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Unplasticized poly(vinyl chloride) (PVC-U) pipes — Dichloromethane resistance at specified temperature (DCMT) — Test method

Tubes en poly(chlorure de vinyle) non plastifié (PVC-U) — Résistance au dichlorométhane à une température spécifiée (DCMT) — Méthode d'essai

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Foreword

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 9852 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 5, *General properties of pipes, fittings and valves of plastic materials and their accessories — Test methods and basic specifications*.

This second edition cancels and replaces the first edition (ISO 9852:1995), which has been revised to align it with EN 580:2003.

The principal modifications are the following:

— the wall thickness ranges "$8 \leqslant e \leqslant 16$" and "$e > 16$" in Table 1 have been changed to "$8 \leqslant e < 16$" and "$16 \leqslant e$", respectively, to align them with those in EN 580:2003;

— the surface of the dichloromethane layer has been reduced to the minimum and the thickness of the water layer covering the dichloromethane increased (see 6.2);

— after immersion in the dichloromethane, the test piece is held in the water layer to allow it to "drip" before final drying and inspection (see 7.4);

— in the event of the pipe being attacked (see 8.2), giving a description of the attack has become optional, dealt with in a new Annex A (informative).

— the lower limit for the test temperature (12 °C) has been moved to 6.3, and Annex A, "Basic specification", has been deleted;

— a typical test arrangement, with the deeper water layer (acting both as a block to evaporation and as a "drip" zone), is shown in a new Annex B.

These modifications allow the consumption of dichloromethane to be reduced, thus improving the environment for the staff conducting the test without reducing the number of tests. Experience has shown that this modified procedure and test arrangement can result in a reduction of dichloromethane consumption of more than 90 %.

Introduction

The maximum temperature at which unplasticized poly(vinyl chloride) (PVC-U) pipe is not attacked by dichloromethane gives an indication of the level and homogeneity of gelation of the PVC material in the pipe. This characteristic is related to the mechanical properties and, in particular, the long-term performance of the pipe.

Unplasticized poly(vinyl chloride) (PVC-U) pipes — Dichloromethane resistance at specified temperature (DCMT) — Test method

1 Scope

This International Standard specifies a method for determining the resistance of unplasticized poly(vinyl chloride) (PVC-U) pipes to dichloromethane at a specified temperature (DCMT).

It is applicable to all PVC-U pipes, irrespective of their intended use.

The method can be used as a rapid means of quality control during manufacture.

NOTE The temperature of the dichloromethane up to which the pipe shall not be attacked is specified in the referring standard.

2 Principle

A piece of PVC-U pipe, of specified length, chamfered at one end to an angle dependent on its thickness, is immersed for (30 $\pm$ 1) min in dichloromethane, at a temperature T specified by the referring standard, to verify that the PVC-U is not attacked at that temperature. For safety reasons, the surface area of the dichloromethane is kept to the minimum and the dichloromethane is covered by a deep layer of water to reduce evaporation. After immersion in the dichloromethane, the test piece is held in the water layer to allow it to "drip" before final drying and inspection.

NOTE 1 If the PVC-U has not sufficiently gelled, whitening of the surface will occur and, in the worst case, a precipitate will be observed.

NOTE 2 It is assumed that the following test parameters are set by the standard making reference to this International Standard:

a) the temperature T of the dichloromethane (see 4.3 and 6.3);

b) the minimum wall thickness for which the test can be used;

c) the number of test pieces, if appropriate (see 5.1).

3 Reagent

3.1 Dichloromethane, technical grade.

NOTE Technical-grade dichloromethane contains small quantities (at the most, 1 % of each) of chloromethane (CH_3Cl), trichloromethane ($CHCl_3$) and tetrachloromethane (CCl_4). It has been noted that, even if the level of these impurities reaches 5 % in total, the results are not significantly affected.

WARNING — The boiling point of dichloromethane is low (40 °C). Consequently, it has a high vapour pressure at ambient temperature. Further, it can be toxic by absorption through the skin and eyes. It is therefore necessary to take precautions when handling dichloromethane or test pieces which have been immersed in it. The vapour is also toxic, the threshold limit value (TLV) corresponding to the maximum admissible concentration (MAC) being 100 ml/m^3 (ppm). Ventilation of the room or area in which the container is located and where the test pieces are dried is therefore essential.

