

BS EN 4593:2011



BSI Standards Publication

Aerospace series — Paints and varnishes — Determination of solar absorptance

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN 4593:2011.

The UK participation in its preparation was entrusted to Technical Committee ACE/65, Non-metallic materials for aerospace purposes (excluding textiles).

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© BSI 2011

ISBN 978 0 580 73663 6

ICS 49.040

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 July 2011.

Amendments issued since publication

Date	Text affected
------	---------------

ICS 49.040

English Version

Aerospace series - Paints and varnishes - Determination of solar absorptance

Série aérospatiale - Peintures et vernis - Détermination de l'absorption solaire

Luft- und Raumfahrt - Beschichtungsstoffe - Bestimmung der Sonnenlichtabsorption

This European Standard was approved by CEN on 19 February 2011.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG**Management Centre: Avenue Marnix 17, B-1000 Brussels**

Contents

	Page
Foreword.....	3
1 Scope	4
2 Normative references	4
3 Definitions	4
4 Principle.....	4
5 Apparatus	4
6 Specimens	5
7 Procedure	5
8 Calculation.....	5
9 Supplementary information	6
10 Test report	6
11 Designation	6

Foreword

This document (EN 4593:2011) has been prepared by the Aerospace and Defence Industries Association of Europe - Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has received the approval of the National Associations and the Official Services of the member countries of ASD, prior to its presentation to CEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2011, and conflicting national standards shall be withdrawn at the latest by December 2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies the method of test for determining the solar absorptance of paints and varnishes.

The test procedure determines the amount of energy reflected by the material in the range of wavelengths at which there is energy from the sun hitting the Earth's surface, and with the aid of a standard solar spectrum it allows a calculation to determine the solar absorptance which can then be used to determine the efficiency of solar heat reflecting paints.

The procedure is applicable to products intended for use in aerospace applications.

2 Normative references

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

EN 23270, *Paints and varnishes and their raw materials — Temperatures and humidities for conditioning and testing (ISO 3270:1984)*

EN ISO 15528, *Paints, varnishes and raw materials for paints and varnishes — Sampling (ISO 15528:2000)*

EN ISO 1513, *Paints and varnishes — Examination and preparation of test samples (ISO 1513:2010)*

EN ISO 2808, *Paints and varnishes — Determination of film thickness (ISO 2808:2007)*

CIE publ No 85, *Solar spectral irradiance*

3 Definitions

For the purposes of this document, the following terms and definitions apply.

3.1
solar absorptance
proportion of the energy emitted by the sun which hits the Earth's surface which is absorbed by the material under test

4 Principle

The reflectance of specimens, comprising of coated test panels is measured and summated over the range of solar energy which hits the Earth's surface through two air masses, allows the calculation of solar absorptance.

5 Apparatus

A recording spectrophotometer fitted with an integrating sphere which has the specular component included, a 10°/diffuse measuring geometry and is capable of meeting the following requirements.

Measuring range: 300 nm to 2 300 nm

Wavelength accuracy: ± 5 nm

Measuring accuracy: ± 2 %

Bandpass: 4 nm

Replace (23 ± 2) °C and (50 ± 5) % relative humidity with EN 23270, where applicable.

6 Specimens

Take a representative sample of the product to be tested or of each component in the case of a multi-coat system as described in EN ISO 15528.

Examine and prepare each sample for testing as described in EN ISO 1513.

The test panels shall be of a size suitable for the performance of the tests identified by this and the product standard.

Coat the test panels with the test product as specified by the product standard.

Dry/cure the coating for the time and under the conditions specified in the product standard.

The coating thickness, when determined using one of the non destructive procedures specified in EN ISO 2808 shall comply with the requirements of the product standard.

Condition the test panels at a temperature and at a relative humidity of EN 23270 for a minimum of 16 h and a maximum of 72 h prior to testing.

7 Procedure

Measure and record the reflectance spectrum using the reflectance grade barium sulphate as the reflectance standard on the spectrophotometer in the wavelength range 300 nm to 2 300 nm.

8 Calculation

Unless specified, use the solar spectral irradiance data (CIE publ No 85) through 2 air masses, 0,2 nm optical depth at 50 nm, 0,3 cm ozone and 2,0 cm precipitable water.

Calculate the solar absorptance using the following equation:

$$\alpha(s) = \frac{\sum_{300}^{2300} \left(\frac{100 - R_m}{100} \right) \times E_\lambda}{\sum_{300}^{2300} E_\lambda}$$

where

$\alpha(s)$ is the solar absorptance;

R_m is the measured reflectance of paint, as a percentage;

E_λ is the solar irradiance, in watt per square metre.

9 Supplementary information

In the performance of this test standard there is a requirement for supplementary information to be provided by the product standard for the material under test. This information consists of:

- a) substrate type and method of preparation;
- b) method of application of the coating including, where applicable, the duration and conditions of drying/curing between coats in the case of multi-coat systems;
- c) duration and conditions of drying/curing of the final coat before test;
- d) thickness of the dry coating or combination of coatings in micrometres;
- e) properties of the coating to be evaluated following exposure;
- f) number of air masses to employ for standard solar spectrum.

10 Test report

The test report shall contain at least the following information:

- a) all details necessary to identify the product tested;
- b) a reference to this test standard;
- c) a reference to the product standard;
- d) the items of supplementary information (see clause 9);
- e) the results of the test work in terms of the stated requirements;
- f) any deviation from the test method specified;
- g) the date(s) of the test;
- h) name of the operator.

11 Designation

EXAMPLE



Number of this standard _____

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards-based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

All the data, software and documentation set out in all British Standards and other BSI publications are the property of and copyrighted by BSI, or some person or entity that owns copyright in the information used (such as the international standardization bodies) and has formally licensed such information to BSI for commercial publication and use. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI. Details and advice can be obtained from the Copyright & Licensing Department.

Useful Contacts:

Customer Services

Tel: +44 845 086 9001

Email (orders): orders@bsigroup.com

Email (enquiries): cservices@bsigroup.com

Subscriptions

Tel: +44 845 086 9001

Email: subscriptions@bsigroup.com

Knowledge Centre

Tel: +44 20 8996 7004

Email: knowledgecentre@bsigroup.com

Copyright & Licensing

Tel: +44 20 8996 7070

Email: copyright@bsigroup.com



...making excellence a habit.™