
**Plastics pipes and fittings — Bending-
tensile cycle test for PE/metal transition
fittings, PE tapping tees and PE branch
saddles**

*Tubes et raccords en matières plastiques — Essai de flexions-tractions
répétées pour raccords PE/métal, prises de branchement et selles de
dérivation en PE*

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 13924 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 5, *General properties of plastics pipes, fittings and valves of plastic materials and their accessories — Test methods and basic specifications*.

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Plastics pipes and fittings — Bending-tensile cycle test for PE/metal transition fittings, PE tapping tees and PE branch saddles

1 Scope

This International Standard specifies a method for testing the flexural fatigue resistance of piping assemblies under pressure.

The method is applicable to polyethylene (PE) tapping tees, PE/metal transition fittings and PE branch saddles, intended for use with PE pipes having a nominal outside diameter $d_e \leq 63$ mm.

NOTE The test is based on simulating the stresses generated in practice on buried piping networks, i.e. combined bending and tensile stresses, at ambient temperature. The test is accelerated by magnifying the displacements observed in practice.

2 Principle

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A bending-load application system imposes a vertical displacement perpendicular to the axis of a pipe which is mounted in a fixed assembly with the fitting under test. An intermittent up-and-down movement causes combined bending and tensile stresses in the fixed assembly. A further loading system is used to apply a longitudinal stress along the pipe.

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Each complete loading cycle consists of the following stages:

- Starting from the neutral position (straight pipe), the bending-load application system deflects the PE pipe downwards by a specified amplitude at the mid-point of a specified span and allows it to return to the neutral position.
- The pipe remains at rest in the neutral position for 10 s.
- The load application system deflects the PE pipe upwards by a specified amplitude at the mid-point of the specified span and allows it to return to the neutral position.
- The pipe remains at rest in the neutral position for 10 s.

The pauses of 10 s are included in the cycle in order to avoid heating effects.

The airtightness is verified during the test.

The test is carried out at a temperature of $(23^{+3}_{-1})^{\circ}\text{C}$.

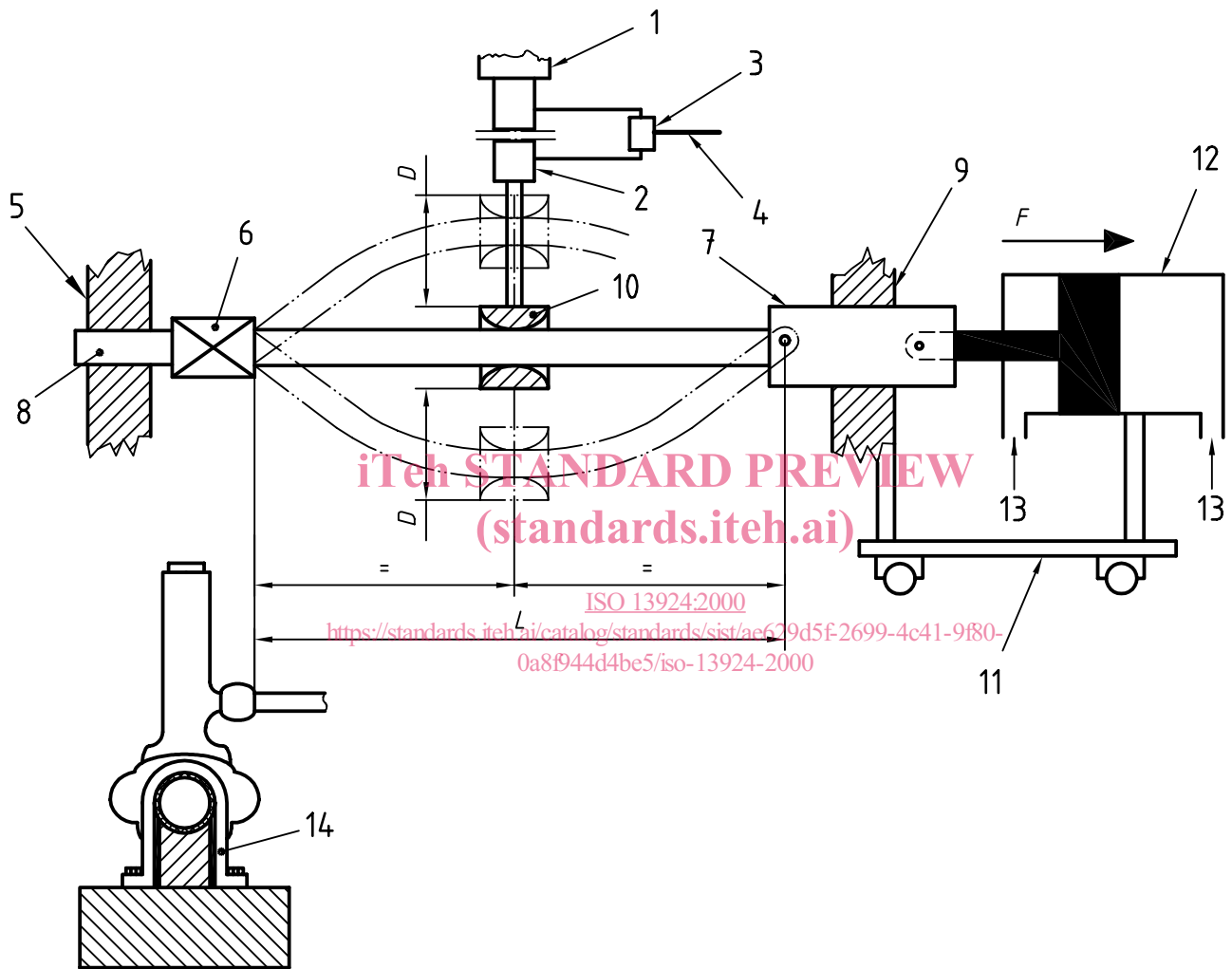
NOTE It is assumed that the following test parameters are set by the standard making reference to this International Standard:

