



JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS K 6261-3 : 2017

(JRMA/JSA)

**Rubber, vulcanized or
thermoplastic—Determination of
low-temperature properties—
Part 3: Low temperature stiffening
(Gehman test)**

ICS 83.060

Reference number : JIS K 6261-3 : 2017 (E)

PROTECTED BY COPYRIGHT



Documents

Document Sharing Hub

15 S

Date of Establishment: 2017-10-20

Date of Public Notice in Official Gazette: 2017-10-20

Investigated by: Japanese Industrial Standards Committee
Standards Board for ISO area
Technical Committee on Chemical Products and
Analytical Methods

JIS K 6261-3:2017, First English edition published in 2018-01

Translated and published by: Japanese Standards Association
Mita MT Building, 3-13-12, Mita, Minato-ku, Tokyo, 108-0073 JAPAN

In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

© JSA 2018

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 the publisher.

Printed in Japan

PROTECTED BY COPYRIGHT

Contents

	Page
Introduction	1
1 Scope	1
2 Normative references	1
2A Terms and definitions	2
3 Principle	2
4 Apparatus	2
5 Calibration	5
6 Test pieces	5
6.1 Preparation of test piece	5
6.2 Conditioning of test piece	5
7 Procedure	5
7.1 Mounting of test piece	5
7.2 Stiffness measurements in liquid media	5
7.3 Stiffness measurements in gaseous media	6
7.4 Crystallization or plasticizer effect	7
8 Number of test pieces	8
9 Expression of test results	8
9.0 Calculation of torsional stiffness	8
9.1 Torsional modulus	8
9.2 Relative modulus	8
9.3 Apparent torsional modulus of rigidity	10
9.4 Expression of test results	11
10 Test report	11
Annex A (normative) Calibration schedule	13
Annex JA (informative) Low-temperature torsion test after long-term exposure	16
Annex JB (informative) Calculation formula for apparent torsional modulus of rigidity	18
Annex JC (informative) Comparison table between JIS and corresponding International Standard	20

Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee according to the proposal for establishment of Japanese Industrial Standard submitted by The Japan Rubber Manufacturers Association (JRMA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law. Consequently **JIS K 6261**:2006 has been withdrawn and partially replaced with this Standard.

This **JIS** document is protected by the Copyright Law.

Attention is drawn to the possibility that some parts of this Standard may conflict with patent rights, applications for a patent after opening to the public or utility model rights. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying any of such patent rights, applications for a patent after opening to the public or utility model rights.

JIS K 6261 series consists of the following 4 parts under the general title “*Rubber, vulcanized or thermoplastic—Determination of low-temperature properties*”:

Part 1: General introduction and guide

Part 2: Low-temperature brittleness

Part 3: Low temperature stiffening (Gehman test)

Part 4: Low-temperature retraction (TR test)

Rubber, vulcanized or thermoplastic— Determination of low-temperature properties—Part 3: Low temperature stiffening (Gehman test)

Introduction

This Japanese Industrial Standard has been prepared based on **ISO 1432:2013**, Edition 4, with some modifications of the technical contents.

The vertical lines on both sides and dotted underlines indicate changes from the corresponding International Standard. A list of modifications with the explanations is given in Annex JC.

1 Scope

This Standard specifies a static procedure, known as the Gehman test, for determining the relative stiffness characteristics of vulcanized or thermoplastic rubbers over a temperature range from room temperature to approximately $-150\text{ }^{\circ}\text{C}$.

NOTE 1 The low-temperature torsion test after long-term exposure is described in Annex JA.

NOTE 2 The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 1432:2013 *Rubber, vulcanized or thermoplastic—Determination of low-temperature stiffening (Gehman test)* (MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

WARNING 1 Persons using this 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 of this Standard to establish appropriate safety and health practices.

WARNING 2 Certain procedures specified in this Standard might involve the use or generation of substances, or the generation of waste, that could constitute a local environmental hazard. Reference should be made to related laws and regulations on safe handling and disposal after use.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS G 3522 Piano wires

JIS K 6200 Rubber—Vocabulary

JIS K 6250 Rubber—General procedures for preparing and conditioning test pieces for physical test methods

NOTE : Corresponding International Standard: ISO 23529 *Rubber—General procedures for preparing and conditioning test pieces for physical test methods* (MOD)

JIS Z 8401 Guide to the rounding of numbers

ISO 18899 Rubber—Guide to the calibration of test equipment

2A Terms and definitions

For the purpose of this Standard, the terms and definitions given in **JIS K 6200** apply.

3 Principle

The torsional stiffness is measured as a function of temperature, starting from a low temperature and up to the ordinary temperature. The stiffness is measured by connecting the test piece in series with a calibrated torsion wire and measuring the angle of twist of the test piece after a specified duration when the top of the wire is turned 180°.

