Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

Indian Standard

RUBBER SEALS FOR HYDRAULIC GATES — SPECIFICATION

ICS 93.160
FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Hydraulic Gates and Valves Sectional Committee had been approved by the Water Resources Division Council.

To prevent flow of water past closed hydraulic gates, seals are provided either on the gate or on a metal frame on the gate slot. Rubber is the most commonly used material for such seals as it is elastic, deforms readily and regains its original shape on the removal of load. The provisions of this standard were earlier covered in IS 11855:1986 'Guidelines for use of different types of rubber seals for hydraulic gates'. In this revision only the guidelines for the use of different types have been retained while the different type of rubber seals and the specification of rubber material are now being covered in a separate standard.

There is no ISO Standard on the subject. Assistance has been drawn from ASTM D 2137 'Standard test methods for rubber property — Brittleness point of flexible polymers and coated fabrics for the method of test for low temperature brittleness'.

The composition of the technical Committee responsible for the formulation of this standard is given in Annex C.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (revised)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.
Indian Standard

RUBBER SEALS FOR HYDRAULIC GATES — SPECIFICATION

1 SCOPE
This standard lays down the types and specification for rubber seals used for all common types of hydraulic gates.

2 REFERENCES
The standards listed below contain provisions which through reference in this text constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

<table>
<thead>
<tr>
<th>IS No.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>3400</td>
<td>Methods of test for vulcanized rubbers</td>
</tr>
<tr>
<td>(Part 1) : 1987</td>
<td>Tensile stress-strain properties (second revision)</td>
</tr>
<tr>
<td>(Part 4) : 1987</td>
<td>Accelerated ageing (second revision)</td>
</tr>
</tbody>
</table>

3 MATERIALS
3.1 The basic polymer shall be natural rubber, or a co-polymer of butadiene and styrene, or a blend of both and the compound shall contain not less than 70 percent, by volume, of the basic polymer and the remainder shall consist of reinforcing carbon black, zinc oxide, accelerators, antioxidants, vulcanizing agents and plasticizers.

3.2 Rubber seals should be moulded only ensuring homogeneous section. These may be cladded by fluoro carbon.

4 PHYSICAL REQUIREMENT
The compound shall have the physical properties as shown in Table 1.

Table 1 Physical Properties
(Clauses 4 and Table 3)

<table>
<thead>
<tr>
<th>SI No.</th>
<th>Property</th>
<th>Requirement</th>
<th>Methods of Test, Ref to</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>IS No.</td>
</tr>
<tr>
<td>i)</td>
<td>Shore A durometer hardness</td>
<td>65 ± 5</td>
<td>IS 3400 (Part 23) : 2002</td>
</tr>
<tr>
<td>ii)</td>
<td>Elongation at break, percent, Min</td>
<td>450</td>
<td>IS 3400 (Part 1) : 1987</td>
</tr>
<tr>
<td>iii)</td>
<td>Tensile strength, N/mm², Min</td>
<td>14.5</td>
<td>IS 3400 (Part 1) : 1987</td>
</tr>
<tr>
<td>iv)</td>
<td>Mass of water absorbed in 7 days, percent, Max</td>
<td>10</td>
<td>IS 3400 (Part 6) : 1983</td>
</tr>
<tr>
<td>v)</td>
<td>Tensile strength after accelerated aging test of 48 h in oxygen at 70 ± 1°C and 2.1 ± 0.1 N/mm² pressure</td>
<td>Shall not be less than 80 percent of the strength before aging</td>
<td>IS 3400 (Part 4) : 1987 and IS 3400 (Part 1) : 1987</td>
</tr>
<tr>
<td>vi)</td>
<td>Low temperature brittleness</td>
<td>Non brittle after 3 min – 40°C</td>
<td>—</td>
</tr>
</tbody>
</table>

IS 15466 : 2004
5 TYPES, SHAPES AND DIMENSIONS

5.1 The length of the seal should preferably be limited to 3 m, unless otherwise agreed between the purchaser and the manufacturer. All the corner seals should be fully moulded. The most common types of rubber seals used in gates are given in Table 2.