- the number of test pieces (see 4.2);
- the number of cycles (see 6.7).

3 Apparatus (see Figure 1)

3.1 Frame, to support the bending-load application system (1, 2, 3 and 4) and adjustable in length to receive, at one end, clamps (5 or 14) holding the fitting assembly (6) in place and, at the other end, a pivot clamp (7) which is connected to the pipe as shown in Figure 1. The pivot clamp (7) slides in a co-axial guide so that a tensile force may be applied to the PE pipe.

3.2 Pivot clamp (7), matching the diameter of the PE pipe, permitting rotation of the pipe in the vertical plane only.



Upper rig: Configuration A (PE/metal transition fitting)

Lower rig: Configuration B (PE tapping tee)

Key

- | | | | |
|------------|---|----|--|
| 1, 2, 3, 4 | System for applying a bending load | 10 | Grips for transmitting cyclic displacement to pipe |
| 5 | Anchorage clamps | 11 | Adjustable mounting |
| 6 | Fitting under test | 12 | System for applying a tensile load |
| 7 | Pivot clamp attached to PE pipe | 13 | Hydraulic or pneumatic pressure |
| 8 | Metal part of the PE/metal transition fitting | 14 | Ring clamp |
| 9 | Co-axial guide for pivot clamp (7) | | |

L Distance between fitting and pivot clamp (span) (see 4.1)

F Tensile force (see 6.5)

D Displacement in each direction from neutral axis

Figure 1 — Schematic examples of test rigs for the bending-tensile cycle test

3.3 Bending-load application system (1, 2, 3, 4) (hydraulic or pneumatic cylinder), capable of producing the required displacement of the pipe as given in Table 1.

3.4 Set of two grips (10), matching the diameter of the PE pipe, attached to the rod of the bending-load application system.

3.5 Control system (3, 4), capable of applying the cyclic bending load as required in clause 6, including a counter to record the number of cycles.

3.6 Test piece pressurization system, capable of applying the specified internal pressure (see 6.6), with a pressure-loss detection device designed to stop the counter (see 3.5) if the pressure drops.

3.7 Tensile-loading system (12) (hydraulic or pneumatic cylinder), connected to the pivot clamp to apply a longitudinal tensile load.

