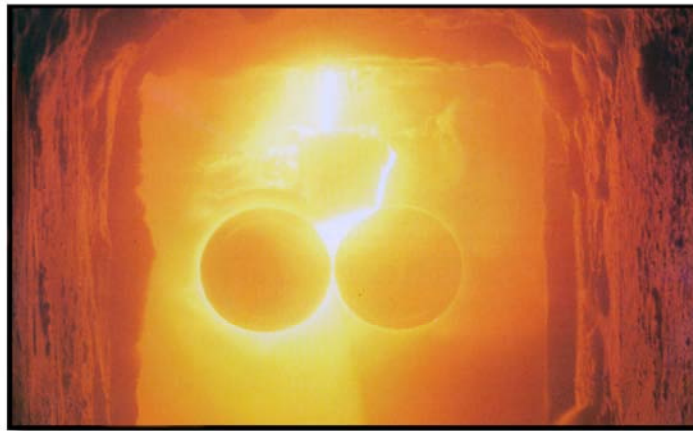


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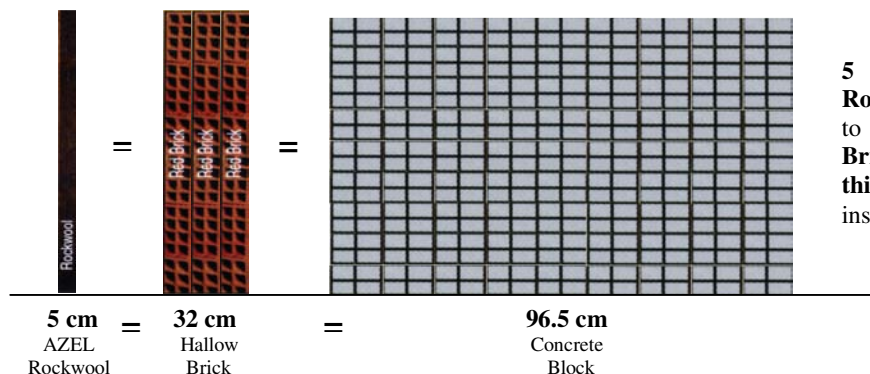
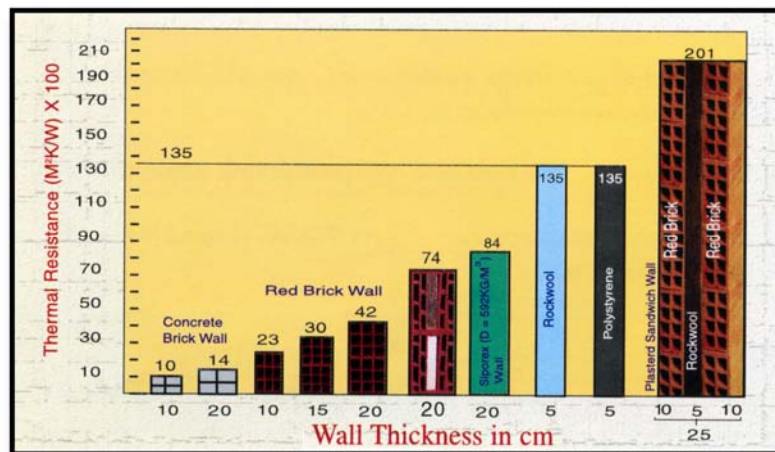
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AZEL National Rockwool Insulation Products Factory, Saudi Arabia's first manufacturer of high quality rockwool insulation products, started its operations in 1993 in the City of Medina. It has since developed a sophisticated manufacturing system to meet the growing demand of its clientele around the Kingdom, in the GCC area, and in Asia.

AZEL Rockwool insulation products are produced from molten basalt rocks and spun to fibers. AZEL uses the most advance spinning technology to produce very fine fibers to achieve the best insulating properties and excellent fire protection qualities for its products.



AZEL Rockwool products have been tested in King Fahd University and have been proven to achieve 70% savings in electricity when used between two red bricks, 10 cm each, as shown in the figure below.



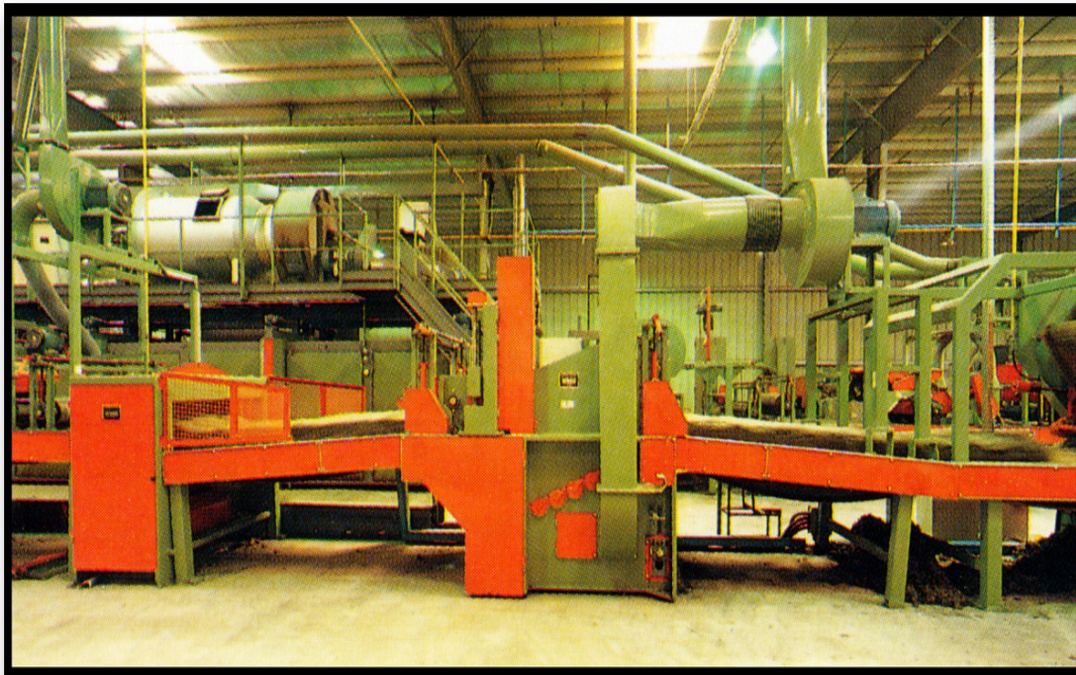
5 cm thick AZEL Rockwool is equivalent to 32 cm thick Hollow Bricks and 96.5 cm thick Light Concrete in insulation value.

AZEL Rockwool insulation is the most versatile FIRE SAFE insulation material. It has been used as THERMAL, ACOUSTIC, and FIRE INSULATION for construction, industrial, agricultural, and marine applications. AZEL rockwool insulation products have been used as Thermal insulation in power plants, desalination and petrochemical plants, refineries, as well as Acoustic and Fire insulation in residential and school buildings, hospitals, offices, and factories.

High quality AZEL Rockwool products meet the requirements of international standards as proven by test certificates of different independent international testing laboratories. AZEL Rockwool products have been approved by SAUDI ARAMCO, SCECO, SABIC, and ENPPI for all their insulation requirements.

**AZEL’s Quality Policy is “to achieve consistently high quality thermo-acoustical insulation products that meet the requirements of customers and offer them maximum satisfaction.”**

Our commitment to our Quality Policy that exemplifies; better customer service, on time delivery, quick response, superior technical back up, and prices that are more competitive puts us ahead of other competitors.



**AZEL National Rockwool Insulation Products Factory**

## GENERAL PROPERTIES AND CHARACTERISTICS



### **CHEMICAL AND PHYSICAL PROPERTIES**

**Chemical composition:** (ASTM C871 - 84)

SiO<sub>2</sub> : 46.6 (%)

Al<sub>2</sub>O<sub>3</sub> : 14.1

TiO<sub>2</sub> : 1.9

Fe<sub>2</sub>O<sub>3</sub> : 12.3

CaO : 11.9

MgO : 8.6

Na<sub>2</sub>O : 3.0

K<sub>2</sub>O : 0.9

P<sub>2</sub>O<sub>5</sub> : 0.4

Chloride : <5mg/kg

No asbestos content

Chemically Inert

**pH** : 7 - 8 (ASTM C871 - 84)

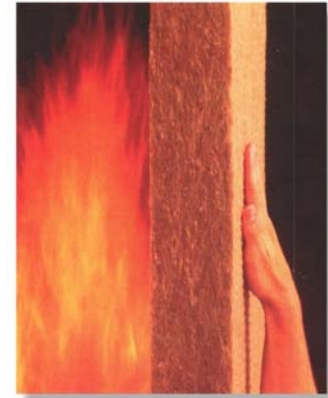
**Fiber Diameter:** 4 - 8 micron

**Fiber Length :** 30-60 mm

**Service Temperature:** -240°C to +800°C (DIN 52 271)

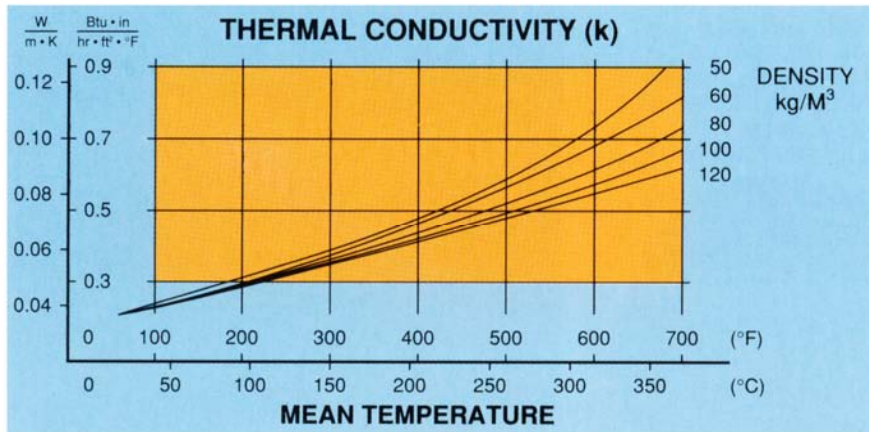
## FIRE PROTECTION PROPERTIES

|                              |  |
|------------------------------|--|
| <b>Surface Flame Spread:</b> | Class 1 (ASTM E84 – 91a <sup>e1</sup> )              |
| <b>Combustibility</b>        | : Non-combustible<br>(ASTM E136 – 82, BS 476: Part4) |
| <b>Fire Resistance</b>       | :  |
| Stability                    | : more than 5 h. (BS 476: Part 8)                    |
| Integrity                    | : more than 4 h.                                     |
| Insulation                   | : more than 1 h                                      |



## THERMAL INSULATION PROPERTIES

Thermal conductivity (ASTM C177 - 85)



## ACOUSTIC INSULATION PROPERTIES

**STC value** : 44 (when used in gypsum board composite wall)  
**Sound Transmission Class (STC)** is a number rating which express the sound power transferred though a barrier.

**Coefficients of Sound Absorption** (DIN/EN 20 354)

| Density<br>(kg/m <sup>3</sup> ) | Sound Frequency in Hz |      |      |      |      |      |
|---------------------------------|-----------------------|------|------|------|------|------|
|                                 | 125                   | 250  | 500  | 1000 | 2000 | 4000 |
| 50                              | 0.22                  | 0.62 | 0.88 | 0.96 | 1.00 | 1.00 |
| 60                              | 0.22                  | 0.62 | 0.90 | 0.98 | 1.00 | 1.00 |
| 70                              | 0.23                  | 0.62 | 0.91 | 1.06 | 1.00 | 1.00 |
| 80                              | 0.23                  | 0.66 | 0.96 | 1.06 | 1.00 | 1.00 |
| 100                             | 0.25                  | 0.67 | 1.00 | 1.06 | 1.00 | 1.00 |

**Sound Reduction Index (dB)**

| Thickness<br>(mm) | Sound Frequency in Hz |     |     |      |      |      |
|-------------------|-----------------------|-----|-----|------|------|------|
|                   | 125                   | 250 | 500 | 1000 | 2000 | 4000 |
| <b>50</b>         | 15                    | 21  | 22  | 38   | 52   | 61   |
| <b>80</b>         | 16                    | 22  | 23  | 40   | 54   | 63   |
| <b>100</b>        | 16                    | 22  | 24  | 43   | 57   | 67   |
| <b>140</b>        | 17                    | 23  | 27  | 45   | 60   | 70   |



## **DIMENSIONAL STABILITY**

### **Compressive Properties (ASTM C 165 – 92)**

Typical compression property of Panel Board, 100kg/m<sup>3</sup>

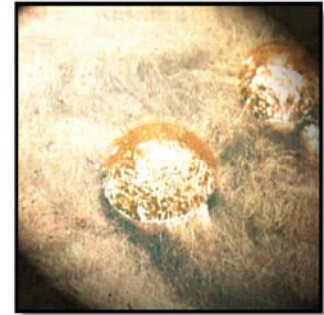
|                       |     |   |   |   |   |   |    |
|-----------------------|-----|---|---|---|---|---|----|
| <b>Pressure, Kpa*</b> | 1   | 2 | 3 | 4 | 5 | 6 | 7  |
| <b>Compression. %</b> | 1.5 | 3 | 4 | 6 | 7 | 9 | 10 |

AZEL Rockwool Panel Boards, with a density of 140kg/m<sup>3</sup> have a compression of 7% when subjected to a 1,000 kg per square meter of load.

\* Kilo Pascal (Kpa) = 102 kg/m<sup>2</sup>

## **WATER RESISTANCE PROPERTIES**

AZEL Rockwool repels water due to its non-hygroscopic and non-capillary properties. It does not absorb moisture from the air. When soaked in water and let dried naturally, AZEL rockwool retains its original insulating properties.



## **BIOLOGICAL PROPERTIES**

AZEL Rockwool products are completely vermin and rot proof and do not encourage fungi, moulds, or bacterial growth. (ASM C 665 – 91)

## **HEALTH ISSUES**

AZEL Rockwool products are made from neutral stable rocks. They are non-carcinogenic, as proven at the WORLD HEALTH ORGANIZATION (W.H.O.) congress in April 1983. Likewise, in a recent International Agency for Research and Cancers (IARC), an arm of WHO, study of synthetic mineral fiber production workers in seven European countries found that rockwool products are health safe materials.

**AZEL Rockwool products are not asbestos, are not asbestos substitutes, and do not contain asbestos substance.**

## **STORAGE AND HANDLING**

AZEL Rockwool Insulations, being light in weight, are very easy to handle. They can be cut to shape or size with a sharp knife.

