***भारतीय मानक***

***Indian Standard***

**IS 10077 : 2024**

**संकुचन कारकों के निर्धारण के लिए**

**उपकरण — विशिष्टि**

*( पहला पुनरीक्षण )*

**Equipment for Determination of Shrinkage Factors — Specification**

( *First Revision* )

ICS 13.080.20; 93.020

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भारतीय मानक ब्यूरो

BUREAU OF INDIAN STANDARDS

मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002

MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG

NEW DELHI - 110002

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**October 2024 Price Group X**

Soil and Foundation Engineering Sectional Committee, CED 43

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Soil and Foundation Engineering Sectional Committee had been approved by the Civil Engineering Division Council.

There are a series of standards on methods of testing of soils. It has been recognized that reliable and inter-comparable test results can be obtained only with the standard testing equipment capable of giving the desired level of accuracy. With this objective, a series of specifications covering the requirements of equipment used for testing soils have been published to encourage their development and manufacturing in the country.

The equipment covered in this standard is used in the apparatus for determination of shrinkage factors of soils covered in IS 2720 (Part 6) : 1972 ‘Methods of test for soils: Part 6 Determination of shrinkage factors (*first revision*)’.

This standard was first published in 1982. The present revision has been taken up with a view to incorporate the modifications found necessary as a result of experience gained in the use of this standard. Also, in this revision, the standard has been brought into latest style and format of Indian Standards, and references to Indian Standards, wherever applicable have been updated. The other major modifications incorporated in this revision of the standard are given below:

1. The requirement of conformity of polymethyl methacrylate (acrylic) sheets to IS 14753 : 1999 ‘Polymethyl methacrylate (PMMA) (acrylic) sheets’ has been added.
2. BIS certification marking clause has been modified to align with the revised *Bureau of Indian Standards Act*, 2016.

This standard contributes to the Sustainable Development Goal 9: ‘Industry, innovation and infrastructure’: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

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

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 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. 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*

EQUIPMENT FOR DETERMINATION OF SHRINKAGE FACTORS ― SPECIFICATION

*( First Revision )*

**1 SCOPE**

This standard covers the requirements of equipment for the apparatus used for determination of shrinkage limit, shrinkage ratio, shrinkage index and volumetric shrinkage of soils.

**2 REFERENCES**

The standards listed in Annex A contain provisions, which through references 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 edition of these standards.

**3** **DIMENSIONS**

Dimensions and tolerances of different equipment shall be as detailed in Fig. 1 to Fig. 6.Except where tolerances are specifically mentioned against the dimensions, all dimensions shall be taken as nominal dimensions and tolerances as given in IS 2102 (Part 1) shall apply.

**~~4~~ MATERIALS**

The materials of construction for various parts of the equipment shall be as given in Table 1.

**Table 1 Materials of Construction for Parts of Equipment**

(*Clause* 4)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl No.** | **Equipment** | **Material** | **Special Requirement, if any** | **Relevant Grade/Conforming to Indian Standard** |
| (1) | (2) | (3) | (4) | (5) |
| i) | Evaporating dish | Porcelain | – | IS 2837 (Part 2) |
| ii) | Spatula: |  |  |  |
| 1. Blade
 | Steel | Polished | IS 2507 |
| 1. Handle
 | Wood | Painted | IS 620 |
| iii) | Shrinkage dish | Stainless steel | – | Grade X 07Cr18Ni9 ofIS 6911 |
| iv) | Prong plate: |  |  |  |
| 1. Prong
 | 1) Brass | – | IS 319 |
| 2) Stainless steel | – | Grade X 07Crl8Ni9 ofIS 6911 |
| 1. Plate
 | Acrylic plastic | – | IS 14753 |
| v) | Plain plate | Acrylic plastic | – | IS 14753 |
| vi) | Glass cup | Glass | – | IS 878 |

**5** **CONSTRUCTION**

**5.1 Evaporating Dish**

Theevaporating dish shall be as detailed in Fig 1. The inside of the evaporating dish shall be smooth.

