

BS EN 4160:2011



BSI Standards Publication

# Aerospace series — Paints and varnishes — Determination of the effect of thermal exposure

**bsi.**

...making excellence a habit.™

**National foreword**

This British Standard is the UK implementation of EN 4160:2011.

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 73882 1

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 May 2011.

**Amendments issued since publication**

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

---

EUROPEAN STANDARD

**EN 4160**

NORME EUROPÉENNE

EUROPÄISCHE NORM

May 2011

ICS 49.040

English Version

## Aerospace series - Paints and varnishes - Determination of the effect of thermal exposure

Série aérospatiale - Peintures et vernis - Détermination de l'effet thermique

Luft- und Raumfahrt - Beschichtungsstoffe - Thermische Beanspruchung

This European Standard was approved by CEN on 3 March 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 Terms and definitions .....	4
4 Principle .....	4
5 Apparatus .....	5
6 Specimens .....	5
7 Procedure .....	5
8 Supplementary information .....	6
9 Test report .....	6
10 Designation .....	6

## Foreword

This document (EN 4160:2011) 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 November 2011, and conflicting national standards shall be withdrawn at the latest by November 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 resistance of paints and varnishes to the effects of heat or cold within the limits of – 50 °C to 200 °C.

The test procedure assesses the resistance of paint coatings, varnishes or related products to changes of gloss, colour, blistering, cracking and/or detachment from the substrate as a result of exposure to elevated or sub-ambient temperature.

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 2744, *Aerospace series — Non metallic materials — Preferred test temperatures*

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

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)*

EN ISO 2813, *Paints and varnishes — Determination of specular gloss of non-metallic paint films at 20°, 60° and 85° (ISO 2813:1994, including Technical Corrigendum 1:1997)*

EN ISO 4628-2, *Paints and varnishes — Evaluation of degradation of paint coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 2: Assessment of degree of blistering (ISO 4628-2:2003)*

EN ISO 4628-4, *Paints and varnishes — Evaluation of degradation of paint coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 4: Assessment of degree of cracking (ISO 4628-4:2003)*

EN ISO 4628-6, *Paints and varnishes — Evaluation of degradation of paint coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 6: Assessment of degree of chalking by tape method (ISO 4628-6:2007)*

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

ISO 7724 (all parts), *Paints and varnishes — Colorimetry*

## 3 Terms and definitions

Not applicable.

## 4 Principle

Specimens comprising of coated test panels are exposed to a specified thermal environment, either elevated or sub-ambient, for a specified period.

Changes in appearance, mechanical or physical properties are then determined.

## 5 Apparatus

An air circulating temperature controlled chamber capable of maintaining the test specimens within the tolerance limits specified in EN 2744 for the test temperature specified.

## 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 at the standard temperature and humidity defined in EN 23270 for a minimum of 16 h and a maximum of 72 h prior to testing.

## 7 Procedure

Expose the panel for the time and temperature stated in the product standard. Where a continuous performance temperature range is quoted in the standard then the upper and lower limits of the temperature range shall be tested.

Exposure shall be achieved by placing the test panels in the chamber set at the desired test temperature. Panels shall be placed not less than 100 mm from the sides of the chamber and not closer than 20 mm apart.

NOTE The preferred method of maintaining even heating of the test panels is to suspend them by means of fine wire, alternatively, the panels may be supported in a rack made from suitable, heat resistant material which will not damage the coating.

After the completion of the required exposure period, remove the test panels from the chamber. Condition at the standard temperature and humidity defined in EN 23270 for a period of 16 h. Examine the coating for change of gloss, colour or other signs of deterioration when compared with identically prepared but unexposed (reference) panels in accordance with EN ISO 2813, ISO 7724 (all parts), EN ISO 4628-2, EN ISO 4628-4 and EN ISO 4628-6.

Subject the test panels and reference panels to any additional paint performance tests specified in the product standard either immediately following thermal exposure or after the conditioning period, dependant upon the requirements of the performance test. Examine for compliance with the requirements of the product standard.

## 8 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.

## 9 Test report

The test report shall contain at least the following information:

- a) all details necessary to identify the product tested;
- b) reference to this test standard;
- c) reference to the product standard;
- d) items of supplementary information (clause 8);
- e) results of the test work in terms of the stated requirements;
- f) any deviation from the test method specified;
- g) date(s) of the test.

## 10 Designation

EXAMPLE







# 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](http://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](http://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](http://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](http://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](mailto: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](mailto:orders@bsigroup.com)

**Email (enquiries):** [cservices@bsigroup.com](mailto:cservices@bsigroup.com)

### Subscriptions

**Tel:** +44 845 086 9001

**Email:** [subscriptions@bsigroup.com](mailto:subscriptions@bsigroup.com)

### Knowledge Centre

**Tel:** +44 20 8996 7004

**Email:** [knowledgecentre@bsigroup.com](mailto:knowledgecentre@bsigroup.com)

### Copyright & Licensing

**Tel:** +44 20 8996 7070

**Email:** [copyright@bsigroup.com](mailto:copyright@bsigroup.com)



...making excellence a habit.™