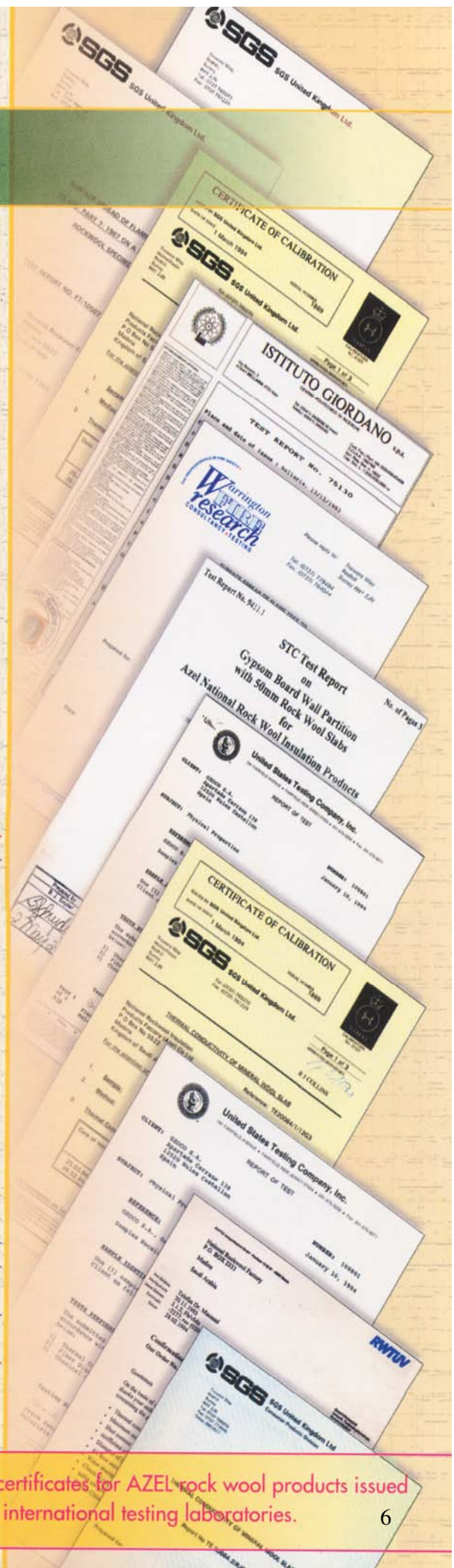
AZEL Rockwool Insulation products are usually supplied in polythene bags or shirk-wrapped polythene packs, which provide short-term protection. For long-term protection purposes, rockwool products should be stored safely in a building.

If rockwool insulation has to be stored outside, it should be stacked clear of the ground and covered with a securely-anchored weather protection. Rockwool insulations should not be left exposed to the weather.

Should rockwool insulation becomes wet, it should be allowed to dry naturally before other finishes are applied. When dried-out naturally, the rockwool does not detract from its original thermal properties.

## Test Conducted on AZEL Rockwool

- |  |  |
|--|--|
| <b>1. Chemical Composition</b>             | <ul style="list-style-type: none"> <li>• RWTUV, Germany</li> <li>• SGS, UK</li> <li>• US Testing Co. Inc.</li> </ul>           |
| <b>2. Dimensions and Bulk Density</b>      | <ul style="list-style-type: none"> <li>• RWTUV, Germany</li> </ul>   |
| <b>3. Fiber Diameter and Length</b>        | <ul style="list-style-type: none"> <li>• US Testing Co. Inc.</li> </ul>  |
| <b>3. Behavior at Elevated Temperature</b> | <ul style="list-style-type: none"> <li>• RWTUV, Germany</li> </ul>   |
| <b>4. Fusion Point</b>                     | <ul style="list-style-type: none"> <li>• Istituto Giordano, Italy</li> </ul>   |
| <b>5. Thermal Conductivity</b>             | <ul style="list-style-type: none"> <li>• SGS, UK</li> <li>• Istituto Giordano, Italy</li> <li>• US Testing Co. Inc.</li> </ul> |
| <b>6. Non-combustibility</b>               | <ul style="list-style-type: none"> <li>• Warrington Fire Research</li> </ul>   |
| <b>7. Surface Flame Spread</b>             | <ul style="list-style-type: none"> <li>• Warrington Fire Research, US</li> <li>• SGS, UK</li> </ul>                            |
| <b>8. Shot Content</b>                     | <ul style="list-style-type: none"> <li>• SGS, UK</li> </ul>  |
| <b>9. Water Absorption</b>                 | <ul style="list-style-type: none"> <li>• RWTUV, Germany</li> </ul>   |
| <b>10. Air Flow Resistance</b>             | <ul style="list-style-type: none"> <li>• RWTUV, Germany</li> </ul>   |
| <b>11. Sound Transmission Class</b>        | <ul style="list-style-type: none"> <li>• NU Laboratories, US</li> </ul>  |
| <b>12. Sound Absorption</b>                | <ul style="list-style-type: none"> <li>• RWTUV, Germany</li> </ul>   |



## AZEL Duct Roll Insulation

Manufactured in accordance with ASTM C612



### Description

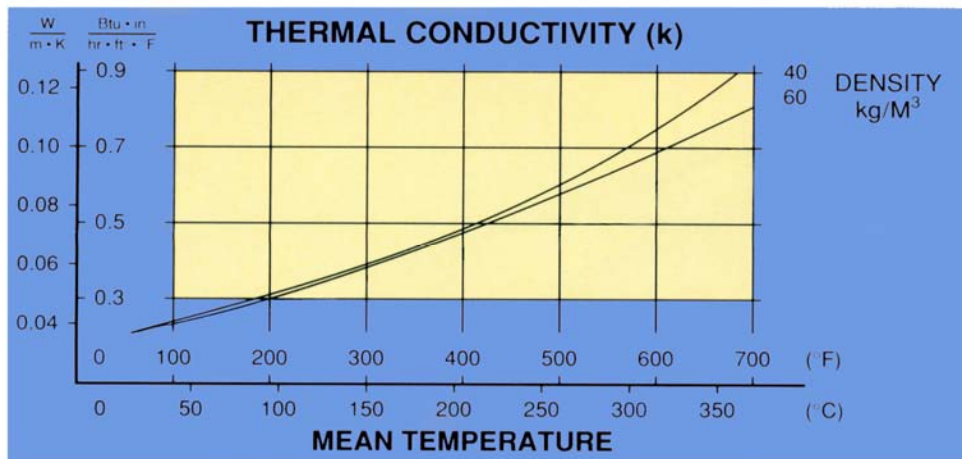
AZEL Rockwool Duct Roll Insulation is a low density blanket insulation that is produced from molten mineral basalt rocks spun to fine fibers, sprayed with thermo-setting binder and cured to form felt. It could withstand an operating temperature up to 750°C. It is easy to cut and handle.

### Applications:

AZEL Rockwool Duct Roll Insulation is used as Thermal, Acoustic, and Fire Insulation for flat and curved surfaces operating at a maximum temperature of 750°C. Duct Roll Insulation is designed for use in commercial and industrial applications as external liners for Heating, Ventilating, and Air Conditioning ducts to prevent condensation. It is used in cavity walls and ceilings of residential and school buildings, hospitals, offices, auditoriums, broadcasting stations, and factories.

### Product Properties

Thermal Conductivity ASTM C 177





### Thermal Resistance (R value)

| Thickness<br>mm | R Value, m <sup>2</sup> K/ W |                     |                     |                     |
|-----------------|------------------------------|---------------------|---------------------|---------------------|
|                 | 30kg/m <sup>3</sup>          | 40kg/m <sup>3</sup> | 50kg/m <sup>3</sup> | 60kg/m <sup>3</sup> |
| 25              | 0.68                         | 0.68                | 0.70                | 0.72                |
| 30              | 0.81                         | 0.81                | 0.84                | 0.86                |
| 40              | 1.08                         | 1.08                | 1.12                | 1.15                |
| 50              | 1.36                         | 1.36                | 1.4                 | 1.44                |
| 60              | 1.63                         | 1.63                | 1.68                | 1.72                |
| 75              | 2.03                         | 2.03                | 2.10                | 2.16                |
| 100             | 2.71                         | 2.71                | 2.80                | 2.87                |

### Service Temperature

Has service temperature range from -240°C to +750°C, as tested according to (DIN 52 271).

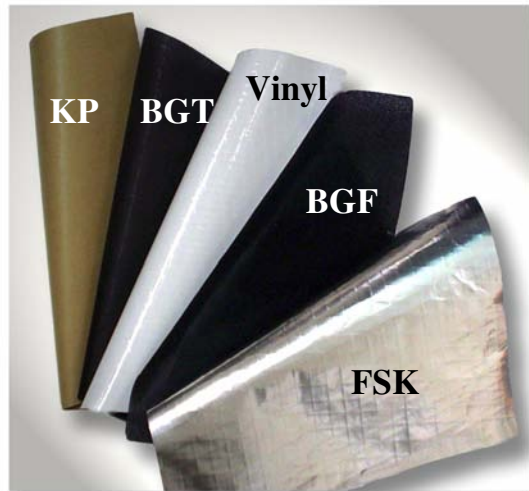
### Product highlights:

- Low Thermal Conductivity
- Excellent Thermal and Acoustic insulation
- Non-combustible
- Water repellent
- Easy to handle
- Chemically inert
- Environment friendly

### Facing Materials:

- Aluminum Foil (\*FSK)
- Kraft Paper (KP)
- Vinyl
- Black Glass Tissue (BGT)
- Black Glass Fabric (BGF)

- \* Description of Aluminum Facing per ASTM, consisting of:  
**Aluminum Foil + Kraft Paper + Glass Scrim**

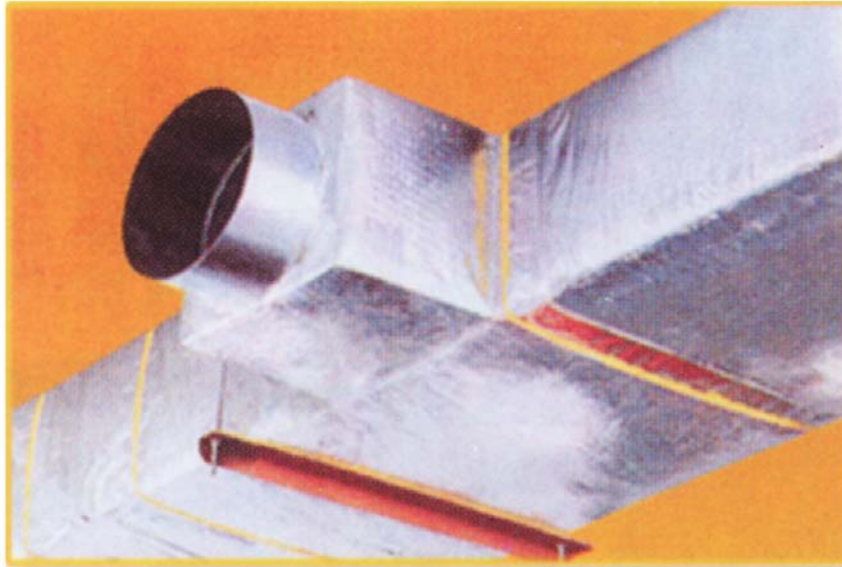


### Product Dimensions and Specifications

| Density, kg/m <sup>3</sup> | Thickness, mm                            | Standard Sizes |           |
|----------------------------|--|----------------|-----------|
|                            |  | Length, M*     | Width, M* |
| 30, 40, 50, 60             | 25, 30, 40, 50, 60, 75, 100              | 10, 20         | 1.2       |
|                            | * other sizes are available upon request |                |           |

**Packaging**

Inside individually sealed plastic bag.



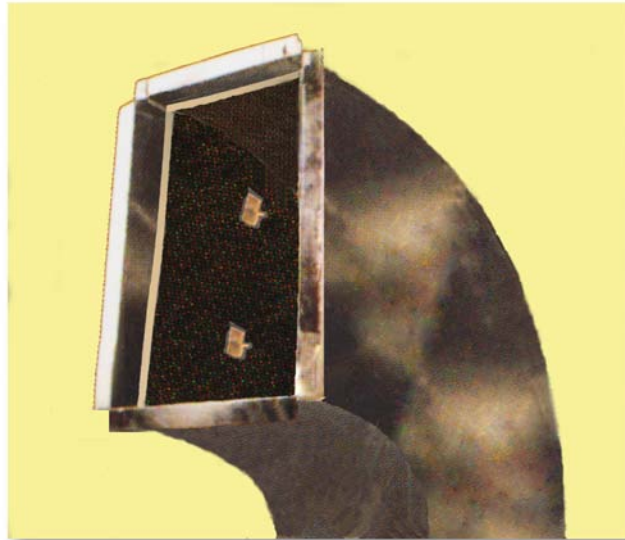
Duct Roll Insulation used as outer insulation for air ducts in HVAC applications.



Duct Roll Insulation with wire mesh support used as external insulation for air ducts in HVAC applications. Wire Mesh is sold separately.

## AZEL Duct Inner-Board Insulation

Manufactured in accordance with ASTM C612



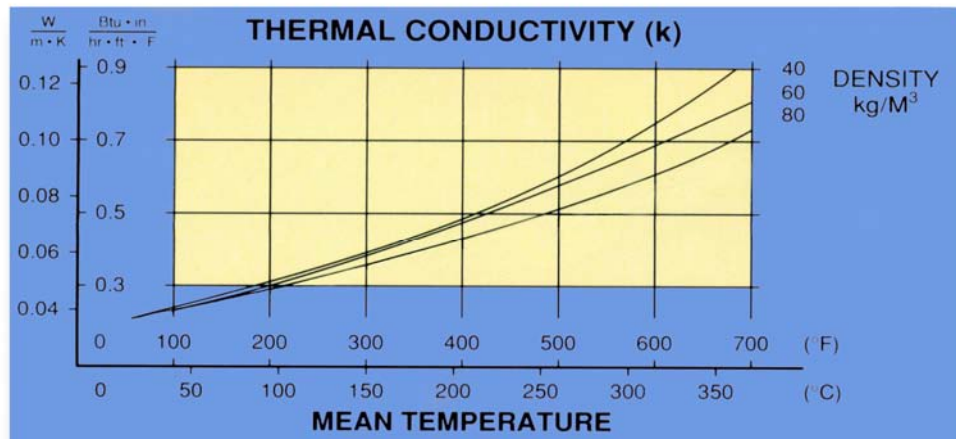
### Description

AZEL Rockwool Duct Inner-Board Insulation is a low density semi-rigid board insulation that is produced from molten mineral basalt rocks spun to fine fibers, sprayed with thermo-setting binder and cured. It could withstand an operating temperature up of 750°C. It is easy to cut and handle.

### Applications:

AZEL Rockwool Duct Inner-Board Insulation is used as Thermal, Acoustic, and Fire Insulation for flat and slightly curved surfaces operating at a maximum temperature of 750°C. Duct Inner Board Insulation is designed for use in commercial, industrial, and residential applications as internal liners for Heating, Ventilating, and Air Conditioning ducts; air handling equipment (1.58 kN s/m<sup>3</sup>-max airflow resistance); and cavity walls and ceilings of residential and school buildings, hospitals, offices, auditoriums, broadcasting stations, and factories.

