BRITISH STANDARD AEROSPACE SERIES

BS EN
2243-2:2005

Non-metallic materials — Structural adhesives — Test method —

Part 2: Peel metal-metal

The European Standard EN 2243-2:2005 has the status of a British Standard

ICS 49.025.50

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 2243-2:2005. It supersedes BS EN 2243-2:1991 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee ACE/65, Non-metallic materials for aerospace purposes (excluding textiles), to Subcommittee ACE/65/-/63, Structural adhesives, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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

Cross-references

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Summary of pages

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Série aérospatiale - Matériaux non-métalliques - Système d'adhésifs structuraux - Méthodes d'essai - Partie 2 : Essai de pelage métal-métal

Luft- und Raumfahrt - Nichtmetallische Werkstoffe - Strukturelle Klebstoffsysteme - Prüfverfahren - Teil 2: Rollen-Schälversuch Metall-Metall

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This European Standard (EN 2243-2:2005) has been prepared by the European Association of Aerospace Manufacturers - Standardization (AECMA-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 AECMA, 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of an identical text or by endorsement, at the latest by April 2006, and conflicting national standards shall be withdrawn at the latest by April 2006.

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.

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Introduction

This standard is part of the series of EN non-metallic material standards for aerospace applications. The general organization of this series is described in EN 4385. This standard is a level 3 document as defined in EN 4385.

1 Scope

This standard defines the general requirements for the determination of strength of structural adhesives by testing in peel metal to metal joints, at ambient or other temperatures.

This method is not suitable for adhesives having an average peeling strength of less than 30 N per 25 mm.

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 ISO 7500-1, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system (ISO 7500-1:2004).*

EN 2090, *Aerospace series — Aluminium alloy AL-P2024- — T3 — Clad sheet and strip — 0,3 mm ≤ a ≤ 6 mm.*[1)]

EN 2334, *Aerospace series — Chromic-sulphuric acid pickle of aluminium and aluminium alloys.*

EN 4385*, Aerospace series — Non-metallic materials — General organisation of standardisation — Links between types of standards.*[1)]

3 Definitions, symbols and abbreviations

3.1 Definitions

Not applicable

3.2 Symbols and abbreviations

For the purposes of this document, the following symbols and abbreviations apply.

F peeling load (in newtons);

W width of the specimen (in centimetres);

τ peeling strength (in newtons/centimetres).

1) Published as AECMA Prestandard at the date of publication of this standard.

4 Health and safety

This standard does not necessarily include all health and safety requirements, associated with its use.

Persons using this standard shall be familiar with normal laboratory/test house practices.

It is the responsibility of the user to establish satisfactory health and safety practices and to ensure conformity with any European, national or local laws/regulations.

5 Principle/Technique

Not applicable

6 Resources

6.1 Apparatus

All test equipment shall be calibrated at intervals not exceeding 12 months.

6.1.1 Tensile testing machine

The tensile testing machine shall conform to class 1 of EN ISO 7500-1. The failing load of the test specimen shall be within 10 % and 90 % of the upper limit of the selected loading range of the machine.

6.1.2 Fixing

Peeling jig, see Figure 1.

6.1.3 Recorder

It shall record continuously the displacement (see Figure 3) relative to the load applied throughout the test until failure occurs.

6.2 Materials/Reagents

Not applicable

6.3 Qualification of personnel

Not applicable

7 Test samples/Test pieces

7.1 Materials

Aluminium alloy EN 2090

7.2 Surface preparation before bonding

EN 2334 unless otherwise specified

7.3 Bonding

The application and curing of the adhesive system (adhesive and primer) shall be carried out according to the material standard unless otherwise agreed with the adhesive system manufacturer.

7.4 Dimensions of panels

See Figure 2.

7.5 Storage of test panels after bonding

They shall be stored under the following conditions:

— temperature : (23 ± 2) °C;

— relative humidity : (50 ± 5) %.

7.6 Cutting of panels and preparation of test pieces

The panels shall be cut into test pieces (see Figure 2).

The panels made with high temperature curing adhesives shall be cut only after a storage period of 16 hours (see note 1).

NOTE 1 For batch acceptance testing, this 16 hours period can be omitted. Nevertheless, for temperature curing adhesive, care shall be taken to cut panels only when their temperature is down to ambient.

Perform the cutting operation so as to avoid overheating (≤ 50 °C) or mechanical damage to the joint (see note 2).

NOTE 2 A fine-tooth, circular or band saw has been found suitable for this purpose.

Cutting shall be straight and parallel.

The use of cooling liquids is not permitted, unless otherwise specified.

7.7 Test pieces

7.7.1 Dimensions

See Figure 2.

7.7.2 Number of specimen

See material standard.

