

Rubber or plastics hoses and tubing — Bending tests

The European Standard EN ISO 1746:2000 has the status of a
British Standard

ICS 23.040.20; 23.040.70

National foreword

This British Standard is the official English language version of EN ISO 1746:2000. It is identical with ISO 1746:1998. It supersedes BS EN 21746:1993 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee PRI/66, Rubber and plastics tubing, hoses and hose assemblies, to Subcommittee PRI/66/4, Methods of test, 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 subcommittee can be obtained on request to its secretary.

Cross-references

Attention is drawn to the fact that CEN and CENELEC Standards normally include an annex which lists normative references to international publications with their corresponding European publications. The British Standards which implement these international or European publications may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

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 6, the annex ZA page and a back cover.

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

Amendments issued since publication

Amd. No.	Date	Comments

This British Standard, having been prepared under the direction of the Sector Committee for Materials and Chemicals, was published under the authority of the Standards Committee and comes into effect on 15 April 2001

© BSI 04-2001

ISBN 0 580 34805 9

English version

Rubber or plastics hoses and tubing - Bending tests (ISO
1746:1998, including technical corrigendum 1:1999)

Tuyaux et tubes en caoutchouc ou en plastique - Essai de
courbure (ISO 1746:1998, corrigendum technique 1:1999
compris)

Gummi- oder Kunststoffschläuche mit und ohne Einlage -
Biegeprüfungen (ISO 1746:1998, einschließlich
technischen Corrigendum 1:1999)

This European Standard was approved by CEN on 7 March 2000.

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.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



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 45 "Rubber and rubber products" of the International Organization for Standardization (ISO) has been taken over as an European Standard by Technical Committee CEN/TC 218 "Rubber and plastics hoses and hose assemblies", the secretariat of which is held by BSI.

This European Standard replaces EN 21746:1993.

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 October 2000, and conflicting national standards shall be withdrawn at the latest by October 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 1746:1998, including technical corrigendum 1:1999, has been approved by CEN as a European Standard without any modification.

NOTE: Normative references to International Standards are listed in annex ZA (normative).

INTERNATIONAL
STANDARD

ISO
1746

Third edition
1998-05-15

**Rubber or plastics hoses and tubing —
Bending tests**

Tuyaux et tubes en caoutchouc ou en plastique — Essais de courbure



Reference number
ISO 1746:1998(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 1746 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Hoses (rubber and plastics)*.

This third edition cancels and replaces the second edition (ISO 1746:1983), which has been technically revised.

Rubber or plastics hoses and tubing — Bending tests

WARNING — Persons using this International Standard should be familiar with normal laboratory practice. This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

1 Scope

This International Standard specifies two methods for the determination of the behaviour of rubber or plastics hoses or tubing when bent to a specified radius.

Method A is suitable for hoses and tubing of internal diameter up to about 80 mm; the size of the apparatus for testing hoses and tubing of larger bore sizes becomes excessive. The method also provides a means of measuring the force required to reach a specified bend radius, and the test may be carried out at a specified internal pressure.

In method B, the bending characteristics, including the force required for bending, may be determined over a range of temperatures from $-60\text{ }^{\circ}\text{C}$ to $+200\text{ }^{\circ}\text{C}$. The nature of the apparatus, however, limits its applicability to hoses and tubing of small internal diameter, i.e. up to about 12,5 mm.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 471:1995, *Rubber — Temperatures, humidities and times for conditioning and testing*.

ISO 4671:—¹⁾, *Rubber and plastics hose and hose assemblies — Methods of measurement of dimensions*.

3 Method A

3.1 Apparatus

The apparatus consists of two guides A and B, guide A being fixed in a plane and guide B being movable in that plane, parallel to, and in line with, guide A (see figure 1).

¹⁾ To be published. (Revision of ISO 4671:1984)

If it is desired to measure the force required to attain the specified radius of curvature, this may be done, for example, by means of a system of pulleys and weights (see figure 2). Care shall be taken to minimize the effect of frictional resistance.

3.2 Test pieces

3.2.1 Types and dimensions

The test pieces shall consist either of complete manufactured lengths of hose or of suitable test lengths. If the manufactured length is shorter than the length required for the test, test pieces of adequate length shall be specially manufactured.

3.2.2 Number

Unless otherwise specified, two test pieces shall be tested.