### Product Properties



**Thermal Resistance (R value)**

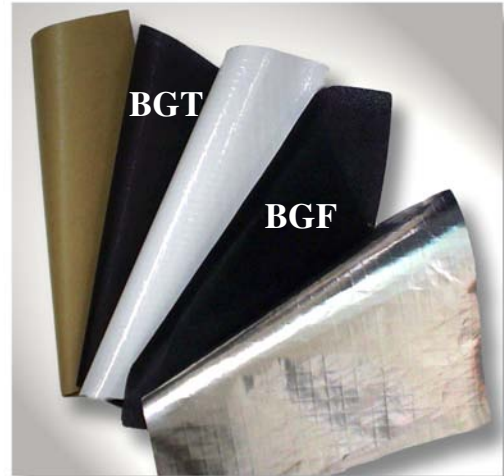
| Thickness<br>mm | R Value, m <sup>2</sup> K/ W |                     |                     |                     |                     |
|-----------------|------------------------------|---------------------|---------------------|---------------------|---------------------|
|                 | 40kg/m <sup>3</sup>          | 50kg/m <sup>3</sup> | 60kg/m <sup>3</sup> | 70kg/m <sup>3</sup> | 80kg/m <sup>3</sup> |
| 25              | 0.68                         | 0.70                | 0.72                | 0.73                | 0.74                |
| 30              | 0.81                         | 0.84                | 0.86                | 0.87                | 0.88                |
| 40              | 1.08                         | 1.12                | 1.15                | 1.16                | 1.18                |
| 50              | 1.36                         | 1.4                 | 1.44                | 1.45                | 1.47                |

**Service Temperature**

Has service temperature range from -240°C to +750°C, as tested according to (DIN 52 271).

**Product highlights:**

- Low Thermal Conductivity
- Excellent Thermal and Acoustic insulation
- Non-combustible
- Water repellent
- Easy to handle
- Chemically inert
- Environment friendly



**Facing Materials:**

- Black Glass Tissue (BGT)
- Black Glass Fabric (BGF)

**Product Dimensions and Specifications**

| Density, kg/m <sup>3</sup> | Thickness, mm                            | Standard Size |           |
|----------------------------|--|---------------|-----------|
|                            |  | Length, M*    | Width, M* |
| 40, 50, 60, 70,<br>80      | 25, 30, 40, 50                           | 1.0           | 1.2       |
|                            | * other sizes are available upon request |               |           |

**Packaging**

Inside individually sealed plastic bag.

## AZEL Wall Board Insulation

Manufactured in accordance with ASTM C612



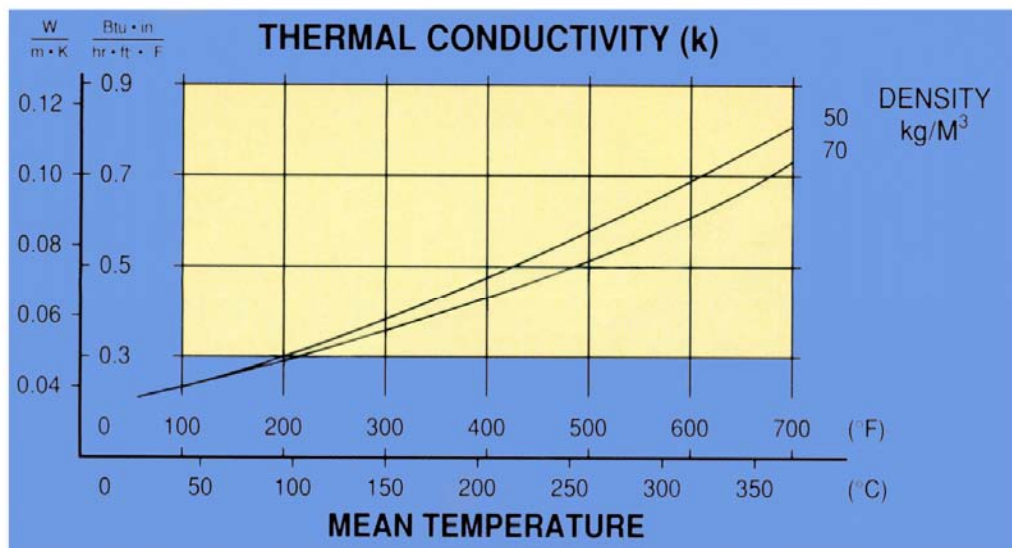
### Description

AZEL Rockwool Wall Board Insulation is a low density board insulation that is produced from molten mineral basalt rocks, spun into fine fibers, sprayed with thermo-setting binder and cured to form into board. It has fire resistance stability of more than 5 hours. It is easy to cut and handle.

### Applications:

AZEL Rockwool Wall Boards are used as Thermal, Acoustic, and Fire Insulation for flat surfaces operating at a maximum temperature of 750°C. They are installed on wall or in cavity walls of residential and school buildings, hospitals, offices, auditoriums, broadcasting stations, and factories.

### Product Properties



### Thermal Resistance (R value)

| Thickness<br>mm | R Value, m <sup>2</sup> K/ W |                     |                     |
|-----------------|------------------------------|---------------------|---------------------|
|                 | 50kg/m <sup>3</sup>          | 60kg/m <sup>3</sup> | 70kg/m <sup>3</sup> |
| 25              | .70                          | 0.72                | 0.73                |
| 30              | 0.84                         | 0.86                | 0.87                |
| 40              | 1.12                         | 1.15                | 1.16                |
| 50              | 1.4                          | 1.44                | 1.45                |
| 60              | 1.68                         | 1.72                | 1.74                |
| 75              | 2.10                         | 2.16                | 2.18                |
| 100             | 2.80                         | 2.87                | 2.91                |

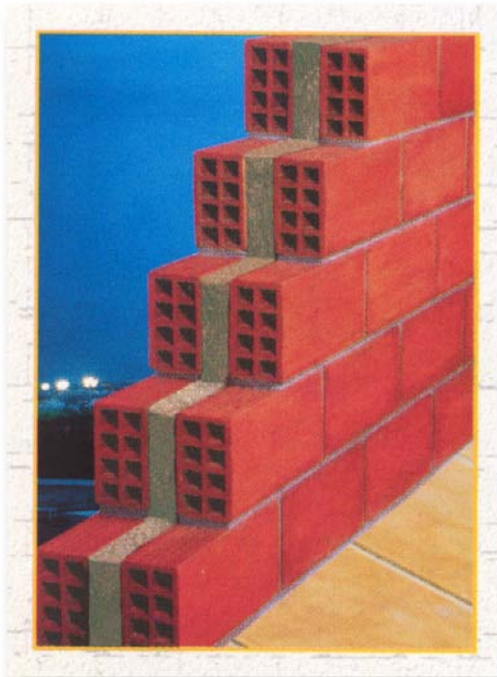
**Test Report from King Fahd University shows that AZEL Rockwool Wall Board Insulation achieved a Thermal Resistance of 2.01 m<sup>2</sup> K/W when used between two bricks of 10 cm thick.**

### Service Temperature

Has service temperature range from -240°C to +750°C, as tested according to (DIN 52 271).

### Product highlights:

- Low Thermal Conductivity
- Excellent Thermal and Acoustic insulation
- Non-combustible
- Water repellent
- Easy to handle



**AZEL Rockwool Wall Board Insulation has the following Fire Resistance properties:**

- Stability** : more than 5 hours
- Integrity** : more than 4 hours
- Insulation** : more than 1 hour

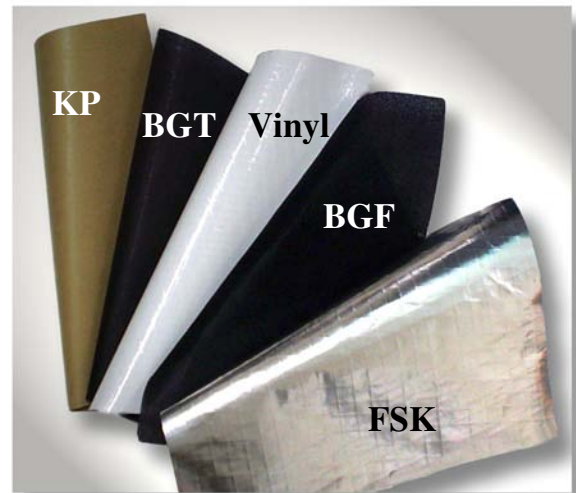
### Energy Savings

**AZEL Rockwool products have been tested in King Fahd University and have been proven to achieve 70% savings in electricity when used between two red bricks, 10 cm each, as shown in this figure.**

### Facing Materials:

- Aluminum Foil (\*FSK)
- Black Glass Tissue (BGT)
- Black Glass Fabric (BGF)
- Vinyl
- Kraft Paper (KP)
- Bare or un-faced

\* Description of Aluminum Facing per ASTM, consisting of:  
**Aluminum Foil + Kraft Paper + Glass Scrim**



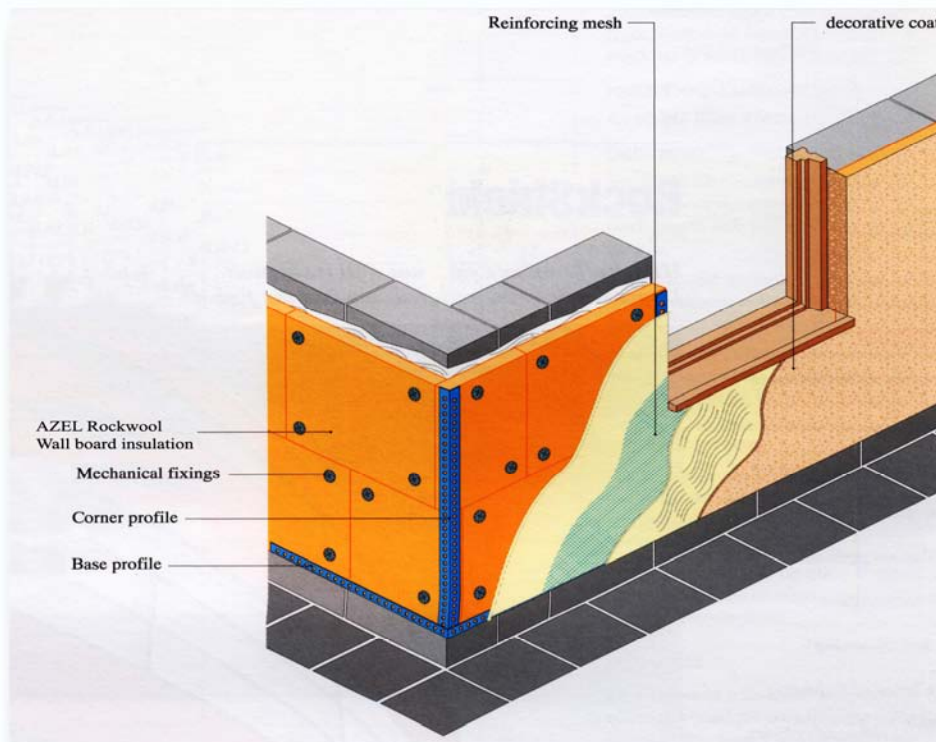
### Product Dimensions and Specifications

| Density, kg/m <sup>3</sup>               | Thickness, mm           | Standard Size |           |
|--|-------------------------|---------------|-----------|
|  |                         | Length, M*    | Width, M* |
| 50, 60, 70                               | 25, 30, 40, 50, 75, 100 | 1.2           | 0.6       |
| * other sizes are available upon request |                         |               |           |

### Packaging

Inside individually sealed plastic bags upon customer request.

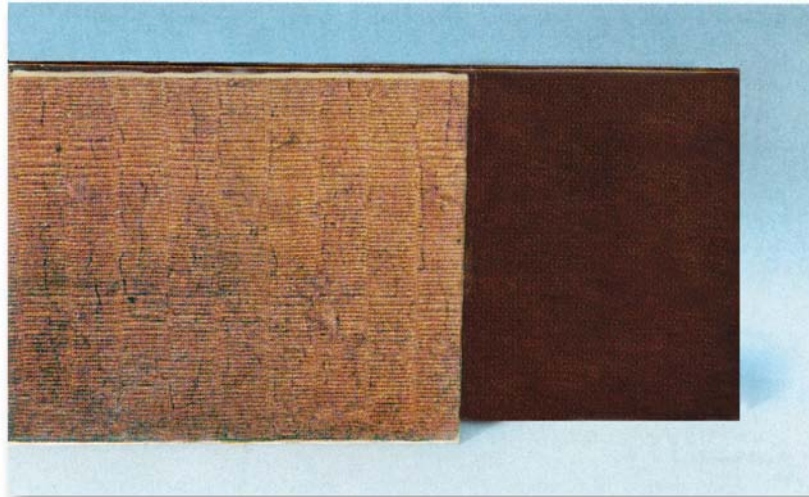
### Method of application



AZEL Rockwool Wall Board Insulation can be installed on the external surface of the perimeter wall of old buildings to improve Thermal Resistance and to save working space inside. Usual decorative slabs or coat can be fixed over the wall board insulation.

## AZEL Sound Insulation Board

Manufactured in accordance with ASTM C612



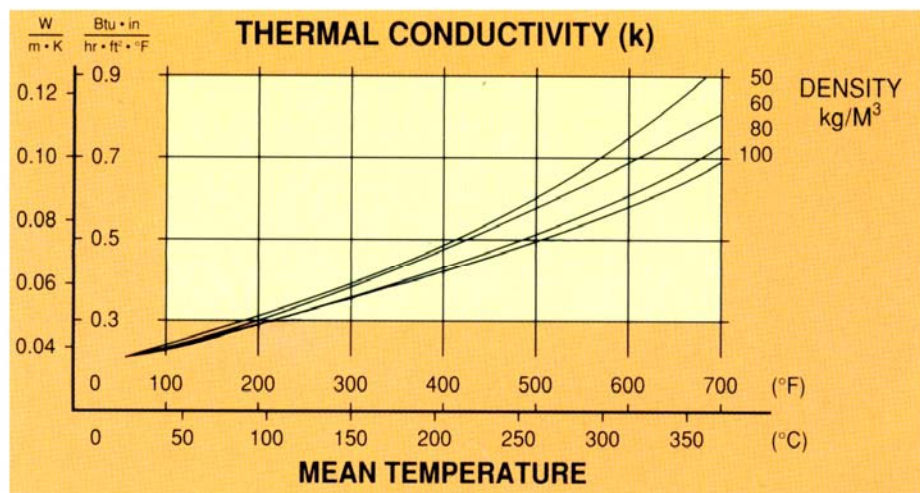
### Description

AZEL Rockwool Sound Insulation Board is a low to medium high density board insulation that is produced from molten mineral basalt rocks spun to fine fibers, sprayed with thermo-setting binder and cured to form board. It has excellent sound absorbing property. It is easy to cut and handle.

### Applications:

AZEL Rockwool Sound Insulation Boards are used as Thermal, Acoustic and Fire Insulation for flat surfaces operating at a maximum temperature of 750°C. They are installed in cavity walls, roofs, and floors of residential and school buildings, hospitals, offices, auditoriums, broadcasting stations, and factories.