7.7.3 Identification

Each test piece shall be marked to identify the panel from which it was cut and its position in the panel.

8 Testing procedure

8.1 Dimensions measurement

Measure the width W with an accuracy of ± 0,1 mm.

Measure the thickness of the adhesive in the middle of the overlap at both sides of the test piece with an accuracy of ± 0,01 mm. The average thickness shall be determined.

8.2 Fixing

See Figure 2.

Install the peeling jig in the upper grip of the test machine.

Insert test piece in peeling jig.

Fix the non-bonded, thin end of the test piece that has been passed through the rollers in the lower grip of the test machine.

8.3 Test temperatures

When the test temperature is different from ambient temperature (23 ± 2) °C, then the chamber including peeling jig shall be stabilized within the test temperature tolerance for at least 30 minutes prior to inserting the test piece.

The temperature control of the test piece shall be carried out using a thermocouple.

The junction of the thermocouple shall be firmly attached to the test piece in immediate contact with the metal. It shall be shielded from direct heating.

8.4 Loading

For test temperature different from ambient, and unless otherwise specified (see note), a minimum exposure time of 10 minutes at the required temperature shall be applied prior to loading.

NOTE For non-ambient temperature tests, there is a requirement for the test portion of the specimen to be within the specified temperature tolerance throughout the period of loading to failure.

The exposure time of 10 minutes is normally sufficient to fulfil this requirement.

Nevertheless, the test laboratory may be required to prove the heat dwell concept (procedure and conditions) by means of temperature/time records on dummy specimen(s) incorporating thermocouple(s) embedded in drilled hole(s) within the test portion of the specimen. These records shall be made available to demonstrate the validity of the heat dwell conditions.

In this case, for tests under non-ambient conditions, the specimen shall be placed in the grips of the test machine and the temperature monitored according to the heat dwell concept previously established. When it reaches the lower (or upper, for temperature below ambient) limit of the test temperature tolerance, allow the specimen to dwell within the tolerance band for a minimum of 3 minutes prior to loading. The test shall be completed within a maximum dwell of 10 minutes.

The heat-up/dwell cycle used shall be given in the test report.

The load shall be applied at a uniform jaws separation of 50 mm/min to 150 mm/min.

A minimum length of 150 mm shall be peeled.

Record the load-displacement curve.

9 Expression of results

The peeling diagram shall be evaluated as follows:

The average peeling load shall be determined over a peeling strength of 125 mm, by inserting the estimated average value into the diagram as shown in Figure 3.

The results of the first 10 mm of the peel separation on the specimen as shown on the peeling diagram after the first maximum load are to be excluded from the assessment of the average value.

In case of doubt, the average peeling load shall be determined by means of a planimeter.

The peeling strength shall be expressed in newtons/centimeter as follows:

$$\tau = \frac{F}{W}$$

10 Designation

EXAMPLE

Description block	Identity block
PEEL STRENGTH	**EN2243-2**

Number of this standard

11 Test report

The test report shall include:

— reference to the test method designation;

— the type of tensile testing machine, the speed of loading, the exposure conditions and test temperature;

— complete identification of the adhesive system, including the type, manufacturer, date of manufacture, batch number, material standard or specification number;

— complete identification of the metal used;

— detailed information about the surface preparation before bonding;

— application and bonding conditions including the bonding method (press, autoclave, ...), pressure on the adhesive joint, heat-up rate, curing time and temperature;

