BRITISH STANDARD

BS EN ISO 3325:1999
Incorporating Amendment No. 1

Sintered metal materials, excluding hardmetals — Determination of transverse rupture strength

The European Standard EN ISO 3325:1999, with the incorporation of amendment A1:2002, has the status of a British Standard

ICS 77.160

British Standards

National foreword

This British Standard is the official English language version of EN ISO 3325:1999, including amendment A1:2002. It is identical with ISO 3325:1996, including amendment 1:2001. It supersedes BS 5600-3-3.8:1979 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ISE/65, Sintered metal components, 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 the UK interests informed;

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

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

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

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

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This British Standard, having been prepared under the direction of the Engineering Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 September 1999

Summary of pages

This document comprises a front cover, an inside front cover, the EN ISO title page, the EN ISO foreword page, the ISO title page, page ii, pages 1 to 4, an inside back cover and a back cover.

The BSI copyright date displayed in this document indicates when the document was last issued.

Amendments issued since publication

Amd. No.	Date	Comments
13886	9 October 2002	Addition of 6.3

ISBN 0 580 32778 7

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN ISO 3325

July 1999

+ A1

March 2002

ICS 77.040.10; 77.160

English Version

Sintered metal materials, excluding hardmetals — Determination of transverse rupture strength

(including amendment A1:2002)

(ISO 3325:1996 + A1:2001)

Matériaux métalliques frittés à l'exclusion des métaux-durs — Détermination de la résistance à la rupture transversale
(inclut l'amendement A1:2002)
(ISO 3325:1996 + A1:2001)

Sintermetalle, ausgenommen Hartmetalle — Ermittlung der Biegebruchfestigkeit
(enthält Änderung A1:2002)
(ISO 3325:1996 + A1:2001)

This European Standard was approved by CEN on 3 June 1999. Amendment A1 was approved by CEN on 3 January 2002.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Foreword

The text of the International Standard from Technical Committee ISO/TC 119 "Powder metallurgy" of the International Organization for Standardization (ISO) has been taken over as an European Standard by CEN/CS.

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 January 2000, and conflicting national standards shall be withdrawn at the latest by January 2000.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of the International Standard ISO 3325:1996 has been approved by CEN as a European Standard without any modification.

Foreword to amendment A1

The text of this amendment EN ISO 3325:1999/A1:2002 to the EN ISO 3325:1999 from Technical Committee ISO/TC 119 "Powder metallurgy" of the International Organization for Standardization (ISO), the Secretariat of which is held by CMC.

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 September 2002, and conflicting national standards shall be withdrawn at the latest by September 2002.

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

Endorsement notice

The text of the amendment to the International Standard ISO 3325:1996/Amd. 1:2001 has been approved by CEN as an amendment to the European Standard without any modifications.

INTERNATIONAL STANDARD

ISO 3325

Second edition
1996-11-01

Sintered metal materials, excluding hardmetals — Determination of transverse rupture strength

Matériaux métalliques frittés à l'exclusion des métaux-durs — Détermination de la résistance à la rupture transversale

Reference number
ISO 3325:1996(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 3325 was prepared by Technical Committee ISO/TC 119, *Powder metallurgy*, Subcommittee SC 3, *Sampling and testing methods for sintered metal materials (excluding hardmetals)*.

This second edition cancels and replaces the first edition (ISO 3325:1975), which has been technically revised.

Descriptors: powder metallurgy, metallic powder, sintered products, tests, bend rupture tests, determination, break strength, test equipment.

Sintered metal materials, excluding hardmetals — Determination of transverse rupture strength

1 Scope

This International Standard specifies a method for the determination of the transverse rupture strength of sintered metal materials, excluding hardmetals. The method is particularly suitable for comparing the sintered strength of a batch of metal powder with that of a reference powder or with a reference strength.

The method is applicable to sintered metal materials, excluding hardmetals, whether they have been subjected to heat treatment after sintering or not, and also to materials that have been sized or coined after sintering.

It is specially suitable for materials having a uniform hardness throughout their section and negligible ductility, i.e. a ductility corresponding to a permanent deformation of less than about 0,5 mm measured between the two supports during the transverse rupture strength determination. If the test is applied to materials under conditions other than those specified above, the conditions shall be reported.

NOTE 1 The permanent deformation can be measured with sufficient precision from the two fragments of the broken or cracked bar by indexing the lower surface. Alternatively, the deflection of a straight line drawn horizontally on the side of the test piece can be measured using an optical instrument such as a measuring microscope or optical comparator.

