

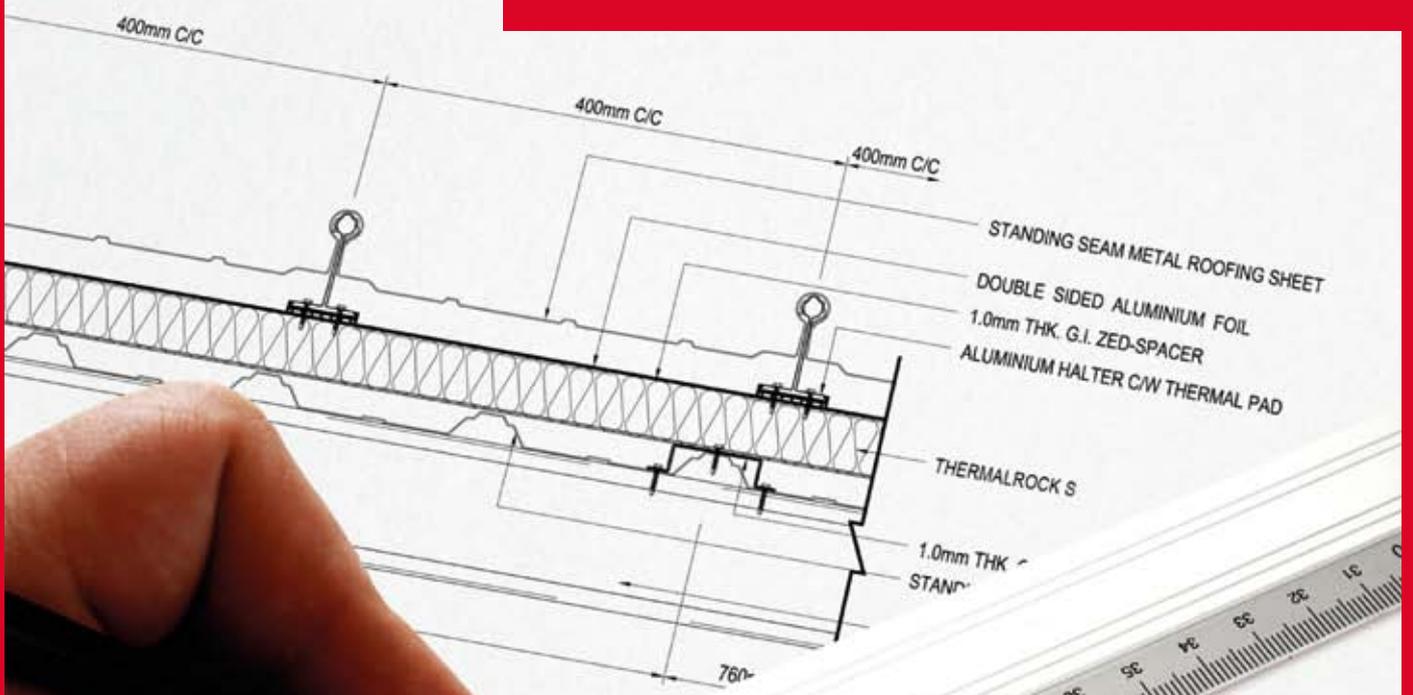
Roofing Applications

Using ThermalRock Insulation

ROCKWOOL
FIRE SAFE INSULATION

LONGITUDINAL SECTION

U Value : 0.4 W/m²K
STC Value : > 40
Fire Rating : A1 / Non-combustible



Introduction

ROCKWOOL ThermalRock is a high performance roof insulation that provides the unique combination of thermal, acoustic and fire properties to enhance the performance of roofing systems. It is an environmentally green product endorsed by Singapore Green Building Council to satisfy energy efficiency building requirements in Asia.

Description

ROCKWOOL ThermalRock is designed for single or double skin metal roof, with or without skylight, to satisfy U-value requirements in order to achieve the desired roof thermal transmittance value (RTTV). It is also available with a radiant barrier facing to suit the requirements of all types of roofs in commercial and industrial buildings. ThermalRock is highly effective in reducing solar heat gain through the roof for non-air conditioned buildings; and where air-conditions are used, ThermalRock insulation helps to save energy and reduce energy costs. The unique properties of ThermalRock contributes to making an energy efficient, environmentally sustainable and fire safe roofing system, thereby creating a cool, comfortable and safe indoor environment.