****

Fig. 1 Evaporating Dish

**5.2** **Spatula**

The spatula shall be as detailed in Fig. 2. A wooden handle shall be fixed as shown in Fig 2.

~~~~

All dimensions in millimetres.

Fig. 2 Spatula

**5.3 Shrinkage Dish**

Theshrinkage dish shall be as detailed in Fig. 3. The internal corner between the bottom and the vertical sides shall be rounded into a smooth concave curve of approximately 3 mm radius.

****

All dimensions in millimetres.

Fig. 3 Shrinkage Dish

**5.4** **Glass Cup**

The glass cup shall be as detailed in Fig. ~~4~~.



All dimensions in millimetres.

Fig. 4 Glass Cup

**5.5** **Prong Plate**

Theprong plate shall be as detailed in Fig. 5. The plate shall be plain. Three prongs as detailed in Fig. 5 shall be fixed to the plate at 120° to each other and at a spacing of 30 mm (centre to centre).



All dimensions in millimetres.

Fig. 5 Details of Prong

**5.6 Plain Plate**

The plain plate shall be of size 75 mm square and of 3 mm thickness. The plate shall be plain (*see* Fig. 6).



All dimensions in millimetres.

Fig. 6 Plain Plate

**5.7 Other Accessories**

The equipment shall also have the following other accessories:

1. Straight edge, 150 mm long and 25mm wide as per IS 2220; and
2. Measuring cylinder of 25 ml capacity as per IS 878.

**6 MARKING**

**6.1** The following information shall be clearly and indelibly marked on the equipment:

1. Name of the manufacturer or his registered trade-mark or both;
2. Type of material used; and
3. Date of manufacture.

**6.2** **BIS Certification Marking**

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

**ANNEX A**

(*Clause* 2)

**LIST OF REFERRED STANDARDS**

|  |  |
| --- | --- |
| *IS No.* | *Title* |
| IS 319 : 2007 | Free cutting brass bars, rods and section — Specification (*fifth revision*) |
| IS 620 : 1985 | Specification for wooden tool handles general requirements (*fourth revision*) |
| IS 878 : 2008/ ISO 4788 : 2005 | Laboratory glassware — Graduated measuring cylinders (*second revision*) |
| IS 2102 (Part 1) : 1993/ISO 2168-1 : 1989 | General tolerances: Part 1 Tolerances for linear and angular dimensions without individual tolerance indications (*third revision*) |
| IS 2220 : 1990 | Engineering metrology — Steel straightedges — Specification (*first revision*) |
| IS 2507 : 1975 | Specification for cold-rolled steel strips for springs (*first revision*) |
| IS 2837 (Part 2) : 1977 | Specification for porcelain crucibles and basins: Part 2 Basins (*first revision*) |
| IS 6911 : 2017 | Stainless steel plate, sheet and strip — Specification (*second revision*) |
| IS 14753 : 1999 | Polymethyl methacrylate (PMMA) (acrylic) sheets |

**ANNEX B**

(*Foreword*)

**COMMITTEE COMPOSITION**

Soil and Foundation Engineering Sectional Committee, CED 43

| *Organization* |  | *Representative(s)* |
| --- | --- | --- |
| In Personal Capacity (*473, Vinayak Apartments, BHEL Housing Society, Plot No. C-58/19, Sector 62, Noida* - *201301*) |  | Shri C. Pushpakaran **(*Chairperson*)** |
| AFCONS Infrastructure Limited, Mumbai |  | Dr Sunil BasarkarDr Lakshmana Rao Mantri (*Alternate* I)Shri Budhmal Jain (*Alternate* II) |
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| CEM Engineers and Consultants Pvt Ltd, Bhubaneswar |  | Shri Ashok BasaShri Dilip Basa (*Alternate*) |
| Cengrs Geotechnica Pvt Ltd, Noida |  | Shri Sanjay GuptaShri Ravi Sundaram (*Alternate*)  |
| Central Board of Irrigation and Power, New Delhi |  | Director |
| Central Electricity Authority, New Delhi |  | Shri Baleshwar Thakur Shri Deepak Singh Raghuvansi (*Alternate*) |
| Central Public Works Department, New Delhi |  | Shri Nagendra PrasadShri Amrendra Kumar Jalan (*Alternate*) |
| Central Soil and Materials Research Station, New Delhi |  | Dr Manish Gupta Ms Swapna Varma (*Alternate*) |
| CSIR - Central Building Research Institute, Roorkee |  | Shri Manojit SamantaDr S. Ganesh Kumar (*Alternate*) |
| CSIR - Central Road Research Institute, New Delhi |  | Dr Kanwar SinghDr P. S. Prasad (*Alternate*) |
| CSIR - Structural Engineering Research Centre, Chennai |  | Dr P. KamatchiShrimati R. Sreekala (*Alternate*) |
