(ICS 87.040)

# SINGAPORE STANDARD Specification for solar reflective water-based coatings

Incorporating Corrigendum No. 1





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SINGAPORE STANDARD

Specification for solar reflective water-based coatings

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## Foreword

This Singapore Standard was prepared by the Working Group on Cool Coatings set up by the Technical Committee on Surface Coatings under the purview of the Chemical Standards Committee (CSC).

This standard provides a solar reflective water-based topcoat applied on both concrete and cementbased substrate external facades. Solar reflective coating reduces the solar energy absorption of facades by reflecting the radiation thereby keeping the building cool. This feature is most useful to countries with hot equatorial or tropical climates experiencing strong direct sunlight. The standard aims to promote the use of cool coatings as one of the mitigation technologies to reduce cooling loads in buildings. The standard also encourages manufacturers to produce innovative products that can effectively lower surface temperatures of urban environment by reflecting solar radiation without restricting the coatings to only white pigments.

This standard retains the specifications of SS 345: 2015 *Specification for algae-resistant emulsion paint for decorative purposes* in entirety with the addition of solar reflective performance properties as black dirt trapped by algae growth will hinder the solar reflective performance of products meeting this new standard. A clean façade with solar reflective properties will bring about energy savings from cooler building interiors from reduced air-conditioning costs while maintain a pleasing aesthetic look for these buildings when applied over an extended period of time before the next repainting cycle.

The specifications of this standard are currently in line with global trend and movement towards ecofriendly coatings by reducing volatile organic compounds (VOCs), toxic heavy metals and hazardous substances that may be present in a number of water-based paints and coatings. In specifying waterbased product, this standard is intended to further improve the comfort of end-users and safety of general worker from its inherent non-flammable components. It is also intended to support environmental quality in the Green Building Masterplan under the Building and Construction Authority. The standard aims to support sustainability efforts in encouraging the use of water-based coatings products manufactured locally. This standard would help contribute to global sustainability efforts and maintain a green environment in line with global trends.

This standard specification limits are based on a series of laboratory tests done under the Singapore climate to ensure its suitability for use in the harsh hot and wet equatorial climate of Singapore and other countries located in hot tropical regions.

In preparing this standard, reference was made to the following publications:

- 1. ANSI/CRRC S100:2016 Standard test methods for determining radiative properties of materials
- 2. Federal Specification TT-E-491C
- 3. SS 500:2015 Specification for elastomeric wall coating

Acknowledgement is made to the following organisations for the reproduction of materials from their publications:

#### ASTM International

- 1. ASTM E903-12, Standard test method for solar absorptance, reflectance, and transmittance of materials using integrating spheres
- 2. ASTM E1980-11(2019), Standard practice for calculating solar reflectance index of horizontal and low sloped opaque surfaces

3. ASTM D7897-15 Standard practice for laboratory soiling and weathering of roofing materials to simulate effects of natural exposure on solar reflectance and thermal emittance.

Copyright ASTM International, West Conshohocken, PA, 2019, www.astm.org

#### Singapore Green Building Council

SGBC Report TFFR-01/28-022011 Assessment guidelines for green building product certification

Attention is drawn to the possibility that some of the elements of this Singapore Standard may be the subject of patent rights. Enterprise Singapore shall not be held responsible for identifying any or all such patent rights.

### NOTE

- 1. Singapore Standards (SSs) and Technical References (TRs) are reviewed periodically to keep abreast of technical changes, technological developments and industry practices. The changes are documented through the issue of either amendments or revisions. Where SSs are deemed to be stable, i.e. no foreseeable changes in them, they will be classified as "mature standards". Mature standards will not be subject to further review unless there are requests to review such standards.
- 2. An SS or TR is voluntary in nature except when it is made mandatory by a regulatory authority. It can also be cited in contracts making its application a business necessity. Users are advised to assess and determine whether the SS or TR is suitable for their intended use or purpose. If required, they should refer to the relevant professionals or experts for advice on the use of the document. Enterprise Singapore and the Singapore Standards Council shall not be liable for any damages whether directly or indirectly suffered by anyone or any organisation as a result of the use of any SS or TR. Although care has been taken to draft this standard, users are also advised to ensure that they apply the information after due diligence.
- 3. Compliance with a SS or TR does not exempt users from any legal obligations.

## Specification for solar reflective water-based coatings

## 0 Introduction

Solar reflective cool coating is a passive building energy saving solution which helps to lower the surface temperature of buildings by reflecting solar radiation before it can be absorbed. The benefits of cool coatings include energy savings, improved thermal comfort, mitigating the Urban Heat Island (UHI) effect and potentially cooling global temperatures. This is extremely useful to Singapore in creating a better quality of urban living in a high-density environment.

