*भारतीय मानक*

संघट्ट विधि द्वारा मृदा की तरल सीमा के निर्धारण के लिए

कासाग्रांडे उपकरण **—** विशिष्टि

**(*पहला पुनरीक्षण*)**

*Indian Standard*

**Casagrande Apparatus for Determination of Liquid Limit of Soils by Impact Method — Specification**

(*First Revision*)

(ICS 93.020; 13.080.20)



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 for determination of liquid limit of soils by impact method as covered in IS 2720 (Part 5): 1985 ‘Methods of test for soils: Part 5 Determination of liquid and plastic limit (s*econd revision*)’.

This standard covers the minimum requirements for the apparatus. The apparatus may also be manufactured with a revolution counter to indicate the number of falls of cup automatically and/or a motorized driving arrangement to give approximately 120 rev/min.

This standard was first published in 1980. 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 title of the standard has been modified from ‘Specification for liquid limit apparatus for soils' to 'Casagrande apparatus for determination of liquid limit of soils by impact method ― Specification’ considering that the apparatus for determination of liquid limit by cone penetration method is separately covered in IS 11196 : XXXX ‘Equipment for determination of liquid limit of soils by cone penetration method — Specification (*first revision*)’ (*under preparation*).
2. Relevant grade of vulcanized rubber for making base feet and base of the apparatus as per the revised IS 5192 (Part 1) : 1994 'Natural rubber compounds ― Specification: Part 1 For moulded products (*second revision*)' has been specified.
3. 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 the standard is given in Annex A.

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*

**CASAGRANDE APPARATUS FOR DETERMINATION OF LIQUID LIMIT OF SOILS BY IMPACT METHOD ― SPECIFICATION**

(*First Revision*)

**1 SCOPE**

This standard covers the requirements of Casagrande apparatus used for the of liquid limit of soils by impact method.

**2 REFERENCES**

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

|  |  |
| --- | --- |
| *IS No.* | *Title* |
| IS 292 : 1983 | Specification for leaded brass ingots and casting (*second revision*) |
| IS 410 : 1977 | Specification for rolled brass plate, strip and foil (*third revision*) |
| IS 2102 (Part 1) : 1993 | General tolerances: Part 1 Tolerances for linear and angular dimensions without individual tolerance indications (*third revision*) |
| IS 3400 (Part 11) : 2021 | Methods of test for vulcanized rubbers: Part 11 Determination of rebound resilience (*second revision*) |
| IS 4170 : 1967 | Specification for brass rods for general engineering purposes |
| IS 4413 : 1981 | Specification for brass wires for general engineering purposes (*first revision*) |
| IS 5192 (Part 1) : 1994 | Natural rubber compounds ― Specification: Part 1 For moulded products (*second revision*) |

**3 DIMENSIONS**

Thedimensions, with tolerances, of different components of Casagrande apparatus, that is, liquid limit device, grooving tool and gauge block shall be as detailed in Fig. 1 to 3. The dimensions against which tolerances are not specifically mentioned shall be taken as nominal dimensions and tolerances thereon shall be as given in IS 2102 (Part 1) shall apply.

**4 LIQUID LIMIT DEVICE**

**4.1 Materials**

The materials of construction for different components of the liquid limit device shall be given in Table 1. All parts made of brass shall be chrome plated.

**Table 1 Materials for Different Components of**

**Liquid Limit Device**

(*Clause* 4.1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl No.** | **Part** | **Material** | **Special Requirement** | **Conforming To** |
| (1) | (2) | (3) | (4) | (5) |
| i) | Base | Vulcanized rubber | Resilience1) : 30 to 40 percent | Grade Z80 of IS 5192 (Part 1) |
| ii) | Base feet | Vulcanized rubber | Resilience1) : 30 to 40 percent | Grade Z80 of IS 5192 (Part 1) |
| iii) | Cup | Sheet brass | - | IS 410  |
| iv) | Cam housing | Cast brass | - | IS 292  |
| v) | Sliding carriage |  | - | IS 292 |
| vi) | Cam | Brass | - | IS 4170  |
| vii) | Pin | Brass | - | IS 4170 |
| viii) | Handle | Brass | - | IS 4170 |
| ix) | Handle Knob | Brass | - | IS 4170 |
| 1) The resilience of the materials shall be determined in accordance with IS 3400 (Part 11). |

