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Polyolefin pipe assemblies with or without jointed fittings — Resistance to internal pressure — Test method

Assemblages de tubes en polyoléfines comportant ou non des raccords — Résistance à la pression intérieure — Méthode d'essai

Reference number
ISO 9356:1989(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 9356 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*.

Annex A of this International Standard is for information only.

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Polyolefin pipe assemblies with or without jointed fittings — Resistance to internal pressure — Test method

1 Scope

This International Standard specifies a test method for determining the resistance to pressure of polyolefin assemblies obtained by fusion welding of polyolefin pipes and fittings (for example, by socket fusion, butt fusion or electrofusion) for the transport of fluids with or without pressure.

It enables, in particular, the resistance of fittings and saddles to internal pressure to be tested.

NOTE 1 For testing of individual (unjointed) pipes, attention is drawn to ISO 1167 (see bibliography).

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 3126:1974, *Plastics pipes — Measurement of dimensions*.

3 Principle

Test pieces, made up from fittings welded to lengths of pipe or from pipes butt-welded to each other, are conditioned and then submitted to a constant internal pressure for a specified period of time or to failure.

Throughout the test, the test pieces are kept in an environment at a specified constant temperature; this environment may be water ("water in water" test), another liquid ("water in liquid" test) or air ("water in air" test).

4 Apparatus

The apparatus consists essentially of the following components:

4.1 End caps, fixed to the ends of the test piece.

They shall, by means of an appropriate system, maintain the pressure-tightness of the assembly and provide a means of connection to the pressurizing unit.

The material from which the end caps are made shall not have any adverse effect on the pipe under test; for example, copper end caps are not to be used for testing polypropylene (PP) pipes.

The following three types of end cap are permitted.

a) Fittings rigidly connected to the test piece [see figure 1a)].

b) Female parts, made of metal, fitted with joints ensuring sealing onto the external surface of the test piece and connected to one another by a metal rod (with a central hole) allowing longitudinal movement at the ends of the test piece. Pressure is applied through the rod [see figure 1b)].

c) Male parts, made of metal, fitted with joints ensuring sealing onto the internal surface of the test piece and connected to one another by a metal rod (with a central hole) allowing longitudinal movement at the ends of the test piece [see figure 1c)].