### Product Properties



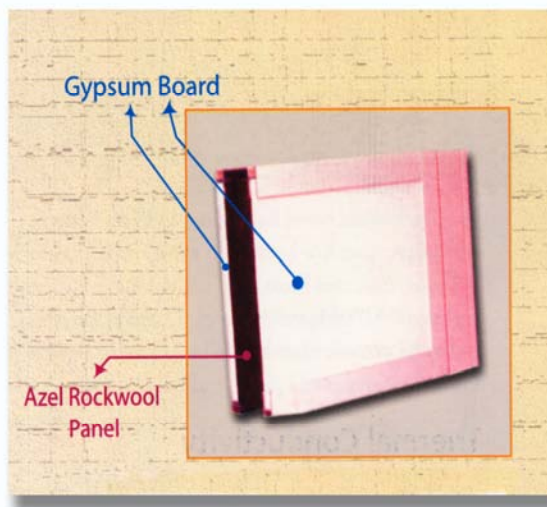


## Typical Sound Absorption Coefficient

| Density<br>(kg/m <sup>3</sup> ) | Sound Frequency in Hz |      |      |      |      |      |
|---------------------------------|-----------------------|------|------|------|------|------|
|                                 | 125                   | 250  | 500  | 1000 | 2000 | 4000 |
| 50                              | 0.22                  | 0.62 | 0.88 | 0.96 | 1.00 | 1.00 |
| 60                              | 0.22                  | 0.62 | 0.90 | 0.98 | 1.05 | 1.00 |
| 70                              | 0.23                  | 0.62 | 0.91 | 1.06 | 1.00 | 1.00 |
| 80                              | 0.23                  | 0.66 | 0.96 | 1.06 | 1.00 | 1.00 |
| 100                             | 0.25                  | 0.67 | 1.00 | 1.06 | 1.00 | 1.00 |

## Sound Transmission Class

Sound Transmission Class is a number rating which express the sound power transferred through a barrier.



STC Test from NU Laboratories, USA shows the following results:

| Composite Wall System  | STC |
|--|-----|
| Gypsum Boards<br>15mm on<br>both sides<br>+ AZEL<br>Rockwool,<br>50mm<br>thick | 40  |
| Gypsum Boards<br>15mm on<br>both sides<br>+ AZEL<br>Rockwool,<br>50mm<br>thick | 44  |

## Service Temperature

Has service temperature range from -240°C to +750°C, as tested according to (DIN 52 271).

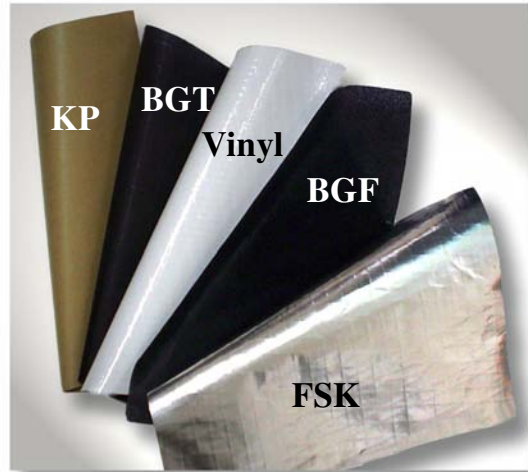
## Product highlights:

- Low Thermal Conductivity
- Excellent Thermal and Acoustic insulation
- Non-combustible
- Water repellent
- Easy to handle
- Chemically inert
- Environment friendly

**Facing Materials:**

Aluminum Foil (\*FSK)  
 Black Glass Tissue (BGT)  
 Black Glass Fabric (BGF)  
 Vinyl  
 Kraft Paper (KP)  
 Bare or un-faced

\* Description of Aluminum Facing per  
 ASTM, consisting of:  
**Aluminum Foil + Kraft Paper + Glass  
 Scrim**

**Product Dimensions and Specifications**

| Density, kg/m <sup>3</sup>               | Thickness, mm           | Standard Size |           |
|--|-------------------------|---------------|-----------|
|  |                         | Length, M*    | Width, M* |
| 50, 60, 70, 100                          | 25, 30, 40, 50, 75, 100 | 1.2           | 0.6       |
| * other sizes are available upon request |                         |               |           |

**Packaging**

Inside individually sealed plastic bags upon customer request.

**AZEL Concrete Roof Board Insulation**  
 Manufactured in accordance with ASTM C612



**Description**

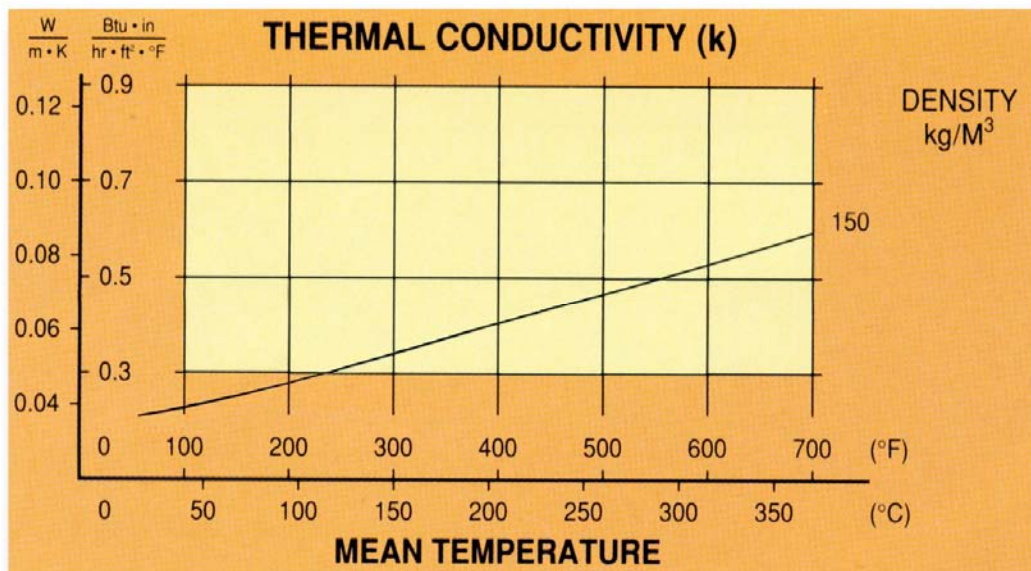
AZEL Rockwool Concrete Roof Board Insulation is a high density board insulation that is produced from molten mineral basalt rocks spun to fine fibers, sprayed with thermo-setting binder and cured to form board. It has high compression resistance but it is easy to cut and handle.

**Applications:**

AZEL Rockwool Concrete Roof Board Insulation are used as Thermal Insulation for concrete roof decks, as well as metal sheet roof of residential and school buildings, hospitals, offices, auditoriums, broadcasting stations, and factories.

**Product Properties**

Thermal Conductivity



## Thermal Conductivity

| Density<br>Kg/m <sup>3</sup> | Thermal Conductivity, W/m k |        |        |       |        |       |       |
|------------------------------|-----------------------------|--------|--------|-------|--------|-------|-------|
|                              | 50°C                        | 100 °C | 150 °C | 200°C | 250 °C | 300°C | 350°C |
| 150                          | 0.038                       | 0.042  | 0.048  | 0.056 | 0.064  | 0.075 | 0.084 |

## Compression Properties

| Density<br>Kg/m <sup>3</sup> | % Compression |       |       |       |        |        |        |
|------------------------------|---------------|-------|-------|-------|--------|--------|--------|
|                              | 4 Kpa         | 6 Kpa | 7 Kpa | 8 Kpa | 12 Kpa | 16 Kpa | 20 Kpa |
| 150                          | 1             | 2     | 2.5   | 3     | 5      | 6      | 8      |

\* Kilo Pascal (Kpa) = 102 kg(f)/m<sup>2</sup>

## Service Temperature

Has service temperature range from -240°C to +750°C, as tested according to (DIN 52 271).

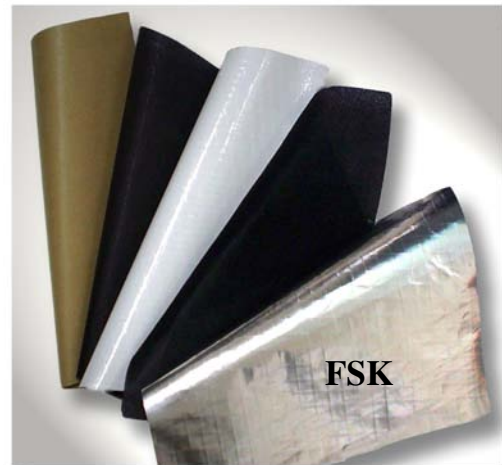
## Product highlights:

- Low Thermal Conductivity
- Excellent Thermal and Acoustic insulation
- Non-combustible
- Water repellent
- Easy to handle
- Chemically inert
- Environment friendly

## Facing Materials:

- Aluminum Foil (\*FSK)
- Plastic Bag

- \* Description of Aluminum Facing per ASTM, consisting of:  
**Aluminum Foil + Kraft Paper + Glass Scrim**



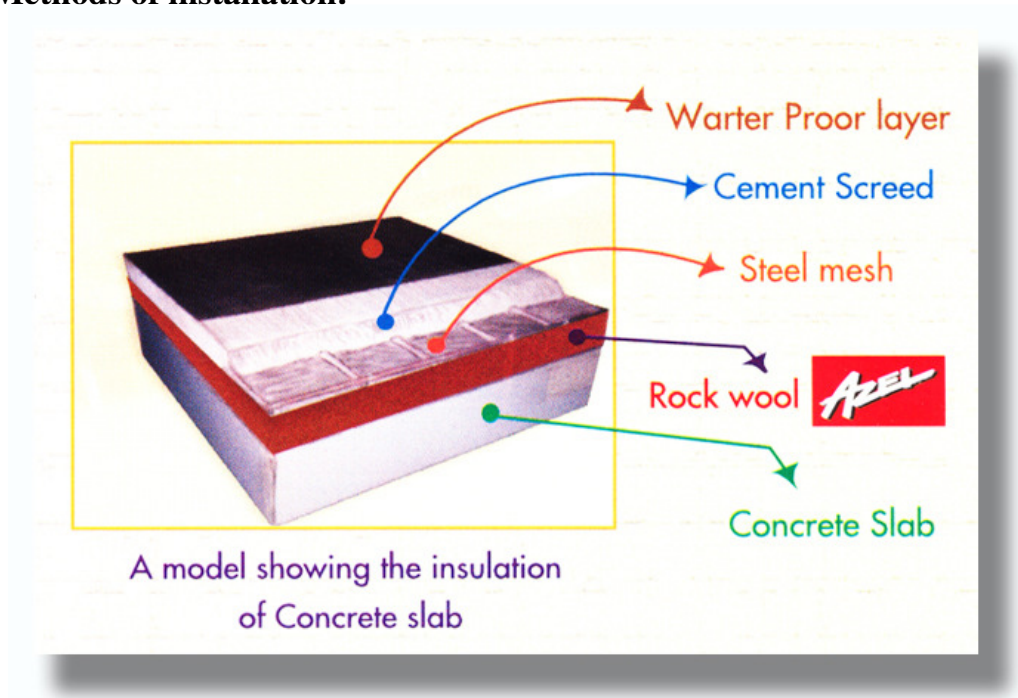
## Product Dimensions and Specifications

| Density, kg/m <sup>3</sup> | Thickness, mm                            | Standard Size |           |
|----------------------------|--|---------------|-----------|
|                            |  | Length, M*    | Width, M* |
| 150                        | 40, & 50                                 | 1.2           | 0.6       |
|                            | * other sizes are available upon request |               |           |

## Packaging

Polyethylene plastic bags

## Methods of installation:



Workers installing Rockwool Concrete Board over waterproofing material

## AZEL Felt Insulation

Manufactured in accordance with ASTM C553 and C665



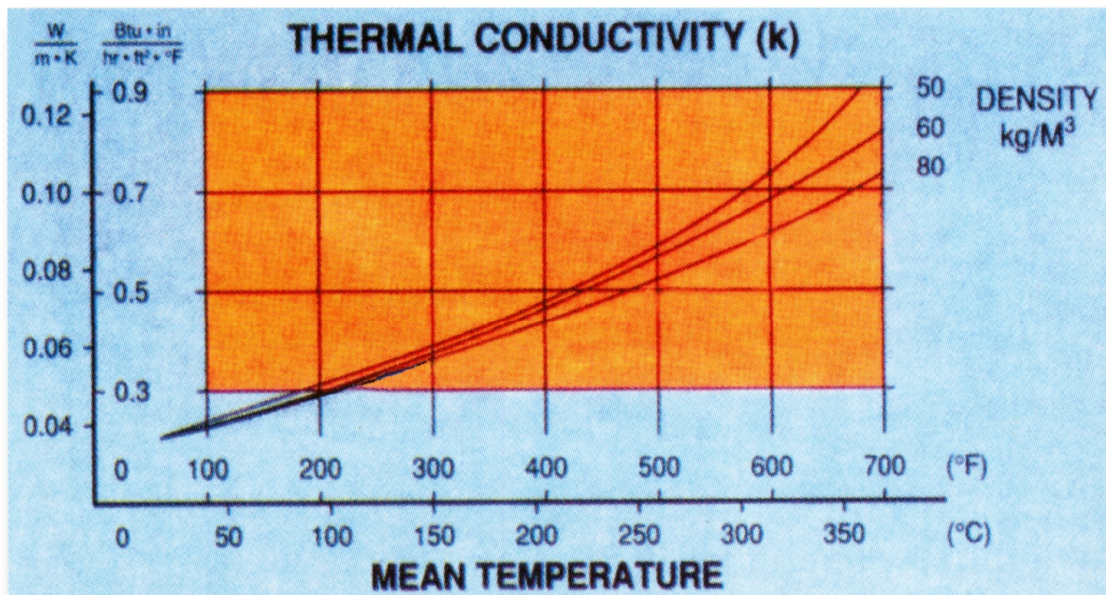
### Description

AZEL Rockwool Felt Insulation is a low density blanket insulation that is produced from molten mineral basalt rocks, spun to fine fibers, sprayed with thermo-setting binder and cured to form felt. It could withstand an operating temperature up to 750°C. It is easy to cut and is suited for irregularly shaped surfaces and implements.

### Applications:

AZEL Rockwool Felts are used as Thermal, Acoustic, and Fire Insulation for flat and curved surfaces operating at a maximum temperature of 750°C. They are designed for hot and cold applications such as in cold rooms, cold storage tanks, refrigerated containers, ovens, chimney walls, heated ducts, and others. AZEL Rockwool Felts are likewise suited for insulation of walls or in cavity walls of residential and school buildings, hospitals, offices, auditoriums, broadcasting stations, and factories.

