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**Thermoplastics piping systems  
for underground non-pressure  
applications — Test method for  
leaktightness of elastomeric sealing  
ring type joints**

*Systèmes de canalisations en thermoplastiques pour applications  
enterrées sans pression — Méthodes d'essai d'étanchéité des  
assemblages à bague d'étanchéité en élastomère*

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## 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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 1, *Plastics pipes and fittings for soil, waste and drainage (including land drainage)*.

This second edition cancels and replaces the first edition (ISO 13259:2010), which has been technically revised.

The main changes compared to the previous edition are as follows:

- in Clause 7, the temperature conditions are revised;
- in 8.1, c), in the general procedure, a test at 0° angular deflection is added;
- in 8.2, in the procedure for applying diametric deflection to spigot and socket, test arrangement for testing the tightness of couplers/repair collars is added, as well as the related figures.

# Thermoplastics piping systems for underground non-pressure applications — Test method for leaktightness of elastomeric sealing ring type joints

## 1 Scope

This document specifies a test method for determining the leaktightness of elastomeric sealing ring type joints for buried thermoplastics non-pressure piping systems.

Unless otherwise specified in the referring standard, the tests are carried out at the following basic test pressures:

- $p_1$ : internal negative air pressure (partial vacuum);
- $p_2$ : a low internal hydrostatic pressure;
- $p_3$ : a higher internal hydrostatic pressure.

It also describes the following four test conditions under which the tests are performed:

- a) Condition A: without any additional diametric or angular deflection;
- b) Condition B: with diametric deflection;
- c) Condition C: with angular deflection;
- d) Condition D: with simultaneous angular and diametric deflection.

The applicable selection of the test pressure(s) and the test condition(s) is specified in the referring standard.

## 2 Normative references

There are no normative references in this document.

## 3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

## 4 Principle

A test piece assembled from pipes and/or fittings is subjected to a specific initial internal negative air pressure,  $p_1$  followed by a low specific initial internal hydrostatic pressure,  $p_2$  and a higher internal hydrostatic pressure,  $p_3$ .

During testing the joint may be subjected to diametric and/or angular deflection(s). The referring product standard shall specify which of the test pressures and deflection conditions have to be carried out.

Each pressure is maintained for a specific period during which the joint is monitored for leakage (see [Clause 8](#)).

It is assumed that the following test parameters are set by the referring standard:

- a) the test pressure(s),  $p_1$  [see [8.1](#) item e)],  $p_2$  [see [8.1](#) item g)] and  $p_3$  [see [8.1](#) item h)], as applicable, and the percentage of loss of partial vacuum [see [8.1](#) item e)];
- b) the required diametric and angular deflections and their combination with each other and/or the test pressure(s).