3.3 Conditioning of test pieces

No tests shall be carried out within 24 h of manufacture.

For evaluations which are intended to be comparable, the test shall, as far as possible, be carried out after the same time interval after manufacture. ISO 471 shall be followed for time between sample manufacture and testing.

Before testing, test pieces shall be conditioned for at least 16 h at a standard laboratory temperature and humidity (see ISO 471); this 16 h period may be part of the 24 h interval after manufacture.

3.4 Test procedure

3.4.1 If required, apply the specified test pressure as given in the relevant product specification.

3.4.2 Measure and determine the average outside diameter D of the hose by means of a suitable measuring instrument as specified in ISO 4671.

3.4.3 Draw two parallel and diametrically opposed lines along the length of the hose. If the hose has natural curvature, one of the lines shall be on the outside of the curve. On each of these lines, mark a distance of $1,6C + 2D$ or 200 mm, whichever is the longer, where C is twice the minimum bend radius specified in the appropriate specification, so that the marked distances are exactly opposed. This will ensure a sufficient length for the bend test and adequate support of the hose.

3.4.4 Separate guides A and B to a distance slightly less than $1,6C + 2D$. Place the hose between the guides so that the ends of the marked distances are parallel to the ends of the guides and remain in this position while the guides are closed to a distance of $C + 2D$ (see figure 1).

3.4.5 Check that the hose on each side is supported to a length of not less than D .

3.4.6 Measure and determine the minimum outside dimension T in the curved portion of the hose (see figure 3).

4 Method B

4.1 Apparatus

4.1.1 **Compression testing machine**, with a rate of travel of the moving jaw of 100 mm/min, preferably provided with a chart recorder. A scale, graduated in millimetre divisions, may be attached to the moving jaw to enable the bend diameter to be measured or, preferably, this may be determined from a graphical record.

4.1.2 **Pair of twin channel-shaped holders**, fitted with end stops for the hose test pieces (see figure 4).

4.1.3 Thermostatically controlled environmental chamber, which can be fitted to the testing machine, with provision for access to enable the external diameter of the hose to be measured.

4.2 Test pieces

4.2.1 Types and dimensions

The test shall be carried out on two pieces, of equal length, of the hose or tubing under test. The length of the test pieces depends on the dimensions of the test piece holders and shall be $2G + 0,5\pi C$, where G is the length of the test piece holders (see figure 4) and C is twice the minimum bend radius specified in the appropriate specification. In no case shall the test pieces come into contact with the walls of the chamber and the length L shall always be less than the length of the enclosure.

4.2.2 Number

Unless otherwise specified, three sets of tests shall be carried out.

4.3 Conditioning of test pieces

No test shall be carried out within 24 h of manufacture.

For evaluations which are intended to be comparable, the test shall, as far as possible, be carried out after the same time interval after manufacture. ISO 471 shall be followed for time between sample manufacture and testing.

Before testing, test pieces shall be conditioned in the straight condition or conforming to their natural curvature for 5 h in the environmental chamber (4.1.3) at the specified test temperature (see 4.4).

4.4 Test temperature

The test temperature will be specified in the appropriate hose specification.

4.5 Test procedure

4.5.1 Measure the outside diameter D at the mid-point of the test pieces in the unstressed condition by means of a suitable measuring instrument as specified in ISO 4671.

4.5.2 Install the test pieces between the holders with a large bend radius and the ends of the test pieces against the end stops.

The curvature shall follow the natural curvature, if any.

4.5.3 Start the machine and determine the force required to reach the specified bend radius.

4.5.4 Divide the force value obtained by direct reading or from a graphical record by two to obtain the bending force for a single test piece.

4.5.5 Measure the outside dimension T at any point in the curved portion of the hose.

NOTE — It is advantageous if the machine can be pre-set to stop when twice the specified bend radius C has been reached.

5 Expression of results

For both method A and method B, calculate the value of T/D using the mean values obtained. Compare the result with the permitted deformation given in the appropriate hose specification.

6 Test report

The test report shall include the following information:

- a) a reference of this International Standard;
- b) the method used;
- c) a full description of the hose or tubing tested and a reference to the hose specification in accordance with which the hose was tested;
- d) the test temperature;
- e) the internal pressure at which the test was carried out;
- f) observation on any abrupt change(s) in hose section or irregularity in curvature caused by kinking;
- g) the value of D , T and T/D ;
- h) whether T/D was within the permitted deformation;
- i) the force required to reach the specified bending radius, if appropriate;
- j) the date of the test.