Table 2 Types of Rubber Seal
(Clauses 5.1 and 8.1; and Table 3)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Types of Rubber Seal</th>
<th>Designation</th>
<th>Ref to Fig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>i)</td>
<td>Angle shaped seals</td>
<td>ASS</td>
<td>1</td>
</tr>
<tr>
<td>ii)</td>
<td>Flat/wedge seals</td>
<td>FWS</td>
<td>2</td>
</tr>
<tr>
<td>iii)</td>
<td>Music note seal</td>
<td>MNS</td>
<td>3</td>
</tr>
<tr>
<td>iv)</td>
<td>Double caisson seal</td>
<td>DCS</td>
<td>4</td>
</tr>
<tr>
<td>v)</td>
<td>Double bulb seal</td>
<td>DBS</td>
<td>5</td>
</tr>
<tr>
<td>vi)</td>
<td>Corner seals:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Type I</td>
<td>CST I</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>2) Type II</td>
<td>CST II</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>3) Type III</td>
<td>CST III</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>4) Type IV</td>
<td>CST IV</td>
<td></td>
<td>9</td>
</tr>
</tbody>
</table>

NOTE — All corner seals should be fully moulded.

5.2 The tolerance on sectional dimension of all seals shall be ± 0.5 percent, however tolerance shall not apply to the thickness of cladding film.

6 ADDITIONAL REQUIREMENTS FOR CLADDED SEALS

6.1 Rubber seals are fluorocarbon cladded to reduce frictional forces. The fluorocarbon is introduced into the mould along with the raw unvulcanized rubber compound and gets moulded or vulcanized simultaneously with the rubber so that the film is inserted or recessed into the rubber. The normal thickness of cladding should not be less than 1 mm.

6.2 These seals are less flexible than rubber seals. The cladding may be provided on portion of the seal as shown in Fig. 10 (see page 7) to overcome the drawback of reduced flexibility of fully cladded seals.

6.3 Cladding of seals may be done with fluorocarbon or teflon. The fluorocarbon cladded seals have more flexibility and a very low value of friction.

6.4 The seal should not fail in adhesion between the rubber and the cladding. The test should ensure adhesion bond of 176 N/cm width of the seal for a separation rate of 2.5 cm/min.

6.5 The test should ensure adhesion bond between the fluorocarbon and rubber as 54 N/cm width of the seal for a separation rate of 5 cm/min.

7 SAMPLING

7.1 Scale of Sampling and Criteria for Conformity
For the purpose of ascertaining conformity to this standard the scale of sampling and criteria for conformity shall be as prescribed in Annex B.

8 MARKING

8.1 Each rubber seal or packing or both shall be marked indelibly with the:
   a) manufacturer’s name or trade-mark,
   b) designation/Type of seal as per Table 2, and
   c) month and year of manufacture.

8.2 BIS Certification Marking
Each rubber seal or packing or both may also be marked with the Standard Mark.

8.2.1 The use of Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.
FIG. 1 COMMON SIZES OF ANGLE SHAPED SEALS

NOTE — The dimensions of the seals shown in the figure may be taken as indicative and nearest size seals as per moulds available with the manufacturers may also be used.

FIG. 2 COMMON SIZES OF FLAT SEALS

NOTE — The dimensions of the seals shown in the figure may be taken as indicative and nearest size seals as per moulds available with the manufacturers may also be used.
IS 15466:2004

SOLID BULB SEAL  

HOLLOW BULB SEAL

Dimensions

<table>
<thead>
<tr>
<th>SI No.</th>
<th>Description</th>
<th>D</th>
<th>d</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Solid &amp; Hollow</td>
<td>57</td>
<td>22</td>
<td>10</td>
</tr>
<tr>
<td>2.</td>
<td>do</td>
<td>100</td>
<td>44</td>
<td>25</td>
</tr>
<tr>
<td>3.</td>
<td>do</td>
<td>125</td>
<td>44</td>
<td>25</td>
</tr>
</tbody>
</table>

NOTE — The dimensions of seals shown in the figure may be taken as indicative and nearest size seals as per moulds available with the manufacturers may also be used.