General Stone Wool Benefits

ROCKWOOL ThermalRock is a stone wool insulation product made from basalt, a volcanic stone with a melting point of approximately 1000°C. It is available in ThermalRock S, slab products or ThermalRock B, blanket products to suit different roofing designs.

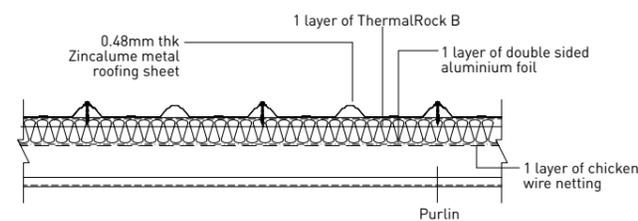
Key benefits:

- Excellent thermal properties
- Improved fire safety
- Good acoustic performance
- Water repellent
- Chemically inert, vermin and rot proof
- No asbestos, CFCs, HFCs and HCFCs in product and process



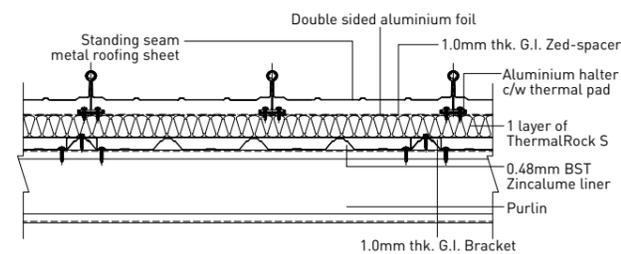
Applications

Metal roofing systems are generally categorised as single skin metal roof or double skin metal roof. In single skin roof system, insulation is installed below the metal cladding sheet held by steel wire mesh and aluminum foil rolled over purlins. This roofing system is an economically sound option for the construction industry. ThermalRock B, a non-combustible light weight thermal insulation blanket provides an ideal insulation solution to single skin roofing system.



Single skin roof sectional drawing

The double skin roofing system is a high performance roofing system comprising of an aesthetically designed trapezoidal or standing seam profile metal sheet on the top and a metal trapezoidal tray at the bottom. The two metal sheets are fixed together with a z-purlin creating a gap in the roof space for installation of insulation and vapor barrier. Coupled with the performances of ThermalRock S stone wool insulation, it boost the performance of the double skin metal roofing system with improved level of thermal efficiency, acoustic and fire performance as compared to other roofing system. To further improve the acoustic design of the roof system, the bottom metal tray can be perforated allowing noise to pass through the metal sheet so that it can be absorbed by ThermalRock S insulation. ThermalRock S, a semi rigid slab product, is a versatile insulation that is available in various sizes to provide ease of installation and a perfect fit between purlins.



Double skin roof sectional drawing

Benefits and Performances

Fire

One of the unique properties of ThermalRock products is the fire performance of the insulation material. ThermalRock is non-combustible and achieve the highest European fire classification, A1, according to EN13501-1. The products can withstand at least 1000oC without melting according to DIN 4102-17. Thus, it can effectively impede the spread of fire and provide the critical extra minutes for occupants to escape as it does not contribute to fire load within the building.

With its fire retardant properties, ThermalRock complies with ASTM E84-10 to achieve Flame Spread '0' and Smoke Development '5' that surpass NFPA Class A requirement.

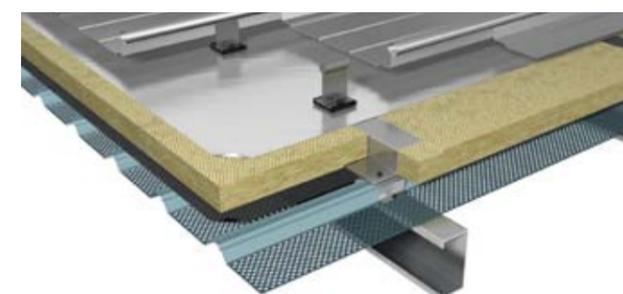
Thermal

ThermalRock products achieve the insulation properties by trapping air within the material, creating millions of trapped air pockets to resist thermal transfer. Unlike other insulation materials that uses gases, ThermalRock products uses air that is stable, thus ensuring the thermal properties of the material remain the same throughout the life of the products.

