International Standard 2507

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Unplasticized polyvinyl chloride (PVC) pipes and fittings — Vicat softening temperature — Test method and specification

Tubes et raccords en polychlorure de vinyle (PVC) non plastifié — Température de ramollissement Vicat — Méthode d'essai et spécification

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2507 was developed by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, and was circulated to the member bodies in November 1980.

It has been approved by the member bodies of the following countries :

Austria	Greece	Portugal
Belgium	India	Romania
Brazil	Ireland	South Africa, Rep. of
Czechoslovakia	Israel	Spain
Denmark	Italy	Sweden
Egypt, Arab Rep. of	Japan	United Kingdom
Finland	Mexico	USA
France	New Zealand	USSR
Germany, F.R.	Poland	

The member body of the following country expressed disapproval of the document on technical grounds :

Norway

This second edition cancels and replaces the first edition (i.e. ISO 2507-1976), and also International Standard ISO 2056-1976.

Printed in Switzerland

Unplasticized polyvinyl chloride (PVC) pipes and fittings — Vicat softening temperature — Test method and specification

1 Scope and field of application

This International Standard specifies a method for the determination of the Vicat softening temperature of pipes and fittings moulded in unplasticized polyvinyl chloride (PVC) and includes the adaption, for this purpose, of method B specified in ISO 306, using a force of 49,05 N.

It also lays down the minimum permissible value of the Vicat softening temperature for pipes and fittings respectively.

2 Reference

ISO 306, *Plastics — Determination of the Vicat softening temperature of thermoplastics.*

Section one : Test method

3 Principle

Determination of the temperature at which a standard indenter, under a force of 49,05 N, penetrates 1 mm into a test piece cut from the wall of the fitting or the pipe, the temperature increasing linearly as a function of time during the period of the test.

The temperature corresponding to 1 mm penetration is called the Vicat softening temperature; its value is expressed in degrees Celsius.

4 Apparatus

The apparatus consists essentially of :

4.1 Rod, provided with a load-carrying plate held in a rigid metal frame so that it can move freely in the vertical direction, the base of the frame serving to support the test piece under the indenting tip at the end of the rod (see figure).

4.2 Indenting tips preferably of hardened steel, 3 mm long, having a circular cross-section with an area of 1,000 ± 0,015 mm², fixed at the bottom of the rod. The lower surface of the indenting tip shall be plane and perpendicular to the axis of the rod and free from burrs.

4.3 Micrometer dial gauge (or any other suitable measuring instrument), graduated in divisions of 0,01 mm, to measure the penetration of the indenting tip into the test piece. The thrust of the dial gauge, which contributes to the thrust on the test piece, must be known and shall comply with the requirements of 4.4.

4.4 Load-carrying plate, fitted to the rod (see 4.1), and suitable weights located centrally so that the total thrust applied to the test piece can be adjusted to between 49,05 N and 49,54 N. The combined weight of the rod, indenting tip and load-carrying plate shall not exceed 100 g.

The construction of the apparatus shall be such that the micrometer dial gauge reading caused by the differential expansion of the system over the intended temperature range does not exceed 0,02 mm when the test piece is replaced by a piece of borosilicate glass or low thermal expansion alloy steel.

It is recommended that the apparatus be constructed of low thermal expansion alloy.

4.5 Heating bath, containing a suitable liquid (see note 1 below), in which the apparatus is immersed so that the test piece is at least 35 mm below the surface of the liquid. An efficient stirrer shall be provided. The heating bath shall be equipped with a suitable means of control so that the temperature of the liquid can be raised at a uniform rate of 50 ± 5 °C/h (see note 2 below). This rate of temperature rise shall be considered to be met if, over every 5 min interval during the test, the temperature change is within the specified limits.

NOTES

1 Water, liquid paraffin, transformer oil, glycerol and silicone oils may be suitable heat-transfer media, but other liquids may be used. In all cases, it should be established that the liquid chosen is stable at the temperatures used and does not affect the product under test.

2 A uniform rate of temperature rise can be obtained by controlling the heat either manually or automatically, although the latter is strongly recommended. One method of operation found to be satisfactory is to use an immersion heater adjusted to give the desired rate of tempera-

ture rise at the starting temperature of the test, and then to increase the heating power (either by means of the immersion heater itself, or by means of a subsidiary heater) by adjustment of a rheostat or a variable transformer.