4 Apparatus

The apparatus shall consist of a torsion apparatus for twisting the test piece via. torsion wire, a torsion wire, a test piece rack for holding the test piece, and a container for heat-transfer medium capable of maintaining the test piece at a constant temperature. Example of this apparatus is shown in Figure 1.

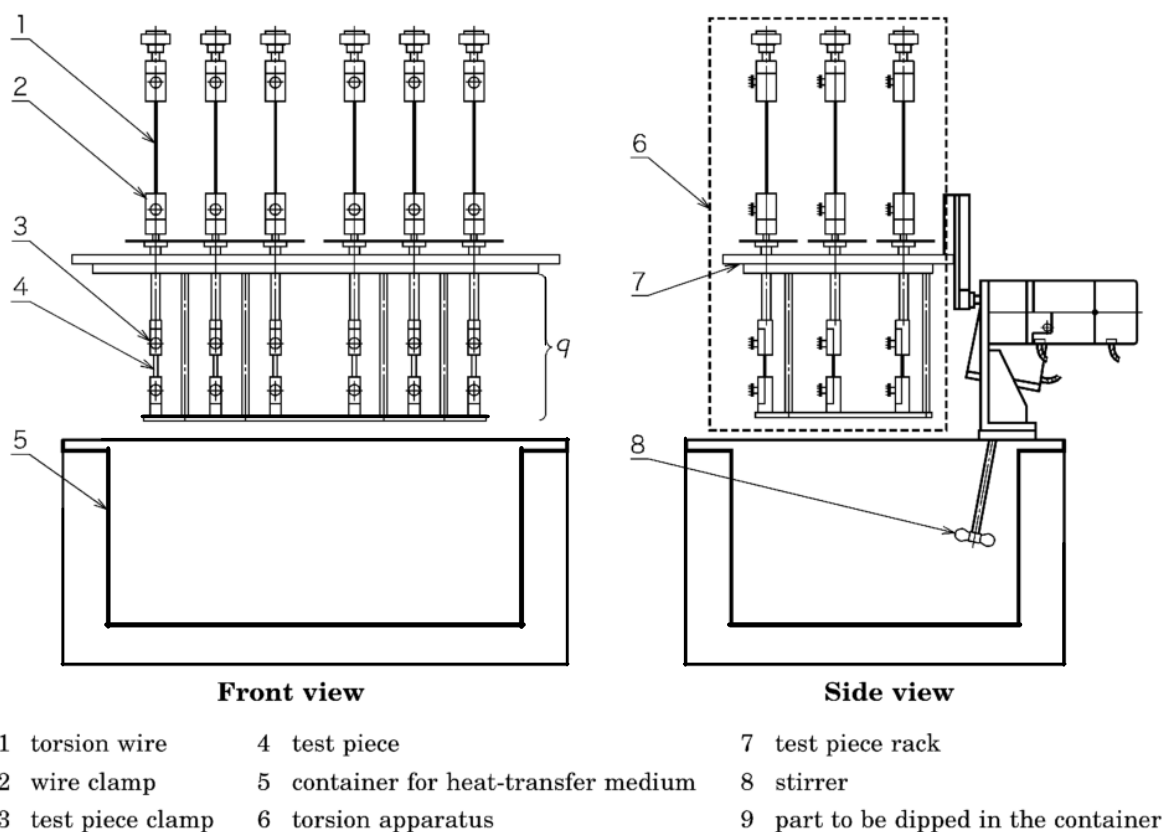


Figure 1 Example of low-temperature torsion apparatus

4.1 Torsion apparatus, consisting of a torsion head, capable of turning the upper end of the torsion wire 180° in a plane normal to the wire, the torsion wire whose lower end is fastened to the test piece clamp, and an angle measuring device which is connected to the wire, “friction-free” and allows reading to the nearest degree shall be provided. This principle is shown in Figure 2.