2 Principle

A test piece resting on two supports is broken by the application of a load at the midpoint between the supports, under short-term static loading conditions.

3 Apparatus

3.1 Test equipment, of any type providing static loading conditions and an accuracy of ±1 %.

The equipment shall have two support cylinders (rollers) with a fixed distance between them and a load-application cylinder (roller). All three cylinders shall be 3,2 mm ± 0,1 mm in diameter and shall be made either of hardened steel with a hardness of at least 700 HV or of hardmetal.

The support cylinders shall be mounted parallel to each other, and the distance between their centrelines shall be either 25,0 mm ± 0,2 mm or 25,4 mm ± 0,2 mm, measured with an accuracy of ± 0,1 mm for the calculation. The load-application cylinder shall be mounted midway between the support cylinders.

For better accuracy, the mounting of the cylinders should preferably be such as to compensate for any deviation from parallelism between the top and bottom faces of the test piece. This can be accomplished by mounting the support cylinders so that each can be adjusted vertically (see figure 1).

A diagrammatic arrangement of a typical test rig is shown in figure 1.

The fixture should preferably be surrounded by a suitable safety guard.

4 Test piece

4.1 The test piece shall be nominally 6 mm thick and produced from a die cavity of nominal dimensions 30 mm × 12 mm. The test piece thickness shall be uniform to within 0,1 mm over the whole length and to within 0,04 mm across any width line perpendicular to the height and length.

4.2 Alternatively, machined test pieces may be used, in which case care shall be taken during machining to ensure that no stress raisers are introduced into the test piece. The test piece shall be cut with the 30 mm × 12 mm faces perpendicular to the compaction axis, on account of possible anisotropy, choosing a region of uniform density. Furthermore, the machining technique employed to obtain the test piece shall not cause significant structural changes, such as densification when shearing a soft material or microstructural changes produced by electro-erosion machining techniques. If such changes do occur, grinding to remove the disturbed material is recommended.

5 Procedure

5.1 Measure the width and thickness of the test piece at its midpoint to the nearest 0,01 mm.

5.2 Place the test piece on one of its 30 mm × 12 mm faces symmetrically on the support cylinders so that its longitudinal axis is at 90° ± 30′ to the longitudinal axes of the cylinders. Precise positioning of the test piece can be easily ensured by pushing the side of the test piece up against a suitably located, removable stop. Apply a load at a position midway between the two cylinders. Increase the load slowly and steadily, so that the time to fracture is not less than 10 s. Record the value at which the load suddenly drops due to formation of the first crack.

5.3 Repeat the determination with a suitable number of test pieces.

6 Expression of results

6.1 The transverse rupture strength R_{tr}, in newtons per square millimetre, is given by the equation

$$R_{tr} = \frac{3FL}{2bh^2}$$

where

F is the load, in newtons, required for fracture;

L is the distance, in millimetres, between the supports;

b is the width, in millimetres, of the test piece at right angles to its height;

h is the height (thickness), in millimetres, of the test piece parallel to the direction of application of the test load.

Report the arithmetical mean of the transverse rupture strength determinations, rounded to the nearest 10 N/mm^2.

6.2 The absolute uncertainty of this method is given by the equation

$$\Delta R = R\left(\frac{\Delta F}{F} + \frac{\Delta L}{L} + \frac{\Delta b}{b} + 2\frac{\Delta h}{h}\right)$$

or

$$\Delta R = R\left(\frac{1}{100} + \frac{0{,}1}{25} + \frac{0{,}01}{12} + \frac{2 \times 0{,}01}{6}\right)$$

or

$$\Delta R = 0{,}02R$$

This value shall be taken into account if any precision statement is made.

6.3 The values given in Table 1 were calculated for repeatability limit (r) and reproducibility limit (R). These values state that it is to be expected that when testing samples from any given lot, a laboratory will repeat its own measurements within the appropriate value of (r) 95 % of the time and that a laboratory will duplicate the results of any other given laboratory within the larger value of (R), 95 % of the time.

