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Plastics piping and ducting systems — Injection-moulded thermoplastics fittings — Methods for visually assessing the effects of heating

Systèmes de canalisations et de gaines en plastiques — Raccords thermoplastiques moulés par injection — Méthodes d'essai pour estimer visuellement les effets de la chaleur

Reference number
ISO 580:2005(E)

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 580 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 third edition cancels and replaces the second edition (ISO 580:1990), which has been technically revised.

Introduction

The test for determination of the resistance to heat according to the two test methods specified in this International Standard is applicable for distinguishing between properly and improperly moulded thermoplastics pipe fittings.

It can be used to

— determine whether cold slugs (pieces of material that enter the mould at a temperature significantly lower than the rest of the mass) or unfused areas are present,

— reveal cavities and porosity,

— determine the amount of moulded-in stress produced by the moulding process,

— reveal contamination, and

— show the integrity of the fusion line.

A stress-free part will generally have better properties and higher strength than parts with a higher degree of residual stress and will generally be less reactive when exposed to chemicals. By placing moulded fittings in a heated medium (air or liquid) at elevated temperature for a period of time dependant on their wall thickness, it is possible to detect internal stress.

Since the stresses start to be released as soon as the material passes to the rubbery state, it is only necessary to maintain the moulded pieces at a higher temperature for a defined period of time.

NOTE Injection-moulded fittings can be made by a number of techniques, whereby the material is injected into the mould cavity. These include single- or multi-point injection, diaphragm gating and ring gating. The technique used in the manufacture of mouldings will affect the way in which they are assessed.

Plastics piping and ducting systems — Injection-moulded thermoplastics fittings — Methods for visually assessing the effects of heating

1 Scope

This International Standard specifies two methods for assessing the effects of heating on injection-moulded thermoplastics pipe fittings — method A, using an air oven, and method B, using a liquid bath. In case of disagreement, method A is the reference method.

This International Standard is applicable to cement-welded fittings as well as to flanged fittings and fittings incorporating elastomeric seals and to fittings consisting of the assembly of several moulded parts (e.g. union connectors). It is applicable to both pressure and non-pressure fittings.

2 Principle

Complete mouldings are subjected to an elevated specified temperature in an air-circulating oven or a liquid bath for a given period of time, depending upon the wall thickness of the fitting and the material being moulded.

The surfaces of the moulding are examined before and after heating, and any cracks, blisters, delaminations or opening of fusion lines are measured and expressed as a percentage of the wall thickness.

3 Test parameters

The following test parameters are specified by the subclauses referenced as follows and in Table 1 for the particular material used in the manufacturer of the fitting, unless the referring standard (a standard making reference to this International Standard in its own provisions) or regulations specify otherwise:

a) the test temperature, T (see 4.1.1 and 4.3);

b) the number of test pieces (see 4.2.2);

c) the heating time, t (see 4.3.3);

d) the test method to be used and, for method B (liquid bath) only, the test liquid.

e) the acceptable limits for the occurrence or dimensions of any cracks or other features found (see 4.3.6).

Unless otherwise specified in the referring standard or regulations, the test parameters shall be in accordance with Table 1.

Table 1 — Test parameters to be used in absence of guidance in the referring standard

Material	Temperature T $\pm$ 2 °C	Heating time	
		Mean wall thickness e_m mm	Duration t min
ABS	150	$e_m \leqslant 3$	15
PE	110	$3 < e_m \leqslant 10$	30
PP	150	$10 < e_m \leqslant 20$	60
PVC-U		$20 < e_m \leqslant 30$	140
PVC-C		$30 < e_m \leqslant 40$	220
SAN+PVC		$40 < e_m$	240

4 Method A

4.1 Apparatus

4.1.1 Air-circulating oven, thermostatically controlled, equipped with a thermostat so that the temperature of the working zone can be maintained at the prescribed test temperature throughout the test and of sufficient heating capacity to enable the test temperature to be regained within 15 min of insertion of the test pieces.

4.1.2 Thermometer, graduated in 0,5 °C. Or a type "T" **thermocouple** with a resolution of 0,1 °C and an accuracy of at least $\pm$ 0,8 °C.

