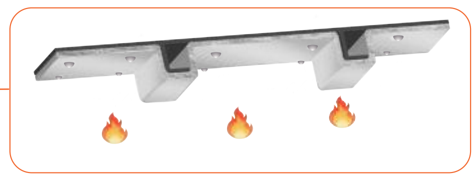
A-60 Class Steel Deck

	Ref	Type	Density (kg/m³)	Thickness (mm)	Weight (kg/m²)	U-Value [W/M2.K]	Rw (dB)
A-60 Class Steel Deck	Plate	AESWOOL	60	50	3.00	0.66	47
	Stiffer	AESWOOL	60	50	3.00	0.66	47

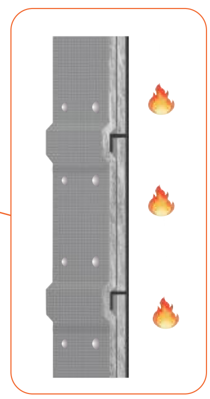
A-60 class steel bulkhead

	Ref	Type	Density (kg/m³)	Thickness (mm)	Weight (kg/m²)	U-Value [W/M2.K]	Rw (dB)
A-60 Steel Bulkhead (Unrestricted)	Plate	AESWOOL	60	50+25	4.50	0.44	>47
	Stiffer	AESWOOL	60	25	1.50	1.32	





A-60 Class Steel Deck



A-60 Steel Bulkhead (Unrestricted)

Easy Handling

Fast Installation

Eco-Friendly

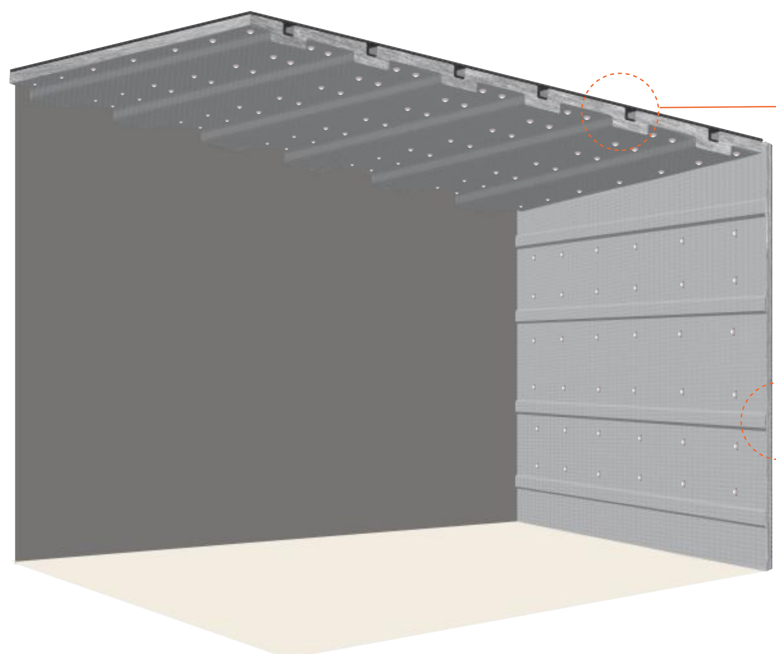
Inorganic Materials

H-60 Class Steel Deck

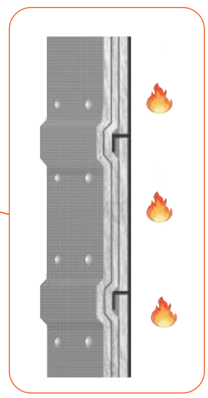
	Ref	Type	Density (kg/m³)	Thickness (mm)	Weight (kg/m²)	U-Value [W/M2.K]	Rw (dB)
H-60 Class Steel Deck	Plate	AESWOOL	80	40+40	6.40	0.41	52
	Stiffer	AESWOOL	80	40+40	6.40	0.41	52

H-60 Class Steel Bulkhead

	Ref	Type	Density (kg/m³)	Thickness (mm)	Weight (kg/m²)	U-Value [W/M2.K]	Rw (dB)
H-60 Class Steel Bulkhead (Unrestricted)	Plate	AESWOOL	80	40+40+40	9.60	0.25	≥52
	Stiffer	AESWOOL	80	40+40	6.40	0.41	



