What are S.R.I. Figures ?

Solar reflectance index (SRI), is another measurement beginning to get some attention as a numerical expression of a coating's overall ability to reject solar heat.

Total Solar Reflectance (T.S.R.) figures are expressed as a percentage falling between 0% and 100% dependant on a product's Total Solar Reflectance as tested to ASTM C-1549 or ASTM E-903.

Emissivity or (Infrared emittance), is a measure of the ability of a surface to shed some of it's heat in the form of infrared radiation away from the surface. The results from tests conducted to ASTM C-1371, express the emittance value as a percentage falling between 0% and 100% depending on the product's performance.

Solar reflectance index (SRI), combines both the T.S.R.% reflectivity value and emittance value as a measure of a coating's overall ability to reject solar heat.

The (S.R.I.) index calculation is done in accordance with ASTM E 1980-01. The calculation is based on a mathematical formula that includes values for thermal emittance, total solar reflectance, solar absorptance, three convective coefficients, solar flux, the Stefan Boltzman constant, and various other coefficients.

Example: A standard black with reflectivity 5% and emittance 90% has an index of 0.
A standard white with reflectivity 80% and emittance 90% has an index of 100.

Note: Very hot materials can actually have negative values.
Very cool materials can have values greater than 100.

Extract on topic from Lawrence Berkeley National Laboratory (LBNL):

"The ASTM's Cool Construction Materials Committee has developed a Solar Reflectance Index with values from 0 to 100, where 100 will be a defined standard white and 0 will be a defined standard black. According to Hashem Akbari, staff scientist and leader of the Heat Island Group at Lawrence Berkeley National Laboratory (LBNL) and chairman of the ASTM committee, the Index measures a material's solar reflectance and thermal emissivity. Thermal emissivity, according to Akbari, is the power to radiate heat from a surface. Given the combination of reflectance and emissivity, Akbari believes it is possible for dark colored materials to be cool and also have high Solar Reflectance."

Using ASTM E 1980-01 the solar reflectance index can be calculated for any given material provided the exact T.S.R.% and emittance values are known.

Coatings with the highest ***Solar reflectance index*** (SRI), are the coolest choice for exterior applications.

ASTEC PAINTS

Astec Paints Australasia Pty Ltd. 262 Marion Road, Netley, South Australia 5037

Ph +618 82972000 **Fax +618 82972555**
Web www.astecpaints.com.au **Email enquiries@astecpaints.com.au**

Example 1: New Galvalume Roofing Sheet vs Astec Energy Star Slate Grey.

Galvalume roofing sheet is widely selected as a roofing sheet known to have reasonably good reflectance with a T.S.R.% of (0.673). However, when the emittance value is also taken into account, (0.261) the overall performance as a reflective roofing sheet is lower.

As seen by the two samples below calculated to ASTM E-1980-01 the **GALVALUME** zinc sheet has an **S.R.I. of 44.09** under low wind conditions and the **ENERGY STAR TILESHIELD SLATE GREY** has an **S.R.I. of 48.91.**

When the two S.R.I. figures are compared, the Slate Grey, which is almost black, will provide the same ability to reject solar heat as a new Galvalume sheet.

ASTM E1980-01 Solar Reflectance Index Calculator for Low-Slope Roofing

Product	**GALVALUME SHEET**
Colour	**N/A**
Thermal emittance=	0.261
TSR=	0.673
Solar Absorbance=	0.327

	Wind Condition		
	Low	Medium	High
Convective coefficient=	5	12	30
X=	0.589	0.459	0.381
SRI=	**44.09**	**61.17**	**71.45**

Standard solar conditions
Solar Flux=1000 W/m2
Ambient Air Temp=310K (37C)
Ambient Sky Temp=300K (27C)
No conductive heat transfer

Low Slope Roofing Temperatures for above standard solar conditions

Surface Temperature (K)=	353	332	320
Surface Temperature (C)=	**80**	**59**	**47**
Surface Temperature (F)=	176	139	116

ASTM E1980-01 Solar Reflectance Index Calculator for Low-Slope Roofing

Product	**ENERGY STAR TILESHIELD**
Colour	**C/B SLATE GREY**
Thermal emittance=	0.903
TSR=	0.430
Solar Absorbance=	0.570

	Wind Condition		
	Low	Medium	High
Convective coefficient=	5	12	30
X=	0.552	0.549	0.547
SRI=	**48.91**	**49.27**	**49.59**

Standard solar conditions
Solar Flux=1000 W/m2
Ambient Air Temp=310K (37C)
Ambient Sky Temp=300K (27C)
No conductive heat transfer

Low Slope Roofing Temperatures for above standard solar conditions

Surface Temperature (K)=	350	337	324
Surface Temperature (C)=	**77**	**64**	**51**
Surface Temperature (F)=	170	147	124

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Example 2: Astec Energy Star C/B Slate Grey vs Standard paint C/B Gull Grey

As seen by the two samples below calculated to ASTM E-1980-01, in a standard paint you would have to select a light colour of C/B Gull Grey to achieve the same overall ability to reject solar heat as the dark Energy Star colour of C/B Slate Grey.

