JAMES M FRICKER PTY LTD
ABN 32 080 307 348
54 Felix Crescent
Ringwood North, Vic 3134
Mobile: 0414 804 097
Phone: 03 9879 5744
http://fricker.net.au

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Thermoshield Australia Pty Ltd.
P.O. Box 16,
SILVAN. VIC 3795

PEAK SOLAR LOAD REDUCTION DUE TO THERMOSHIELD COATING

I confirm that solar reflective coatings such as THERMOSHIELD TC 938/45S/101[@] can reject solar radiant heating of roofs and walls, thus providing peak-load air conditioning energy savings or improved comfort over conventional paints and roof surfaces. [@]tested Total Solar Reflectance of 81% and Infrared Emittance of 90%

The actual benefit is complex to analyse and depends on a number of factors, principally solar reflectance, infrared emittance, solar insolation (climate, cloud, surface orientation, sun angle), dirt deposits (if any), wind pattern, total thermal resistance, and the thermal capacitance of the surface and the interior. An example is presented below to illustrate the potential benefits:

The simple heat load through a surface is found by

Heat Load = Temperature difference X surface Area / Total thermal Resistance (R_T)

When it is windy and cloudy, the difference can be taken as the air temperature difference.
E.g. Melbourne: For an **R_T3.0** roof example, **Heat Load = (38°-24°C) x 100sqm / 3.0m²·K/W = 0.47 kW**

But when it is still and sunny, the temperature difference must be taken as the sunlit surface temperature minus the indoor air temperature. Example, when the above unreflective surface is perpendicularly sunlit and there is no wind, **Heat Load would be (94.2°-24°C) x 100sqm / 3.0m²·K/W = 2.34 kW**

But coating the exterior surface with a solar reflective paint or coating will reduce the sunlit surface temperature, for an example, to 46.6°C for THERMOSHIELD TC 938/45S/101.
In this case, the resulting sunlit **Heat Load = (46.6°-24°C) x 100sqm / 3.0m²·K/W = 0.75 kW**
Thus, in this case, the load saving is (2.34-0.75)/2.34 = **68%**.

To obtain the same[#] Peak Solar Load reduction as the THERMOSHIELD TC 938/45S/101 coating provides, R6.3* m²·K/W added insulation would be needed. [#]This case, *only*. * R3x2.34/0.75-R3)=R6.3

The above example illustrates the potential solar performance benefit for THERMOSHIELD TC 938/45S/101. Depending on the climate, surface orientation, duration of exposure, dirt cover, etc., the annual energy benefit could be large or small. For a particular location, the coating will give most benefit on surfaces that are poorly insulated and that have the most hours' exposure to the sun. (The benefit ceases when the surface is in shade, or the surface has been covered with thick grime.)

Almost uniquely, THERMOSHIELD TC 938/45S/101 has this performance because it has a high infrared emittance to complement the high solar reflectance, thus heat absorbed reradiates upward more rapidly than if it had low infrared emittance, lowering the potential surface maximum temperature.

LIMITATION OF RESULTS: Although THERMOSHIELD TC 938/45S/101 reduces peak air conditioning load (a saving in equipment size), the benefit ceases when it is windy and cloudy, and at night. Thus the coating does not have a constant "R" benefit daytime, and nil benefit at night time.

Yours sincerely,

James Fricker

JAMES M FRICKER
B Mech Eng, CPEng, F.AIRAH, M.Eng.Aust

The Institution of Engineers, Australia
James M. Fricker
MIEAust CPEng
Chartered Professional Engineer
Membership No. 1179647