There is a growing number of solar reflective water-based coating products in Singapore. A set of standard guidelines and minimum performance requirements is essential for the development, manufacture, and adoption of such products. This standard specifies the quality and performance requirements of solar reflective water-based coatings for the exterior surfaces of buildings, complementing the existing paint performance standards. The product that meets this standard has the capability of reducing the solar heat absorption by the building which, consequently, contributes to improving energy efficiency.

This standard provides references to align the different specifications and requirements currently used by different voluntary green building/product certification schemes to a commonly-compatible standard. This promotes the awareness and acceptance of such coating products amongst the building industry and the general public. This standard also provides support to the relevant industries for innovations to achieve better quality and performance for such coating products and to align with internationally recognised specifications and performance requirements for overseas markets.

## 1 Scope

This standard applies to a ready-for-use, solar reflective water-based coating on cementitious façade. All facades, new or previously painted, are prepared according to the paint manufacturer's recommendation. The test methods for the quality and performance of the coatings are also covered in this standard.

This standard specifies the requirements of solar reflective coatings that are formulated with environmentally-friendly materials containing low hazardous substances and low volatile organic compound (VOC) levels. Such materials help reduce chemical emissions during application, are chemically non-toxic in nature and are environmentally non-polluting at any stage of the product lifecycle.

This standard does not cover roofs, pavements, metallic substrates applications, elastomeric coatings for waterproofing or other exterior cladding. Facades are walls with slope angles of more than 70°.

## 2 Normative references

The following referenced documents are indispensable for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ASTM C1371-15 Standard test method for determination of emittance of materials near room temperature using portable emissometers

ASTM D1014-18	Standard practice for conducting exterior exposure tests of paints and coatings on metal substrates
ASTM E903-12	Standard test method for solar absorptance, reflectance, and transmittance of materials using integrating spheres
ASTM E1980- 11(2019)	Standard practice for calculating solar reflectance index of horizontal and low-sloped opaque surfaces
ASTM G154-16	Standard practice for operating fluorescent ultraviolet (UV) lamp apparatus for exposure of non-metallic materials
BS 5252:1976	Framework for colour co-ordination for building purposes
IEC 62321-7-2:2017	Determination of certain substances in electrotechnical products – Part 7-2: Hexavalent chromium – Determination of hexavalent chromium (Cr (VI)) in polymers and electronics by the colorimetric method
ISO 11890-2:2020	Paints and varnishes – Determination of volatile organic compounds (VOC) and/or semi volatile organic compounds (SVOC) content – Part 2: Gas-chromatographic method
SS 5 :	Methods of test for paints, varnishes and related materials
	Part A1 : 2018 – Sampling
	Part A2 : 2013(2018) – Examination and preparation of samples for testing
	Part A3 : 2020 – Standard panels for testing
	Part B2 : 2013(2018) – Determination of non-volatile matter content
	Part B4 : 2003(2013) – Condition in container
	Part B7 : 2013 (2018) – Density
	Part B9 : 2003 (2013) – Brushing properties
	Part B12 : 2013(2018) – Consistency of paints using the Stormer viscometer
	Part B13 : 2018 – Fineness of grind
	Part C4 : 1988(2013) $-$ Determination of low concentrations of mercury in paint by atomic absorption spectroscopy
	Part C6 : 1988(2013) – Determination of low concentrations of lead, cadmium and cobalt in paint by atomic absorption spectroscopy
	Part D6 : 2020 – Hard dry time – Test using a mechanical recorder
	Part E1 : 2020 – Determination of gloss value at 20°, 60° and 85°
	Part E2 : 2013(2018) – Determination of contrast ratio (opacity) of light-coloured paints at fixed spreading rate
	Part E3 : 2019 – Visual comparison of the colour of paints
	Part F6 : 2014(2020) – Determination of wet-scrub resistance
	Part G2 : 2003(2013) Alkali resistance (spotting method)
	Part G11 : 2020 – Methods of exposure to laboratory light sources – General guidance

Part G12 : 2020 – Methods of exposure to laboratory light sources – Xenon-arc lamps

SS 579:2015 Specification for water-based sealer for interior and exterior uses

NOTE -

- 1 The review of the SS 5 series was completed in 2020
- 2 IEC 62321-7-2:2017 is used for the evaluation of Cr (VI) content in electrochemical products and can also be used for coatings