All dimensions in millimetres.

FIG. 3 COMMON SIZES OF MUSIC NOTE SEALS

SOLID DOUBLE STEM SEAL

HOLLOW DOUBLE STEM SEAL

SOLID DOUBLE STEM WITH BULBS AT ENDS TYPE - I

SOLID DOUBLE STEM WITH BULBS AT ENDS TYPE - II

NOTE — The dimensions of seals shown in the figure may be taken as indicative and nearest size seals as per moulds available with the manufacturers may also be used. (Thickness of stem shall not be less than 14 mm.)

All dimensions in millimetres.

FIG. 4 COMMON SIZES OF DOUBLE STEM SEALS
DOUBLE BULB SEAL

NOTE — The dimensions of seals shown in the figure may be taken as indicative and nearest size seals as per moulds available with the manufacturers may also be used.

All dimensions in millimetres.

FIG. 5 COMMON SIZE OF DOUBLE BULB SEAL

SECTION AA (ENLARGED VIEW)

FIG. 6 DETAIL OF MOULDED CORNER SEAL

SECTION AA (ENLARGED VIEW)

FIG. 7 DETAIL OF MOULDED CORNER SEAL
SECTION AA (ENLARGED VIEW)

SECTION BB (ENLARGED VIEW)

FIG. 8 DETAIL OF MOULDED CORNER SEAL

SECTION BB (ENLARGED VIEW)

FIG. 9 DETAIL OF MOULDED CORNER SEAL.
ANNEX A

METHODS OF TEST FOR LOW TEMPERATURE BRITTELNESS

A-1 SCOPE
This test method covers the determination of the lowest temperature at which the rubber vulcanizates.

A-2 PRINCIPLE
This test method covers the evaluation of rubber materials subjected to low temperature flexing with impact under well defined conditions of striker speed. The response is largely dependent on effects of low temperatures such as crystallization incompatibility of plasticizer or the inherent dynamic behaviour of the material itself. Data obtained by this test method may be used to predict the product behaviour in applications where the conditions are similar to those specified in the test method.

A-3 APPARATUS
A-3.1 Specimen Clamp, designed so as to hold firmly the specimen(s) as cantilever beams (see Fig. 10).

A-3.2 Striker
The edge of the striker shall have a radius of 1.6 ± 0.1 mm. The edge shall move relative to the specimen at a rectilinear speed of 2.0 ± 0.2 m/s at impact and immediately after. NOTE — The striker may be motor-driven, solenoid-operated, gravity-activated or spring loaded. The motor-driven tester should be equipped with a safety interlock to prevent striker motion when the cover is open.

A-3.2.1 Position of Striking Edge
The distance between the center line of the striking edge and the clamps shall be 8.0 ± 0.3 mm. The clearance between the striking arm and the clamp at and immediately following impact shall be 6.4 ± 0.3 mm.

A-3.3 Tank or Test Chamber
A tank for liquid heat transfer media or a test chamber for gaseous media is required. To ensure thorough circulation of the heat transfer medium, a stirrer should be provided for liquids and a fan or blower for gaseous media.

A-3.4 Heat Transfer Media
A-3.4.1 Liquid Heat Transfer Medium
Methanol is the recommended heat transfer medium. Since methanol is flammable and toxic, the bath should be isolated in a closed hood.

NOTES
1 Any other liquid heat transfer medium that remains fluid at the test temperature and will not appreciably affect the material tested may be used.
2 The desired temperature may also be obtained by filling the tank with the heat transfer medium and lowering its temperature by the addition of liquid carbon dioxide controlled by solenoid-activated unit with an associated temperature control. Where temperatures below that obtainable by solid or liquid carbon dioxide are required, liquid nitrogen may be used.

A-3.4.2 Gaseous Medium
A gaseous medium may be used provided ample time is allowed for the specimens to reach temperature equilibrium with the temperature of the medium.

A-3.5 Temperature Control
Suitable means shall be provided for controlling the temperature of the heat transfer medium within ±0.5°C if the medium is liquid and within ±1°C with gaseous medium.