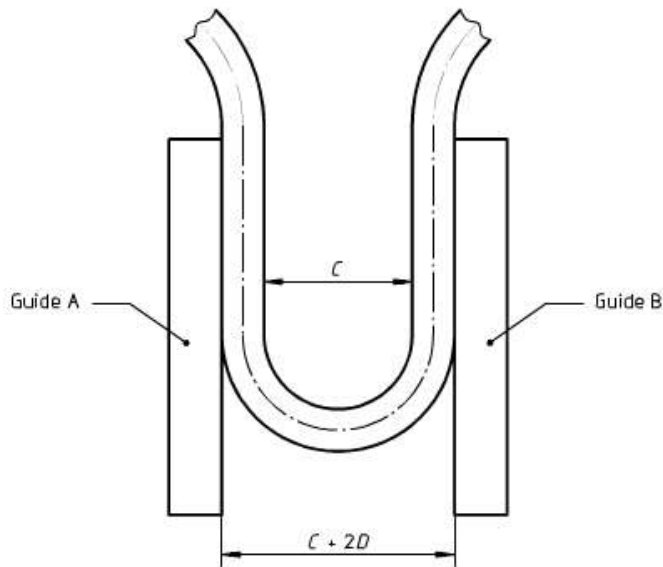


Figure 1 — Schematic arrangement for method A

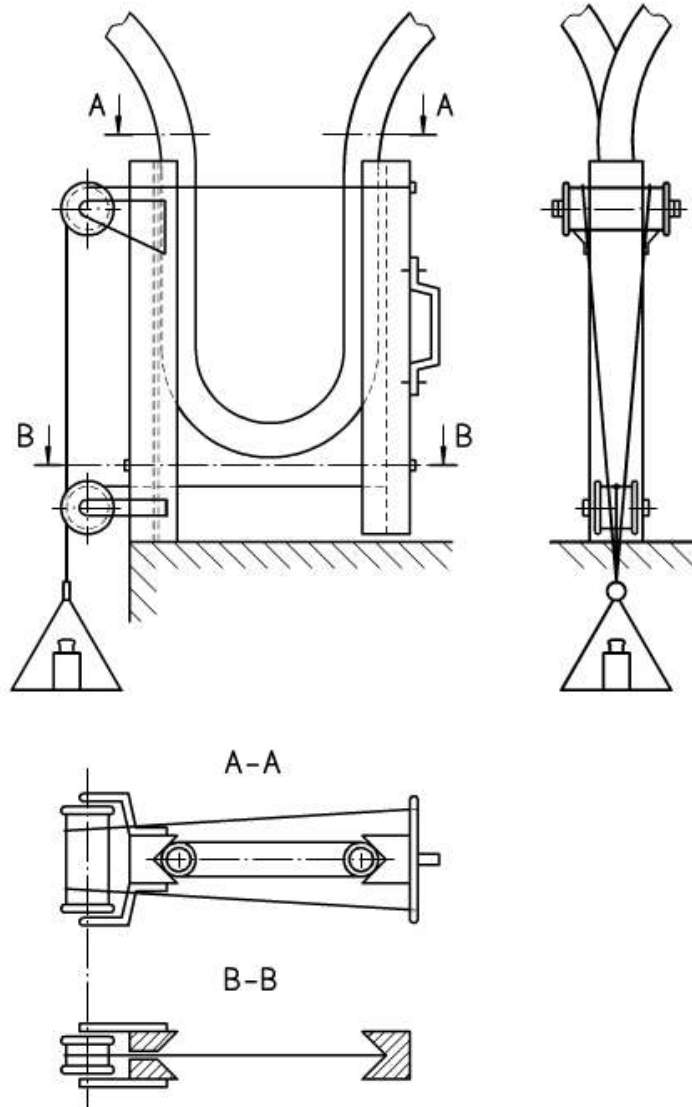


Figure 2 — Method A — Arrangement for measuring bending force

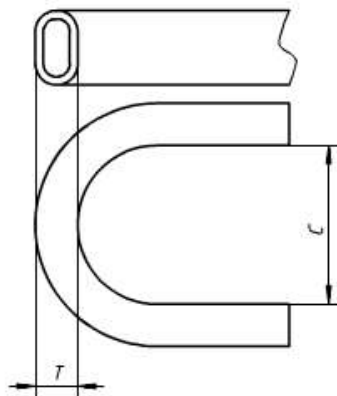


Figure 3 — Measurement of coefficient of deformation

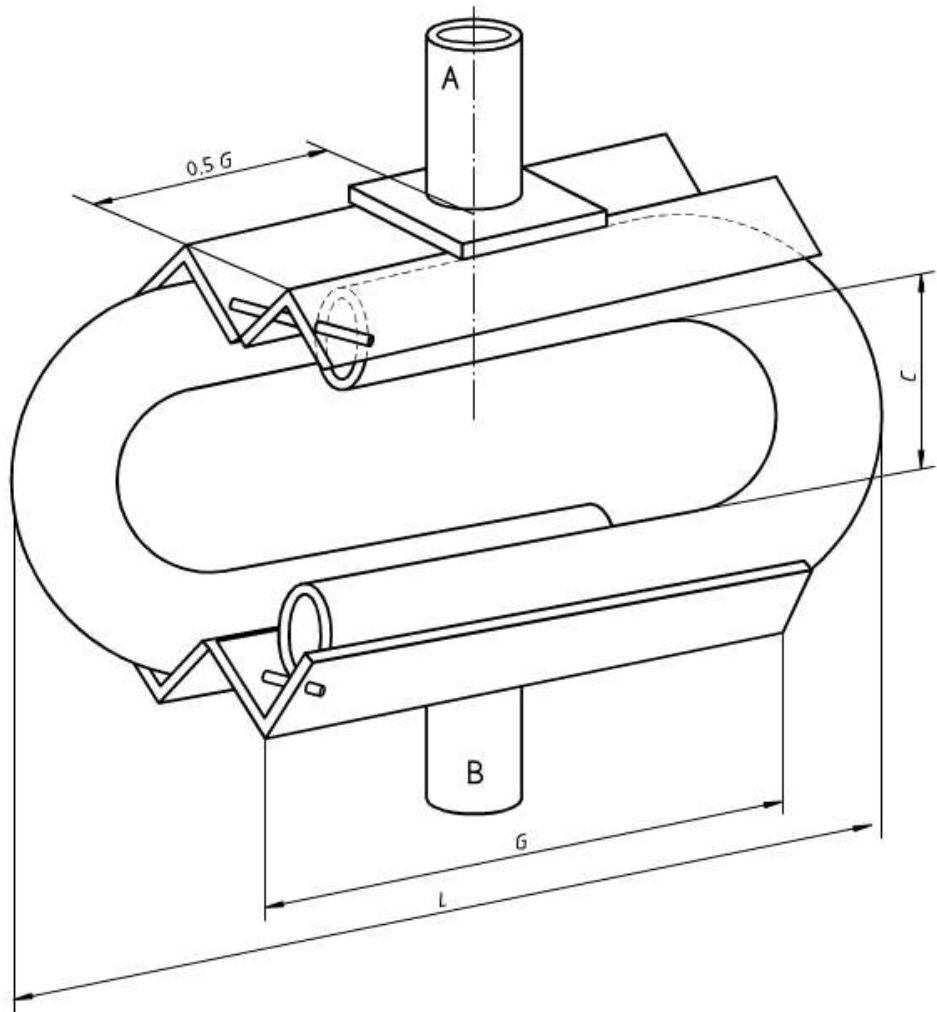


Figure 4 — Schematic arrangement for method B

Licensed Copy: sheffieldun sheffieldun, na, Sat Nov 18 16:09:19 GMT+00:00 2006, Uncontrolled Copy, (c) BSI

Annex ZA (normative)**Normative references to international publications with their relevant European publications**

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN</u>	<u>Year</u>
ISO 4671	1984	Rubber and plastics hose and hose assemblies - Methods of measurement of dimensions	EN 24671	1993

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover.
Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001. Standards are also available from the BSI website at <http://www.bsi-global.com>.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre.
Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration.
Tel: 020 8996 7002. Fax: 020 8996 7001. Further information about BSI is available on the BSI website at <http://www.bsi-global.com>.

Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. 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.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

If permission is granted, the terms may include royalty payments or a licensing agreement. Details and advice can be obtained from the Copyright Manager.
Tel: 020 8996 7070.