3 It is advisable to have a cooling coil in the liquid of the heating bath in order to reduce the time required to lower the temperature between two consecutive tests. This must be removed or drained before starting a new test, as boiling of the liquid used as coolant can affect the rate of temperature rise.

4.6 Mercury-in-glass thermometer (or any other accurate temperature-measuring device), of appropriate range, and with graduations at least at each 0,5 °C. The scale error at any reading shall not exceed 0,5 °C.

5 Test pieces

5.1 Pipes

5.1.1 The test pieces shall consist of segments of rings removed from the pipes, limited by cross-sections having the following dimensions :

— length : approx 50 mm;

— width : between 10 and 20 mm;

— thickness : between 2,4 and 6 mm.

5.1.2 If the wall thickness of the pipe is greater than 6 mm, it shall be reduced to 4 mm by machining the outer surface of the pipe only, by a suitable process.

5.1.3 If the wall thickness of the pipe is less than 2,4 mm, each test piece shall consist of two pipe-ring segments superimposed so as to give a total thickness of at least 2,4 mm. The lower segment, which will serve as a base, shall be flattened. To do this heat it to 140 °C for 15 min, while resting a thin metal plate on it. The upper segment shall be left as such.

5.1.4 Use two test pieces for each test, but anticipate the need for additional test pieces, in case the difference between the results is too great (see 8).

5.2 Fittings

5.2.1 The test pieces shall consist of segments of rings removed from the sockets of the fitting to be tested, limited by cross-sections, with a length equal to the length of the socket for fittings having a diameter less than or equal to 90 mm, and with a length equal to 50 mm for fittings having a diameter of more than 90 mm. Their width shall be between 10 and 20 mm.

Cut the test pieces from an area which does not include a weld line.

5.2.2 If the wall thickness of the fittings is greater than 6 mm, it shall be reduced to 4 mm by machining the outer surface of the fitting only, by a suitable process.

In the case of sockets with screw threads, the threaded part shall be machined until a smooth surface is obtained.

5.2.3 Test as such test pieces with a thickness of between 2,4 and 6 mm.

5.2.4 If the wall thickness of the test piece is less than 2,4 mm, each test piece shall consist of two ring segments superimposed so as to give a total thickness of at least 2,4 mm. The lower segment, which will serve as a base, shall be flattened. To do this, heat it to 140 °C for 15 min, while resting a thin metal plate on it. The upper segment shall be left as such.

5.2.5 Use two test pieces for each test, but anticipate the need for additional test pieces in case the difference between the results is too great (see 8).

6 Conditioning

Condition the test pieces for 5 min, at a temperature at least 50 °C lower than the expected softening temperature.

7 Procedure

For each test piece :

7.1 Raise the heating bath to a temperature about 50 °C lower than that anticipated for the softening temperature of the product under test (see 4.5, note 3). Maintain this temperature constant.

7.2 Mount the test piece horizontally under the indenting tip (see 4.2) of the unloaded rod (see 4.1), which shall rest on the concave surface of the test piece.

For pipes and fittings with a wall thickness of less than 2,4 mm, the indenting tip shall rest on the concave surface of the non-flattened segment, the latter being placed on the flattened segment.

The indenting tip shall at no point be nearer to the edge of the test piece than 3 mm.

7.3 Immerse the apparatus in the bath (see 4.5). The bulb of the thermometer (see 4.6) shall be at the same level as, and as close as possible to, the test piece.

7.4 After 5 min, with the indenting tip still in position, note the reading of the micrometer dial gauge (see 4.3) or set the micrometer to zero. Then add the weight to the load-carrying plate (see 4.4) so that the total thrust on the test piece is between 49,05 N and 49,54 N.

7.5 Increase the temperature of the heating bath at a uniform rate of 50 ± 5 °C/h and stir the liquid well during the test.

7.6 When the micrometer indicates that the indenting tip has penetrated 1,00 mm into the test piece beyond its starting position defined in 7.4, note the temperature of the heating bath, which will correspond to the Vicat softening temperature of the test piece.

8 Expression of results

Express the Vicat softening temperature of the pipe or fitting examined as the arithmetic mean of the Vicat softening temperatures of the two test pieces. Express the result in degrees Celsius. If the individual results differ by more than 2 °C, these values cannot be accepted and a repeat test must be carried out.