### Product Properties



## Thermal Resistance (R value)

| Thickness<br>mm | R Value, m <sup>2</sup> K/ W |                     |                     |                     |                     |
|-----------------|------------------------------|---------------------|---------------------|---------------------|---------------------|
|                 | 30kg/m <sup>3</sup>          | 40kg/m <sup>3</sup> | 50kg/m <sup>3</sup> | 60kg/m <sup>3</sup> | 80kg/m <sup>3</sup> |
| 25              | 0.68                         | 0.68                | .70                 | 0.72                | 0.74                |
| 30              | 0.81                         | 0.81                | 0.84                | 0.86                | 0.88                |
| 40              | 1.08                         | 1.08                | 1.12                | 1.15                | 1.18                |
| 50              | 1.36                         | 1.36                | 1.4                 | 1.44                | 1.47                |
| 60              | 1.63                         | 1.63                | 1.68                | 1.72                | 1.76                |
| 75              | 2.03                         | 2.03                | 2.10                | 2.16                | 2.21                |
| 100             | 2.71                         | 2.71                | 2.80                | 2.87                | 2.94                |

## Service Temperature

Has service temperature range from -240°C to +750°C, as tested according to (DIN 52 271).

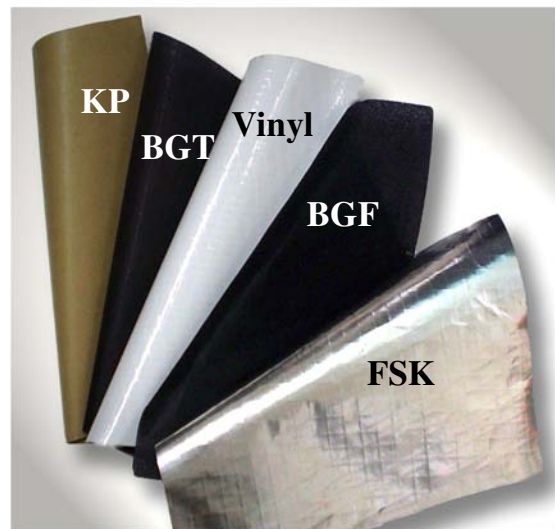
### Product highlights:

- Low Thermal Conductivity
- Excellent Thermal and Acoustic insulation
- Non-combustible
- Water repellent
- Easy to handle
- Chemically inert
- Environment friendly

### Facing Materials:

- Aluminum Foil (\*FSK)
- Black Glass Tissue (BGT)
- Black Glass Fabric (BGF)
- Kraft Paper (KP)
- Vinyl
- Bare or un-faced

\* Description of Aluminum Facing per ASTM, consisting of:  
**Aluminum Foil + Kraft Paper + Glass Scrim**



## Product Dimensions and Specifications

| Density, kg/m <sup>3</sup>               | Thickness, mm               | Standard Sizes |           |
|--|-----------------------------|----------------|-----------|
|  |                             | Length, M*     | Width, M* |
| 30, 40, 50, 60, 80                       | 25, 30, 40, 50, 60, 75, 100 | 10, 20         | 1.2       |
| * other sizes are available upon request |                             |                |           |

## Packaging

Polyethylene bags

### Some Applications:



**AZEL Rockwool Felt Insulation** with Aluminum facing was used as wall insulation for buildings in Medina Central area. Installing the insulation at the external of the perimeter walls provided extra space inside the buildings.





## AZEL Metal Structure Insulation

Manufactured in accordance with ASTM C553 and C665



### Description

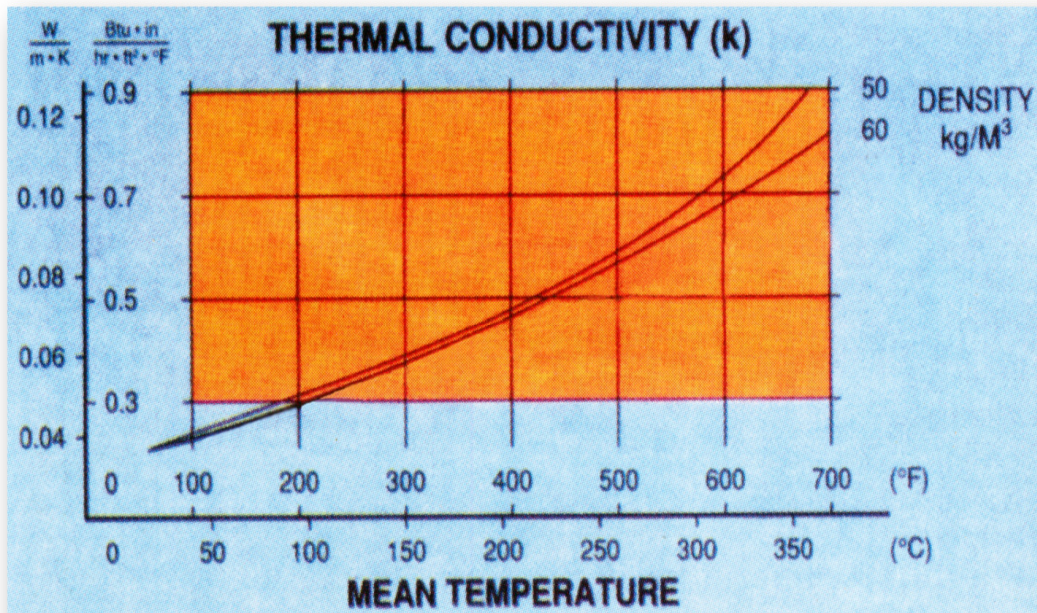
AZEL Rockwool Metal Structure Insulation is a low density blanket insulation that is produced from molten mineral basalt rocks, spun to fine fibers, sprayed with thermo-setting binder and cured to form felt. Rockwool Metal Structure Insulation is provided with extra 50mm facing on each side for overlap to prevent vapour leaks.

### Applications:

AZEL Rockwool Metal Structure Insulation are used as Thermal, Acoustic, and Fire Insulation for flat and curved surfaces operating at a maximum temperature of 750°C. They are designed as roof insulation for steel hangers, wall insulation for residential and school buildings, hospitals, offices, auditoriums, broadcasting stations, and factories.

For a more secured installation, the use of Galvanized Wire Mesh support is recommended. Galvanized Wire Mesh can be bought separately from AZEL.

### Product Properties



**Thermal Resistance (R value)**

| Thickness<br>mm | R Value, m <sup>2</sup> K/ W |                     |                     |                     |
|-----------------|------------------------------|---------------------|---------------------|---------------------|
|                 | 30kg/m <sup>3</sup>          | 40kg/m <sup>3</sup> | 50kg/m <sup>3</sup> | 60kg/m <sup>3</sup> |
| 25              | 0.68                         | 0.68                | .70                 | 0.72                |
| 30              | 0.81                         | 0.81                | 0.84                | 0.86                |
| 40              | 1.08                         | 1.08                | 1.12                | 1.15                |
| 50              | 1.36                         | 1.36                | 1.4                 | 1.44                |
| 60              | 1.63                         | 1.63                | 1.68                | 1.72                |
| 75              | 2.03                         | 2.03                | 2.10                | 2.16                |
| 100             | 2.71                         | 2.71                | 2.80                | 2.87                |

**Service Temperature**

Has service temperature range from -240°C to +750°C, as tested according to (DIN 52 271).

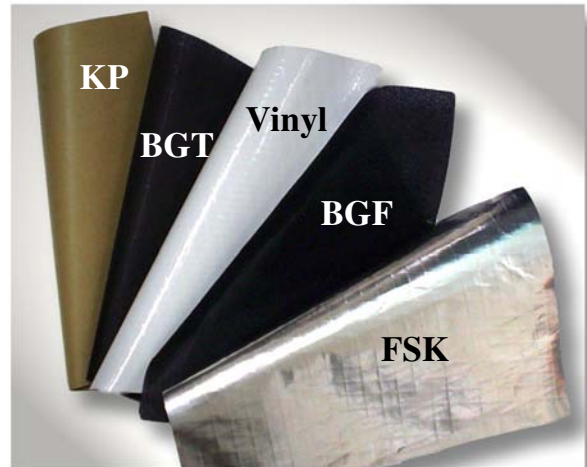
**Product highlights:**

- Low Thermal Conductivity
- Excellent Thermal and Acoustic insulation
- Non-combustible
- Water repellent
- Easy to handle
- Chemically inert
- Environment friendly

**Facing Materials:**

- Aluminum Foil (\*FSK)
- Black Glass Tissue (BGT)
- Black Glass Fabric (BGF)
- Kraft Paper (KP)
- Vinyl
- Bare or un-faced

\* Description of Aluminum Facing per ASTM, consisting of:  
**Aluminum Foil + Kraft Paper + Glass Scrim**



**Product Dimensions and Specifications**

| Density, kg/m <sup>3</sup> | Thickness, mm   | Standard Sizes |              |
|----------------------------|---|----------------|--------------|
|                            |   | Length, M*     | Width, M*,** |
| 30, 40, 50, 60             | 25, 30, 40, 50, 60, 75, 100   | 10, 20         | 1.1          |
|                            | * other sizes are available upon request<br>** Width of Facing material is 1.20 M |                |              |

## Packaging

Polyethylene bags

### Some Applications:



Metal Structure Insulation with Vinyl Facing used as roof and wall insulation



Metal Structure Insulation with Aluminum Facing used as roof and wall insulation

The use of Wire Mesh as an added support to the insulation is recommended.

## AZEL Sound Insulation Felt

Manufactured in accordance with ASTM C553 and C665



### Description

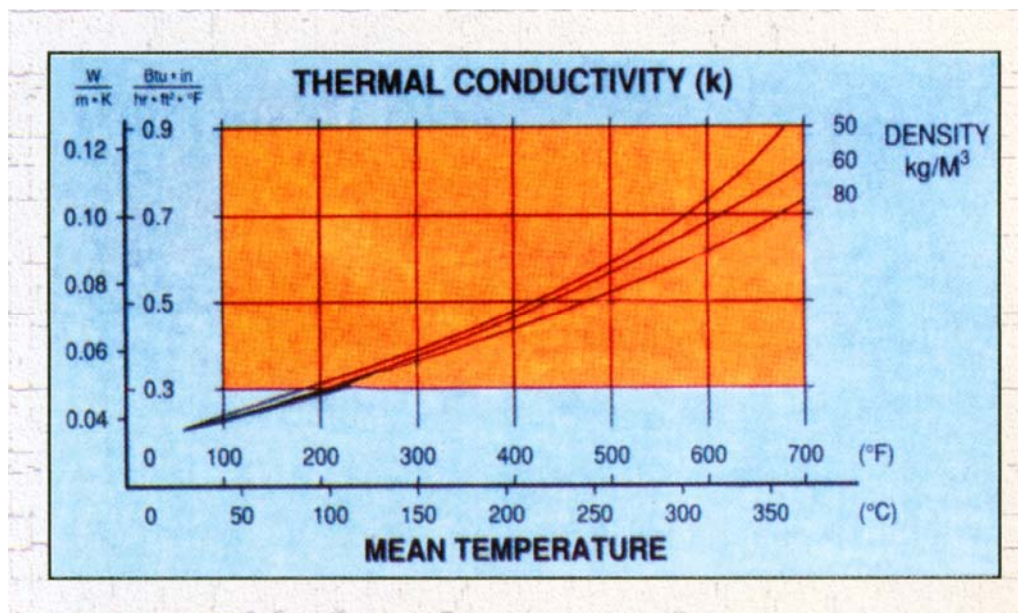
AZEL Rockwool Sound Insulation Felt is a low to medium density blanket insulation that is produced from molten mineral basalt rocks, spun to fine fibers, sprayed with thermo-setting binder and cured to form felt. It has excellent sound absorbing property. It is easy to cut and fit irregularly shaped surfaces and implements.

### Applications:

AZEL Rockwool Sound Insulation Felts are designed for Acoustic Insulation of commercial, industrial, and residential buildings, such as schools and offices, hospitals, auditoriums, broadcasting stations and factories.

### Product Properties

Thermal Conductivity



## Typical Sound Absorption Coefficient

| Density<br>(kg/m <sup>3</sup> ) | Sound Frequency in Hz |      |      |      |      |      |
|---------------------------------|-----------------------|------|------|------|------|------|
|                                 | 125                   | 250  | 500  | 1000 | 2000 | 4000 |
| 50                              | 0.22                  | 0.62 | 0.88 | 0.96 | 1.00 | 1.00 |
| 60                              | 0.22                  | 0.62 | 0.90 | 0.98 | 1.05 | 1.00 |
| 70                              | 0.23                  | 0.62 | 0.91 | 1.00 | 1.00 | 1.00 |
| 80                              | 0.23                  | 0.66 | 0.96 | 1.00 | 1.00 | 1.00 |

## Sound Transmission Class

Sound Transmission Class is a number rating which expresses the sound power transferred through a barrier. **AZEL Rockwool Sound Insulation Felt, 50mm thick and 60 kg/m<sup>3</sup> density, have been tested by NU Laboratories, USA and found to achieve an STC 44 when used in composite system using 15mm gypsum boards on its two sides.**

## Service Temperature

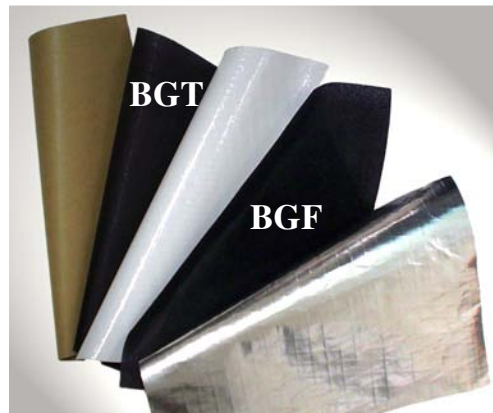
Has service temperature range from -240°C to +750°C, as tested according to (DIN 52 271).