A-4 TIME LAPSE BETWEEN VULCANIZATION AND TESTING
A-4.1 For all test purposes, the minimum time between vulcanization and testing shall be 16 h.
A-4.2 For product tests, whenever possible, the time between vulcanization and testing should not exceed three months. Tests should be made within two months of the date of receipt by the customer.

A-5 TEST SPECIMENS
The die punched Type A specimens as illustrated in Fig. 11 shall be used.

NOTE — Specimens of other than 2.0 ± 0.2 mm thickness may be used provided it can be shown that they give equivalent results for the material being tested.
A-6 CONDITIONING
Prepared test pieces shall be conditioned immediately before testing for a minimum of 16 h at a temperature of 27 ± 2°C and a relative humidity of 65 ± 5 percent.

A-7 PROCEDURE

A-7.1 Test with Liquid Heat Transfer Medium
A-7.1.1 Prepare and bring the bath to a temperature below the expected lowest temperature of non-failure. Place sufficient liquid in the tank to ensure approximately 25 mm liquid covering the test specimens.
A-7.1.2 Mount five type specimens in the apparatus with the entire tab in the clamp. Immerse the specimens for 3.0 ± 0.5 min at the test temperature.
A-7.1.3 After immersion for the specified time, record the actual test temperature and deliver a single impact to the specimens.
A-7.1.4 Examine each specimen to determine whether or not it has failed. Failure is defined as any crack, fissure, or hole visible to the naked eye or complete separation into two or more pieces. Where a specimen has not completely separated, bend it to an angle of 90° in the same direction as the bend caused by the impact, then examine it for cracks at the bend.
A-7.1.5 Repeat the test at next higher temperatures at 10°C intervals using new specimens each time until no failure is obtained. Then decrease the bath temperature at 2°C intervals. Test at each temperature to determine the lowest temperature at which no failure occurs. Record this temperature as the lowest temperature of non-failure.

A-7.2 Test with Gaseous Heat Transfer Medium
A-7.2.1 Adjust the refrigerating unit and bring the test chamber, test apparatus and specimens to the desired temperature.
A-7.2.2 The testing is performed as described in A-7.1.

A-8 REPORT
Report the following information:

a) Thickness and type of specimen;
b) No. of specimens tested at a single impact, if other than five;
c) Conditioning period, method and procedure;
d) Heat transfer medium; and
e) The brittleness temperature to nearest 1°C.

ANNEX B
(Clause 7.1)

SAMPLING AND CRITERIA FOR CONFORMITY

B-1 SCALE OF SAMPLING

B-1.1 Lot
In a consignment all the rubber seal of the same type, dimension, shape and manufactured from the same type of rubber under essentially similar conditions of production shall be grouped together to constitute a lot.

B-1.2 Samples shall be selected and tested from each lot separately for ascertaining its conformity or otherwise to the requirements of this specification.

B-1.3 The number of rubber seals to be selected at random from a lot for different tests shall depend upon the size of the lot and shall be in accordance with col 1 and 2 of Table 3.

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>No. of Rubber Seals in Lot</th>
<th>Number of Samples for Dimensions</th>
<th>No. of Tests for Each Characteristic for Hardness, Tensile Strength, Elongation and Water Absorption</th>
<th>No. of Tests for Each Characteristic, for Ageing and Low Temperature Britteness Test (Tables 1 and 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Size</td>
<td>Permissible No. of Defectives</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N)</td>
<td>(n)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
</tr>
<tr>
<td>i) Up to 100</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>ii) 101 to 150</td>
<td>8</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>iii) 151 to 300</td>
<td>13</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>iv) 301 to 500</td>
<td>20</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>v) 501 to 1000</td>
<td>32</td>
<td>1</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>vi) 1001 and above</td>
<td>50</td>
<td>2</td>
<td>8</td>
<td>3</td>
</tr>
</tbody>
</table>
B-1.3.1 The seals to be selected from the lot shall be chosen at random. In order to ensure the randomness of selection, random number tables shall be followed. In case random number tables are not available, the seals may be selected from the lot in the following manner:

Starting from any seal in the lot, the seals shall be counted as 1, 2, ..., r and so on in one order, where r is the integral part of N/n (N and n being the lot size and sample size respectively). Every rth seal thus counted shall be withdrawn to constitute the sample.