H-60 Class Steel Deck



H-60 Class Steel Bulkhead

Easy Handling

Fast Installation

Eco-Friendly

Inorganic Materials

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04

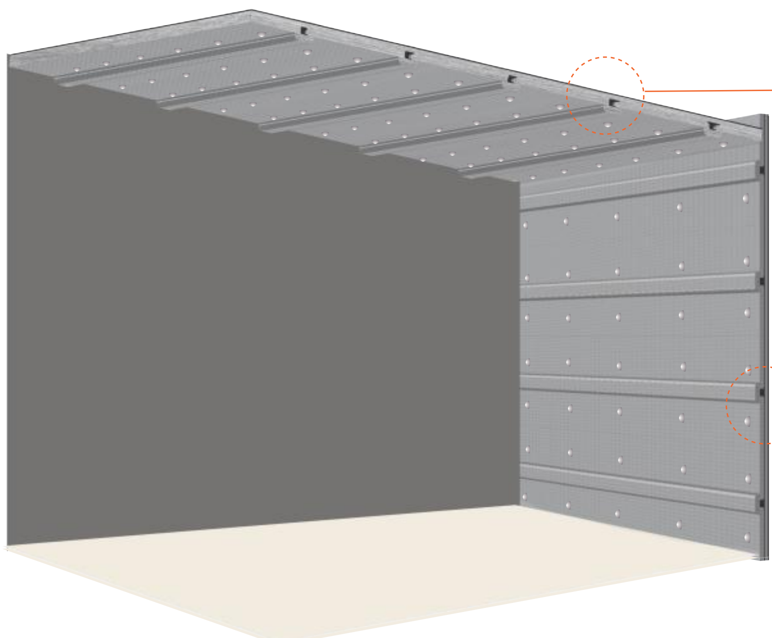
Fire Divisions For Aluminum Construction

A-30 Class Aluminum Deck

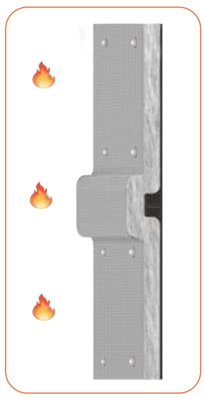
	Ref	Type	Density(kg/m³)	Thickness (mm)	Weight (kg/m²)	U-Value [W/M2.K]	Rw (dB)
A-30 Class Aluminum Deck	Plate	AESWOOL	70	50	3.50	0.66	47
	Stiffer	AESWOOL	70	50	3.50	0.66	47

A-30 class Aluminum bulkhead

	Ref	Type	Density(kg/m³)	Thickness (mm)	Weight (kg/m²)	U-Value [W/M2.K]	Rw (dB)
A-30 Class Aluminum Bulkhead (Restricted)	Plate	AESWOOL	70	50	3.50	0.66	47
	Stiffer	AESWOOL	70	50	3.50	0.66	47



A-30 Class Aluminum Deck



A-30 Class Aluminum Bulkhead (Restricted)

Easy Handling

Fast Installation

Eco-Friendly

Inorganic Materials

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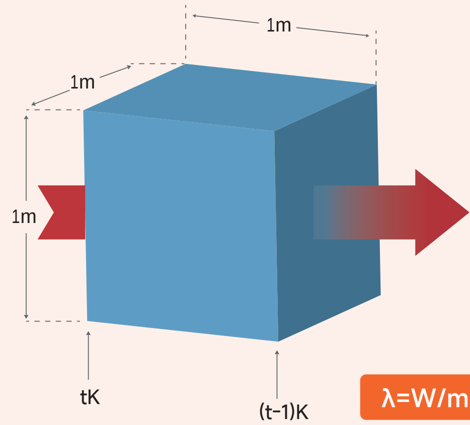
05

Thermal And Acoustic Insulation Of Bulkheads And Decks

□ ermal calculations

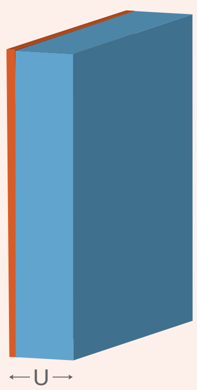
Thermal conductivity (λ)

The lambda (λ) value, also referred to as thermal conductivity, is a value indicating how well a material conducts heat. It indicates the quantity of heat (W), which is conducted through a 1 m 2 wall, in a thickness of 1 m, when the difference in temperature between the opposing surfaces of this wall equals 1 K (or 1°C). In practice, λ is a numerical value expressed in terms of W/(mK). The lower the λ value, the better the insulation property of the material.