ThermalRock is available in semi-rigid slabs or blankets, and is flexible enough in roof installation, allowing a perfect fit for the insulation material to be butt jointed tightly or lapped joint. This ensures all gaps are filled within the roofing system to give maximum thermal efficiency. Furthermore, ThermalRock is water repellent and dimensionally stable, so it is not affected by moisture and heat over time. This means the product will not sag or change its shape; which when occurs affects the thermal performance of the roofing system.

ThermalRock products easily meet the thermal transmittance (U-value) requirements for building codes and energy efficiency programmes such as the Malaysian Standard, MS1525 or Singapore Green Mark.

Acoustic



Build-up of perforated double skin roofing system

ThermalRock is one of the most used insulation products for sound insulation in roofing system. With the porous open structure of the material, the spaces between the fibres create open air voids to allow sound absorption. Coupled with the low stiffness of the stone wool, it provides an effective damping in the roofing system to enable high sound transmission loss in a light weight roofing system.

To enable sound transmission loss in a double skin metal roof, ThermalRock should be installed in the middle of the roofing system cavity. In order to achieve high sound absorption for controlling of internal room reverberation, ThermalRock should be installed resting on the bottom metal tray liner with perforations. The perforations allow sound waves to pass through the metal tray liner so that it can be absorbed by ThermalRock insulation. A fibre glass tissue can also be installed to protect ThermalRock through the perforations. ThermalRock S80 is the recommended product for acoustic applications.

Condensation

Condensation occurs when surface temperature reaches dew point and moisture suction between two surfaces does not reach equilibrium through the construction. To address this issue, ThermalRock products with high thermal efficiency installed with an appropriate vapour barrier is essential in minimizing surface and interstitial condensation. As a general guide, vapour barrier with low permeability, less than 1 perm, is recommended to be installed on the warm surface side of the construction. Vapour barrier should be tapped at joints to ensure its effectiveness.

Environmental

With the abundance of natural and renewable raw materials available, ThermalRock stone wool products provide a sustainable insulation solution. Currently, basalt stone reserves are large enough to support human activities for millions of years. The chemical composition of ThermalRock products are close to average composition of the earth's surface. ThermalRock does not use or contain Persistent, Bioaccumulative, Toxic (PBT) substances or substances with high global warming potential (GWP) or ozone depleting potential (ODP).

To ensure a safe and pleasant indoor air quality, ThermalRock products surpass the requirements on low total volatile organic emissions and particles emissions established by Singapore Green

Building Council for green products. No fungi activities are found on ThermalRock products when subjected to ASTM C1338 as the product do not offer favourable conditions for mould and fungi growth. When subjected to odour test in ASTM C665, no perceptible odour is present within the product, thus ensuring the product delivers a safe, comfortable and pleasant environment for the building.

Standards

ThermalRock is designed to meet the requirements of Malaysian Standard, MS1525 (Code of Practice on Energy Efficiency and Use of Renewable Energy for Non-Residential Buildings) and Singapore BCA Green Mark for Residential and Non-Residential (version 4.0).

Following illustrate the compliance of these requirements.

Table 1: Typical construction for light weight single skin metal roofing system under 50kg/m²

Description	Thickness (mm)	MS1525, Thermal Resistance, R-value (m ² K/W)	Thickness (mm)	BCA Green Mark, Thermal Resistance, R-value, (m ² K/W) for Non-Residential
Outside air film, R _{se}		0.055		0.055
Metal roof deck	0.048	0.00001	0.048	0.00001
ThermalRock B60	100	2.941	50	1.471
Internal air film, R _{si}		0.162		0.133
Total Thermal Resistance (R-value), m ² K/W		3.158		1.659
Thermal Transmittance (U-value), W/m ² K		0.317		0.603
Required U-value in standard, W/m ² K		0.4		0.7

Table 2: Typical construction for light weight double skin metal roofing system under 50kg/m²

