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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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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.

International Standard 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 first edition of ISO 9852 cancels and replaces ISO 7676:1990, of which it constitutes a technical revision. The changes made to the method given in ISO 7676 are explained in the fourth paragraph of the introduction.

Annex A of this International Standard is for information only.

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Introduction

Studies carried out at international level show that the degree of gelation of converted PVC-U is one of the fundamental characteristics which determines the properties of pipes (matrix strength).

The method, using dichloromethane, proposed in this document enables the area of the tube whose degree of gelation is the lowest to be identified and estimated quantitively. This is in contrast to other methods (test of elasticity at fusion or tensile test at temperatures in excess of 80 °C) which only give overall information.

The method also has the advantage of being capable of being carried out quickly during manufacture, thus enabling steps to be taken to correct any defects which have been identified.

The dichloromethane test which was specified in ISO 7676:1990, *Unplasticized poly(vinyl chloride) (PVC-U) pipes — Dichloromethane test* (see the foreword), is modified in the following way: the pipe, chamfered at one end so that the complete cross-section of the pipe is in contact with the fluid, is immersed in dichloromethane for a period of 30 min, then successively in baths whose temperature varies by increments of 5 °C, for example.

Under these conditions, the degree of gelation corresponds to the temperature at which attack of the PVC-U first occurs.

A study of a large number of samples with different degrees of gelation has established that attack can occur at temperatures over the range − 20 °C to + 30 °C. The results of these tests prove that the degree of gelation is defined by the highest temperature at which no attack of the PVC-U occurs.

In fact, the experimental results demonstrate that the correlation between the degree of gelation, as defined by the temperature, and the performance of the pipes with time is confirmed up to a level of approximately 10 °C to 15 °C.

Above these temperatures, the scatter increases and the curves tend to level off as parameters other than gelation influence the matrix strength.

In practice, it is sufficient to check that the gelation is greater than a minimum specified level. For this purpose, test pieces are immersed in dichloromethane at a specified temperature for 30 min. The test pieces are acceptable if there is no attack of the PVC-U.

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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 PVC pipes to dichloromethane at a specified temperature (DCMT).

The method can be used for any homogeneous plain-walled unplasticized-PVC pipes, irrespective of their intended application. It can be used as a rapid means of quality control during manufacture.

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 a fixed period of time in a thermo-controlled dichloromethane bath in order to verify that the PVC-U is not attacked at the temperature θ specified in the product standard.

The test pieces are dried in air and then examined to determine whether the PVC has been attacked or not.

NOTES

1 If the PVC has not been sufficiently gelled, whitening of the surface will occur and, in the worst case, a powdery precipitate will be produced.

2 The maximum temperature at which the PVC-U is not attacked gives an indication of the degree and homogeneity of gelation of the PVC-U of which the pipe is made. This characteristic is related to the mechanical properties, and in particular the long-term pressure resistance, of the pipe.

3 The minimum permitted bath temperature at which attack by the dichloromethane shall not take place is specified.

3 Reagent

3.1 Dichloromethane, analytical grade.

WARNING — Dichloromethane can be toxic by absorption through the skin and eyes. It is therefore necessary to take precautions when handling liquid dichloromethane or test pieces which have been immersed in it. Furthermore, the boiling point of dichloromethane is low (40 °C). Consequently, it has a high vapour pressure at ambient temperatures. The vapour is also toxic, the threshold limit value corresponding to the maximum admissible concentration being 500 ml/m^3 (ppm). Ventilation of the room or area in which the container is kept and where the test pieces are dried is therefore essential.

4 Apparatus

4.1 Chamfering machine.

4.2 Glass or stainless-steel container, of suitable dimensions to accommodate one or more test pieces under the specified conditions (see 7.4). A mark on the inside surface to indicate a suitable dichloromethane level is useful.

4.3 Grating, fitted so that it is approximately 1 cm above the bottom of the container.

4.4 Lid, to limit evaporation of the dichloromethane.

4.5 Thermostat, to maintain the temperature of the dichloromethane at θ °C $\pm$ 0,5 °C (see clause 2).

4.6 Cooling device, to cool the dichloromethane to the specified temperature.

4.7 Stirrer, to homogenize the temperature of the bath.

4.8 Hood, fitted with a fume extraction system.

5 Use of the dichloromethane bath

5.1 Maintain the dichloromethane at a suitable level in the container.

5.2 The constancy of colour, and hence purity, of the dichloromethane in the bath shall be checked regularly by measuring the refractive index, which shall not vary in use by more than ±0,002 of its initial value.