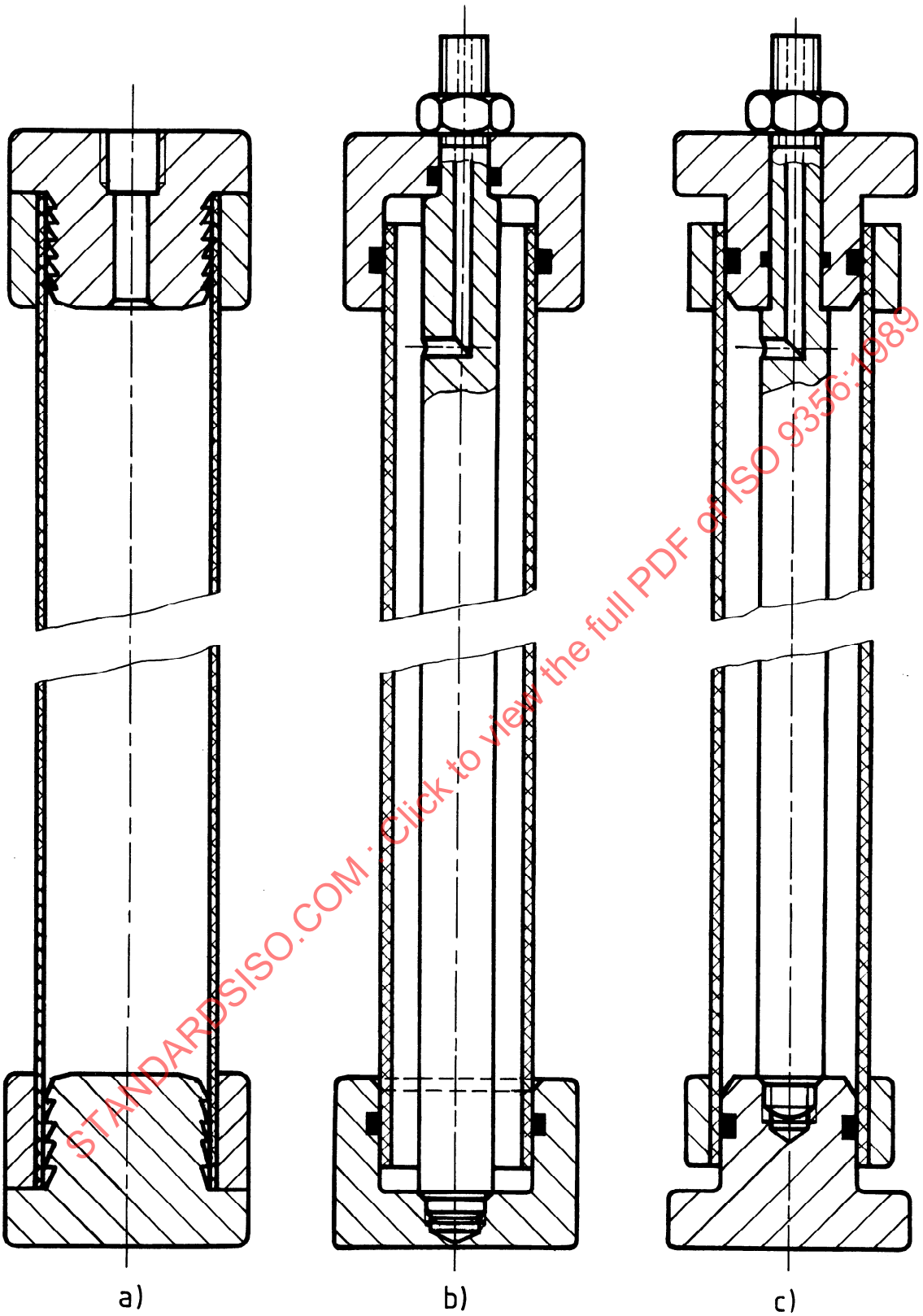

Figure 1 — Examples of devices for the internal pressure testing of pipes

The reference end cap is the type a). The stresses corresponding to types b) and c) may be calculated. The stresses and deformations obtained with types a), b) and c) of figure 1 are not the same. It is necessary, in particular, to take precautions to avoid buckling of the test pieces with types b) and c).

4.2 Tank, filled with water, or **oven**, the temperature of which shall be kept at the specified value (see the appropriate product standard) to within ± 1 °C at all points by means of a heat controller and appropriate devices (to ensure circulation, mixing, etc.).

As the results are strongly influenced by temperature, the tolerance on temperature shall be kept as small as possible within the limits defined above.

A check shall be kept to ensure that the water does not contain impurities which could affect the results.

If other environments (air, liquid) are used, the same temperature tolerance shall be used.

When such environments are used, the necessary precautions shall be taken, in particular those concerning safety and interaction between liquids and polyolefins.

The tests shall always be carried out in the same environment.

4.3 Equipment, enabling the test pieces to be placed in the tank or oven (4.2) in such a way that there is no contact between them or with the sidewalls of the tank or oven.

4.4 Suitable pressurizing equipment, enabling the required pressure to be applied gradually and evenly in 60 s and then kept constant to within ± 1 % for the duration of the test.

NOTES

2 As the results are strongly influenced by pressure, the tolerance on pressure should be kept as small as possible within the limits defined above.

3 The pressure should, preferably, be applied individually to each test piece. However, the use of equipment enabling the pressure to be applied simultaneously to several test pieces is also permitted if there is no danger of interference when failure occurs (e.g. by the use of an isolation valve, a test based on the first failure in a batch, etc.).

4 It is recommended that a system be introduced which automatically resets the pressure, when it drops slightly (owing, for example, to swelling of the test piece), to the specified value.

4.5 Pressure gauges, with appropriate scales for checking the pressure in the test pieces, such that the required pressure setting lies between one-quarter and three-quarters of the full-scale reading.

The pressure gauges shall be oil-free to prevent contamination of the test fluid.

The use of master gauges for initial pressurization is recommended.

4.6 Timer, enabling the duration of the pressure application to be recorded up to the moment of failure or the first decrease in pressure.

