IS 2720 (Part 9) : 1992
(Reaffirmed 1997)

भारतीय मानक

मृदा परीक्षण पद्धतियाँ

भाग 9 मिट्टी की पद्धति की स्थिर संहति द्वारा नमी के अंश से सम्बन्धित शुष्क घनत्व ज्ञात करना

(पहला पुनरीक्षण)

Indian Standard

METHODS OF TEST FOR SOILS

PART 9 DETERMINATION OF DRY DENSITY-MOISTURE CONTENT RELATION BY CONSTANT MASS OF SOIL METHOD

(First Revision)

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BUREAU OF INDIAN STANDARDS
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Price Group 2

FOREWORD

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

With a view to establish uniform procedures for the determination of different characteristics of soils and also for facilitating comparative studies of the results, an Indian Standard methods of test for soils (IS : 2720) has been published in 41 parts. This part deals with the determination of moisture content-dry density relation of soil using a constant mass of dry soil. This is a rapid method and is essentially useful as a field control method. It may be used as a substitute for the tests covered by IS 2720 (Part 7) : 1980 'Methods of test for soils: Part 7 Determination of water content-dry density relation using light compaction (*second revision*)' and IS 2720 (Part 8) : 1983 'Methods of test for soils: Part 8 Determination of water content-dry density relation using heavy compaction (*second revision*)'.

This standard was first published in 1971. In this revision apart from general updation, the amendment issued has been incorporated. Further the revision has been made in SI units only.

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

Indian Standard

METHODS OF TEST FOR SOILS

PART 9 DETERMINATION OF DRY DENSITY-MOISTURE CONTENT RELATION BY CONSTANT MASS OF SOIL METHOD

(First Revision)

1 SCOPE

1.1 This standard (Part 9) lays down the method for the determination of the dry density-moisture content relation of soil passing 4·75 mm IS Sieve, using constant mass of soil on oven dry basis in the compacted mass.

2 REFERENCES

2.1 The following Indian standard are the necessary adjuncts to this standard.

IS No.	*Title*
460 (Part 1) : 1985	Specification for test sieves : Part 1 Wire cloth test sieves (*third revision*)
2720 (Part 1) 1983	Methods of test for soils : Part 1 Preparation of dry soil samples for various tests (*second revision*)
2720 (Part 2) : 1973	Methods of test for soils : Part 2 Determination of water content (*second revision*)
2809 : 1972	Glossary of terms and symbols relating to soil engineering (*first revision*)

3 TERMINOLOGY

3.1 For the purpose of this standard, the definitions given in IS 2809 : 1972 shall apply.

4 APPARATUS

4.1 A Cylindrical Metal Tube with Base Plate

Having an internal diameter of 50 mm and height of 435 mm. The tube shall be fitted with a detachable base plate. A suitable design of the tube with flange and base plate is shown in Fig. 1. The internal surface of the tube shall be smooth. At a height of about 100 mm from the bottom 8 holes of 1·5 mm dia, equally spaced, shall be provided in the wall of the tube. Similarly at a height of about 50 mm from the top of four holes of 1·5 mm. diameter at 90° to each other shall be provided in the wall of the tube.

4.2 A Metal Rammer

48 mm in diameter and about 48·5 mm in height attached to a metallic rod and knob so as to have a combined height of about 550 mm and a total mass of 2·6 kg. The rod shall also carry a cap for the tube. The rammer shall have a drop of 310 mm. When the rammer is resting on the base plate without the specimen the position of the rod touching the cap of the tube shall be marked zero. The rod shall then be marked in cm and mm upto 8 cm, downwards from zero.

4.3 Balances

One of capacity of 10 kg sensitive to 2 g, and another of capacity of 200 g sensitive to 0·01 g.

4.4 Oven

Thermostatically controlled with interior of non-corroding material to maintain temperature between 105 and 110°C.

4.5 Container

Any suitable non-corrodible air-tight container to determine the moisture content of soils for tests conducted in the laboratory.

4.6 Sieve

4·75 mm IS Sieve conforming to the requirements of IS 460 (Part 1) : 1985.