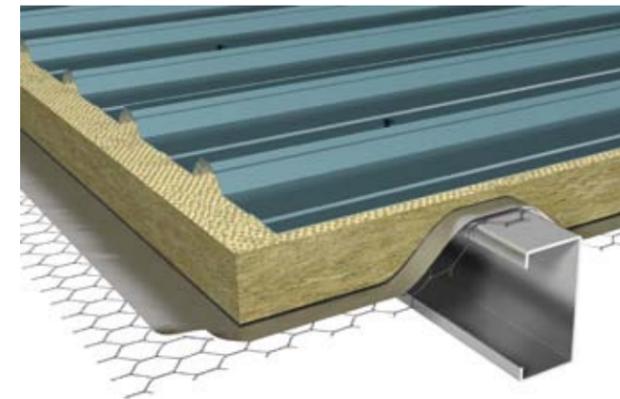
Description	Thickness (mm)	MS1525, Thermal Resistance, R-value (m ² K/W)	Thickness (mm)	BCA Green Mark, Thermal Resistance, R-value, (m ² K/W) for Non-Residential
Outside air film, R _{se}		0.055		0.055
Metal roof deck	0.48	0.00001	0.48	0.00001
ThermalRock S80	100	2.941	50	1.471
Metal roof deck	0.48	0.00001	0.48	0.00001
Internal air film, R _{si}		0.162		0.133
Total Thermal Resistance (R-value), m ² K/W		3.158		1.659
Thermal Transmittance (U-value), W/m ² K		0.317		0.603
Required U-value in standard, W/m ² K		0.4		0.7

Note: All above values are calculated based on standard roof system without taking into consideration thermal bridges and thermal conductivity safety factor. These factors may influence thermal performance of a roof. Therefore, it is recommended that the thickness of the insulation material be increased by 20%. For other types of roof systems, please contact your local ROCKWOOL representative.

Table 1 and 2 clearly illustrates that the thermal performance of roofing systems are supplemented by the performance of ThermalRock insulation to meet the requirements within MS1525 and BCA Green Mark. With insulation product of 50mm thickness, the roofing system can achieve 2 points under BCA Green Mark system for non-residential buildings. If 5 points is desired for the scoring of Green Mark, insulation thickness can be increased to 120mm to achieve a U-value of 0.28W/m²K. The Singapore Green Building Product (SGBP) certification from Singapore Green Building Council (SGBC) for ThermalRock products may also contribute additional points.

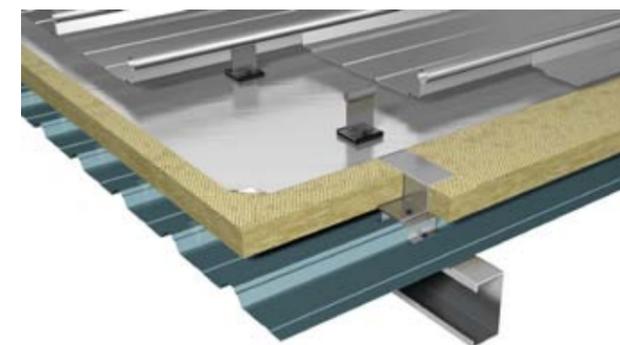
Installation Details

Single skin roof system



1. Install the galvanized high tensile steel wire mesh, of sufficient size to support ThermalRock B.
2. Lay aluminum foil on to the back of the steel wire mesh, ensuring a minimum of 50mm overlap at all joints.
3. Install ThermalRock B tightly butted.
4. Install the metal deck fixing clip and top deck.

Twin skin roof system



1. Install the metal deck as the bottom layer.
2. Install the Z purlins by screwing through the thermal pad, metal deck (bottom layer) into the purlins.
3. Install the ThermalRock S tightly butted.
4. Lay aluminium foil on top of the ThermalRock S, ensuring a minimum of 50mm overlap at all joints.
5. Align the commercially available standing seams halter with the thermal pads on all top hat Z purlins. Fasten by screwing the aligned halters through the thermal pad onto the Z purlins.
6. Install the top roofing sheet according to the manufacturer's installation procedure.

Design Considerations

Thermal bridging and air leakage

The roof system should be constructed properly so that there are no significant thermal bridges or gaps. This can be achieved by designing connection detailing using thermal pad, proper sealant and gasket that are readily available in the market.

Avoid point thermal bridges and linear thermal bridges as much as possible. It is advisable to increase the thickness of the insulation to help overcome thermal bridges.

Attention should also be given to joints details, connection of the construction and openings in order to limit air leakages from the building. This will provide a controlled air exchange environment that will give better thermal comfort. Proper design and construction is critical in ensuring lower energy consumption in buildings, at the same time providing a comfortable indoor climate.

