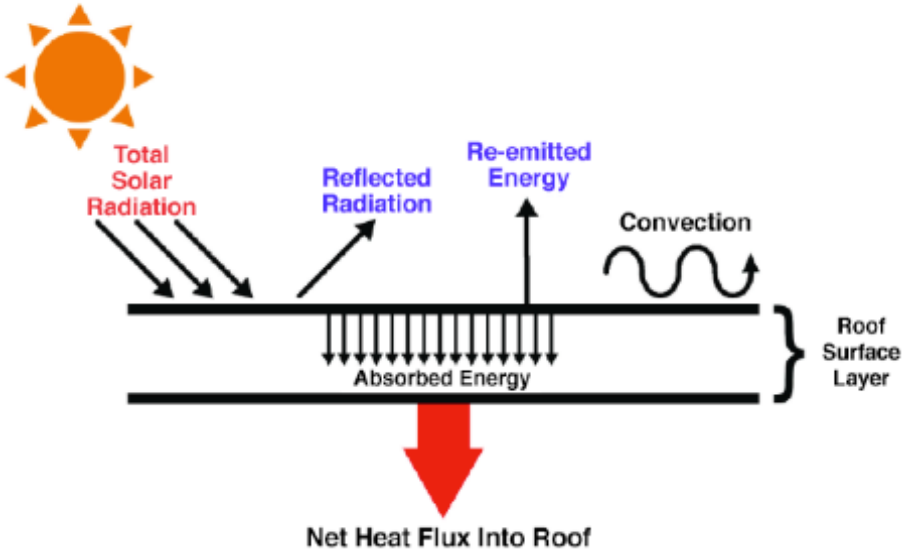
Technical Note 4.05: Reflectivity of Pre-finished Sheet Steel

# Indian Sheet Steel Building Group: Technical Note 4.05

## Reflectivity of Pre-finished Sheet Steel

### Introduction

It's a fact that buildings are a major consumer of energy. While it is recognized that cooling and heating costs can be reduced by adding insulation under the roof surface, there is a diminishing return on the strategy of increasing insulation to conserve energy costs. This is where "cool roofing" can play a role in further reducing the energy consumed, and in minimizing the Heat Island effect created in the big urban cities. Cool roofing relies on the properties of reflectivity and emissivity of the roofing material.




### Reflectivity

Reflectivity is the ability of the roof to reflect solar radiation back into the atmosphere. Its primary measure is solar reflectance - the proportion of the total solar radiation that is reflected back to the atmosphere. Any solar radiation that is not reflected is absorbed into the building envelope, requiring further energy to cool the building; or partially convected into the atmosphere increasing the ambient air temperature in the surrounding environment (Heat Island effect).

The measure of reflectivity is the Solar Reflectance Index (SRI), which takes into account the properties of the material as well as the cooling effect of wind passing over the roof. The SRI for a low slope roof will be 0 for standard black (reflectance 0.05, emittance 0.90) and 100 for standard white (reflectance 0.80, emittance 0.90).

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**Emissivity**

Emissivity is the ability of the roof to re-radiate absorbed solar infrared radiation back to the atmosphere. This takes place at all times, but mostly at night. Its measure is Infrared Emittance - the proportion of absorbed infrared solar radiation that is re-emitted back to the atmosphere. For prepainted sheet steel colors, the emissivity is generally high and close to 0.90 galvanized steel materials where there has been rainwater run-off or dripping from pre-coated galvanized steel roofs and glass roofs (greenhouses).

**Properties of Prefinished Sheet Steel**

Prefinished sheet steel is a coil-coated product manufactured under stringent quality control in a modern coating factory. Coil coating is a precise, multi-step process that applies paint coatings to specially prepared sheet steel in a continuous operation. There are a variety of paint systems available (e.g. polyesters, fluorocarbons, plastisols) to suit the needs of the consumer and the environmental conditions. Each paint system and color can have different reflectivity depending mostly on pigment quality. 50% of sunlight is visible (color vision) and 50% invisible (UV and near infrared). The reflectivity can then be improved by modifying the thermal property of the paint in the invisible part of the sunlight without modifying the color. Listed in Tables 1 and 2 are the properties of some common Perspectra Series and 10 000 Series colors respectively.

***The following definitions apply to these tables:***

TSR = Total Solar Reflectance

SRI = Solar Reflectance Index calculated at the Medium wind condition per ASTM E1980, *Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low Sloped Opaque Surfaces*.

**Table 1. Typical Solar Reflectance Values for Silicon Polyester Painted Steel**

| Color Description | TSR | SRI |
|---|---|---|
| **WHITE** | 0.58 | 68 |
| **LIGHT GREY** | 0.46 | 51 |
| **DARK GREY** | 0.37 | 39 |
| **TILE RED** | 0.31 | 31 |
| **BROWN** | 0.27 | 26 |
| **GREEN** | 0.27 | 26 |
| **ROYAL BLUE** | 0.24 | 21 |
| **NAVY BLUE** | 0.12 | 6 |
| **BLACK** | 0.05 | -1 |

**Table 2. Typical Solar Reflectance of PVDF (Kynar) Prepainted Sheet Steel**

| Color Description | TSR | SRI |
|---|---|---|
| **WHITE** | 0.58 | 69 |
| **SAND BIEGE** | 0.51 | 57 |
| **LIGHT GRAY** | 0.31 | 30 |
| **DARK GRAY** | 0.27 | 26 |
| **SAFETY ORANGE** | 0.26 | 52 |
| **RED** | 0.21 | 17 |
| **DARK GREEN** | 0.12 | 6 |
| **DARK BROWN** | 0.10 | 2 |
| **BLACK** | 0.06 | -3 |



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