### Product highlights:

- Low Thermal Conductivity
- Excellent Thermal and Acoustic insulation
- Non-combustible
- Water repellent
- Easy to handle
- Chemically inert
- Environment friendly

### Facing Materials:

- Black Glass Tissue (BGT)
- Black Glass Fabric (BGF)
- Bare



## Product Dimensions and Specifications

| Density, kg/m <sup>3</sup>               | Thickness, mm               | Standard Sizes |           |
|--|-----------------------------|----------------|-----------|
|  |                             | Length, M*     | Width, M* |
| 50, 60, 70, 80                           | 25, 30, 40, 50, 60, 75, 100 | 10, 20         | 1.2       |
| * other sizes are available upon request |                             |                |           |

**Packaging**

Polyethylene bags

Applications

## AZEL Rockwool Stitched Mattress Insulation

Manufactured in accordance with ASTM C553, C592 and C665



### Description

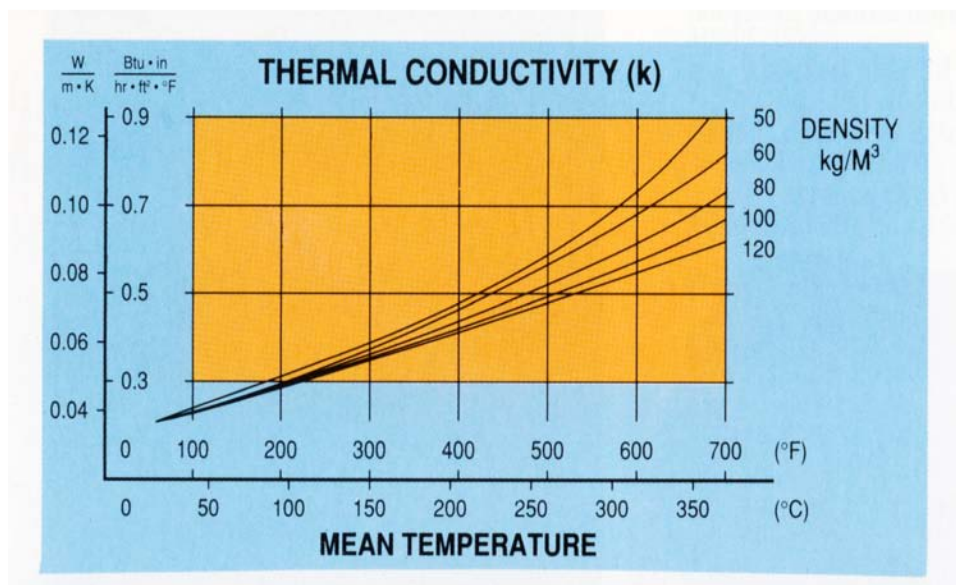
AZEL Rockwool Stitched Mattress Insulation is a low to high density blanket insulation that is produced from molten mineral basalt rocks spun to fine fibers and sprayed with emulsifying oil. It could withstand an operating temperature up to 800°C. It has excellent water repellent property. Stitched Mattress is a sturdy and flexible insulation that is suited for diverse types of insulation works.

### Applications:

AZEL Rockwool Stitched Mattress are very efficiently as Thermal, Acoustic, and Fire Insulation for various applications such as insulation for wood and steel structures, sandwich insulation for prefabricated houses, hot and cold surfaces in refineries, desalination plants, petrochemical plants, furnaces, boilers, large pipes, water tanks and vessels. They are used in flat and curved surfaces operating from -240°C to +800°C.

### Product Properties

Thermal Conductivity



## Thermal Conductivity

| Mean Temp<br>°C | Thermal Conductivity, W/m K |                     |                      |                      |
|-----------------|-----------------------------|---------------------|----------------------|----------------------|
|                 | 70kg/m <sup>3</sup>         | 80kg/m <sup>3</sup> | 100kg/m <sup>3</sup> | 120kg/m <sup>3</sup> |
| 20              | 0.037                       | 0.033               | 0.032                | 0.031                |
| 50              | 0.038                       | 0.035               | 0.034                | 0.034                |
| 100             | 0.043                       | 0.043               | 0.043                | 0.042                |
| 150             | 0.054                       | 0.051               | 0.052                | 0.050                |
| 200             | 0.062                       | 0.060               | 0.06                 | 0.056                |
| 250             | 0.073                       | 0.071               | 0.070                | 0.069                |
| 300             | 0.086                       | 0.084               | 0.081                | 0.079                |
| 350             | 0.103                       | 0.099               | 0.095                | 0.093                |
| 400             | 0.120                       | 0.116               | 0.110                | 0.102                |

## Service Temperature

Has service temperature range from -240°C to +800°C, as tested according to (DIN 52 271).

## Product highlights:

- Low Thermal Conductivity
- Excellent Thermal and Acoustic insulation
- Non-combustible
- Water repellent
- Easy to handle
- Chemically inert
- Environment friendly

**Facing Materials: (\*Stitched on Rockwool) \*** Standard Stitching Materials is made of Iron Thread. Stainless Steel Thread can also be used for special applications.

- Wire Mesh-Galvanized
- Wire Mesh- Stainless Steel
- Aluminum Foil (\*\*FSK)
- Combination of Aluminum and Wire Mesh
- Kraft Paper
- Vinyl
- Also available without facing

\*\* Description of Aluminum Facing per ASTM, consisting of:  
**Aluminum Foil + Kraft Paper + Glass Scrim**

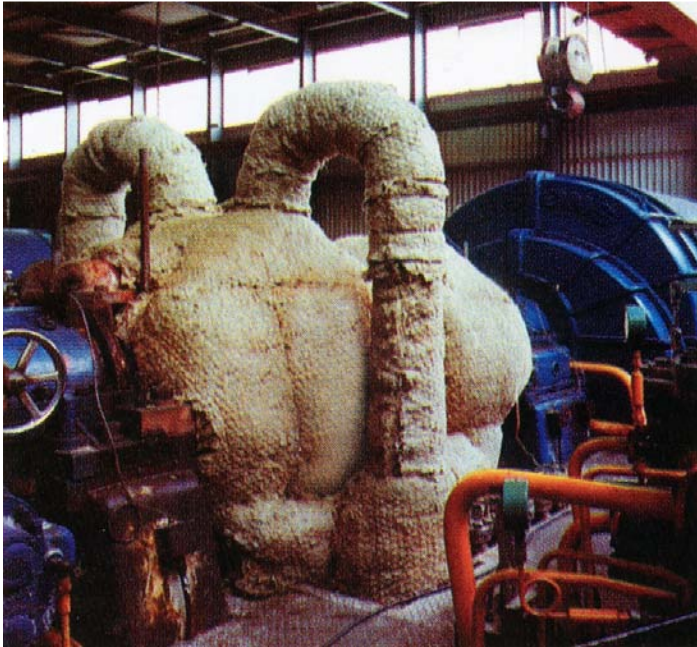
## Product Dimensions and Specifications

| Density, kg/m <sup>3</sup> | Thickness, mm                            | Standard Sizes |           |
|----------------------------|--|----------------|-----------|
|                            |  | Length, M*     | Width, M* |
| 60, 70, 80, 100, 120, 128  | 25, 30, 40, 50, 60, 75, 100, 120         | 4.0, 5.0       | 1.0       |
|                            | * other sizes are available upon request |                |           |

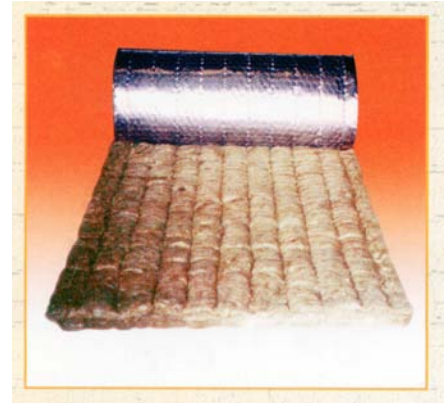


## Packaging

Polyethylene bags



**Mattress with Wire Mesh used as insulation for turbine**



**Mattress with Stitched Wire Mesh and Aluminum Facing**



**Mattress with Stitched Polyethylene (Plastic) Facing**



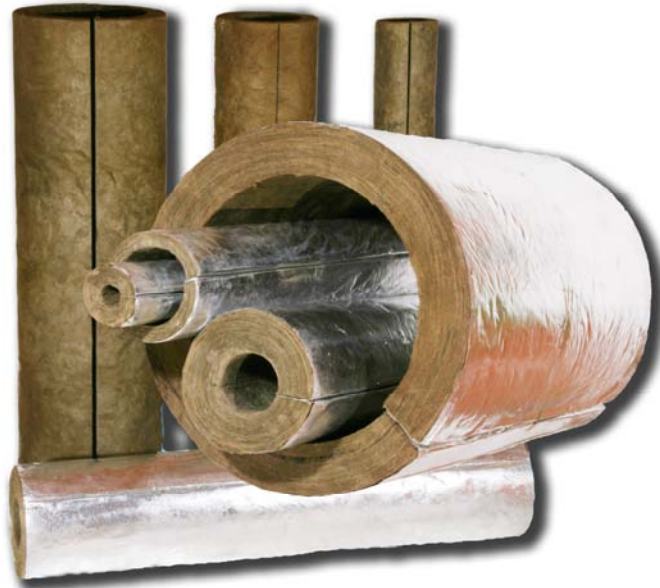
**Mattress with Wire Mesh used as insulation for big vessels**



**Mattress with Stitched Kraft Paper Facing**

## AZEL Rockwool Preformed Pipe Insulation

Manufactured in accordance with  
ASTM C 547



### **Description**

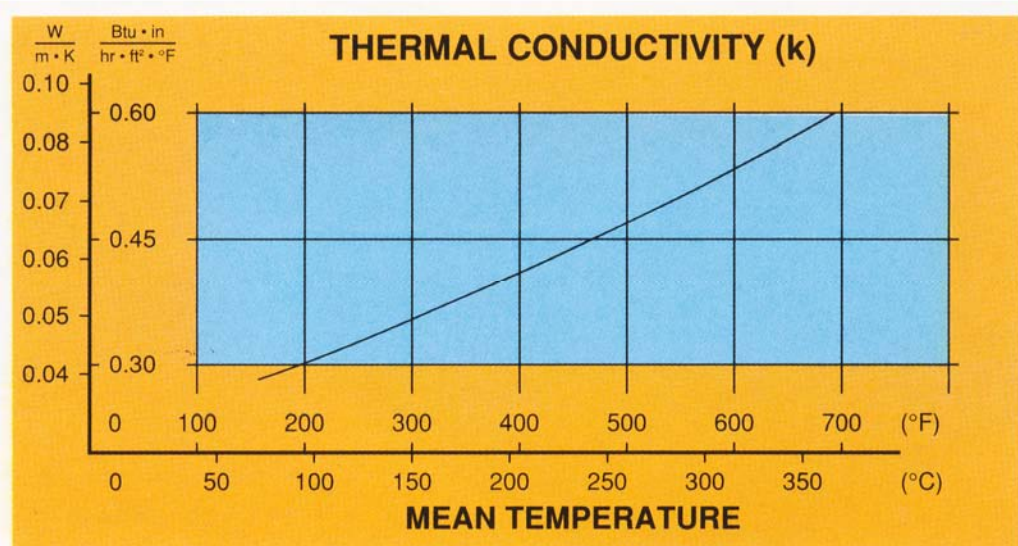
AZEL Rockwool Preformed Pipe Section is made from molten mineral basalt rocks spun into fine fibers and sprayed with thermo-setting binder, rolled and pressed into pipe section, then cured. It could withstand an operating temperature up to 750°C. Preformed Pipe Section can be supplied with or without facing material.

### **Applications:**

AZEL Rockwool Preformed Pipe Insulation are suited for hot and cold applications, such as in high pressure steam mains, turbine pipeworks and pumps, boilers and integral pipeworks, super heaters and control valves, cold room storage, refrigerated rooms, air conditioning, etc... They are easy to cut and form pipe elbows and joints.

### **Product Properties**

Thermal Conductivity



## Thermal Conductivity

| Mean Temp<br>°C | Thermal Conductivity, W/m k |                       |
|-----------------|-----------------------------|-----------------------|
|                 | 100 kg/m <sup>3</sup>       | 150 Kg/m <sup>3</sup> |
| 20              | .033                        | .032                  |
| 50              | .037                        | .035                  |
| 100             | .043                        | .041                  |
| 150             | .052                        | .049                  |
| 200             | .061                        | .057                  |
| 250             | .071                        | .065                  |
| 300             | .084                        | .073                  |
| 350             | .099                        | .082                  |

### Service Temperature

Has service temperature range from -240°C to +750°C, as tested according to (DIN 52 271).

### Product highlights:

- Low Thermal Conductivity
- Excellent Thermal and Acoustic insulation
- Non-combustible
- Water repellent
- Easy to handle
- Chemically inert
- Environment friendly

### Facing Materials:

Aluminum Foil (\*FSK)  
Bare or un-faced

\* Description of Aluminum Facing per ASTM, consisting of:  
**Aluminum Foil + Kraft Paper + Glass Scrim**

## Product Dimensions and Specifications

| Density, kg/m <sup>3</sup> | Thickness, mm*   | Diameter, Inch | Length, M |
|----------------------------|--|----------------|-----------|
| 100 & 150                  | 25, 30, 40, 50, 60, 70,<br>80, 90, 100                       | ½ to 26        | 1.0       |
|                            | * thickness more than 100mm can be supplied in double layers |                |           |

## Nominal Pipe Sizes (NPS) of available Pipe Sections

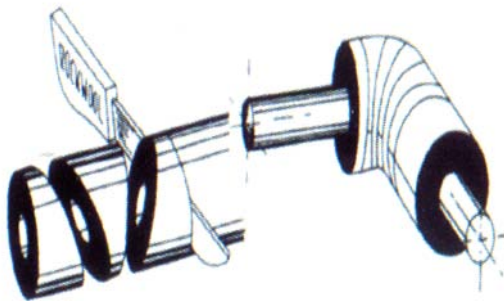
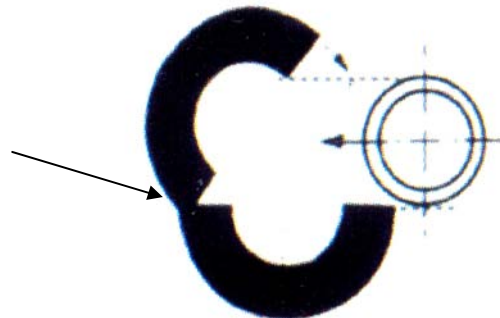
| NPS | Actual Outer Pipe Diameter |       | NPS | Actual Outer Pipe Diameter |       |
|-----|----------------------------|-------|-----|----------------------------|-------|
|     | Inch                       | mm    |     | Inch                       | mm    |
| ½   | 0.840                      | 42.2  | 5   | 5.563                      | 141.4 |
| ¾   | 1.050                      | 26.7  | 6   | 6.625                      | 168.3 |
| 1   | 1.315                      | 33.4  | 8   | 8.625                      | 219.1 |
| 1¼  | 1.660                      | 42.2  | 10  | 10.750                     | 273.0 |
| 1½  | 1.900                      | 48.3  | 12  | 12.750                     | 323.8 |
| 2   | 2.375                      | 60.3  | 14  | 14.000                     | 355.6 |
| 2½  | 2.875                      | 73.0  | 16  | 16.000                     | 406.4 |
| 3   | 3.500                      | 88.9  | 18  | 18.000                     | 457.2 |
| 3½  | 4.000                      | 101.6 | 20  | 20.000                     | 508.0 |
| 4   | 4.500                      | 114.3 | 24  | 24.000                     | 609.6 |
| 4½  | 5.000                      | 127.0 | 26  | 26.000                     | 660.4 |

### Packaging

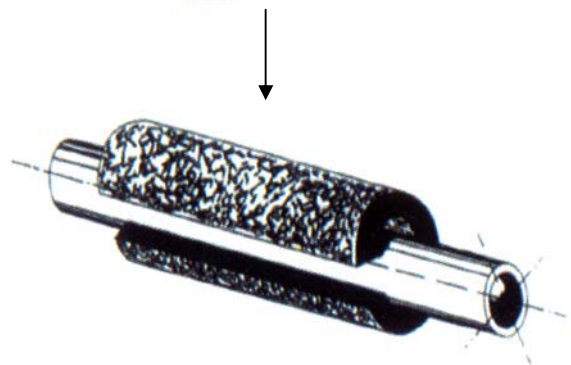
Packed between two carton edges inside Polyethylene bags

### Useful information:

AZEL Rockwool Preformed Pipe Sections are supplied with **full and slight slits** on opposite sides of their diameter to prevent them from breaking. This also allows ease of installation.



