INTERNATIONAL STANDARD

ISO 13956

First edition
2010-10-01

Plastics pipes and fittings — Decohesion test of polyethylene (PE) saddle fusion joints — Evaluation of ductility of fusion joint interface by tear test

Tubes et raccords en matières plastiques — Essai de décohésion des selles en polyéthylène (PE) assemblées par soudage — Évaluation de la ductilité de l'interface de soudage par essai d'arrachement

Reference number
ISO 13956:2010(E)

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

COPYRIGHT PROTECTED DOCUMENT

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

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 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 13956 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*.

Plastics pipes and fittings — Decohesion test of polyethylene (PE) saddle fusion joints — Evaluation of ductility of fusion joint interface by tear test

1 Scope

This International Standard specifies a method for the evaluation of the ductility of the fusion joint interface of assemblies of polyethylene (PE) pipe and electrofusion or heated tool saddles, intended for the conveyance of fluids.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 11413, *Plastics pipes and fittings — Preparation of test piece assemblies between a polyethylene (PE) pipe and an electrofusion fitting*

3 Principle

A load is applied to the saddle of an assembly of an electrofusion or heated tool saddle fused on to a pipe.

The ductility of the fusion joint interface is characterized by the appearance of the failure in the fusion plane and by the determination of the percentage of decohesion.

4 Apparatus

4.1 General

The test apparatus shall comprise a tensile equipment type A1 or A2, as indicated in Figures 1 and 2 respectively, or a compressive equipment type B as indicated in Figure 3. For nominal outside pipe diameter $\geqslant$ 250 mm, equipment type C as indicated in Figure 4 may be used.

4.2 Tensile test equipment — Type A1 or A2

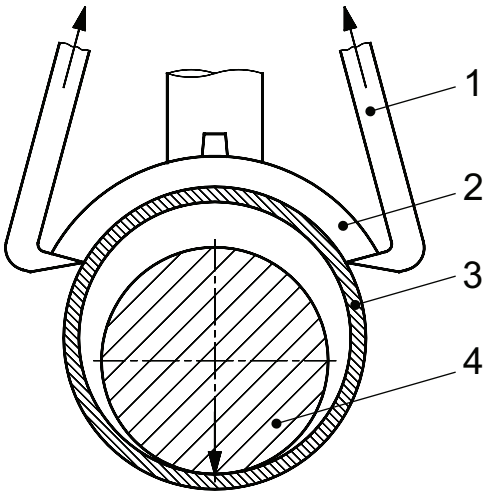
The tensile equipment shall include the following main parts.

4.2.1 Tensile testing machine, capable of maintaining a speed of (100 $\pm$ 10) mm/min, with sufficient force to separate the saddle from the pipe.

4.2.2 Loading pin, with an outside diameter of at least 1/2 of the nominal outside diameter of the pipe and allowing rotation.

4.2.3 Appropriate clamping device, to grip the saddle and allow separation from the pipe.

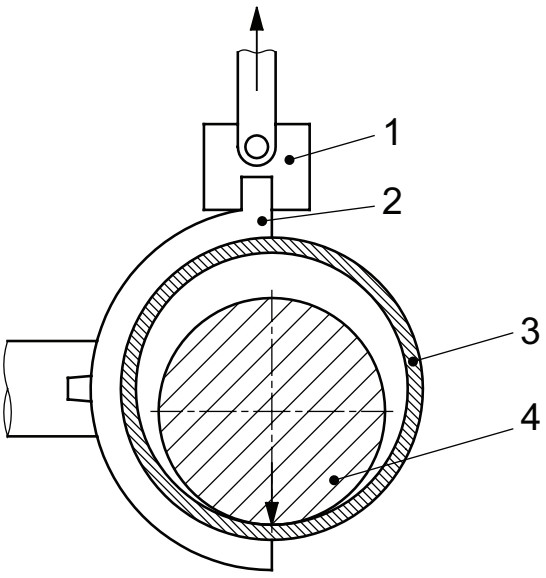
NOTE The type A1 clamping device allows symmetrical loading of the saddle from both sides (an example is shown in Figure 1). The type A2 clamping device grips the saddle only from one side (an example is shown in Figure 2).



