IS 10810-22 (1984): Methods of test for cables, Part 22: Vicat softening point [ETD 9: Power Cables]

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(Reaffirmed 2001)

Indian Standard

METHODS OF TEST FOR CABLES

PART 22 VICAT SOFTENING POINT

[Ref : Doc : ETDC 59 (2240)]
Power Cables Sectional Committee, ETDC 59; Panel for Methods of Tests for Cables, ETDC 59/P1

1. Scope — Covers the procedure for measuring vicat softening point of polyethylene insulation and sheath of electrical cables.

2. Significance — Data obtained by this method may be used to compare heat softening qualities of polyethylene.

3. Terminology — Vicat softening point is the temperature at which a flat ended needle of cross sectional area of 1 mm² loaded with a weight of 1 kg penetrates 1 mm into a polyethylene sample of thickness varying from 3 to 4 mm when tested in a bath of glycerol which is heated at a rate of temperature rise 50°C/h from the room temperature.

4. Apparatus

4.1 *Vicat Softening Point Apparatus* (*see Fig. 1*) — The construction of the apparatus shall be such that the dial gauge reading caused by differential thermal expansion over the intended temperature range does not exceed 0·02 mm when the test specimen is replaced by a piece of borosilicate glass or low expansion alloy steel. It is recommended that the apparatus be constructed of low expansion alloy. The details of parts of apparatus are given in **4.1.1** to **4.1.6**.

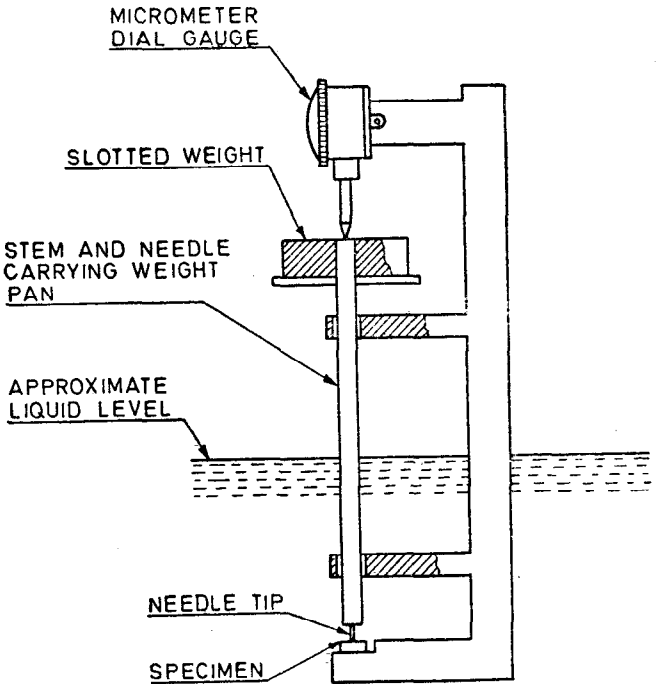

FIG. 1 SCHEMATIC ARRANGEMENT OF VICAT SOFTENING POINT APPARATUS

4.1.1 *Weighted rod* — It is held in a rigid metal frame so that it can move freely and vertically; the base of the frame serving to support the test specimen under the indenter at the end of the rod.

4.1.2 *Needle* — The needle has a cylindrical indenting tip, preferably of hardened steel, 3 mm long, of circular or square cross-sectional area 1·000 ± 0·015 mm². The lower surface of the tip is square to the axis of the rod and free from burrs.

4.1.3 *Micrometer* — The penetration of the indenting tip into the test specimen is measured by means of a micrometer dial gauge graduated in divisions of 0·01 mm. The thrust of the dial gauge, which contributes to the thrust on the test specimen, shall be known and shall comply with the requirements laid down in **4.1.4**.

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4.1.4 *Weight pan* — It is fitted to the rod and a removable cylindrical weight slotted midway is provided such that the total thrust applied to the test specimen can be made between 1 000 g and 1 050 g. The combined weight of the rod, indenter and weight pan shall not exceed 100 g.