**4.2 Construction**

The liquid limit device shall be constructed in accordance with Fig. 1. It shall consist of a base carrying a sliding carriage assembly to which a cup shall be hinged. The cup shall be suspended in such a way that it may be raised and dropped through a height of 10 mm with the help of a lead screw provided at the back of the sliding carriage. For ease of operation, the handle to rotate the cam shall be provided for right-hand operation. The base feet shall be fixed to the base, and both shall be made of the same material. The cup shall have dimensions as detailed in Fig. 1. The inside of the cup shall be finished smooth. The cup shall have a brass follower block brazed to it for being suspended from the sliding carriage with the help of a brass pin. It shall be suspended from the top bracket with the help of the brass pin in such a way that it falls freely without having much play at its hinge. The sliding carriage shall have two grooves to facilitate adjustment of fall of the cup to 10 mm. The contract face of the cam shall be smoothly curved. The sliding carriage shall be secured to the top of the cam housing with two knurled head screws made of brass. The handle shall be fixed to the cam shaft. The handle knob shall have free rotating movement.

**5 GROOVING TOOLS AND GAUGE BLOCK**

**5.1** Grooving tools shall be of three types, namely, Type A, Type B and Type C (*see* Fig. 2).

**5.2 Materials**

The materials of construction for the three different types of the grooving tools and of the gauge block shall be as given in Table 2.

**Table 2 Materials for Grooving Tools and Gauge Block**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl No.** | **Part** | **Material** | **Special Requirement** | **Conforming to Indian Standard** |
| (1) | (2) | (3) | (4) | (5) |
| i) | Grooving tool,Type A | Sheet brass orCast brass | Smooth finish | IS 410  orIS 292  |
| ii) | Grooving tool,Type B: |  |  |  |
|  |  a) Handle | Brass rod | Smooth finish | IS 4170  |
|  |  b) Tool | Cast brass | Smooth finish | IS 292  |
| iii) | Grooving tool,Type C: |  |  |  |
|  |  a) Tool | Sheet brass | Smooth finish | IS 410  |
|  |  b) Handle | Brass wire | Smooth finish | IS 4413  |
| iv) | Gauge block | Cast brass | Smooth finish | IS 292  |



DETAILS OF CUP

All dimensions in millimetres.

FIG. 1 LIQUID LIMIT DEVICE



|  |  |  |
| --- | --- | --- |
| TYPE A | TYPE B | TYPE C |

All dimensions in millimetres

FIG. 2 GROOVING TOOLS

**5.3 Construction**

**5.3.1** The shapes and dimensions of the grooving tools shall be in accordance with Fig. 2. In the case of Type B grooving tool, the handle shall be of such a shape and dimensions that it serves for the gauge block.

**5.3.2** The shape and dimensions of the gauge block shall be in accordance with Fig. 3. The gauge block shall be finished smooth.



All dimensions in millimetres.

FIG. 3 GAUGE BLOCK

**6 MARKING**

**6.1** The liquid limit device, the grooving tools and the gauge block of the Casagrande apparatus shall be clearly marked with the following information:

1. Name of manufacturer or his registered trade-mark or both;
2. Type (where applicable); and
3. Date of manufacture.

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

The product 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 there under, and the product may be marked with the Standard Mark.