Key

1 clamping device
2 PE saddle
3 PE pipe
4 loading pin

Figure 1 — Typical type A1 test arrangement



Key

1 clamping device, allowing rotation of the loading point
2 PE saddle
3 PE pipe
4 loading pin

Figure 2 — Typical type A2 test arrangement

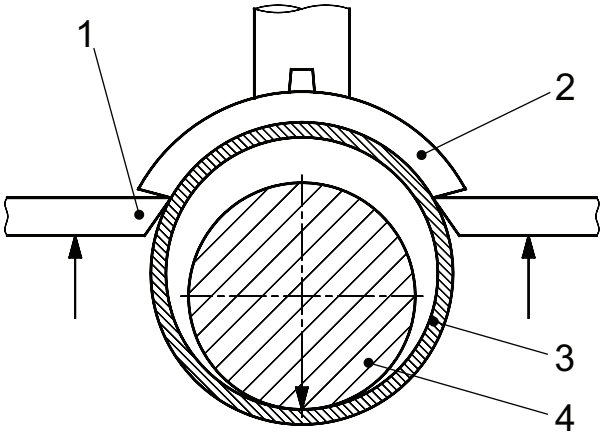
4.3 Compressive equipment — Type B

The compression equipment shall include the following main parts.

4.3.1 Compression testing machine, capable of maintaining a speed of (100 ± 10) mm/min, with sufficient force to separate the saddle from the pipe.

4.3.2 Loading pin, with an outside diameter of at least 1/2 of the nominal outside diameter of the pipe.

4.3.3 Appropriate clamping device, to grip or support the saddle and allow separation from the pipe (an example is shown in Figure 3).