Table 1 — Precision data

Material [a]	$\bar{R}_{tr}$ N/mm^2	r N/mm^2	R N/mm^2
Iron, 0,5 % combined carbon	490	38	97
Iron, 2 % Cu, 0,8 % combined carbon	990	86	145
Pre-alloyed 4 600, 2 % Cu, 0,8 % combined carbon	1 200	199	286
Iron, 2 % Ni, 0,5 % combined carbon Heat treated	1 320	163	279

[a] Additional information on the materials can be taken from MPIF (Metal Powder Industries Federation, USA) Standard 41:1998, *Determination of Transverse Rupture Strength of Powder Metallurgy Materials.*

7 Test report

The test report shall include the following information:

a) a reference to this International Standard;

b) all details necessary for identification of the test sample;

c) the distance between the centres of the support cylinders;

d) the result obtained;

e) details of any operation not specified by this International Standard, as well as any operation regarded as optional;

f) details of any incident which may have affected the result.

Dimensions in millimetres

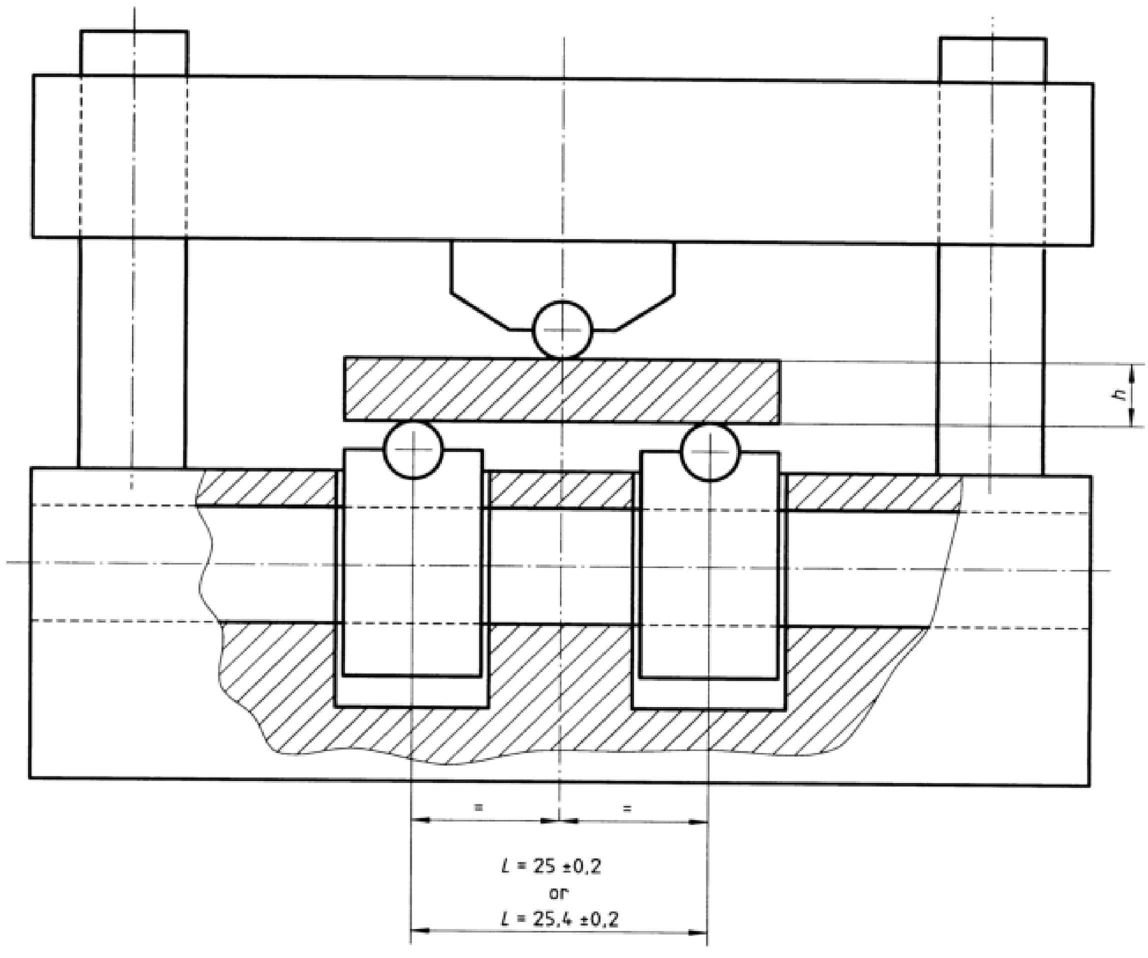

Figure 1 — Test equipment for determination of transverse rupture strength

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389 Chiswick High Road
London
W4 4AL