Whenever the value of the refractive index differs by more than ±0,002 from the original value, the dichloromethane shall be changed.

NOTE 4 In practice, the refractive index will change by 0,000 5 over a period of 3 months if some 700 to 800 tests are carried out per month.

Checking the quality of the dichloromethane in the bath every 3 months should suffice.

6 Preparation of test pieces

Cut from the pipe to be tested test pieces 160 mm in length. The cut shall be perpendicular to the axis of the pipe.

If necessary, cool the test pieces to ambient temperature.

Chamfer by machining one of the ends of each test piece over its complete thickness, the angle of chamfer α depending on the wall thickness e of the pipe (see table 1). The test pieces shall not be allowed to reach a temperature greater than 60 °C during the machining operation.

Table 1

e mm	α
$e < 8$	10°
$8 \leqslant e \leqslant 16$	20°
$e > 16$	30°

7 Procedure

7.1 Fill the container (4.2) with dichloromethane (3.1) to a depth sufficient to cover the chamfered zone of the test pieces introduced in accordance with 7.4.

7.2 Cover the dichloromethane with a layer of demineralized water approximately 20 mm deep.

NOTE 5 The purpose of the water layer is to reduce evaporation [normally 0,6 l/(m^2·h)] of the dichloromethane and to protect the operator from any harmful effects of the vapour.

7.3 Set the thermostat (4.5) at θ °C ± 0,5 °C. Start the cooling device (4.6) and stir to homogenize the temperature of the bath.

7.4 When the temperature of the bath has reached θ °C ± 0,5 °C, place the test pieces on the grating (4.3) so that the chamfered zone is completely immersed in the dichloromethane. Cover the container with the lid (4.4).

7.5 Leave the test pieces for 30 min in the dichloromethane, whilst maintaining its temperature at θ °C ± 0,5 °C.

7.6 Remove the test pieces from the container, avoiding touching them with the fingers (see warning in 3.1); for this operation, use a pair of pincers and gloves.

7.7 Leave the test pieces to dry in air for at least 15 min under the hood (4.8).

IMPORTANT — For safety reasons, it is essential that the container and test pieces are kept under a hood as specified in 4.8.

7.8 Examine the test pieces in accordance with clause 8.

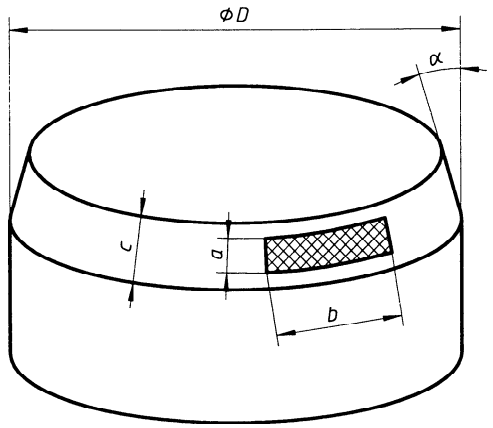
8 Expression of results

8.1 If the test piece shows no signs of attack at θ °C express the result as follows:

"No attack"

8.2 If the test piece shows signs of attack at θ °C, express the result as "Attacked", and describe the appearance and location of the attack.

NOTE 6 When the attack is on the chamfer, it is possible, for information only, to express the result as a percentage of the total chamfer surface (see figure 1).



a) Percentage attack calculated across the chamfer:

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

b) Percentage attack calculated round the chamfer:

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

The rounding interval for the result shall be 5.

Figure 1

9 Test report

The test report shall include the following information:

a) a reference to this International Standard;

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

c) the temperature of the dichloromethane bath;

d) the number of test pieces tested;

e) the results of the test;

f) any other information;

g) the date of the test.

Annex A
(informative)

Basic specification

At the temperature θ specified in the product standard, the test piece should show no signs of attack.

In no case may the temperature θ be lower than 12 °C.

However, for particular applications which have more severe requirements, a higher value may be specified.

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