## 5 Apparatus

### 5.1 General

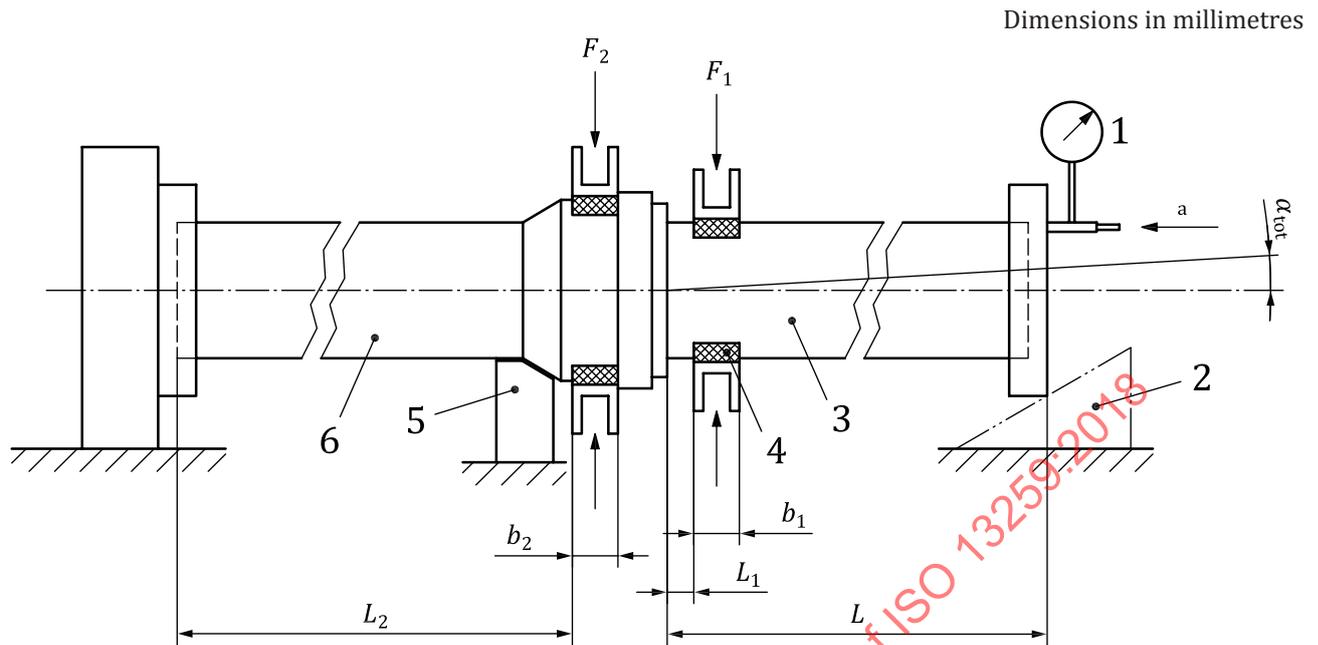
The apparatus shall consist of a jig or any other arrangement capable of:

- a) applying the specified diametric and angular deflection;
- b) applying the specified test pressure(s), positive or negative;
- c) maintaining the test assembly in the required position throughout the test;
- d) resisting the forces resulting from the mass of the water in the test assembly and from the applied hydrostatic test pressure(s) during the test period.

The apparatus shall not otherwise support the joint against the internal test pressure.

A typical arrangement, allowing angular and diametric deflection, is shown in [Figure 1](#).

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**Key**

- 1 vacuum or pressure gauge
- 2 adjustable support
- 3 pipe or fitting with spigot end
- 4 elliptical beam, when applicable
- 5 socket support
- 6 pipe or fitting with socket
- $\alpha_{tot}$  angular deflection applied
- $b_1, b_2$  width of the beam (see 5.2.6 and 5.2.7)
- $F_1, F_2$  compressive force
- $L$  length of spigot-ended pipe or fitting, where  $L \geq d_e$  or  $L \geq 1\,000$ , whichever is the greater, in millimetres
- $L_1$  distance between socket mouth and beam
- $L_2$  distance between the end of pipe and the beam (in contact of the socket), where  $L_2 \geq 1\,000$  for testing pipes only. For testing other components (e.g. inspection chambers, manholes, fittings of large diameters)  $L_2$  may be reduced.
- a Connection to pressure source.

**Figure 1** — Typical arrangement for applying diametric deflection and angular deflection

**5.2 Components of the apparatus**

The apparatus shall include the following items which all shall be capable of resisting the forces and pressures generated during the test.

**5.2.1 End sealing devices**, having a size and using a sealing method appropriate to seal the non-jointed ends of the test assembly. The devices shall be restrained in a manner that does not exert longitudinal forces on the joint at positive pressures.

**5.2.2 Hydrostatic pressure source**, connected to one of the sealing devices, or to the test piece, and capable of applying and maintaining the specified pressure [see 8.1 items g) and h)].

**5.2.3 Negative air pressure source**, connected to one of the sealing devices, or to the test piece, and capable of applying and maintaining the specified internal negative air pressure for the specified time. [See 8.1 item e)].

**5.2.4 Arrangement**, capable of venting air from the assembly.

**5.2.5 Pressure measuring devices**, capable of checking conformity to the specified test pressure [(see 8.1 items e), g) and h)] located at the upper point of the test assembly.

When testing with diametric deflection is required the following items shall also be included.

**5.2.6 Mechanical or hydraulic device**, capable of applying the necessary diametric deflection to the spigot [see 8.1 item b)] and acting on a beam which is free to move in the vertical plane square to the axis of the pipe. For pipes with a diameter equal to or greater than 400 mm, each beam can be elliptically shaped to suit the expected shape of the pipe when deflected as required, see Figure 4. The length of the beam or the curved part of the beam shall be greater than the contact area with the deflected spigot.

