BS ISO 289-1:2015

BSI Standards Publication

Rubber, unvulcanized — Determinations using a shearing-disc viscometer

Part 1: Determination of Mooney viscosity

bsi.

...making excellence a habit.™

Document Sharing Hub

National foreword

This British Standard is the UK implementation of ISO 289-1:2015. It supersedes BS ISO 289-1:2014 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PRI/22, Physical testing of rubber.

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.

© The British Standards Institution 2015.
Published by BSI Standards Limited 2015

ISBN 978 0 580 89162 5

ICS 83.060

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 30 September 2015.

Amendments/corrigenda issued since publication

Date	Text affected

Documents
Document Sharing Hub

Full document details: BS ISO 289-1:2015

INTERNATIONAL STANDARD

ISO 289-1

Fourth edition
2015-09-01

Rubber, unvulcanized — Determinations using a shearing-disc viscometer —

Part 1: Determination of Mooney viscosity

Caoutchouc non vulcanisé — Déterminations utilisant un consistomètre à disque de cisaillement —

Partie 1: Détermination de l'indice consistométrique Mooney

Reference number
ISO 289-1:2015(E)

Documents
Document Sharing Hub

© ISO 2015

Full document details: BS ISO 289-1:2015

COPYRIGHT PROTECTED DOCUMENT

© ISO 2015, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

© ISO 2015 – All rights reserved

Documents
Document Sharing Hub

Full document details: BS ISO 289-1:2015

Contents

Page

Foreword ... **iv**
1 Scope ... **1**
2 Normative references ... **1**
3 Principle ... **1**
4 Apparatus ... **1**
4.1 Typical shearing-disc viscometer ... 1
4.2 Dies ... 2
4.3 Rotor ... 2
4.4 Heating device ... 2
4.5 Temperature-measurement system ... 5
4.6 Die-closure system ... 5
4.7 Torque-measurement device and calibration of the device ... 6
5 Preparation of test piece ... **7**
6 Temperature and duration of test ... **7**
7 Procedure ... **7**
8 Expression of results ... **8**
9 Precision ... **8**
10 Test report ... **8**
Annex A (informative) **Precision statement** ... **10**
Annex B (informative) **Heat-stable film for Mooney viscosity measurements** ... **13**
Annex C (normative) **Calibration schedule** ... **16**

© ISO 2015 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 289-1:2015

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary Information

The committee responsible for this document is ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 2, *Testing and analysis*.

This fourth edition cancels and replaces the third edition (ISO 289-1:2014), which has been technically revised to improve the calibration schedule.

ISO 289 consists of the following parts, under the general title *Rubber, unvulcanized — Determinations using a shearing-disc viscometer*:

— *Part 1: Determination of Mooney viscosity*

— *Part 2: Determination of pre-vulcanization characteristics*

— *Part 3: Determination of the Delta Mooney value for non-pigmented, oil-extended emulsion-polymerized SBR*

— *Part 4: Determination of the Mooney stress-relaxation rate*

© ISO 2015 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 289-1:2015

INTERNATIONAL STANDARD ISO 289-1:2015(E)

Rubber, unvulcanized — Determinations using a shearing-disc viscometer —

Part 1: Determination of Mooney viscosity

WARNING — Persons using this part of ISO 289 should be familiar with normal laboratory practice. This part of ISO 289 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 289 specifies a method using a shearing-disc viscometer for measuring the Mooney viscosity of uncompounded or compounded rubbers.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1795, *Rubber, raw natural and raw synthetic — Sampling and further preparative procedures*

ISO 2393, *Rubber test mixes — Preparation, mixing and vulcanization — Equipment and procedures*

ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1: Test method*

ISO/TR 9272, *Rubber and rubber products — Determination of precision for test method standards*

ISO 18899:2013, *Rubber — Guide to the calibration of test equipment*

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

3 Principle

The torque which has to be applied under specified conditions in order to rotate a metal disc in a cylindrical chamber formed from mating dies filled with rubber is measured. The resistance offered by the rubber to this rotation is expressed in arbitrary units as the Mooney viscosity of the test piece.

4 Apparatus

4.1 Typical shearing-disc viscometer

A typical shearing-disc viscometer (see Figure 1), consisting of

a) two dies to form a cylindrical cavity,

b) a rotor,

c) a means for maintaining the dies at a constant temperature,

d) a means for maintaining a specified closure pressure,

© ISO 2015 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 289-1:2015

e) a means for rotating the rotor at constant angular velocity, and

f) a means for indicating the torque required to rotate the rotor.

The rotor and die cavity have the dimensions shown in Table 1.

Table 1 — Dimensions of essential parts of the apparatus

Part	Dimension mm
Rotor diameter	38,10 ± 0,03
Rotor thickness	5,54 ± 0,03
Die cavity diameter	50,9 ± 0,1
Die cavity depth	10,59 ± 0,03

NOTE Normally, a rotor with these dimensions is called a large rotor.

It is permissible to use a smaller rotor where high viscosity makes this necessary. This small rotor shall have the same dimensions as the large rotor except that the diameter shall be 30,48 mm ± 0,03 mm. Results obtained with the small rotor are not identical with those obtained using the large rotor.

4.2 Dies

The two dies forming the cavity shall be formed from non-deforming unplated hardened steel of minimum Rockwell hardness 60 HRC (see ISO 6508-1). The dimensions of the cavity are given in Figure 1 and shall be measured from the highest surfaces. For good heat transfer, each die should preferably be made from only one piece of steel. The flat surfaces shall have radial V-grooves to prevent slippage. The grooves shall be spaced radially at 20° intervals and shall extend from an outer circle of diameter 47 mm to an inner circle of diameter 7 mm for the upper die and to within 1,5 mm of the hole in the lower die. Each groove shall form a 90° angle in the die surface with the bisector of the angle perpendicular to the surface and shall be 1,0 mm ± 0,1 mm wide at the surface (see Figure 2).

4.3 Rotor

The rotor shall be fabricated from non-deforming unplated hardened steel of minimum Rockwell hardness 60 HRC. The rotor surfaces shall have rectangular-section grooves 0,80 mm ± 0,02 mm wide, of uniform depth 0,30 mm ± 0,05 mm, and spaced 1,60 mm ± 0,04 mm apart (distance between central axes). The flat surfaces of the rotor shall have two sets of such grooves at right angles to each other (see Figure 3). The edge of the rotor shall have vertical grooves of the same dimensions. The large rotor shall have 75 vertical grooves and the small rotor shall have 60. The rotor is fastened at right angles to a shaft having a diameter of 10 mm ± 1 mm and a length such that, in the closed die cavity, the clearance above the rotor does not differ from that below by more than 0,25 mm. The rotor shaft shall bear on the spindle which turns the rotor shaft not on the wall of the die cavity. The clearance at the point where the rotor shaft enters the cavity shall be small enough to prevent the rubber from leaving the cavity. A grommet, O-ring, or other sealing device can be used as a seal at this point.

The eccentricity or runout of the rotor while turning in the viscometer shall not exceed 0,1 mm.

The angular velocity of the rotor shall be 0,209 rad/s ± 0,002 rad/s (2,00 r/min ± 0,02 r/min).

4.4 Heating device

The dies are mounted on, or form part of, platens equipped with a heating device capable of maintaining the temperature of the platens and that of the dies to within ±0,5 °C of the test temperature. After

© ISO 2015 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 289-1:2015