9 Test report

The test report shall include the following particulars :

a) reference to this International Standard;

b) complete identification of the pipe or fitting in question;

c) the thickness of the test pieces and, if applicable, whether they consisted of two parts;

d) the nature of the heating medium;

e) the conditioning and annealing methods used, if any;

f) the Vicat softening temperature obtained for each of the two test pieces;

g) any alterations in the appearance of the test pieces during the test or after their immersion;

h) the results expressed in accordance with the instructions given in clause 8;

j) all operational details not included in this International Standard, and any occurrences capable of having influenced the results.

Section two : Specification

10 Specification

Using the test conditions described in section one, the value of the Vicat softening temperature shall be :

— in case of unplasticized PVC pipes : at least equal to 76 °C;

— in case of unplasticized moulded PVC fittings : at least equal to 72 °C.

For special applications with more stringent requirements, such as for drainage or sanitation, higher minimum values than those defined above may be adopted, and must be indicated in specific products standards.

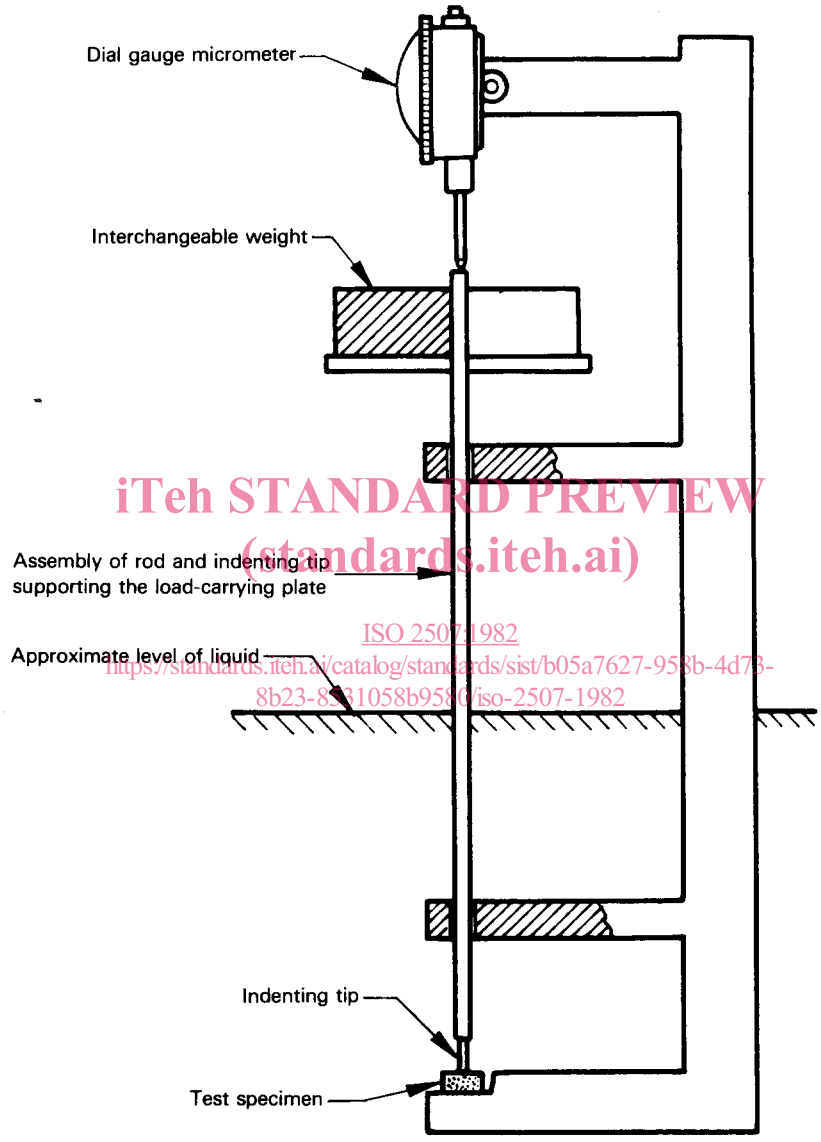

Figure — Schematic diagram of apparatus for the determination of the Vicat softening temperature