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| Delhi Development Authority, New Delhi |  | Shri Arun KumarShri Harindar Pal (*Alternate*) |
| Delhi Technological University, New Delhi |  | Prof Ashok Kumar Gupta  |
| Engineers India Limited, New Delhi |  | Shri V. K. PanwarShri Sampat Raj (*Alternate*) |
| Geodynamics Ltd, Vadodara |  | Dr Ravikiran Vaidya Shri Sujan Kulkarni (*Alternate*) |
| Geological Survey of India, Kolkata  |  | Dr Timir Baran GhosalShri Prashant Tukaram Ilamkar (*Alternate*) |
| Ground Engineering Limited, New Delhi |  | Shri Ashok Kumar Jain Shri Neeraj Kumar Jain (*Alternate*) |
| Hindustan Construction Company Limited, Mumbai |  | Representative  |
| Indian Geotechnical Society, New Delhi |  | Prof H. N. RameshDr Anil Joseph (*Alternate* I) Prof D. Neelima Satyam (*Alternate* II) |
| Indian Institute of Science, Bengaluru |  | Prof Jyant KumarProf G. Madhavi Latha (*Alternate*) |
| Indian Institute of Technology Bombay, Mumbai |  | Prof Deepankar ChoudhuryProf Dasaka Murty (*Alternate*) |
| Indian Institute of Technology Delhi, New Delhi  |  | Dr G. V. RamanaDr J. T. Shahu (*Alternate*) |
| Indian Institute of Technology Kanpur, Kanpur  |  | Prof Priyanka Ghosh |
| Indian Institute of Technology Madras, Chennai |  | Prof Subhadeep BanerjeeProf Ramesh K. Kandasami (*Alternate*) |
| Indian Institute of Technology Roorkee, Roorkee |  | Dr Mahendra SinghDr Vishwas A. Sawant (*Alternate*) |
| Indian Road Congress, New Delhi |  | Secretary General Director (T) (*Alternate*) |
| Indian Society of Earthquake Technology, Roorkee |  | Prof B. K. MaheswariProf Vasant A. Matsagar (*Alternate*) |
| ITD Cementation India Ltd, Kolkata |  | Shri Manish Kumar Shri Aminul Islam (*Alternate*) |
| Jadhavpur University, Kolkata  |  | Prof Sibapriya Mukherjee Prof Ramendu Bikas Sahu (*Alternate*) |
| Keller Ground Engineering Pvt Ltd, Chennai |  | Shri V. V. S. RamadasShri Madan Kumar Annam (*Alternate*) |
| L&T GeoStructure Private Limited, Chennai |  | Shri M. KumaranShri A. Vetriselvan (*Alternate*) |
| MECON Limited, Ranchi |  | Shri Shankar Ray Shri Ayush Srivastava (*Alternate*) |
| Military Engineer Services, Engineer-in-Chief's Branch, Integrated HQ of MoD (Army), New Delhi |  | Shri Manoj BapnaShri Ajay Kumar Sinha (*Alternate*) |
| Ministry of Ports, Shipping and Waterways, New Delhi |  | Shri H. N. AswathShri Anil Pruthi (*Alternate*) |
| Mumbai Port Trust, Mumbai |  | Dy Chief Engineer (Design)Superintending Engineer (Design) (*Alternate*) |
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| National High Speed Rail Corporation Ltd, Mumbai |  | Representative  |
| National Institute of Disaster Management, New Delhi |  | Dr Chandan GhoshDr Amir Ali Khan (*Alternate*) |
| NTPC Limited, Noida |  | Shri Mohit Jhalani |
| Power Grid Corporation of India Limited, Gurugram |  | Representative |
| Research Designs and Standards Organization (Ministry of Railways), Lucknow |  | Shri Sameer Singh Shri S. K. Ojha (*Alternate*) |
| RITES Limited, Gurugram |  | Shri Koshy VaidyanShri Sumeet Mahajan (*Alternate*) |
| Safe Enterprises, Mumbai |  | Shri Vikram Singh Rao Shri Suryaveer Singh Rao (*Alternate*) |
| STUP Consultants Pvt Ltd, Mumbai |  | Shri Anirban SenguptaShri Yogesh Waingankar (*Alternate*) |
| Tata Consulting Engineers Limited, Mumbai |  | Shri Sanjeev Gupta  Shri B. N. Nagaraj (*Alternate*) |
| Telangana State Research Laboratories, Hyderabad |  | Shri A. G. Manoj KumarShri Ashirwadam Jakkula (*Alternate* I) Shrimati M. Manjula (*Alternate* II) |
| The Pressure Piling Co (I) Pvt Limited, Mumbai |  | Shri V. C. Deshpande Shri Pushkar V. Deshpande (*Alternate*) |
| Unique Geocivil Services Pvt Ltd, Surat |  | Shri Nehal H. DesaiShri Hitesh H. Desai (*Alternate* I)Shri Dhruval D. Shah (*Alternate* II) |
| In Personal Capacity (*1-B, Villakkupattam Palace, First Floor, 48, New Avadi Road, Kilpauk, Chennai - 600010*) |  | Dr V. Balakumar |
| BIS Directorate General |  | Shri Dwaipayan Bhadra, Scientist ‘E’/Director and Head (Civil Engineering) [Representing Director General (*Ex-officio*)] |
| *Member Secretary*Shri Dheeraj DamachyaScientist ‘B’/Assistant Director (Civil Engineering), BIS |