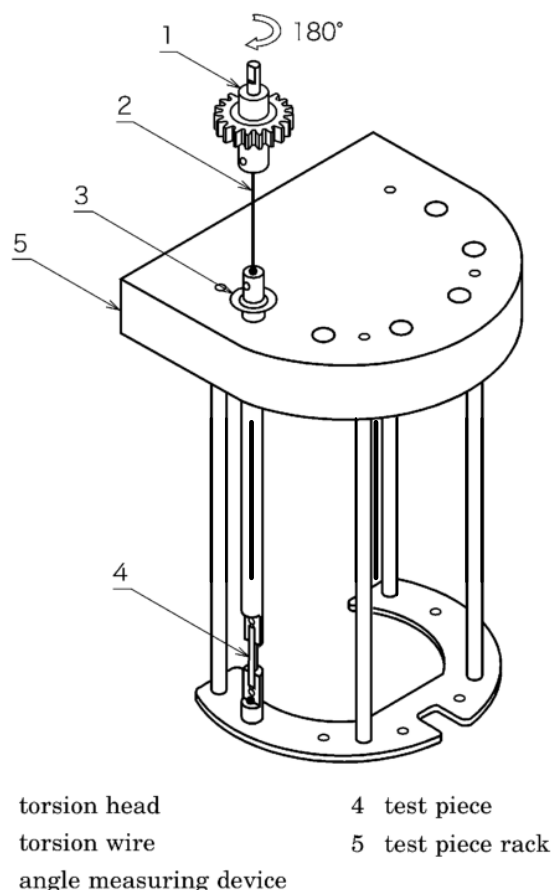


Figure 2 Principle of torsion apparatus

4.2 Torsion wire, made of tempered spring wire specified in **JIS G 3522**, of a length of $65 \text{ mm} \pm 8 \text{ mm}$, and having nominal torsional constants of $0.7 \text{ mN} \cdot \text{m}$, $2.8 \text{ mN} \cdot \text{m}$ and $11.2 \text{ mN} \cdot \text{m}$. In cases of dispute, the $2.8 \text{ mN} \cdot \text{m}$ wire shall be used.

4.3 Test piece rack, made of material of poor thermal conductivity, for holding the test piece in a vertical position in the heat transfer medium. The rack may be constructed to hold several test pieces. Two clamps shall be provided for holding each test piece. The bottom clamp shall be attached to the test piece rack. The top clamp acts as an extension of the test piece and is connected to the torsion wire by a rod.

4.4 Heat-transfer medium, liquid or gaseous, which does not appreciably affect, either physically or chemically, the material being tested.

NOTE : The following heat-transfer media may be used up to the indicated temperature:

- silicone fluids (kinematic viscosity of about $5 \text{ mm}^2/\text{s}$ at ambient temperature) $-60 \text{ }^\circ\text{C}$;
- ethanol $-73 \text{ }^\circ\text{C}$;
- methylcyclohexane (cooled with liquid nitrogen) $-120 \text{ }^\circ\text{C}$

4.5 Temperature-measuring device, capable of measuring the temperature to within $\pm 0.5 \text{ }^\circ\text{C}$ over the whole range of temperatures over which the apparatus is to be used. The temperature sensor shall be positioned near the test pieces.

4.6 Temperature control, capable of maintaining the temperature of the heat-transfer medium to within $\pm 1\text{ }^{\circ}\text{C}$, and for continuous heating, capable of raising the temperature $1\text{ }^{\circ}\text{C}$ every minute, with an error not greater than $10\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ during 10 min of heating.

4.7 Container for heat-transfer medium A heat insulated container capable of containing the specified heat-transfer medium.

4.8 Means of agitating the heat-transfer medium A stirrer, for liquids, or fan or blower, for gases, which ensures thorough circulation of the heat-transfer medium. It is important that the stirrer also moves the liquid vertically to ensure a uniform temperature in the liquid.

4.9 Stopwatch or other timing device, graduated in seconds.

5 Calibration

The test apparatus shall be calibrated in accordance with Annex A.

6 Test pieces

6.1 Preparation of test piece

Test pieces shall be prepared in accordance with clause 8 of **JIS K 6250**.

The test piece shall be a strip $40.0\text{ mm} \pm 2.5\text{ mm}$ in length, $3.0\text{ mm} \pm 0.2\text{ mm}$ in width and $2.0\text{ mm} \pm 0.2\text{ mm}$ in thickness.

If the apparent torsional modulus of rigidity (see 9.3) is required, measure the test length of the test pieces to the nearest 0.5 mm, the width to the nearest 0.1 mm and thickness to the nearest 0.01 mm.

6.2 Conditioning of test piece

Test piece shall be conditioned as follows.

- Sample and test pieces shall be stored in accordance with clause 7 of **JIS K 6250**.
- Samples and test pieces shall be protected from light as much as possible during the interval between forming and testing.
- Test pieces shall be conditioned in accordance with clause 9 of **JIS K 6250**.

7 Procedure

7.1 Mounting of test piece

Clamp each test piece used in such a manner that $25\text{ mm} \pm 3\text{ mm}$ of the test piece is free between the clamps. The test piece clamp shall be located in such a position that the specimen is coaxial with the wire and with a slight pre-load to keep the test piece straight when the temperature changes.

7.2 Stiffness measurements in liquid media

The stiffness measurements in liquid media shall be as follows.