The following width,  $b_1$ , (see Figure 1), shall depend upon the external diameter,  $d_e$ , of the pipe:

- $b_1 = 100$  mm for  $d_e \leq 710$  mm;
- $b_1 = 150$  mm for  $710 \text{ mm} < d_e \leq 1\,000$  mm;
- $b_1 = 200$  mm for  $d_e > 1\,000$  mm.

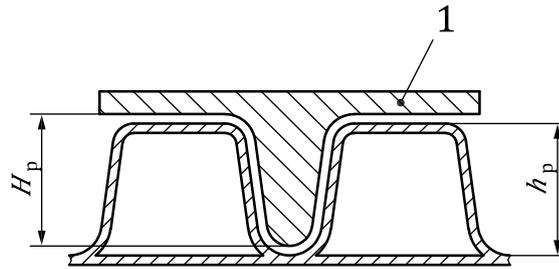
**5.2.7 Mechanical or hydraulic device**, capable of applying the necessary diametric deflection to the socket [see 8.1 item b)] and acting on a beam which is free to move in the vertical plane square to the axis of the socket. The length of the beam or the curved part of the beam shall be greater than the contact area with the deflected socket.

For pipes with a diameter equal to or greater than 400 mm, each beam may be elliptically shaped to suit the expected shape of the socket when deflected as required, see Figure 4.

The following width,  $b_2$ , shall depend upon the external diameter,  $d_e$ , of the pipe:

- $b_2 = 30$  mm for  $d_e \leq 110$  mm;
- $b_2 = 40$  mm for  $110 \text{ mm} < d_e \leq 315$  mm;
- $b_2 = 60$  mm for  $d_e > 315$  mm.

When there is a risk that the stiffening elements (profiles) of a structured wall pipe or socket will deflect more than 0,1 times the profile height, the clamps shall be modified such that they will come into contact with the pipe wall between the profiles when the profile is deflected to between 0,9 times and 0,95 times the profile height (see Figure 2).

**Key**

- 1 modified loading plate  
 $h_p$  construction height  
 $H_p$  profile height of the loading plate;  $0,9h_p \leq H_p \leq 0,95h_p$

**Figure 2 — Example of modified loading plate**

## 6 Test pieces

The test piece shall comprise an assembly of (a) pipe section(s) and/or fitting(s) including at least one elastomeric sealing ring joint.

The joint to be tested shall be assembled in accordance with the manufacturer's instructions where available.

The length  $L$  of the test pieces in pipe form shall be as specified in [Figure 1](#).

The same test assembly shall be used for the entire specified test regime.

To reduce the volume of water needed, a sealed pipe or mandrel may be located within the test piece provided it is 100 % tight to the test pressures applied, and it is not of a shape that can provide support against possible deformation during the test.

When a fitting or any other ancillary component is to be tested, the appropriate end of the test piece shown in [Figure 1](#) is to be replaced by that component.

The component is fixed to the test rig and plugged in its open end(s) as appropriate for its design.

## 7 Temperature of conditioning and testing

When testing with internal hydrostatic pressure using water, the test temperature shall be at the ambient temperature, unless otherwise specified in the referring standard. In case of dispute, the test shall be carried out at  $(23 \pm 5)$  °C.

During testing, pipes should be protected from direct sunlight.

NOTE This protection is intended to avoid heating during testing.

When testing with internal partial vacuum the test temperature shall be in the range of  $(23 \pm 5)$  °C and the temperature variation shall not exceed 2 °C during the testing.

## 8 Procedure

### 8.1 General procedure

Carry out the following procedure at the specified temperatures.

- a) mount the test piece with sealed ends in the apparatus;

- b) when applicable, apply the specified movement of the loading beams for diametric deflection of the spigot and/or socket end(s) as described in 8.2;
- c) before applying the specified angular deflection to the joint, a test at 0° angular deflection for each of the three specified pressures shall be performed as described in e), f), g) and h) with a duration of at least 5 min. Release the test pressure before applying the angular deflection;

NOTE Both angular positions are needed to check possible movement in the position of the sealing ring.