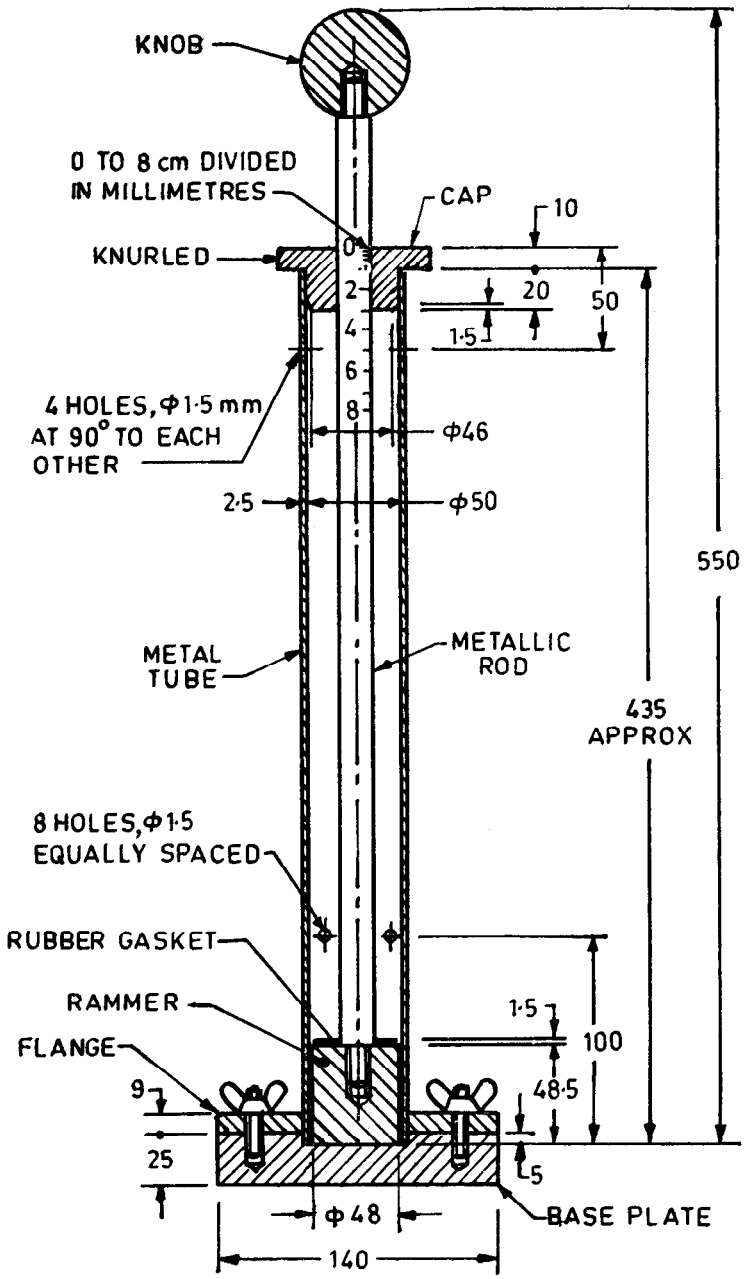
4.7 Pipette

4.8 Mixing Tools

Miscellaneous tools like mixing pan, spoon, trowel, spatula, etc, or a suitable mechanical device for thoroughly mixing the sample of soil with additions of water.

5 SOIL SPECIMEN

5.1 Soil specimen obtained as indicated in **5.2** shall be used for the test.



All dimensions in millimetres.

FIG. 1 APPARATUS FOR COMPACTION BY CONSTANT MASS METHOD

5.2 A representative thoroughly mixed air-dried soil sample passing 4·75 mm IS Sieve and weighing about 2 kg obtained in accordance with the procedure laid down in IS 2720 (Part 1) : 1983 shall be taken for the test. This sample shall be put into an air-tight container. The moisture content of this sample shall be determined in accordance with IS 2720 (Part 2) : 1973.

6 PROCEDURE

6.1 The empty tube shall be cleaned; dried and assembled with the base plate. A known exact mass of the air-dried soil equivalent to

200 g of oven-dried soil shall be taken. If w percent is the moisture content of the air-dried soil sample obtained in accordance with **5.2**, then for 200 g of oven dried soil for each test the mass of the air-dried soil to be taken will be (200 + 2 w) g. Water shall be added in measured quantity so as to have a known moisture content on the oven-dry mass of soil. This shall be thoroughly mixed with a spatula and then poured into the mould. The wet soil shall be given 8 blows of the rammer for light compaction tests and 36 blows of the rammer for heavy compaction tests falling through a height of 310 mm. The height of the compacted mass shall be read from the calibration on the rod. Similar tests shall be carried out with increasing percentage of moisture, each time using a fresh specimen obtained from the sample in **5.2** so as to have enough points even after the volume has started increasing after decreasing initially.

7 CALCULATIONS

7.1 The dry density in g/cm³ shall be calculated by dividing the factor 10·2 by the reading on the rod of the rammer in cm (*see* **6.1**).

NOTE — As the internal diameter of the tube is 50 mm and dry mass of soil for each stage in the test is 200 g, if R is the reading on the rod of the rammer (height of compacted soil in the tube) in centimetres,

$$\text{Dry density} = \frac{200}{\frac{\pi (5^2) R}{4}} = \frac{10{\cdot}2}{R} \text{ g/cm}^3$$

7.2 The moisture content at each test shall be calculated from the water added and moisture already present in the air-dried soil. If W_a ml of water is added in one test the moisture content in terms of percent of dry mass of soil will be (w + 0·5 W_a) where w is the percent moisture already present in the soil sample taken for the test.

8 REPORT

8.1 The results of the test shall be recorded suitably. A recommended proforma for the record of results is given in Annex A.

8.2 The dry density-moisture content relationship curve shall then be drawn and the maximum dry density and the corresponding moisture content shall be reported.

ANNEX A

(*Clause* 8.1)

COMPACTION TEST DATA SHEET (CONSTANT MASS OF SOIL METHOD)

Mass of oven-dried soil = 200 g

Moisture content of air-dried soil taken for test = w percent

Test No.	1	2	3	4	5	6
Water added W_a ml						
Reading on rod R, cm						
Moisture content, percent (w + 0·5 W_a)						
Dry density, in g/cm³ = $\frac{10{\cdot}2}{R}$						

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