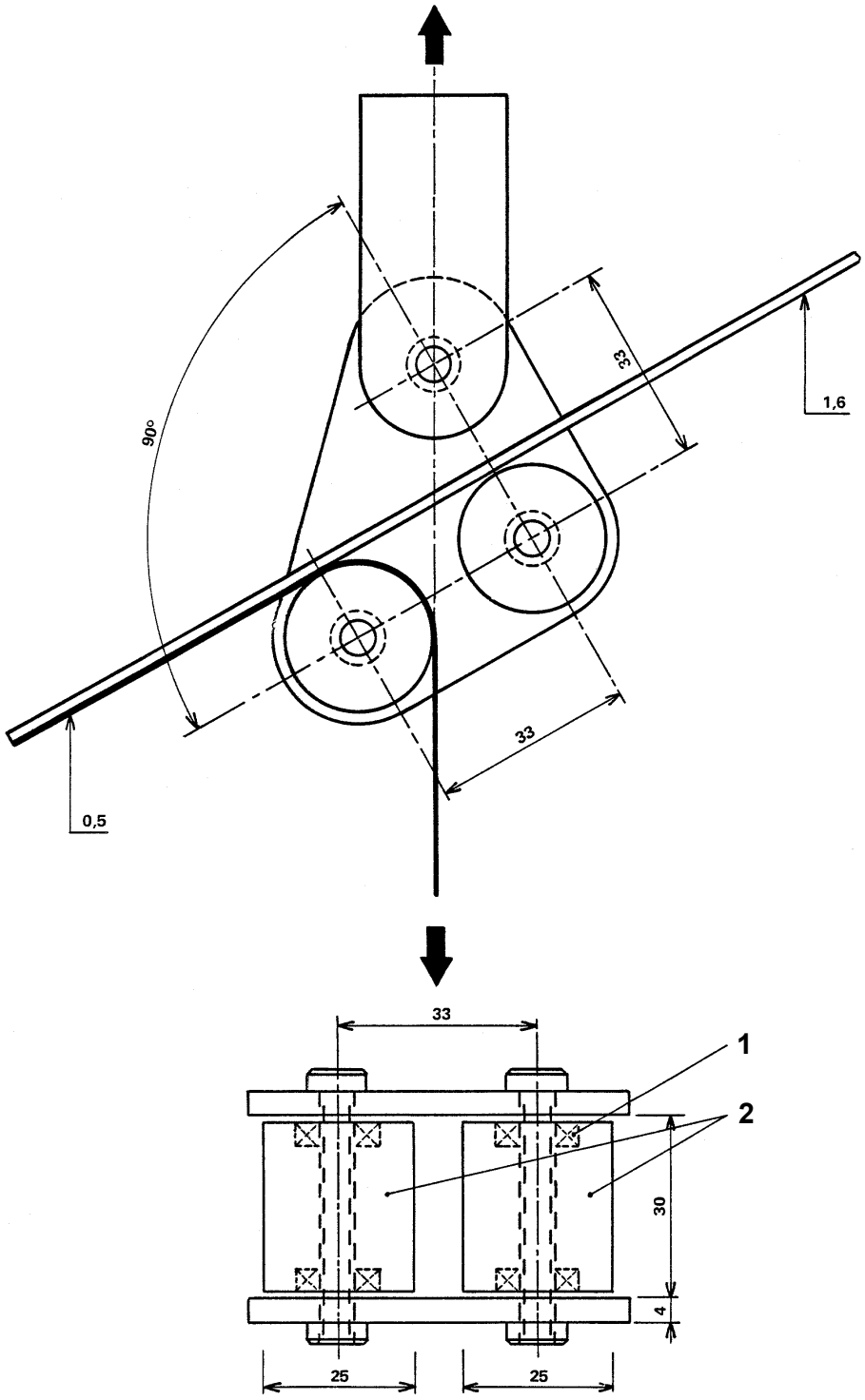
— information about individual test piece including traceability from panel, actual dimensions, sheet thickness and bond line thickness;

— type of recorder;

— expression of individual results, including peel load, nature and location of failure with estimated percentage of failure in cohesion and/or adhesion in adhesive or primer;

- associated diagram;
- in case of multiple tests:
  - number of test pieces;
  - average, standard deviation, maximum and minimum values of the test series.
- traceability to personnel performing the test work;
- any incident which may have affected the result;
- any deviation from this standard described in detail;
- date of test.