- d) when applicable, apply the specified angular deflection to the joint. Unless otherwise specified in the referring standard the applied angular deflection,  $\alpha$ , shall be the following:

$$\alpha = 2^\circ \text{ for } d_n \leq 315 \text{ mm};$$

$$\alpha = 1,5^\circ \text{ for } 315 \text{ mm} < d_n \leq 630 \text{ mm};$$

$$\alpha = 1^\circ \text{ for } d_n > 630 \text{ mm}$$

Tolerance on all deflections  $\alpha^{+0,2}$ .

If a socket is designed to take up an angular deflection,  $\beta$ , the total angular deflection shall be the sum of the design angle  $\beta$ , as declared by the manufacturer, and  $\alpha$ .

Maintain the setting of the angular deflection throughout the 15 min duration;

- e) when applicable, apply the specified negative air pressure (partial vacuum)  $p_1$  gradually over a period of not less than 5 min. Unless otherwise specified in the referring standard,  $p_1$  shall be  $-0,3 \text{ bar}^{1)} \pm 5 \%$ .

Maintain the negative air pressure for a period of not less than 5 min, in order to let the test assembly stabilize.

Close the connection between the test piece and the negative air pressure source. Measure and record the internal negative pressure.

After 15 min, measure and record the internal negative pressure again.

Calculate the loss of partial vacuum and record whether or not it exceeds the specified percentage of  $p_1$ . Unless otherwise specified in the referring standard the percentage shall be 10 %;

- f) when applicable, fill the test assembly with water while bleeding off the air. To ensure temperature equalization, leave it for not less than 5 min for pipes of nominal diameter,  $d_n$ , less than 400 mm and not less than 15 min for larger sizes;
- g) when applicable raise the hydrostatic pressure gradually over a period of not less than 5 min to the specified test pressure,  $p_2$ , and maintain that pressure for at least 15 min, monitor, and record any leakage. Unless otherwise specified in the referring standard,  $p_2$  shall be  $0,05 \text{ bar} \pm 10 \%$ ;
- h) when applicable, raise the hydrostatic pressure gradually over a period of not less than 5 min to the specified test pressure,  $p_3$ , and maintain that pressure for at least 15 min, monitor and record any leakage. Unless otherwise specified in the referring standard,  $p_3$  shall be between  $0,5 \text{ bar}$  and  $(0,5 \text{ bar} + 10 \%)$ . In case of shortening due to the internal water pressure, it is allowed to adjust the end seals to compensate, accordingly;
- i) if applicable start from b) with another set of required test parameters after an appropriate rest period which, in case of dispute, shall be at least 24 h.

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1) 1 bar = 100 kPa.

## 8.2 Procedure for applying diametric deflection to spigot and socket

Using the mechanical or hydraulic device (see 5.2.6 and 5.2.7), apply the necessary compressive forces,  $F_1$  and  $F_2$  (see Figure 1) to the spigot end of the pipe and the socket of the pipe or fitting in such a way that the distance between the beams,  $l_{sp}$  and  $l_{so}$ , are as calculated below.

- a) Calculate the distance between the beams when the socket and/or spigot is deflected using Formulae (1) and (2):

$$l_{sp} = d_{em} \times \left( 1 - \frac{X}{100} \right) \quad (1)$$

$$l_{so} = d_{em,so} - \left( d_{em} \times \frac{Y}{100} \right) \quad (2)$$

where

$l_{sp}$  is the distance between the beams for deflecting the spigot;

$l_{so}$  is the distance between the beams for deflecting the socket;

$d_{em}$  is the mean outside diameter of the spigot end;

$d_{em,so}$  is the mean outside diameter of the socket;

$X$  is the absolute value of the specified nominal spigot deflection;

$Y$  is the absolute value of the specified nominal socket deflection.