Preformed Pipe Sections **can be cut to form pipe elbows**



Preformed Pipe Sections **can be supplied in double layers to attain thickness more than 100mm**



**AZEL Loose and Carded Wool**  
 Manufactured in accordance with ASTM C 764



**Loose Wool**



**Carded Wool**

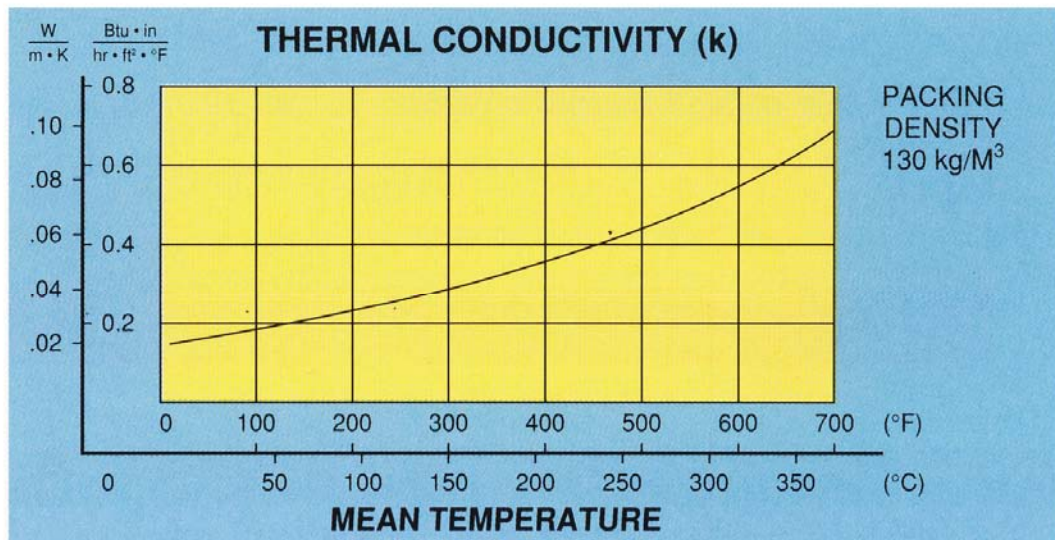
**Description**

AZEL Rockwool Loose and Carded Wool are irregular masses of non-bonded wool that are produced from molten mineral basalt rocks spun to fine fibers and carded to shorten the fibers length.

**Applications:**

AZEL Rockwool Loose and Carded Wool are used as Thermal and Acoustic Insulation for irregularly shaped vessels and surfaces where it is not practical to apply formed products. They are used in packing cavities in furnaces walls, ovens, heaters, valves boxes and other high temperature industrial equipment. AZEL Carded Wool is used as cryogenic insulation for oxygen plants where low levels of organic material are required. AZEL Loose wool is excellent insulation for automobile mufflers, refrigerated containers and cargos, in attics or enclosed spaces in housing and other framed buildings.

**Product Properties**



| Mean Temp.<br>C <sup>o</sup> | K-value W/mk<br>80kg/m <sup>3</sup> |
|------------------------------|-------------------------------------|
| 50                           | 0.034                               |
| 100                          | 0.035                               |
| 150                          | 0.044                               |
| 200                          | 0.054                               |
| 250                          | 0.063                               |
| 300                          | 0.077                               |
| 350                          | 0.098                               |
| 400                          | 0.129                               |

**Service Temperature**

Suitable temperature range for AZEL Rockwool Loose and Carded Wool is from -240°C to +800°C.

**Density:**

Standard density : 80 kg/m<sup>3</sup>  
 Compacted density : 130 kg/m<sup>3</sup>,

**Product highlights:**

- Low Thermal Conductivity
- Excellent Thermal and Acoustic insulation
- Non-combustible
- Water repellent
- Easy to handle
- Chemically inert
- Environment friendly

**Packaging**

25 kg per Polyethylene bags.

## Methods of Application



**Carded Wool Blowing Machine**



## Procedure for filling old cavity wall



*Drilling hole*



*Neat hole ready to receive fill*



*Blown wool being injected*



*Hole sealed with mortar*

**AZEL Loose Wool**  
used as insulation in  
car mufflers.

## Insulation Accessories Supplied by AZEL



**Adhesive Tapes**

A flame resistant vapor barrier tape consisting of Aluminum Foil, a blend of Fiberglass and Polyester Yarn reinforcement, and Kraft Paper laminated together with a flame resistance adhesive. Superior quick stick, superior low temperature performance, and recommended for use at elevated temperature also.

Available in 1", 2", 3" & 4" width



**Pin Welding Machine**



**Welding Pins**

Pins are available in various lengths.



**Adhesive Pins**

Other insulation accessories are available upon request from AZEL.

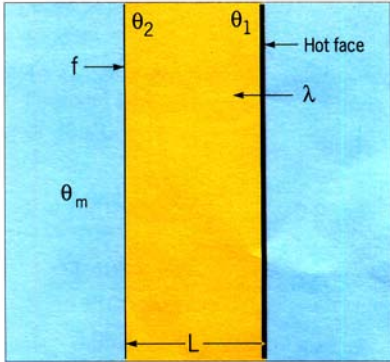


## PRODUCT SELECTION GUIDE

|                           | Duct Roll Insulation | Duct Board-Inner Insulation | Wall Board Insulation | Sound Board Insulation | Concrete Roof Insulation | Felt Insulation | Metal Structure Insulation | Sound Insulation | Stitched Mattress Insulation | Preformed Pipe Section | Loose and Carded Wool |
|---------------------------|----------------------|-----------------------------|-----------------------|------------------------|--------------------------|-----------------|----------------------------|------------------|------------------------------|------------------------|-----------------------|
| Page No.                  | 7                    | 10                          | 12                    | 15                     | 18                       | 21              | 24                         | 27               | 30                           | 33                     | 36                    |
| <b>Thermal Insulation</b> |                      |                             |                       |                        |                          |                 |                            |                  |                              |                        |                       |
| Air Conditioning ducts    | ✓                    | ✓                           |                       | ✓                      |                          | ✓               |                            | ✓                |                              | ✓                      |                       |
| Heating ducts             |                      | ✓                           |                       |                        |                          |                 |                            |                  | ✓                            | ✓                      |                       |
| Chiller Pipes             |                      |                             |                       |                        |                          | ✓               |                            | ✓                | ✓                            | ✓                      |                       |
| Process Pipe Lines        |                      |                             |                       |                        |                          |                 |                            |                  | ✓                            | ✓                      |                       |
| Steam Pipe Lines          |                      |                             |                       |                        |                          |                 |                            |                  | ✓                            | ✓                      |                       |
| Boilers                   |                      |                             |                       |                        |                          |                 |                            | ✓                | ✓                            |                        |                       |
| Tank Walls                | ✓                    |                             | ✓                     | ✓                      | ✓                        |                 |                            | ✓                | ✓                            |                        |                       |
| Tank Roofs                |                      |                             | ✓                     | ✓                      | ✓                        |                 |                            |                  |                              |                        |                       |
| Tank Roofs with traffic   |                      |                             |                       |                        | ✓                        |                 |                            |                  |                              |                        |                       |
| Ovens and Heaters         | ✓                    | ✓                           |                       |                        |                          | ✓               |                            | ✓                | ✓                            |                        | ✓                     |
| Kilns and Furnaces        |                      |                             |                       | ✓                      | ✓                        |                 |                            |                  | ✓                            |                        | ✓                     |
| Power Plants              |                      |                             |                       | ✓                      | ✓                        |                 |                            | ✓                | ✓                            |                        |                       |
| Heat Exchangers           |                      |                             |                       |                        |                          |                 |                            |                  | ✓                            |                        | ✓                     |
| Turbine Engines           |                      |                             |                       |                        |                          |                 |                            |                  | ✓                            |                        |                       |
| Chimney or Stacks         |                      |                             |                       | ✓                      | ✓                        |                 |                            |                  | ✓                            |                        |                       |
| Cryogenic Tanks           |                      |                             |                       |                        |                          |                 |                            |                  |                              |                        | ✓                     |
| Cavity Walls              |                      |                             | ✓                     |                        |                          | ✓               | ✓                          | ✓                |                              |                        | ✓                     |
| <b>Fire Protection</b>    |                      |                             |                       |                        |                          |                 |                            |                  |                              |                        |                       |
| Pipe Lines                |                      |                             |                       |                        |                          |                 |                            | ✓                | ✓                            | ✓                      |                       |
| Steel Structures          |                      |                             | ✓                     |                        |                          | ✓               | ✓                          |                  |                              |                        |                       |
| Air Ducts, Round          | ✓                    |                             |                       |                        |                          | ✓               |                            |                  | ✓                            | ✓                      |                       |
| Air Ducts, Rectangular    |                      |                             |                       | ✓                      | ✓                        |                 |                            |                  | ✓                            |                        |                       |
| Fire Walls                |                      |                             |                       | ✓                      | ✓                        | ✓               |                            |                  | ✓                            |                        |                       |
| Ship Decks & Bulkheads    |                      |                             |                       | ✓                      | ✓                        |                 |                            |                  | ✓                            |                        |                       |
| General Ships-Offshore    |                      |                             |                       | ✓                      | ✓                        |                 |                            |                  | ✓                            |                        |                       |
| <b>Sound Insulation</b>   |                      |                             |                       |                        |                          |                 |                            |                  |                              |                        |                       |
| Pipe Lines and Ducts      | ✓                    | ✓                           |                       | ✓                      |                          |                 |                            | ✓                | ✓                            | ✓                      |                       |
| Flat Surfaces             |                      | ✓                           | ✓                     | ✓                      | ✓                        | ✓               |                            | ✓                | ✓                            |                        |                       |
| Irregular surfaces        |                      |                             |                       |                        |                          |                 |                            |                  |                              |                        | ✓                     |

## CALCULATION METHODS

### THERMAL LOSS AND SURFACE TEMPERATURE FOR PLANE SURFACES INSULATED WITH SLABS OR MATS



#### SYMBOLS

|            |   |
|------------|---|
| $q$        | Heat loss through the insulation material per metre run of pipe ( $W/m^2$ )         |
| $\theta_1$ | Temperature of the hot surface ( $^{\circ}C$ )                                      |
| $\theta_2$ | Temperature of the exterior cold surface of the insulating material ( $^{\circ}C$ ) |
| $\theta_m$ | Temperature of ambient still air ( $^{\circ}C$ )                                    |
| $\lambda$  | Thermal conductivity of insulation material ( $W/mK$ )                              |
| $f$        | Surface coefficient ( $W/m^2K$ )  |
| $L$        | Insulation thickness (m)  |
| $R_s$      | Thermal resistance of surface ( $m^2K/W$ )  |
| $R$        | Thermal resistance of insulation layer ( $m^2K/W$ )                                 |

#### FORMULAE FOR HEAT LOSS AND SURFACE TEMPERATURE

The rate of heat transmission and the temperature gradient through a vertical plane wall is given by:

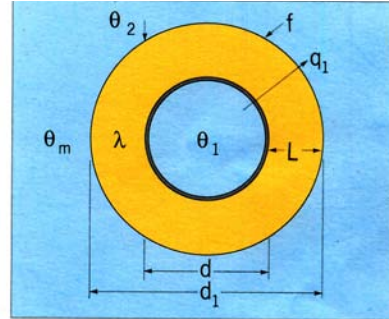
$$q = \frac{\theta_1 - \theta_m}{R_s + R}$$

$$\text{where } R_s = \frac{1}{f} \text{ and } R = \frac{L}{\lambda}$$

The temperature drop across the insulation and hence the surface temperature is calculated from:

$$\theta_1 - \theta_2 = qR$$

### THERMAL LOSS AND SURFACE TEMPERATURE FOR PIPES INSULATED WITH ROCKWOOL MINERAL WOOL



#### SYMBOLS

|            |   |
|------------|---|
| $q_1$      | Heat loss through the insulation material per metre run of pipe ( $W/m$ )             |
| $\theta_1$ | Temperature of the hot surface ( $^{\circ}C$ )  |
| $\theta_2$ | Temperature of the exterior (cold) surface of the insulating material ( $^{\circ}C$ ) |
| $\theta_m$ | Temperature of the ambient still air ( $^{\circ}C$ )                                  |
| $\lambda$  | Thermal conductivity of insulation material ( $W/mK$ )                                |
| $f$        | Surface coefficient ( $W/m^2K$ )  |
| $d$        | Outside diameter of pipe (m)  |
| $d_1$      | Outside diameter of insulation (m)  |
| $L$        | Thickness of insulation   |

#### FORMULAE FOR HEAT LOSS AND SURFACE TEMPERATURE

$$q_1 = \frac{(\theta_1 - \theta_m) \pi}{\frac{1}{2\lambda} \times \ln \left[ \frac{d_1}{d} \right] + \frac{1}{d_1 f}} \text{ W/m}$$

$$\theta_2 = \theta_m + q_1 / \pi \cdot f \cdot d_1 \text{ } ^{\circ}C$$

### MULTILAYER SYSTEMS

The heat lost through surfaces insulated with multiple layers of insulation is given by:

$$q = \frac{\theta_1 - \theta_2}{R_1 + R_2 + \dots + R_n}$$

$$= \frac{\theta_1 - \theta_2}{R_1 + R_2 + \dots + R_n + R_s}$$

Where  $R_1, R_2, R_n$  and  $R_s$  have the following values:

|       | FLAT SURFACES           | CYLINDRICAL SURFACES   |
|-------|-------------------------|--|
| $R_1$ | $\frac{L_1}{\lambda_1}$ | $\frac{d}{2\lambda_1} \times l_n \left[ \frac{d_1}{d} \right]$       |
| $R_2$ | $\frac{L_2}{\lambda_2}$ | $\frac{d}{2\lambda_2} \times l_n \left[ \frac{d_2}{d_1} \right]$     |
| $R_n$ | $\frac{L_n}{\lambda_n}$ | $\frac{d}{2\lambda_n} \times l_n \left[ \frac{d_n}{d_{n-1}} \right]$ |
| $R_s$ | $\frac{1}{f}$           | $\frac{d}{fd_n}$   |

To calculate the heat loss per metre length,  $q_1 = \pi dq$ .

In order to make the calculations and read the tables the nature of the surface has been specified in accordance with the recommendation for surface coefficients (f) described in BS 5422 for surfaces of various emissivities.