**ANNEX A**

(*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, Uttar Pradesh* - *201301* | Shri C. Pushpakaran **(*Chairperson*)** |
| AFCONS Infrastructure Limited, Mumbai | Dr Sunil Basarkar Dr Lakshmana Rao Mantri (*Alternate-I*) Shri Budhmal Jain (*Alternate-II*) |
| AIMIL Limited, New Delhi | Shri Rohitash Barua  Smt Aarti Bhargava (*Alternate-I*) Shri Anil Singh (*Alternate-II*) |
| Bharat Heavy Electricals Ltd, New Delhi | Shri T. M. S. Rao Shri Vikram S. (*Young Professional*) |
| CEM Engineers and Consultants Pvt Ltd, Bhubaneswar | Shri Ashok Basa Shri Dilip Basa (*Alternate*) |
| Cengrs Geotechnica Pvt Ltd, Noida | Shri Sanjay Gupta Shri Ravi Sundaram (*Alternate*) Shri Sorabh Gupta (*Young Professional*) |
| 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 Prasad Shri 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*)Shri Kaushik Pandit (*Young Professional*) |
| CSIR-Central Road Research  Institute, New Delhi | Dr Kanwar Singh Dr P. S. Prasad (*Alternate*) |
| CSIR-Structural Engineering  Research Centre, Chennai | Dr P. Kamatchi Smt R Sreekala (*Alternate*) Dr A. Thirumalaiselvi (*Young Professional*) |
| D-CAD Technologies,  New Delhi | Dr K. G. Bhatia  |
| Delhi Development Authority,  New Delhi | Shri Arun Kumar Shri Harindar Pal (*Alternate*) |
| Delhi Technological University,  New Delhi | Prof. Ashok Kumar Gupta  |
| Engineers India Limited,  New Delhi | Shri V. K. Panwar Shri Sampat Raj (Alternate-I) Shri Anil Banoth (*Young Professional*) |
| Geodynamics Ltd, Vadodara | Dr Ravikiran Vaidya Shri Sujan Kulkarni (*Alternate*) |
| Geological Survey of India,  Kolkata  | Dr Timir Baran Ghosal Shri 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. Ramesh Dr Anil Joseph (*Alternate*) Prof D. Neelima Satyam (*Alternate-II*) |
| Indian Institute of Science,  Bengaluru | Prof Jyant KumarProf G. Madhavi Latha (*Alternate*) |
| Indian Institute of Technology  Delhi, New Delhi  | Dr G. V. Ramana Dr J. T. Shahu (Alternate-I) Dr Prashanth Vangla (*Young Professional*) |
| Indian Institute of Technology  Kanpur, Kanpur  | Prof Priyanka Ghosh |
| Indian Institute of Technology  Madras, Chennai | Prof Subhadeep Banerjee Prof Ramesh K Kandasami (*Alternate*) |
| Indian Institute of Technology  Bombay, Mumbai | Prof Deepankar Choudhury Prof Dasaka Murty (*Alternate*) |
| Indian Institute of Technology  Roorkee, Roorkee | Dr Mahendra Singh Dr Vishwas A. Sawant (*Alternate*) |
| Indian Road Congress, New Delhi | Secretary General  Director (T) (*Alternate*) |
| Indian Society of Earthquake  Technology, Roorkee | Prof B. K. Maheswari Prof 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. Ramadas Shri Madan Kumar Annam (*Alternate*) |
| L&T GeoStructure Private Limited, Chennai | Shri M. KumaranShri A. Vetriselvan (*Alternate*) |
| Military Engineer Services,  Engineer-in-Chief's Branch,  Integrated HQ of MoD (Army), New Delhi | Shri Manoj BapnaShri Ajay Kumar Sinha (*Alternate*) |
| MECON Limited, Ranchi | Shri Shankar Ray Shri Ayush Srivastava (*Alternate*) |
| Ministry of Ports, Shipping and  Waterways, New Delhi | Shri H. N. Aswath Shri Anil Pruthi (*Alternate*) |
| Mumbai Port Trust, Mumbai | Dy Chief Engineer (Design) Superintending Engineer (Design) (*Alternate*) |
| Nagadi Consultants Pvt Limited,  New Delhi | Dr V. V. S. Rao  Shri N. Santosh Rao (*Alternate*) |
| National Capital Region Transport  Corporation, New Delhi | Shri Jitender Kumar |
| National High Speed Rail  Corporation Ltd, Mumbai | **Representative**  |
| National Institute of Disaster Management, New Delhi | Dr Chandan Ghosh Dr 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 Vaidyan Shri Sumeet Mahajan (*Alternate*) |
| Safe Enterprises, Mumbai | Shri Vikram Singh Rao  Shri Suryaveer Singh Rao (*Alternate*) |
| STUP Consultants Pvt Ltd, Mumbai | Shri Anirban Sengupta Shri 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 Kumar Shri Ashirwadam Jakkula (*Alternate-I*) Smt 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. Desai Shri 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 |