λ=W/mK

U value



$U = W/m^2K$

$U = \frac{\lambda}{\text{Thickness}}$

The transport of thermal energy through a structure is expressed by a coefficient, U (Thermal transmittance coefficient). It represents the flow of heat (in W) through 1 m² of a structure, when the difference between the two surrounding temperatures is 1 K (or 1'c). The thermal transmittance coefficient is expressed in W/(m2K). Thelower the coefficient, the better the structure insulates

R-value

Thermal resistance, R' is a measure of the insulation walue of a specified Thickness of an insulation material. It is simply the insulation thickness divided by its thermal conductivity value.

The higher the R-value, the better the insulation.

$R = \frac{1}{U}$ or $R = \frac{\text{Thickness(m)}}{\text{(W/mK)}}$

Thermal resistance, R, is a measure used in aconstruction. The R value is the reciprocal U value.Increasing the thickness of an insulating layerincreases the R value.

AESWOOL Marine blanket U-values and R-values

R-values (m² K/W) and corresponding U-values (W/m²K) for various AESWOOL Plus blanket thicknesses are given in the table

Thickness of blanket	48 kg/m³		60kg/m³	
	R- value	U-value	R- value	U-value
25	0.74	1.36	0.76	1.32
40	1.18	0.85	1.20	0.83
45	1.32	0.76	1.37	0.73
50	1.47	0.68	1.52	0.66
75	2.22	0.45	2.27	0.44

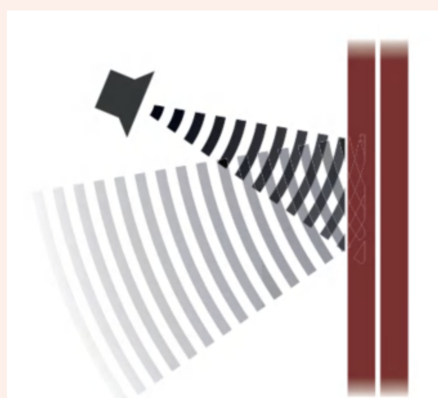
*Basis of calculation: Thermal conductivity of AESWOOL Plus blanket measured at 10°C to BS EN 12667 method : **0.033 W/mK (60kg/m³ density), 0.034 W/mK (48kg/m³ density).**

Acoustic insulation

The acoustic insulation properties of insulation materials are usually expressecin terms of sound absorption or sound reduction/sound transmission loss.Another material property, airflow resistance, is also sometimes used incalculations of acoustic insulation performance.

Sound absorption

Sound absorption is a material property which describes how well sound waves are absorbed in a material. Whena sound wave is absorbed, it simply means that the sound wave is transferred into **another kind of energy i.e. heat.For acoustic insulation requirements,** sound absorptionis relevant when considering noise levels within the samespace as the noise source. The ability of construction walls, floor or roof) to absorb noise will be important to reducing noise reflected back into the room from the surfaces of its boundarie

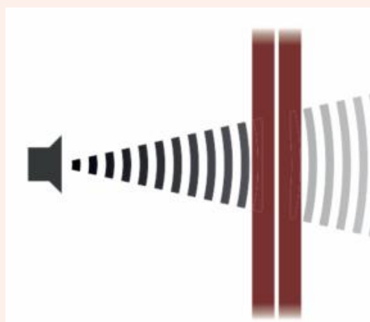


AESWOOL Marine Blanket Sound absorption (60kg/m^3; 50mm)

Frequency (Hz)	Sound absorption coefficient
125	0.45
250	0.90
500	0.75
1000	0.65
2000	0.65
4000	0.45
Overall sound absorption coefficient	0.65

Sound reduction / sound transmission loss

Sound reduction values are specific to constructions rather than a material property. The sound reduction value specifies the reduction of sound throughan element of construction (wall, floor, or roof)For acoustic insulation requirements, the soundreduction value is relevant when considering noise levels in a space that is separate from the noise source.



for example adjacent rooms separated by a wall. Sound reduction values for any construction will vary with the frequency of the sound source.Although sound reduction values for a construction are measured at various frequencies, an overall single figure is used to express the sound reduction value. This figure is called theweighted sound reduction' or sound transmission lossvalue (Rw)

System details	Rw (dB)
60 kg/m3; 50mm AESWOOL Marine blanket with ALGC	47
80 kg/m3; 80mm AESWOOL Marine blanket with ALGC	52

Harmony
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