4 Apparatus

4.1 Chamfering machine (see 5.2).

4.2 Glass or stainless-steel container, of suitable dimensions to accommodate at least one test piece (see Clause 5), with a grating maintained at a depth approximately 10 mm above the bottom of the container, a lid to limit evaporation of the liquid (see 6.1 and 6.2) and temperature-control equipment, with a stirrer, capable of maintaining the temperature of the liquid at ($T \pm 0{,}5$) °C with the help of the cooling equipment (4.3).

NOTE It is recommended that a cylindrical container be used of a suitable small diameter, e.g. slightly greater than 315 mm but chosen to suit the dimensions of the most frequently produced pipe size (larger pipes can be cut into a number of longitudinal sections to be fitted into the container, see 5.1).

In laboratories which previously used a larger container for this test, the container specified here can be placed in the old container, which can be filled with water (see Annex B). Provided the new container is sufficiently small and made from a heat-conducting material like stainless steel, the temperature-control equipment and stirrer can be located in the old vessel. The grating shall be designed so it can be positioned at two different levels as follows:

a) with the appropriate parts of the test pieces or test piece sections immersed in the dichloromethane;

b) with the parts of the test pieces or test piece sections which were immersed in the dichloromethane completely surrounded by water but not in contact with the dichloromethane.

4.3 Cooling equipment, capable of cooling the dichloromethane to the temperature specified in the referring standard.

4.4 Hood fitted with a fume extraction system, mounted for safety reasons (see warning in Clause 3) over the container (4.2).

5 Preparation of test pieces

5.1 Cut from the pipe to be tested test pieces 160 mm in length, such that the cut ends are perpendicular to the axis of the pipe. Unless otherwise specified by the referring standard, the number of test pieces shall be three. The wall thickness of the pipe shall be greater than the minimum thickness specified for this test by the referring standard [see item b) of Note 2 to Clause 2].

5.2 Chamfer, by cutting (see Note) without producing any appreciable heating effect, one of the ends of each test piece over its entire wall thickness (see Figure A.1). The angle of chamfer shall be chosen as a function of the wall thickness of the pipe as specified in Table 1.

NOTE The term “cutting” has been used to exclude grinding.

Table 1 — Angles of chamfer

Pipe wall thickness, e mm	**Angle of chamfer,** α degrees
$e < 8$	10
$8 \leqslant e < 16$	20
$16 \leqslant e$	30

5.3 If the test pieces are larger than the diameter of the container, cut each test piece into a number of longitudinal sections. The maximum width of the saw blade used shall be 2,5 mm. The number of sections into which each test piece is cut shall be the lowest possible number, i.e. the maximum possible size, allowed by the size of the container.

5.4 Cool the test pieces or test piece sections to ambient temperature.

6 Immersion conditions

6.1 Fill the container with dichloromethane of known refractive index to a depth sufficient to completely cover the chamfered zone of the test pieces or test piece sections.

6.2 Cover the dichloromethane with a layer of water preferably 250 mm to 300 mm deep, but not less than 20 mm deep.

6.3 Using the temperature control, cooling equipment and stirrer, establish and maintain the temperature of the dichloromethane in the container at ($T \pm 0{,}5$) °C [see item a) of Note 2 to Clause 2]. This temperature shall not be less than 12 °C.

6.4 Between tests, add dichloromethane as necessary to maintain the level of the dichloromethane in the container.

6.5 Ensure that the refractive index of the dichloromethane does not vary during use by more than $\pm$ 0,002 from its initial value.

NOTE In practice, the refractive index varies by about 0,000 5 every 3 months if some 700 to 800 tests are carried out per month. A check on the quality of the bath every 3 months should suffice therefore.

7 Procedure

7.1 For the duration of the test, avoid touching the test pieces or test piece sections with the fingers (see warning in Clause 3), e.g. by using tongs and gloves.

7.2 Place each test piece or test piece section in the liquid so that the chamfered zone is completely immersed in the dichloromethane.

7.3 Leave the test pieces or test piece sections for (30 $\pm$ 1) min in the dichloromethane.

7.4 After this immersion time, raise the grating to the level described in 4.2 b) for 10 min to 15 min to allow the dichloromethane to “drip” from the test pieces or test piece sections (see Figure B.1).

