

BS ISO 10619-3:2011



BSI Standards Publication

Rubber and plastics hoses and tubing — Measurement of flexibility and stiffness

Part 3: Bending tests at high and low temperatures

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of ISO 10619-3:2011.

The UK participation in its preparation was entrusted to Technical Committee PRI/66/-/4, Rubber and plastics tubing, hoses and hose assemblies - Methods of test.

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 65423 7

ICS 23.040.70

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 December 2011.

Amendments issued since publication

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

**Rubber and plastics hoses and
tubing — Measurement of flexibility and
stiffness —**

Part 3:
**Bending tests at high and low
temperatures**

*Tuyaux et tubes en caoutchouc et en plastique — Mesurage de la
flexibilité et de la rigidité —*

Partie 3: Essais de courbure à des températures basses et élevées





COPYRIGHT PROTECTED DOCUMENT

© ISO 2011

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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

ISO 10619-3 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Hoses (rubber and plastics)*.

ISO 10619 consists of the following parts, under the general title *Rubber and plastics hoses and tubing — Measurement of flexibility and stiffness*:

- *Part 1: Bending tests at ambient temperature*
- *Part 2: Bending tests at sub-ambient temperatures*
- *Part 3: Bending tests at high and low temperatures*

Introduction

This method was originally included in ISO 1746¹⁾. This part of ISO 10619 allows for samples to be tested at sub-ambient temperatures and at elevated temperatures of up to 200 °C.

1) Withdrawn.

Rubber and plastics hoses and tubing — Measurement of flexibility and stiffness —

Part 3: Bending tests at high and low temperatures

WARNING — Persons using this part of ISO 10619 should be familiar with normal laboratory practice. This part of ISO 10619 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 part of ISO 10619 specifies a method for the determination of the bending characteristics of rubber and plastics hoses and tubing, including the force required for bending, 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 rubber and plastics hoses and tubing of small internal diameter, i.e. up to 12,5 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.

ISO 4671, *Rubber and plastics hoses and hose assemblies — Methods of measurement of the dimensions of hoses and the lengths of hose assemblies*

ISO 8330, *Rubber and plastics hoses and hose assemblies — Vocabulary*

ISO 23529, *Rubber — General procedures for preparing and conditioning test pieces for physical test methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8330 and the following apply.

3.1

bending

shaping or forcing something straight into a curve or angle at a specified temperature

3.2

flexibility

ease of bending a hose without it being damaged by kinking, collapse, breaking or cracking

NOTE A hose can be bent around a mandrel, for example.

3.3

stiffness

resistance of a hose to bending

4 Method

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 or other measuring device.

4.1.2 Pair of twin channel-shaped holders, fitted with end stops for the hose test pieces (see Figure 1).

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

4.2 Hose test pieces

4.2.1 Types and dimensions

The test shall be carried out on two hose pieces (one set), of equal length, of the hose or tubing under test. The length of the hose test pieces depends on the dimensions of the hose test piece holders and shall be $2G + 0,5\pi(C+D)$, where G is the length of the hose test piece holders (see Figure 1) and C is twice the minimum bend radius specified in the appropriate specification. In no case shall the hose 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 of hose test pieces

Unless otherwise specified, three sets of tests shall be carried out (one set being two hose test pieces).

4.3 Conditioning of hose 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. The time between sample manufacture and testing shall be in conformity with ISO 23529.

Before testing, the hose 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 temperature (see 4.4).

4.4 Test temperature

The test temperature is specified in the appropriate hose specification.

4.5 Test procedure

4.5.1 Where testing is being done on samples conditioned to sub-ambient temperatures, the following test should be completed within 8 s to 12 s. Testing on samples conditioned at higher temperatures should be completed within 5 s and the test equipment should be conditioned to the same temperature as the test piece.

4.5.2 Measure the outside diameter, D , three times at the midpoint of the test pieces in the unstressed condition by means of a suitable measuring instrument as specified in ISO 4671. A total of three readings per set for each test piece shall be taken and the average of these should be used for the value of D_1 .

4.5.3 Install the test piece 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.

4.5.4 Start the machine. Apply force between A and B (Figure 1) and determine the force required to reach twice the specified bend radius.

4.5.5 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.

4.5.6 Measure the outside dimension, T (see Figure 1) at the smallest diameter in the curved part of the hose. Six readings should be taken and the average of these should be used for the value of T_i .

5 Expression of results

Calculate the value T_i/D_i using the mean values obtained.

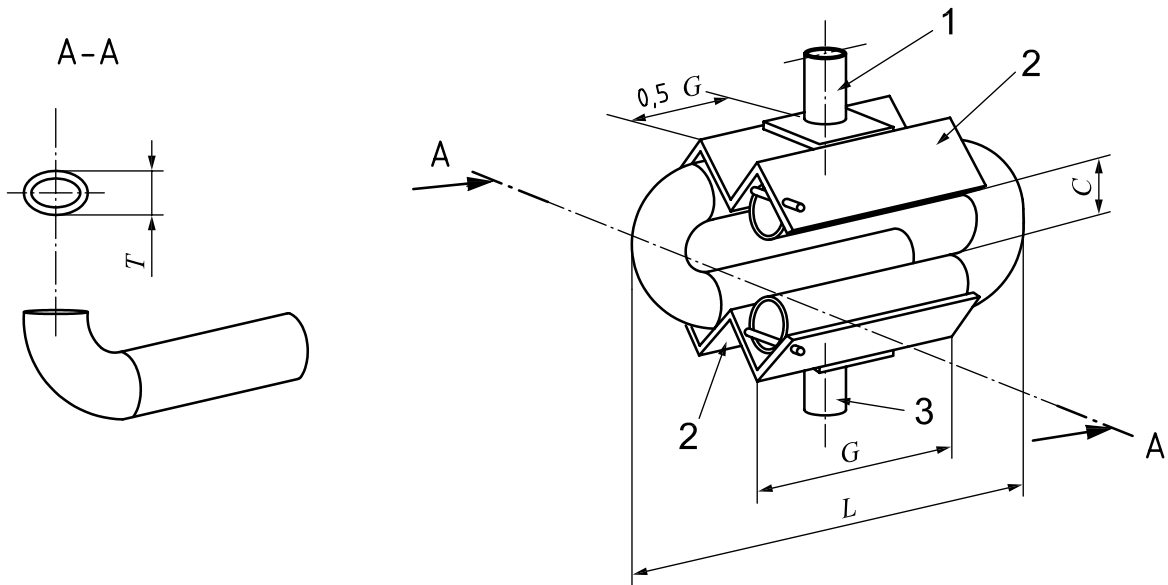
Where T_i is the outside diameter measured (see Figure 1) when the hose sample has been bent to its minimum bend radius and D_i is the outside diameter of the hose measured at the midpoint of the sample in the unstressed state.

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 to this part of ISO 10619, i.e. ISO 10619-3:2011;
- b) details of 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) observation on any abrupt change(s) in hose section or irregularity in curvature caused by kinking;
- f) the value of D_i , T_i and T_i/D_i ;
- g) whether or not T_i/D_i was within the permitted deformation;
- h) the force required to reach the specified bend radius, if appropriate;
- i) the date of the test.



Key

- 1 part A
- 2 twin channel-shaped holders for hose sample
- 3 part B
- C twice the minimum bend radius
- G length of test piece holders
- $0,5 G$ half the length of the test piece holders
- L length of hose sample installed in the apparatus where L is less than the length of the heating or cooling chamber
- T smallest diameter on the curvature of the hose

Figure 1 — Schematic arrangement for test

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.™