Standard specification for roof insulation

The following specification for roof insulation can be used in project specifications:

- Roof insulation material as denoted in the drawings shall be ThermalRock S or ThermalRock B stone wool insulation to provide thermal, fire and sound absorption properties and to achieve the desired performance of the roofing system.
- Roof insulation shall be certified green building product by Singapore Green Building Council (SGBC).
- The insulation shall be able to resist the melting temperature of more than 1000°C in accordance to ASTM E794.
- The insulation shall be classified non-combustible to EN 13501-1, A1 fire classification or in accordance to local fire regulations.
- The insulation shall achieve Flame Spread '0' and Smoke Development '5' according to ASTM E84.
- Water absorption of the insulation shall be less than 1kg/m² in accordance to EN 1609:1997.
- Moisture in the atmosphere shall not be attracted by the insulation. The insulation shall have moisture resistance of less than 0.04Vol % absorption in accordance to ASTM C1104/C1104M.
- Asbestos, CFCs HFCs or HCFCs shall not be used in the manufacture of the insulation.

Installation, Handling & Storage

Installation / Workmanship

- The insulation materials are to be stored and laid strictly in accordance with ROCKWOOL's handling and storage guidelines as stated in the next section.
- The insulation blankets must be protected from the exposure of rain, water immersion and chemical contamination at all times during storage and installation. If the insulation blankets come into contact with water, adequate drying time must be allowed to ensure the insulation blankets are completely dried prior to covering with the roof covers.
- Installations of the insulation are to be butt jointed and friction fitted between roof supports. Use of insulation off-cuts as gaps infill between insulation blankets must be avoided.
- Install the insulation blankets to the thickness specified. Avoid compression of the insulation where ever possible.
- Do not step onto the product as it will damage fibre structure. At all times, use a walking platform that has been laid on the purlins so that the insulation materials are not damaged.
- Install only as much insulation as can be covered and completed before the end of the day's work or before the onset of inclement weather. Large areas of blankets without any roof covering should be avoided.
- Under no circumstances may the finished roof be used as a working platform without adequate protection being provided. It is recommended that either the main contractor or the roofing contractor operate a 'permit to work' system for any follow-on trades in areas where the roof installation has been completed.

Handling and storage of materials

- Adequate ventilation should be maintained in working area during installation period.
- Approved protective respirators should be worn when working in confined areas.
- Gloves and long sleeve shirt should be worn when installing insulation materials.
- Unpack materials at application site to avoid unnecessary handling of products to prevent damage on the edges of the products.
- Insulation materials should be elevated from ground to prevent direct contact with water. If there are facing materials lined on the insulated products, care must be taken to protect from tears and punctures to maintain the continuity of the vapour barrier.
- Protect uninstalled and installed insulation materials from direct exposure to wet weather i.e. rain. Avoid storage of insulation without covering which may get wet in the rain. Insulation materials must be protected at night with polyethylene film, canvas or other coverings.
- Insulation materials should be stored in well-ventilated area. Do not store insulation in non-ventilated area for long hours such as container/warehouse/fully wrapped with tarpaulin, where high humidity and heat may be trapped.
- Do not store insulation in area that is subjected to high heat emission.
- The recommended height of stacking for insulation should not be more than 2.7m. When delivered in pallets, it should not be stacked more than 2 pallets.

Reference Projects



Integrated Transport Terminal

This MYR570 million terminal project will be Kuala Lumpur's main transportation hub, diverting all bus traffic from the city centre to outside the city. The terminal is located at Bandar Tasik Selatan and was opened on 1st January 2011. It has state-of-the-art technology to provide comfort, convenience and a variety of facilities and services including F&B and retail outlets. ROCKWOOL ThermalRock B was used to insulate about 25,000 m² of the roof. The roof system ensures a high level of comfort and safety for this fully air-conditioned building.



Marina Bay Sands

Singapore's newest, brightest icon, this is one of Asia's leading destinations for leisure, entertainment and business. Much more than a luxurious playground, it is a monumental gateway; positioning the city as a centre for innovation, culture and entertainment.

Working closely with its roofing partners, ROCKWOOL supplied 125,000m² of ThermalRock S insulation for the twin skin metal deck roof; helping to create spaces that are comfortable and acoustically sound.



Mega Bangna and IKEA

Built on only two levels, Mega Bangna offers unparalleled convenience for its shoppers all within an internationally recognized and successful concept, never seen before in Southeast Asia. Designed with a new concept of a one-stop mall, its anchor tenants included the much waited IKEA Store as well as over 800 stores and tenants separated into nine Mega zones.

For this project, about 50,000m² of roofing was insulated with ThermalRock S. The insulation provides thermal and acoustic protection for the projected 40 million visitors per year.

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