4 Test pieces

4.1 Preparation

The test piece shall comprise an assembly of the fitting to be tested and PE pipe(s) of the size and pressure rating for which the fitting is intended. The pipe ends shall be fitted with caps of such a design that the test piece can be pressurized and the cap inserted in the pivot clamp (7) can pivot in the clamp (see 3.1 and Figure 1). The pipe which is subjected to the cyclic load shall be connected to the branch of the fitting and fitted at its other end with a cap which fits into the pivot clamp (7).

In the case of a PE tapping tee, the main pipe shall be drilled through using the tapping tee cutter prior to testing.

The length of pipe, i.e. the span L , subjected to the bending and tensile stresses shall be as specified in Table 1.

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Table 1 — Conditions for the bending-tensile cycle test

Nominal outside diameter d_e mm	Distance between clamps (span) L^a mm	Displacement D^b mm	Tensile force $F^{c,d}$ N
20	385	25	600
25	463	29	775
32	608	38	1 025
40	760	47,5	1 585
50	952	59,5	2 460
63	1 200	75	3 900

^a The tolerance on the span L is ± 1 %.

^b The tolerance on the displacement D is ± 1 mm.

^c The tolerance on the tensile force is ± 1 %.

^d SDR 11-based value, calculated using a stress of 3,75 N/mm².

The assemblies shall conform to the requirements of the relevant standards or specifications.

4.2 Number of test pieces

The number of test pieces shall be as specified in the relevant standard.

5 Conditioning

Condition the test pieces for a minimum of 2 h at $(23 \pm 1)^\circ\text{C}$. The test shall not be carried out less than 24 h after assembling the test piece.

6 Procedure

6.1 In the case of a PE/metal transition fitting assembly, clamp the steel part of the fitting in the fixed clamp (see configuration A in Figure 1) and the other end of the assembly, i.e. the PE pipe, in the pivot clamp (7).

In the case of a PE tapping tee or branch saddle, anchor the main pipe of the tapping tee or branch saddle to a fixed mounting, using for instance ring clamps (14) next to the tapping tee or branch saddle, to prevent any rotation during the test (for a tapping tee, see configuration B in Figure 1). Clamp the other end of the test piece assembly, i.e. the PE service pipe, in the pivot clamp (7).

6.2 Tighten the pivot clamp (7) on the PE pipe in such a way that the pipe and clamp axes are horizontal and the clamp is a distance L from the fitting, the distance L being measured between the point of attachment of the PE pipe in the pivot clamp (7) and the edge of the fitting at the other end of the PE pipe. Once fixed, the clamp (7) shall not slip at all on the PE pipe.

6.3 Position the grips of the bending-load application system in the middle of the distance L . Fasten the grips on the pipe and connect them to the rod of the load application system.

6.4 Set the equipment-cycling parameters as follows:

- a) Adjust the stroke of the bending-load application system to give the applicable displacement D as given in Table 1 both above and below the neutral axis, as shown in Figure 1.
- b) Set the timer control system so that:
 - 1) the displacement from the neutral position to each limit position is carried out at a speed of (30 ± 5) mm/s;
 - 2) the pause at the neutral position lasts for (10 ± 1) s.
- c) Set the cycle counter to zero.

6.5 Apply the tensile force F as given in Table 1.

6.6 Place the test piece under an internal air pressure of (50 ± 5) mbar and activate the pressure-loss detector.

6.7 Set the cycle counter to carry out the number of cycles required and start the cyclic loading.

6.8 Record the number of cycles completed as scheduled or, if curtailed by pressure loss or another type of failure, record the details of the leakage or other failure.

7 Test report

The test report shall include the following information:

- a) a reference to this International Standard and, if applicable, the standard making reference to this International Standard;
- b) all details necessary to identify the component under test;
- c) the test temperature, in degrees Celsius;
- d) the tensile force applied;
- e) the displacement used;
- f) the number of test cycles carried out;
- g) whether or not any leakage was observed during the test;
- h) details of any factors or incidents which may have affected the results;
- i) the test laboratory;
- j) the date of the test.

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