SUPPLEMENTARY HEAT LOAD CALCULATION GUIDELINE FOR ARCHITECTS & ENGINEERS

Using NASA's experience, Thermoshield developed an advanced radiant barrier coating with space age insulation properties. This space age product is having a tremendous impact on the environment we live in and is a revolutionary approach to the coatings industry worldwide.

Thermoshield's unique Elastomeric Radiation Control Coatings for roofs and walls is without doubt the coating material of the future.

Why is Thermoshield so effective? With a coating of Thermoshield, radiant heat is deflected, absorbed and dissipated. When solar heat radiates on a roof, the surface temperature of the roof rises, resulting in a 75% to 90% increase in heat build up within the building. With Thermoshield up to 75% heat is repelled in the direction of the source, allowing little heat transfer into the building, therefore reducing the temperature by up to 45%. Thermoshield, furthermore, has an ultraviolet resistance of 96%, a solar reflectance of over 80%, and an emissivity of 90%. In other words – it is nearly as good as a mirror.

Thermoshield's high thermal reflective properties are due to millions of hollow ceramic beads that cluster together and provide dead air space. When applied, this liquid acrylic emulsion dries and forms an elastomeric heat shield. Because of this, it reduces inside temperatures very dramatically.

Unlike other roofing systems, Thermoshield is simple in application and dramatic in results. When a Thermoshield coating is applied, the surface is cleaned, prepared and any loose roof fasteners are replaced or tightened. Reinforcing is applied to seams where needed and two coats of Thermoshield is sprayed on. Once applied the coating chemically converts rust into iron sulphate and prevents continued corrosion. It will also seal and waterproof the roof, apart from forming the radiant heat barrier, and eliminates 80% of the very destructive thermal shock (the movement of various roofing materials, i.e. roof sheets, flashings, purlins and fasteners against each other), a major cause of roof degradation and water leakage.

Thermoshield is available in a variety of pastel colours and are identified according to their product application.

The American Standard Testing Method has verified that Thermoshield is extremely resistant to fire, wind, rain, chemicals, abrasions and fungal growth. Thermoshield is also highly adhesive, flexible, waterborne, non-toxic AND environment friendly. Because of Thermoshield's amazing space age insulation properties, the application possibilities of this product are endless.

Thermoshield Australia Pty Ltd ABN 37 079 666 774 11/42 Mills Road, Dandenong, VIC 3175, Australia Ph: +61 3 9728 8800 thermoshield.com.au

Due to its super effective radiant heat barrier properties, Thermoshield is without doubt today's most revolutionary hi-tech coatings product in the world because it:-

- Reduces temperatures dramatically by up to 45% ;
- Cuts air conditioning and refrigeration equipment running costs ;
- Stops thermal ageing and thermal shock by reducing heat load, Ultra Violet penetration and degradation ;
- Reduces roof maintenance by up to 80%;
- Protects by eliminating blistering, peeling, cracking and fading ;
- Converts rust and increases metal life ;
- Reduces the risk of serious burns caused by high surface temperatures on metals;
- The most advanced radiant barrier insulating coating available, and has waterproofing properties.

Thermoshield is Australia's foremost ceramic based total solution liquid thermal coating which offers:-

- Reduced capital investment in cooling equipment;
- Low maintenance costs ; and
- A better working and living environment in Australia, where many happy clients already exist.

With respect to the running and maintenance costs of refrigeration and air-conditioning units, please refer to the attached worksheets.

HEAT TRANSFER CALCULATION GUIDELINES

Another way to calculate heat leakage is to first determine the thermal resistance of the total structure, then use this value to compute the amount of heat leakage. Thermal resistance is known as the R-Value. It is the reciprocal of conductance (C) or the overall heat transfer (U).

Since there are three general conductivity conditions, the following terms are used:-

a) The letter "K" represents the amount of watts that will be transmitted through 1m² wall (or surface) if there is a temperature difference of 1°C, if the material is 1m thick.

   The unit of "K" is w/m°C.

b) The letter "C" conductivity is used to indicate heat transfer through a wall or roof made of different substances.

$$\frac{1}{C} = \frac{X1 + X2 + X3}{K1 \quad K2 \quad K3}$$

("X" is thickness of material in meters)

OR

$$C = \frac{1}{\frac{X1}{K1} + \frac{X2}{K2} + \frac{X3}{K3}}$$

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c) The letter "U" is used to represent heat leakage from the air on one side of the wall to the air on the other side of the wall or roof. This air film that clings to the outer and inner surface, adds to the insulation value.

The formula for "U" factor for heat leakage is as follows:

$$U = \frac{1}{\frac{1}{Fo} + \frac{X1}{K1} + \frac{X2}{K2} + \frac{X3}{K3} + \frac{1}{Fi}}$$

Where: Fo = Outside Air film (m² Deg. C/w)
Fi = Inside Air film (m² Deg. C/w)

This document reflects the calculations on various composite roof structures for this exercise steel sheets, Polyurethane insulation boards and Thermoshield's radiant heat barrier coating have been utilised.

The effect of the airspace between the steel sheets and the insulation layer was simulated by artificially increasing the insulation layer thickness.

The following assumptions have been made:

- Ambient temperature: 32°C
- Solar radiation intensity: 1000 w/m²
- Inside room temperature: 25°C
- Steel sheet K-value: 43 w/m°C
- Steel sheet thickness 0.6mm
- Insulation material and air space K-value: 0.038 w/m² °C
- Only heat exchange through the roof was taken into account.

CALCULATION RESULTS:

PARAMETER	Steel Sheet	Steel Sheet + 25mm insulation	Thermoshield coated steel sheet + 25mm insulation	Steel sheet with 100mm Styrofoam (extruded)	Steel sheet with Thermoshield coating
	(1)	(2)	(3)	(4)	(5)
Solar radiation	1000	1000	1000	1000	1000
Solar absorbtivity, as	0.4	0.4	0.19	0.4	0.19
Absorbed solar radiation, W/m²	400	400	190	400	190
Roof outer temperature, °C.	64.7	80.2	48.4	86	37
Roof inner temperature, °C.	64.7	41.3	33.0	30	37
Natural convection heat loss, W/m²	149.0	250.7	59.7	280.8	65
Radiation heat loss, W/m²	56.8	90.2	107.3	101.2	107
Heat flow into building	193.6	59.1	16.0	18.0	18.0

- A plain steel sheet roof is shown in Column (1).
- A roof consisting of steel sheet and a 25mm. layer of insulation (2) allows a heat flow of 59.1 W/m² through the roof.
- Coating the roof with a 0.5mm layer of Thermoshield (3) reduces the heat flow into the room to 16.0 W/m².
- The thickness of the insulation material would have to be increased to 100mm (4) to reduce the heat transmission to the same value achievable with no insulation and a Thermoshield coating of 0.5mm. thick (5).

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