4.2 Test pieces

4.2.1 Preparation

After removing any runners, take the complete mouldings as test pieces. If the fitting incorporates an elastomeric sealing ring, remove the ring before testing.

In the case of fittings assembled from more than one element, separate the components and test them out of contact with each other.

4.2.2 Number

The number of test pieces shall be as specified in the product standard. In the absence of any information on the number of test pieces, use at least three pieces.

4.3 Procedure

4.3.1 Set the oven temperature (4.1.1) at the test temperature ($T \pm 2$) °C in accordance with the product standard or Table 1.

4.3.2 Put the test pieces in the oven and arrange them so that they are standing on one side of their sockets wherever possible, avoiding contact with another test piece or the sides of the oven.

4.3.3 Leave the test pieces in the oven until the oven returns to the test temperature ($T \pm 2$) °C and for a further period, t, dependent on the mean wall thickness, e_m, of the thickest part of the test piece(s) in accordance with the product standard or Table 1.

4.3.4 Remove the test pieces from the oven, taking care not to deform or damage them.

4.3.5 Cut the test pieces with a sharp knife or razor blade while they are still hot, to enable the dimensions of cracks, blisters, delaminations and weld-line openings, if any, to be measured as required. Allow the test pieces and/or parts therefrom to cool in air until they can be handled without deformation.

If not otherwise specified in the referring standard, the following number of cuts should be made:

— for cylindrical components of $d_n \leqslant 160$ mm, not less than two cuts equally spaced around the periphery of the mouth of each socket or spigot of the component;

— for cylindrical components of $d_n > 160$ mm, not less than four cuts equally spaced around the periphery of the mouth of each socket or spigot of the component.

For d_n, see Figure 1.

4.3.6 Examine each test piece for, and record, any surface changes, such as cracks, delaminations and weld-line openings as well as changes inside the wall, e.g. blisters, and in the gating area. Determine the extent of such defects in the gating area as a percentage of the wall thickness as follows.

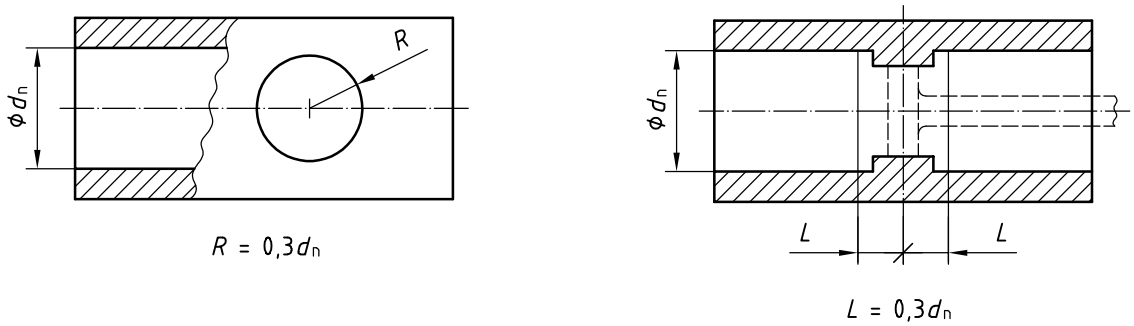
a) For sprue-gated mouldings (see Figure 1): around the injection point(s) within a radius as specified in the referring standard. In the absence of any information in the referring standard, use $R = 0{,}3d_n$ with a maximum value of 50 mm.

b) For ring- or diaphragm-gated mouldings (see Figure 1): within a length, L, of the cylindrical portion of the gating area as specified in the referring standard or, in absence of any information, within a length $L = 0{,}3d_n$. In the case of cracks running through the whole wall thickness of the gating area, determine also the length of the crack.

c) For mouldings containing fusion lines, determine the widest and deepest part(s) of any open part of the fusion line.

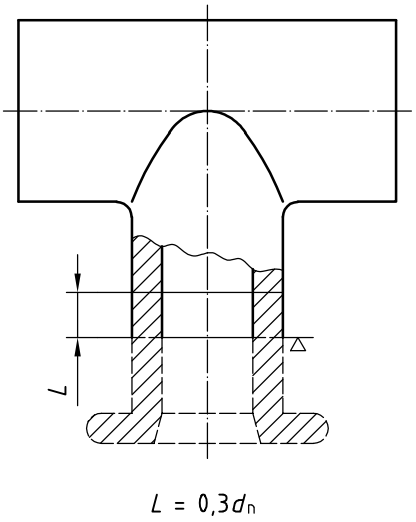
d) For all other parts of the moulding beyond the gating area, examine the surface for any change, such as cracks, blisters, and delaminations of the wall.