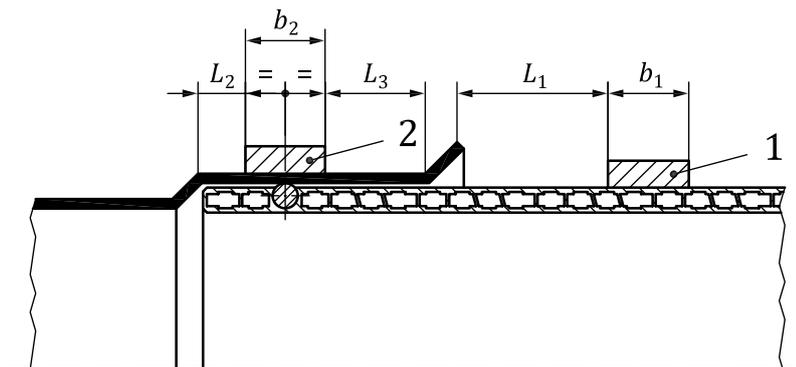
Unless otherwise specified in the referring standard  $X$  shall be 10 % and  $Y$  shall be 5 %. (See Figure 4).

EXAMPLE  $d_{em} = 1\,000$  mm;  $d_{em,so} = 1\,100$  mm;  $X = 10$  %;  $Y = 5$  % results in

$$l_{sp} = 1\,000 \times (1 - 10/100) = 900 \text{ mm};$$

$$l_{so} = 1\,100 - (1\,100 \times 5/100) = 1\,045 \text{ mm}.$$

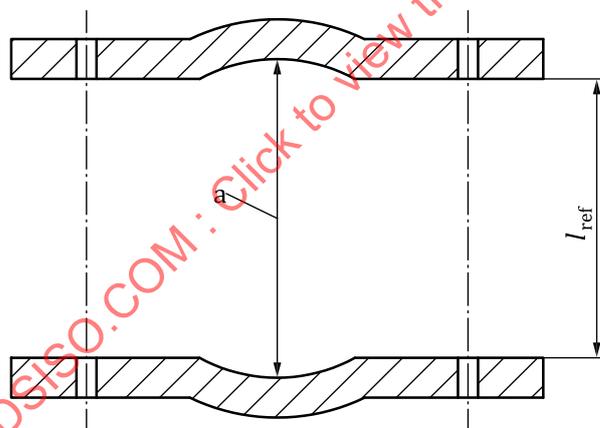
- b) position the spigot deflection clamps such that the distance to the mouth of the socket,  $L_1$ , when the force is applied, is between  $0,14d_e$  and  $0,15d_e$  or  $(100 \pm 5)$  mm, whichever is the greater. In case of structured wall pipes where the profiles are positioned further away from the socket mouth, the clamps shall be modified in order to apply the force to the spigot at the specified distance;
- c) for joints with the sealing ring positioned in the socket, the socket diameter deflection beams shall be positioned next to the sealing ring groove as shown in Figure 1. For joints with the sealing ring(s) positioned on the spigot end of the pipe, the socket diameter deflection beams shall be positioned such that the axis of the beam is aligned with the centre line of the sealing ring profile(s). If the sealing ring(s) are positioned so the distance from the edge of the beams to the end of the socket,  $L_2$  as shown in Figure 3 is less than 25 mm, the edge of the beams shall be located such that  $L_3$  is at least 25 mm and, if possible  $L_2$  is also at least 25 mm;
- d) when testing the tightness of couplers/repair collars, the test arrangement shall be as shown in Figure 5 or Figure 6;
- e) Apply the forces needed to move the spigot and socket diametric deflection devices to the calculated levels. The diametric distortion shall be applied to the spigot first. The diametric deflection of the socket is permitted to be greater than specified if by deflecting the spigot first to the calculated level, the socket without applying any load to it is deflected to more than specified. This shall not be deemed as a failure and the test shall be carried out under these conditions;
- f) continue with 8.1 item d).



**Key**

- 1 beam (in contact with the spigot)
- 2 beam (in contact with the socket)
- $L_1$  distance between the beam and the socket mouth
- $L_2$  distance between the beam and the end of the socket
- $L_3$  distance between the beam and the beginning of the cylindrical part of the socket
- $b_1$  width of the beam 1 (see 5.2.6)
- $b_2$  width of the beam 2 (see 5.2.7)

**Figure 3 — Example showing the positioning of the beams where the sealing ring is placed on the spigot**



**Key**

- $l_{ref}$  reference distance, e.g. for checking conformity to  $l_{sp}$  or  $l_{so}$
- a  $l_{sp}$  or  $l_{so}$ , as calculated in accordance with item a) of 8.2.

**Figure 4 — Example of diametric deflection device**