7.5 Remove the test pieces or test piece sections from the container and leave them to dry in the air until the water has evaporated, but for at least 15 min, in a well-ventilated area or under a hood equipped with a ventilation system.

7.6 Examine the test pieces or test piece sections and determine the result in accordance with Clause 8.

7.7 Repeat the procedure for any remaining test pieces or test piece sections.

8 Expression of results

8.1 If a test piece or the sections making up a test piece show no sign of attack anywhere (other than swelling), express the result as “No attack”.

8.2 If a test piece or the sections making up a test piece show signs of attack anywhere, express the result as “Attacked” and, if required, describe the appearance and location(s) of the attacks.

NOTE An example of the way in which attack on the chamfer can be described is given in Annex A.

9 Test report

The test report shall include the following information:

a) a reference to this International Standard and to the referring standard;

b) all details necessary for complete identification of the pipe under test;

c) the temperature T of the dichloromethane bath;

d) the number of test pieces tested and, if the test pieces were cut into sections, the number of sections into which each was cut;

e) the results of the test and any additional information associated with the results;

f) any factors which could have affected the results, such as any incidents or any procedural details not specified in this International Standard;

g) the date of the test.

Annex A
(informative)

Description of attack

If a test piece or the sections making up a test piece are attacked, it is possible to express the result as a percentage of the total chamfer surface (see Figure A.1) in two ways:

a) percentage attack expressed in terms of the width of the chamfer surface, i.e.

$$\text{Percentage attack 1} = \frac{a}{c} \times 100$$

where

a is the (statistical) average dimension of the attacked zone(s) across the width of the chamfer surface,

c is the width of the chamfer;

b) percentage attack in the circumferential direction, i.e.

$$\text{Percentage attack 2} = \frac{b}{\pi D} \times 100$$

where

b is the (statistical) average dimension of the attacked zone(s) in the circumferential direction round the chamfer,

D is the outside diameter of the pipe.

The rounding interval for the result is 5.

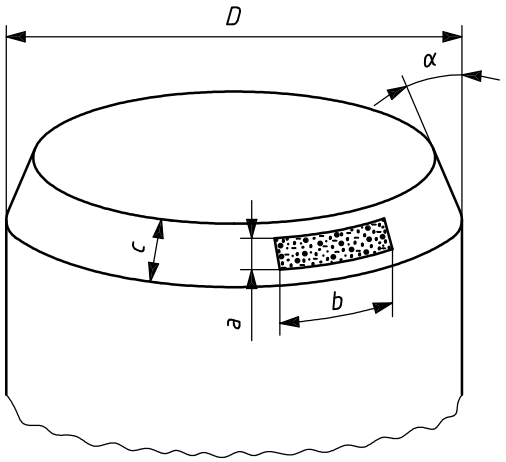
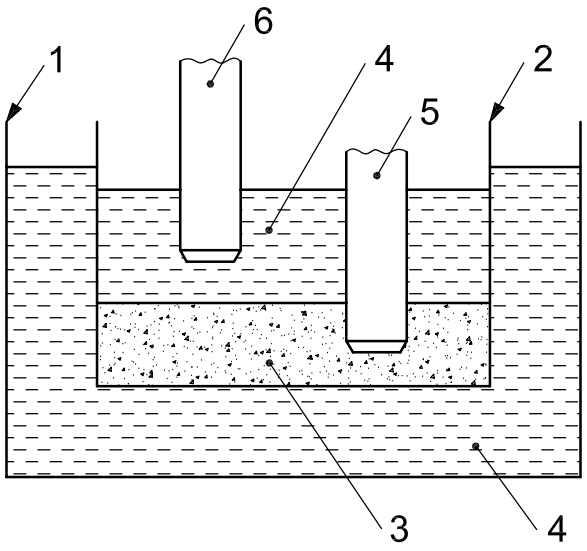


Figure A.1 — Calculation of percentage attack

Annex B
(informative)

Example of small container placed in an existing (larger) container

Figure B.1 shows an example of modifications in test equipment and procedure in order to make it possible to reduce the consumption of dichloromethane.



Key

1 old vessel filled with water at the specified test temperature and stirred
2 new vessel
3 dichloromethane
4 water
5 pipe in testing position
6 pipe in “drip” position

Figure B.1 — Small container placed in an existing (larger) one

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