#### SURFACES OF LOW EMISSIVITY

Bright metal surfaces such as polished aluminium  $f = 5.7$ .

#### SURFACES OF MEDIUM EMISSIVITY

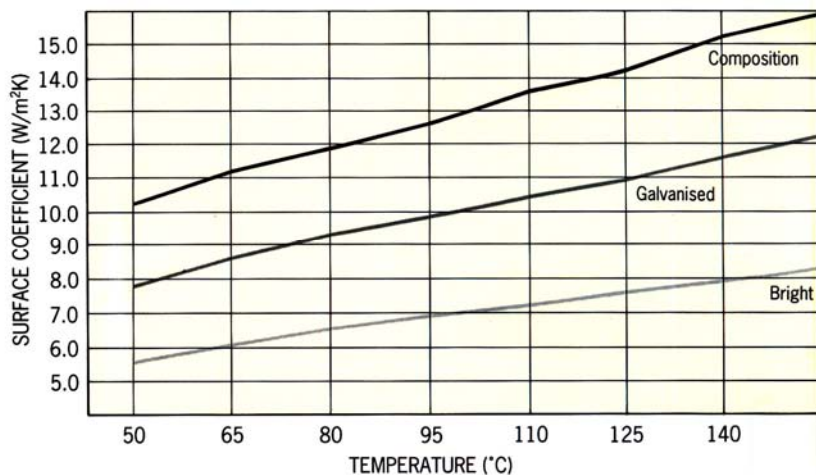
Planished or galvanised steel, aluminium paint and comparable surfaces  $f = 8.0$ .

#### SURFACES OF HIGH EMISSIVITY

Composition, canvas, cement, plastic sheeting of all types and painted metal surfaces  $f = 10.0$ .

The actual surface temperature of a covered section will depend upon various factors such as wind speed and location to such an extent that they are not a reliable guide to the insulation performance. For comparative purposes the calculations have assumed that the air is still and has a constant temperature of 20°C.

f SURFACE COEFFICIENT (W/m<sup>2</sup>K)



## Conversion Table

|                              |   |                         |                            |                         |                       |                |
|------------------------------|---|-------------------------|----------------------------|-------------------------|-----------------------|----------------|
| <b>LENGTH</b>                |   |                         |                            |                         |                       |                |
|                              |   | in                      | ft                         | m                       |                       |                |
| 1 in                         | = | 1                       | 0.093                      | 0.0254                  |                       |                |
| 1 ft                         | = | 12                      | 1                          | 0.3048                  |                       |                |
| 1 m                          | = | 39.37                   | 3.28                       | 1                       |                       |                |
| <b>AREA</b>                  |   |                         |                            |                         |                       |                |
|                              |   | in <sup>2</sup>         | ft <sup>2</sup>            | m <sup>2</sup>          |                       |                |
| 1 in <sup>2</sup>            | = | 1                       | 0.0069                     | 0.00064516              |                       |                |
| 1 ft <sup>2</sup>            | = | 1444                    | 1                          | 0.0929                  |                       |                |
| 1 m <sup>2</sup>             | = | 1550                    | 10.764                     | 1                       |                       |                |
| <b>VOLUME</b>                |   |                         |                            |                         |                       |                |
|                              |   | in <sup>3</sup>         | ft <sup>3</sup>            | UK gallon               | liter                 | m <sup>3</sup> |
| 1 in <sup>3</sup>            | = | 1                       | 0.0005784                  | 0.0036                  | 0.016387              | 0.000016387    |
| 1 ft <sup>3</sup>            | = | 1728.701                | 1                          | 6.2317                  | 28.317                | 0.0283         |
| 1 UK gallon                  | = | 277.412                 | 0.16047                    | 1                       | 4.546                 | 0.004546       |
| 1 liter                      | = | 61.024                  | 0.0353                     | 0.22                    | 1                     | 0.001          |
| 1 m <sup>3</sup>             | = | 61023.38                | 35.315                     | 219.975                 | 1.000                 | 1              |
| <b>MASS</b>                  |   |                         |                            |                         |                       |                |
|                              |   | lb                      | tonne                      | ton                     | kg                    |                |
| 1 lb                         | = | 1                       | 0.00045359                 | 0.00046088              | 0.45359               |                |
| 1 tonne                      | = | 2204.6                  | 1                          | 0.984204                | 1000                  |                |
| 1 ton                        | = | 2169.776                | 1.01605                    | 1                       | 1016.05               |                |
| 1 kg                         | = | 2.2046                  | 0.001                      | 0.0009842               | 1                     |                |
| <b>FORCE</b>                 |   |                         |                            |                         |                       |                |
|                              |   | lbf                     | kgf                        | N                       |                       |                |
| 1 lbf                        | = | 1                       | 0.4536                     | 4.448                   |                       |                |
| 1 kgf                        | = | 2.204                   | 1                          | 9.81                    |                       |                |
| 1 N                          | = | 0.2248                  | 0.102                      | 1                       |                       |                |
| <b>VELOCITY</b>              |   |                         |                            |                         |                       |                |
|                              |   | m/s                     | ft/s                       | ft/min                  |                       |                |
| 1 m/s                        | = | 1                       | 3.2808                     | 196.85                  |                       |                |
| 1 ft/s                       | = | 0.3048                  | 1                          | 60                      |                       |                |
| 1 ft/min                     | = | 0.00508                 | 0.01667                    | 1                       |                       |                |
| <b>POWER</b>                 |   |                         |                            |                         |                       |                |
|                              |   | BTU/h                   | hp                         | W                       |                       |                |
| 1 BTU/h                      | = | 1                       | 0.393                      | 0.2931                  |                       |                |
| 1 hp                         | = | 2.544                   | 1                          | 0.7457                  |                       |                |
| 1 W                          | = | 3.412                   | 1.341                      | 1                       |                       |                |
| <b>PRESSURE</b>              |   |                         |                            |                         |                       |                |
|                              |   | lbf/in <sup>2</sup>     | lbf/ft <sup>2</sup>        | kgf/m <sup>2</sup>      | kPa=kN/m <sup>2</sup> | atm.           |
| 1 lbf/in <sup>2</sup>        | = | 1                       | 144                        | 703                     | 6.895                 | 0.06806        |
| 1 lbf/ft <sup>2</sup>        | = | 0.00694                 | 1                          | 4.883                   | 0.04788               | 0.0004725      |
| 1 kgf/m <sup>2</sup>         | = | 0.00142                 | 0.2048                     | 1                       | 0.00981               | 0.000096757    |
| 1 kPa = 1 kN/m <sup>2</sup>  | = | 0.145                   | 20.886                     | 102                     | 1                     | 0.009869       |
| 1 atm.                       | = | 14.692                  | 2116.27                    | 10335.15                | 101.325               | 1              |
| <b>DENSITY</b>               |   |                         |                            |                         |                       |                |
|                              |   | lb/ft <sup>3</sup>      | kg/m <sup>3</sup>          |                         |                       |                |
| 1 lb/ft <sup>3</sup>         | = | 1                       | 16.0185                    |                         |                       |                |
| 1 kg/m <sup>3</sup>          | = | 0.06243                 | 1                          |                         |                       |                |
| <b>TEMPERATURE</b>           |   |                         |                            |                         |                       |                |
|                              |   | °F                      | K                          | °C                      |                       |                |
| x F                          | = | x                       | 5/9(x-32)+273              | 5/9(x-32)               |                       |                |
| x K                          | = | 9/5(x-273)+32           | x                          | x-273                   |                       |                |
| x C                          | = | 9/5x + 32               | x + 273                    | x                       |                       |                |
| <b>ENERGY</b>                |   |                         |                            |                         |                       |                |
|                              |   | BTU                     | kcal                       | kj                      | kWh                   |                |
| 1 BTU                        | = | 1                       | 0.252                      | 1.055                   | 0.00029               |                |
| 1 kcal                       | = | 3.968                   | 1                          | 4.187                   | 0.001163              |                |
| 1 kj                         | = | 0.948                   | 0.239                      | 1                       | 0.000278              |                |
| 1 kWh                        | = | 3414                    | 860                        | 3600                    | 1                     |                |
| <b>HEAT CAPACITY</b>         |   |                         |                            |                         |                       |                |
|                              |   | BTU/lb                  | kcal/kg                    | kj/kg                   |                       |                |
| 1 BTU/lb                     | = | 1                       | 0.5556                     | 2.3263                  |                       |                |
| 1 kcal/kg                    | = | 1.7998                  | 1                          | 4.187                   |                       |                |
| 1 kj/kg                      | = | 0.43                    | 0.2389                     | 1                       |                       |                |
| <b>SPECIFIC HEAT</b>         |   |                         |                            |                         |                       |                |
|                              |   | BTU/lb°F                | kcal/kg°C                  | kj/kgK                  |                       |                |
| 1 BTU/lb°F                   | = | 1                       | 1                          | 4.1912                  |                       |                |
| 1 kcal/kg°C                  | = | 1                       | 1                          | 4.187                   |                       |                |
| 1 kj/kgK                     | = | 0.2386                  | 0.2389                     | 1                       |                       |                |
| <b>THERMAL CONDUCTIVITY</b>  |   |                         |                            |                         |                       |                |
|                              |   | BTU/ft h°F              | BTU in/ft <sup>2</sup> h°F | kcal/mh°C               | W/mK                  |                |
| 1 BTU/ft h°F                 | = | 1                       | 12                         | 1.488                   | 1.73                  |                |
| 1 BTU in/ft <sup>2</sup> h°F | = | 0.0833                  | 1                          | 0.124                   | 0.1442                |                |
| 1 kcal/mh°C                  | = | 0.672                   | 8.064                      | 1                       | 1.163                 |                |
| 1 W/mK                       | = | 0.578                   | 6.933                      | 0.860                   | 1                     |                |
| <b>THERMAL CONDUCTANCE</b>   |   |                         |                            |                         |                       |                |
|                              |   | BTU/in <sup>2</sup> h°F | BTU/ft <sup>2</sup> h°F    | kcal/m <sup>2</sup> h°C | W/m <sup>2</sup> K    |                |
| 1 BTU/in <sup>2</sup> h°F    | = | 1                       | 144                        | 703                     | 818                   |                |
| 1 BTU/ft <sup>2</sup> h°F    | = | 0.0694                  | 1                          | 4.882                   | 5.678                 |                |
| 1 kcal/m <sup>2</sup> h°C    | = | 0.00142                 | 0.2048                     | 1                       | 1.163                 |                |
| 1 W/m <sup>2</sup> K         | = | 0.00122                 | 0.1761                     | 0.860                   | 1                     |                |

ARAMCO Refineries at Yanbu,  
Jubail Restanurah

SABIC Head Quarter

YanPet Expansion Project

Nasser S. Al Hajri SABIC and  
ARAMCO Projects



## Projects where AZEL Rockwool have been used

Le Meridian

Jizan Projects

KNP MINA Ahmed Refinery

Oil Sector & WATRA Complex

Bahrain Specialist Hospital

SCECO Sector PP5

Kuwait Oil Company

Binladin Group Sawari – 11  
Project

Kaas Hospital, Taif

Red Brick Factory

Bajunaid Projects

AWAZEL Projects

Chiwiy Co. Projects

Mowasat Hospital

Azloon Alnujd Bricks Factory

Al Sudais Red Bricks Factory

El Maimani Red Bricks Factory  
Load Bearing Construction  
Projects

Madina Governor Building

Al Mohsin & Al Hakim Project

Shoiba Phase –HVAC

Al Diyafal Shopping Project

Haradh Gas Plant Utilities and  
Offsite Facilities

New Nicosia General Hospital

Al Jam Jyah Al Khayriya  
Speech and Hearing Center

Disabled Children Project

Al Sahoo Hotel

Karrena Arabia SABIC and  
ARAMCO Project

Al Saghir Steam Boiler Projects

Mutabbagani Est

Bahlas Carpets Printing Factory

Raydan for Prefab Housing

Al Juffali Projects

Azzam Contracting Co.

Olayan Descon Engineering Co.  
Projects

Abdulhadi Ali Al Sahmmary Est.  
Projects

Al Howaish Industrial Co. Projects

Al Madrioun Co.. Projets

Al Ambah Contracting Projects

Al Shamrany For Drawbar

Cystal Co.Projests

Al Kahriji Co. Projects

Al Harty Projects

Ibrahim M. Al Tabsh Projects

International Meal Manufacturing  
Co. Projects

Issam Kabani Partners Projects

Jeddah National Steel Factory  
Projects

Modern Building Projects

Conrniche Garden Project

Saudi Specialist FBT Palace

Abdul Rahman Al Otaishan  
Projects

Khalil Agencies Insulation Projects

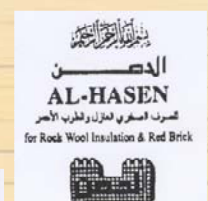
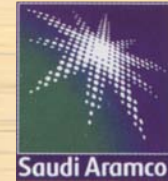
Faisal S. Al Naiman Projects

Al Hasen, Qatar Projects

Al- Yaheesh Accommodation

Abullah Fuad SABIC & ARAMCO  
Projects

Bilad Al Khaliji SCECO –Eastern  
Province Project





# Projects where AZEL Rockwool have been used

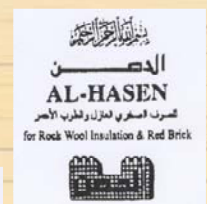
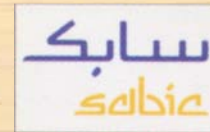
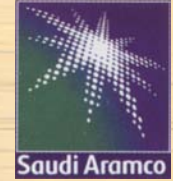
## Recent Projects



Museum of Arts in Doha, Qatar



Olympic Sports Complex in Qatar



# WHY CHOOSE ROCKWOOL FOR FIRE PROTECTION IN BUILDINGS?

## FACTS ABOUT FIRE:

- Gas poisoning is the number one cause of death during fire. Toxic smoke emitted during fire is more fatal than fire itself.
- Hydrogen Cyanide (HCN), a highly toxic gas, is emitted when Polyurethane (PU), Polyisocyanurate (PIR), and other Nitrogen containing insulation materials are subjected to fire.
- Comparative study shows that only 300 ppm concentration of Hydrogen Cyanide (HCN) is equivalent to 8000 ppm of Carbon Monoxide (CO) to cause instant death. Concentration of Hydrogen Cyanide gas increases as the temperature is increased to more than 600°C.



*Fire is a serious matter.*

## FACTS ABOUT ROCKWOOL:

- ✓ Rockwool does not emit toxic gasses during fire. It does not contain Nitrogen.
- ✓ Rockwool is produced from natural volcanic rocks and can resist temperature up to 800° C. It is non-combustible, meaning it does not burn. It acts as fire barrier and deters the spread of fire. AZEL Rockwool provides more than 4 hours insulation in fire; a lot of time to save lives and properties.

**AZEL Rockwool the SAFEST FIRE PROTECTION.**