B-1.3.2 If the seals are packed in bundles, at least 10 percent of the bundles shall be opened and the required number of seals shall be selected by taking approximately equal number of seals at random from each of the bundle.

B-2 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

B-2.1 All the rubber seals selected according to B-1.3 shall be examined for dimensions. Any seal failing in one or more of these characteristics shall be considered as defective. If the number of defectives found in the sample is less than or equal to the corresponding permissible number given in col 3 of Table 3, the lot shall be declared as conforming to these requirements, otherwise not.

B-2.1.1 In the case of those lots which have been found unsatisfactory according to B-2.1 all the rubber seals may depending upon the agreement between the purchaser and the supplier, be inspected for these characteristics and the defective ones removed.

B-2.2 The lot having been found satisfactory for dimensions according to B-2.1 shall then be examined for hardness, tensile strength, elongation strength, and water absorption. The number of tests to be conducted for each of these characteristics is given in col 4 of Table 3. For this purpose, required number of seals shall be selected at random from those already selected under B-1.3 and if necessary, from the lot. For each of the characteristics the various tests shall be conducted on independent test pieces. The lot shall be declared as satisfactory if none of tests fails.

B-2.3 The lot which has been found satisfactory according to B-2.2 shall then be subjected to relevant ageing and low temperature brittleness tests. The number of independent tests to be conducted for each of the characteristics is given in col 5 of Table 3. For this purpose, required number of seals shall be selected from those which have been tested and found satisfactory under B-2.2. The lot shall be declared satisfactory, if none of the tests fails.
ANNEX C
(Foreword)
COMMITTEE COMPOSITION
Hydraulic Gates and Valves Sectional Committee, WRD 12

Organization

In personal capacity (2047, Pocket-2, Sector-D, Vasaiw Kunj, New Delhi)

Bhakra Beas Management Board, Punjab
Bharat Heavy Electricals Ltd, Bhopal
Central Electricity Authority, New Delhi
Central Water & Power Research Station, Pune
Central Water Commission, New Delhi
Himachal Pradesh State Electricity Board, Sunder Nagar, H.P.
Irrigation Department, Maharashtra, Nashik
Irrigation Research Institute, Roorkee
National Hydroelectric Power Corporation Ltd, Faridabad
Orissa Construction Corporation Ltd, Bhubaneshwar
Texmaco Ltd, Kolkata
Triveni Structurals Ltd, Allahabad
Tungabhadra Steel Products Ltd, Karnataka
Water Resources Development Training Centre, Roorkee
BIS Directorate General

Representative(s)

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DEPUTY CHIEF ENGINEER
EXECUTIVE ENGINEER (Alternate)
SHRI A. S. SRIVASTAVA
SHRI S. R. RATHORE (Alternate)
SHRI R. K. RUSTAGI
SHRI R. M. SINHARKAR
SHRI S. L. PATIL (Alternate)
DIRECTOR, GATES (E & NE)
DIRECTOR (GATES-NW & S) (Alternate)
CHIEF ENGINEER (Design)
SHRI D. K. VAIDYARA (Alternate)
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CHIEF ENGINEER (Design)
SHRI G. S. SHARMA
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DIRECTOR (MECHANICAL)
SUPERINTENDING ENGINEER (Alternate)
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SHRI HUSSAIN BIN ALI
SHRI Y. S. CHANDRASHEKARAJA (Alternate)
SHRI (PROF) GOPAL CHAUHAN
SHRI S. S. SETHI, Director & Head (WRD)
[Representing Director General (Ex-officio)]

Member-Secretary
SHRIMATI ROSY DHAWAN
Joint Director (WRD), BIS
Bureau of Indian Standards

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Amendments Issued Since Publication

<table>
<thead>
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<th>Amend No.</th>
<th>Date of Issue</th>
<th>Text Affected</th>
</tr>
</thead>
</table>

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