Even when comparing these two colours, the S.R.I. on the light coloured standard paint is still 7.5 lower in ability.

ASTM E1980-01 Solar Reflectance Index Calculator for Low-Slope Roofing

Product	**ENERGY STAR**
Colour	**C/B SLATE GREY**
Thermal emittance=	0.903
TSR=	0.430
Solar Absorbance=	0.570

	Wind Condition		
	Low	Medium	High
Convective coefficient=	5	12	30
X=	0.552	0.549	0.547
SRI=	**48.91**	**49.27**	**49.59**

Standard solar conditions
Solar Flux=1000 W/m2
Ambient Air Temp=310K (37C)
Ambient Sky Temp=300K (27C)
No conductive heat transfer

Low Slope Roofing Temperatures for above standard solar conditions

Surface Temperature (K)=	350	337	324
Surface Temperature (C)=	**77**	**64**	**51**
Surface Temperature (F)=	170	147	124

ASTM E1980-01 Solar Reflectance Index Calculator for Low-Slope Roofing

Product	**STANDARD PAINT**
Colour	**C/B BIRCH GREY**
Thermal emittance=	0.850
TSR=	0.397
Solar Absorbance=	0.603

	Wind Condition		
	Low	Medium	High
Convective coefficient=	5	12	30
X=	0.609	0.599	0.589
SRI=	**41.41**	**42.81**	**44.06**

Standard solar conditions
Solar Flux=1000 W/m2
Ambient Air Temp=310K (37C)
Ambient Sky Temp=300K (27C)
No conductive heat transfer

Low Slope Roofing Temperatures for above standard solar conditions

Surface Temperature (K)=	354	339	325
Surface Temperature (C)=	**81**	**66**	**52**
Surface Temperature (F)=	178	151	126

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Example 3: Astec Energy Star White vs Standard White Paint.

The two samples below calculated to ASTM E-1980-01 clearly demonstrate that Astec Energy Star coatings are not just a white paint. The S.R.I. of the standard white paint is (99.28) and the S.R.I. of the Energy Star white is (113.83).

To add further meaning to the difference between the S.R.I. results of the standard and Energy Star White.

You could choose a colour as dark as Astec 8096 Light Cream in Energy Star products, S.R.I. (97.46) and you would achieve the same overall ability to reject solar heat as a standard white paint.

ASTM E1980-01 Solar Reflectance Index Calculator for Low-Slope Roofing

Product	**STANDARD PAINT**
Colour	**WHITE**
Thermal emittance=	0.900
TSR=	0.800
Solar Absorbance=	0.200

	Wind Condition		
	Low	Medium	High
Convective coefficient=	5	12	30
X=	0.177	0.176	0.175
SRI=	**99.28**	**99.41**	**99.54**

Standard solar conditions
Solar Flux=1000 W/m2
Ambient Air Temp=310K (37C)
Ambient Sky Temp=300K (27C)
No conductive heat transfer

Low Slope Roofing Temperatures for above standard solar conditions

Surface Temperature (K)=	322	318	314
Surface Temperature (C)=	**49**	**45**	**41**
Surface Temperature (F)=	121	113	106

ASTM E1980-01 Solar Reflectance Index Calculator for Low-Slope Roofing

Product	**ENERGY STAR PAINT**
Colour	**WHITE**
Thermal emittance=	0.900
TSR=	0.903
Solar Absorbance=	0.097

	Wind Condition		
	Low	Medium	High
Convective coefficient=	5	12	30
X=	0.072	0.072	0.071
SRI=	**113.83**	**113.89**	**113.94**

Standard solar conditions
Solar Flux=1000 W/m2
Ambient Air Temp=310K (37C)
Ambient Sky Temp=300K (27C)
No conductive heat transfer

Low Slope Roofing Temperatures for above standard solar conditions

Surface Temperature (K)=	314	313	311
Surface Temperature (C)=	**41**	**40**	**38**
Surface Temperature (F)=	106	103	100

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