If not specified in the referring standard, the specifications given in Annex A should be used for the examination of a test piece.



a) Sprue-gate

b) Diaphragm-gate



c) Ring-gate

Figure 1 — Injection gating areas

5 Method B

5.1 Apparatus

5.1.1 Heating bath, thermostatically controlled, at the prescribed test temperature, $(T \pm 2)$ °C. The volume and agitation of the bath shall be such that the temperature remains within the specified temperature range when the test pieces are immersed.

The liquid chosen shall be stable at the specified temperature and shall not otherwise affect the test piece.

It shall be ensured that the liquid does not cause any safety or health risks.

NOTE 1 Glycerine, glycol, mineral oil free from aromatic hydrocarbons, or a solution of calcium chloride may be suitable, depending upon which of the materials covered by this method is under test. For example, all these liquids are suitable for PVC-U, but the use of glycols is not appropriate for ABS fittings, for which the selection of an appropriate mineral oil is preferable.

NOTE 2 Attention is drawn to any relevant legislation which requires that the use of the liquid chosen does not cause any safety or health risks.

5.1.2 **Holder**, to support the test piece(s) within the heating bath. The fittings shall be supported in such a way as to not cause additional distortion.

5.1.3 **Thermometer**, graduated in 0,5 °C. Or a type "T" **thermocouple** with a resolution of 0,1 °C and an accuracy of at least ± 0,8 °C.

5.2 Test pieces

See 4.2.

5.3 Procedure

5.3.1 Set up the liquid bath (see 5.1.1) to the prescribed test temperature ($T \pm 2$) °C.

5.3.2 Put the test pieces in the liquid bath and arrange them so that they are not touching each other or the sides of the bath.

5.3.3 Leave the test pieces in the bath for a test period, t, as specified in the referring standard for the mean wall thickness, e_m, of the thickest part of the test piece.

If not otherwise specified in the referring standard, use a test period, t, in accordance with Table 1.

5.3.4 Remove the test pieces from the bath, taking care not to deform or damage them.

5.3.5 Cut the test pieces in accordance with 4.3.5.

5.3.6 Examine the test pieces in accordance with 4.3.6.

5.3.7 Record the composition of the liquid used in conjunction with the results obtained [see also Clause 6, c)].

6 Test report

The test report shall include the following information:

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

b) identification of the fittings tested (diameter, wall thickness, type, etc.);

c) method used, i.e. A or B, and, if method B, the composition of the liquid used;

d) test temperature;

e) test duration;

f) number of mouldings tested;

g) details of visible differences from the original surface appearance, such as blisters, delaminations, cracks or opening of fusion lines;

h) maximum dimensions of cracks, blisters etc. expressed as a percentage of the wall thickness;

i) any factors which may have affected the results, such as any incidents or any operating details not specified in this standard;

j) date of test.

Annex A
(informative)

Basic specifications

If not otherwise specified in the referring standard, when examined for signs of cracks, delaminations, blisters and fusion line opening, the fitting should satisfy the following:

— around the injection point(s), within the radius specified in 4.3.6 a), the depth of any single crack, delamination or blister shall not be more than 50 % of the wall thickness at that point;

— for diaphragm-gated mouldings, any crack, delamination or blister shall be within the length specified in 4.3.6 b);

— for ring-gated mouldings, the distance from the ring gate of any cracks in the wall of the mouldings shall not be more than the length specified in 4.3.6 b) and their depths shall not be more than 50 % of the wall thickness;

— for mouldings containing fusions, no part of the fusion shall be open by a distance of more than 50 % of the wall thickness;

— for all other parts of the moulding surface, the depth of any single crack or delamination shall not exceed 10 % of the wall thickness and the length of blisters in the wall of the mouldings shall not exceed 5 times the wall thickness.

For specific applications, more stringent specifications may be adopted if required by the particular product standards.

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