NOTE 5 It is recommended that equipment be used which is sensitive to pressure variations due to leaks or a failure and which is capable of stopping the timer and, if necessary, closing the pressure circuit.

4.7 Measuring equipment, see ISO 3126.

5 Test pieces

5.1 Sampling

The sampling requirements shall be those specified in the individual product standards.

5.2 Constitution

Each test piece is made up of

— two lengths of pipe assembled directly together by butt-welding;

— or a fitting and two lengths of pipe, assembled by welding a length of pipe to each socket of the fitting;

— or an assembly of pipes and fittings assembled by welding.

5.2.1 Pipes

Pipes shall be

— cut in such a way that their ends are perpendicular to the axis of the pipe;

— free from grooving;

— degreased and dried.

The pipe shall be of the largest wall thickness series compatible with the fitting to be tested, unless otherwise stipulated in the product standard.

As an exception, test pieces incorporating a welded saddle shall include a pipe of the smallest wall thickness series compatible with the saddle to be tested.

5.2.2 Fittings

The fitting to be tested shall be degreased and dried.

5.2.3 Welding of pipe and fittings

Pipes and fittings shall be welded in accordance with the manufacturer's welding instructions.

NOTE 6 ISO/TC 138/WG 5 is studying this aspect of test piece preparation.

5.3 Free length of test piece in relation to nominal diameter (DN)

The free length l_0 of the pipe shall be

— 3 × DN, with a minimum of 250 mm, between end caps, in the case of two pipes butt-welded together;

— 2 × DN to each socket in the case of a single fitting;

— 3 × DN between each fitting, where several fittings are being tested in one assembly.

The free length is limited to 1 m in all cases.

For type b) and type c) end caps the total length of the test piece shall be such that at no time during the test is the test piece in contact with the end surface of the end caps.

5.4 Measurement of dimensions

Measure the dimensions of pipes and pipe test pieces using the measuring equipment (4.7).

5.5 Number

The number of test pieces shall be as specified in the product standard; however it is recommended that a minimum of three test pieces be tested.

6 Calibration of the apparatus

The temperature and pressure control systems, and the equipment for measuring temperature, pressure and time, shall be regularly calibrated, to an accuracy compatible with the scales used and at a frequency commensurate with the conditions of use.

7 Conditioning

After welding, set the assembly to one side at ambient temperature for at least 24 h.

The period of time between the date of production of the parts and the tests, which will depend on the type of polyolefin, shall be as defined in the general specifications for the material.

Clean and dry the test pieces (clause 5) so as to remove any traces of dirt, oil, wax, etc., and fit them with the end caps (4.1) chosen for the test. Fill them with water, seal them, and then suspend them in the tank or oven (4.2).

Bring the test pieces to the specified temperature (see the appropriate product standard) and condition them at that temperature for a minimum period of 3 h.

8 Procedure

8.1 Connect the conditioned test pieces (see clause 7) to the pressurizing equipment (4.4), bleed off the air and apply progressively and smoothly, within 60 s, the test pressure to ± 1 %.

Throughout the test, the test pieces shall be suspended in the tank or oven and the temperature (see the appropriate product standard) shall be constant to ± 1 °C (see 4.2).

The type of test, i.e. "water in water", "water in air" or "water in liquid", shall be as specified in the product standard.

8.2 Start the timer when the pressure is within ± 1 % of the calculated test pressure.

8.3 Stop the test either when the specified duration is reached, or when a failure or leak occurs in a test piece, in which case record the time to failure.

If a failure occurs, record the type, i.e. brittle or ductile.

NOTE 7 Failure is "brittle" if no plastic deformation has occurred. If the failure is accompanied by plastic deformation, visible without magnification, it is of the "ductile" type.

8.4 If a break occurs in a test piece at a distance of less than 0,1 l_0 from an end cap, the result shall be disregarded and the test shall be repeated on another test piece.

9 Test criteria

If one of the specified number of test pieces (see 5.5) fails the test, repeat the test on the same number of new test pieces. If one of the second set of test pieces fails the test, the lot shall be considered not to have satisfied the requirements of this International Standard.

10 Test report

The test report shall include the following particulars:

a) reference to this International Standard;

b) complete identification of the test sample;

c) type of material for each of the components of the assembly;

d) nominal dimensions of the fittings;