Dimensions in millimetres

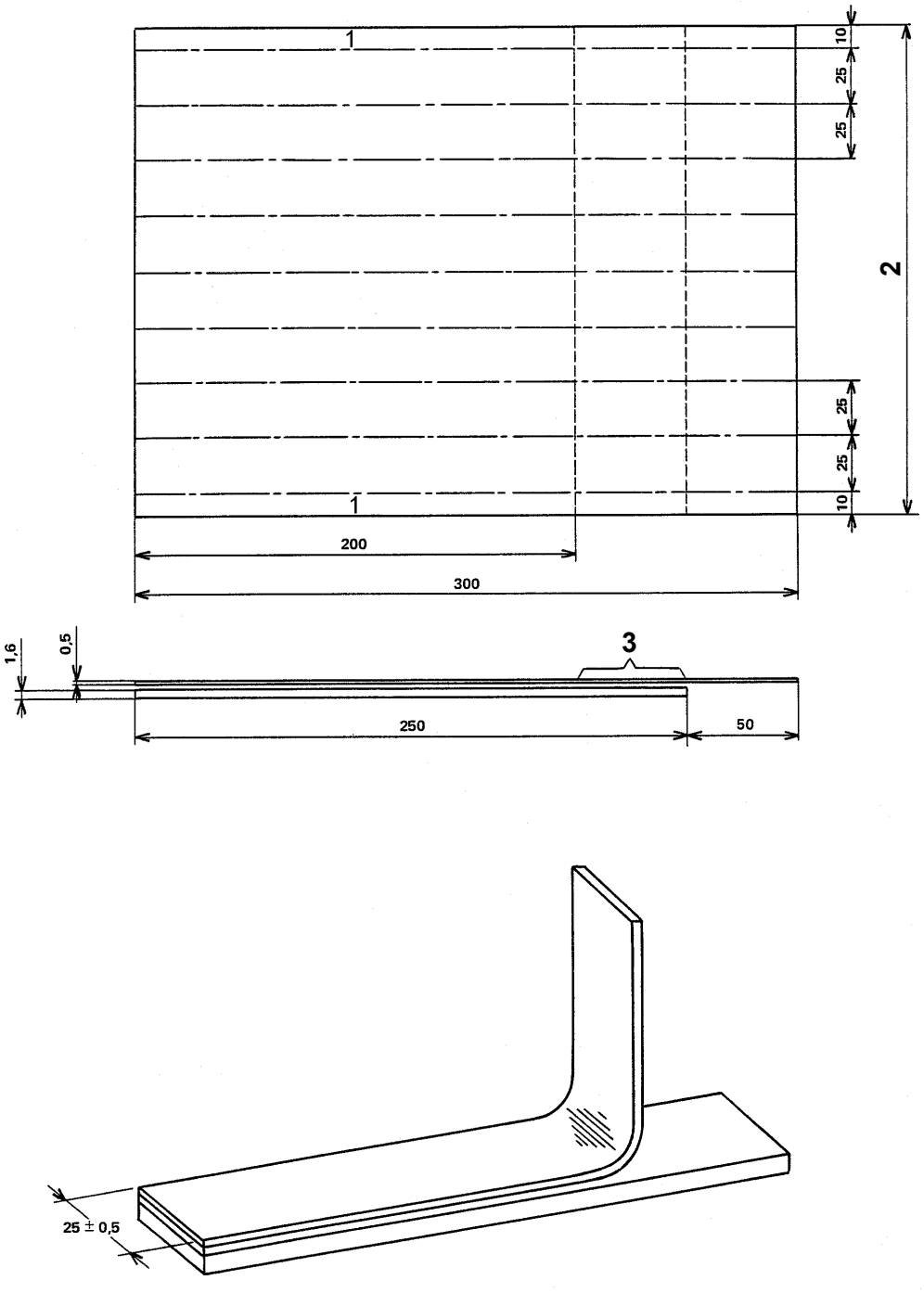


Key

1 Roller bearing
2 Steel rollers

Figure 1 — Peeling jig

Dimensions in millimetres

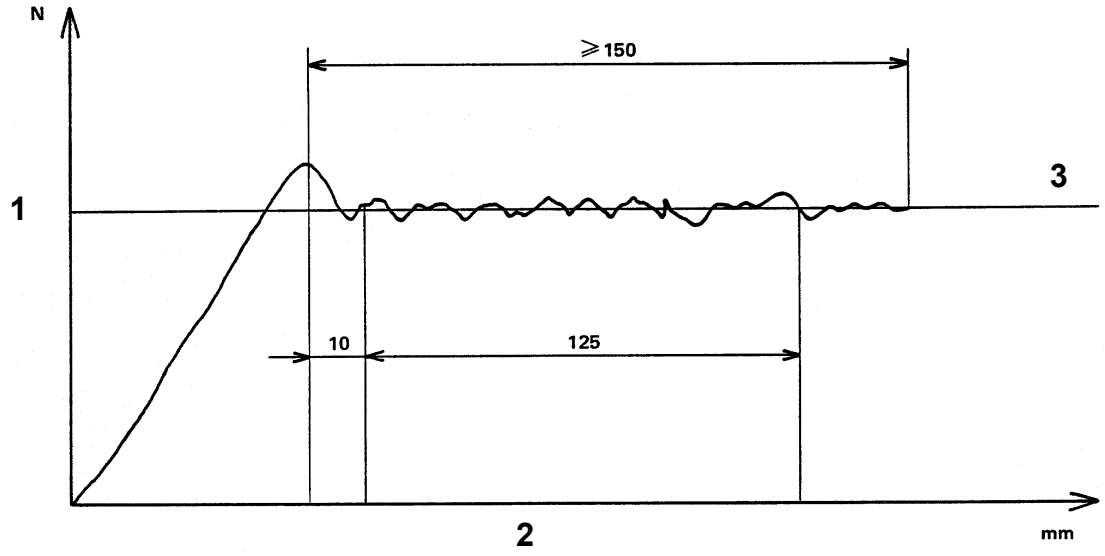


Key

1 Discard
2 Width according to number of test pieces
3 Not bonded

Figure 2 — Test piece

Dimensions in millimetres



Key

1 Load F
2 Peeling length
3 Average value

Figure 3 — Typical peeling diagram

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