4.1.5 *Heating bath* — Containing a suitable liquid in which the apparatus shall be placed so that the test specimen is at least 35 mm below the surface of the liquid. An efficient stirrer shall be provided. The bath shall be equipped with means of control so that the temperature can be raised at a uniform rate of 50 ± 5°C/h.

Note 1 — Liquid paraffin, transformer oil, glycerol and silicone oils may be suitable liquid heat-transformer media, but other liquids may also be used. In all cases, it should be established that the liquid chosen is stable at the temperature used and does not affect the material under test.

Note 2 — A uniform rate of temperature rise can be obtained by controlling the heat input either manually or automatically. One procedure found to be satisfactory is to provide an immersion heater adjusted to give the correct rate of temperature rise at the starting temperature of the test, and then to increase the power input (either in the same heater or in a subsidiary heater) by adjustment of a rheostat or variable transformer.

4.1.6 *Thermometer, mercury-in-glass type* — Of appropriate range with minimum 0·5 °C graduations. The scale error at any reading shall not exceed 0·5°C.

5. Materials

5.1 No material other than test specimen is required for performing this test.

6. Test Specimen

6.1 *Moulding of Test Specimen* — A sheet about 50 × 50 mm shall be compression moulded between highly polished steel plates from the material taken out of the polyethylene insulation or sheath. A suitable space to give a 3 to 4 mm thick sheet shall be used. Moulding shall be carried out at 150°C under a pressure steadily increasing for 5 minutes and reaching 20 kgf/cm^2 *Max* on the sample. The material shall be maintained under these conditions for 5 minutes more and then cooled under pressure till the temperature reaches 40°C. Pressure, then, shall be released and withdrawn.

6.2 The specimen shall be 3 to 4 mm thick with an area of at least 10 × 10 mm and with their surface flat and parallel prepared from moulded sheet.

6.3 *Number of Specimens* — Two.

7. Conditioning — The test specimens shall be annealed by immersing in boiling distilled water for 10 minutes followed by cooling in air.

8. Procedure

8.1 The test specimen shall be mounted horizontally under the needle of the unloaded micrometer as shown in Fig. 1. The tip of the needle shall at no point be nearer to the edge of the test specimen than 3 mm. The surface of the test specimen in contact with the base of the apparatus shall be flat.

8.2 The assembly shall be immersed in the heating bath, the temperature of which shall be constant and at least 50°C below the expected softening point of the material. The bulb of the thermometer should be at the same level as, and as close as is practical to, the test specimen.

Note — It is desirable to have a cooling coil in the liquid bath in order to reduce the time required to lower the temperature after previous tests. This is removed or drained before starting another test, as boiling of coolant can affect the rate of temperature rise.

8.3 After 5 minutes, with the micrometer indenter in position, note the reading of the dial gauge or set to zero; then add the cylindrical slotted weight on to the weight pan so that the total thrust on the test specimen is between 1 000 and 1 050 g.

8.4 Raise the temperature of the bath at a uniform rate of 50 ± 5°C/h. Stir the liquid well during the test.

8.5 Note the temperature of the bath at which the indenting tip has penetrated one millimetre into the test specimen. The mean of the vicat softening points of two test specimens, which shall not differ between themselves by more than 2°C, shall be noted.

9. Tabulation of Observations

Sl No.	*Description of Sample*	*Vicat Softening Point* °C
1.		*P1*
2.		*P2*

10. Calculation

Vicat softening point (average), °C $= \frac{P_1 + P_2}{2}$

11. Report

11.1 *Vicat Softening Point*

Cable Type

Batch No./Lot No.

Cable No./Drum No.

11.2 *Results*

Reference Specification _____

Sample Number	*Vicat Softening Point of Sample*,°C	
	Observed	Specified

11.3 *Conclusion* — Specimen meets/does not meet the requirements of the specification.

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