Key

1 clamping device
2 PE saddle
3 PE pipe
4 loading pin

Figure 3 — Typical type B compression mode test arrangement

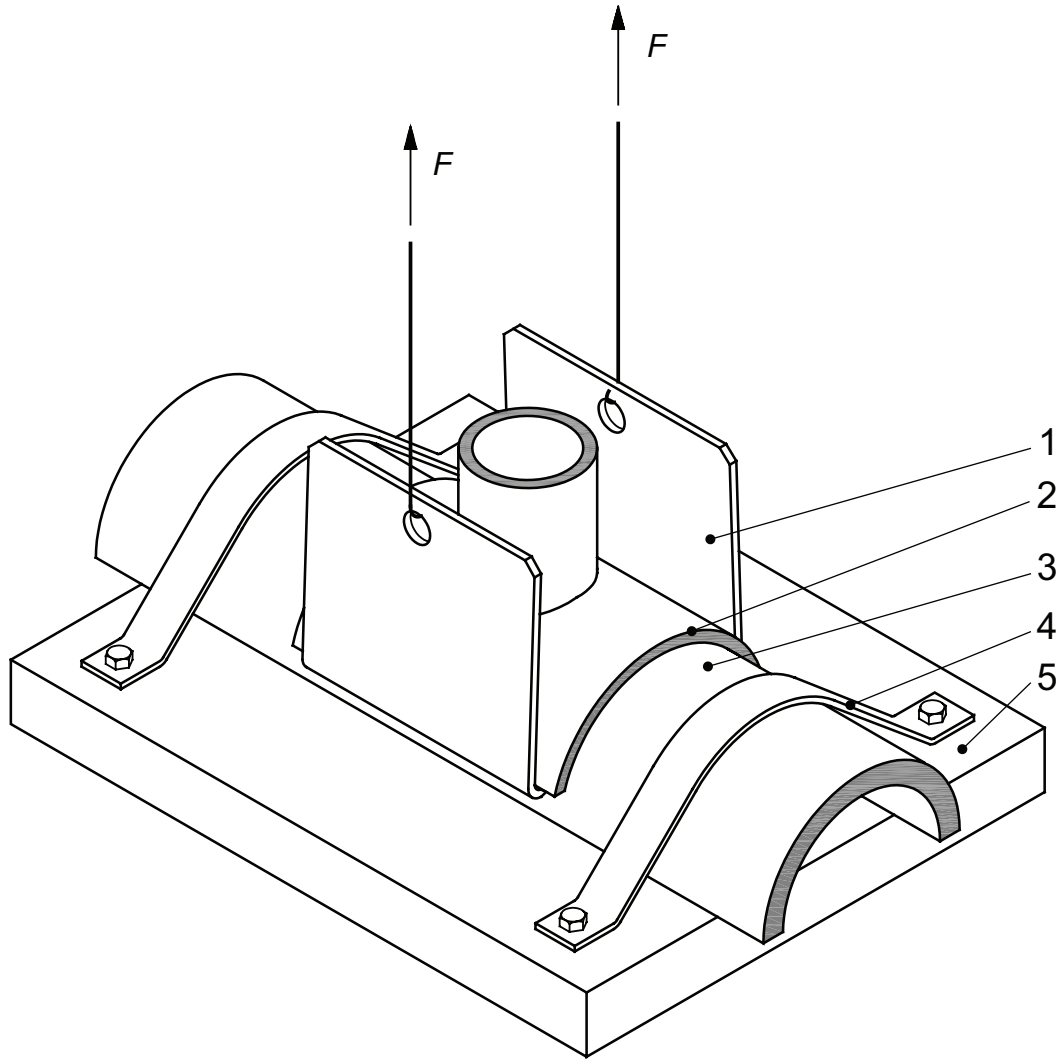
4.4 Equipment — Type C

The equipment shall include the following main parts.

4.4.1 Tensile testing machine, capable of maintaining a speed of (100 ± 10) mm/min, with sufficient force to separate the saddle from the pipe.

4.4.2 Appropriate clamping device, to grip or support the saddle and allow separation from the pipe (an example is shown in Figure 4).

4.4.3 Appropriate supporting frame with fixtures, to fix the pipe, next to the saddle, to the supporting frame (an example is shown in Figure 4).



Key

1 clamping device
2 PE saddle
3 PE pipe
4 fixture
5 supporting frame

F decohesion force

Figure 4 —Typical type C test arrangement

5 Sampling

5.1 Preparation of test pieces

5.1.1 Pipes and components shall be jointed according to the manufacturer's instructions and under conditions given in the product standard. For PE assemblies, the conditions given in ISO 11413 for electrofusion shall be taken into account.

5.1.2 Unless otherwise specified, the main pipe shall not be perforated.

5.1.3 The free pipe length on both sides of the saddle shall be minimum $0{,}1d_n$ (d_n being the nominal outside pipe diameter). For type C test mode, the free pipe length on both sides of the saddle shall be such that it extends out of the fixtures.

5.1.4 For type C test mode, the pipe shall be cut along the pipe axis, as indicated in Figure 4.

5.1.5 All screws, bolts and other fixing accessories (such as under-clamp, if any) shall be removed.

5.1.6 For practical reasons, the branch outlet of the saddle may be removed. To facilitate decohesion at the fusion interface, the removal of parts that are not involved in the fusion joint is allowed.

NOTE The pipe wall thickness can influence the magnitude of applied decohesion force.

5.2 Number of test pieces

Unless otherwise specified in the referring standard, the number of test pieces shall be three.

6 Conditioning

The testing shall be carried out at least 24 h after completion of jointing.

Condition the test piece at an ambient temperature of (23 ± 2) °C for at least 6 h before carrying out the procedure given in Clause 7.

7 Procedure

Carry out the following procedure at an ambient test temperature of (23 ± 2) °C.

a) For type A1, A2 and B test mode, insert the loading pin inside the pipe; for type C test mode, fix the pipe directly next to the saddle to the supporting frame.

b) Position the test piece and the clamping device such that the saddle is separated from the pipe at a speed of (100 ± 10) mm/min.

NOTE 1 An example of the test assembly, using a tensile test, is given in Figure 1 for type A1 test mode and in Figure 2 for type A2 test mode. An example of the test assembly, using a compression test, is given in Figure 3. An example of type C test assembly is given in Figure 4.

c) Continue the loading until complete separation or rupture of one of the parts of the test piece occurs.

If the test piece slips out of the clamps, the test may be continued by repositioning the clamps. For type A2 test mode, repositioning the clamping device on the other side of the saddle is allowed. In case separation cannot be achieved, testing may be carried out at a lower speed of (25 ± 5) mm/min, for instance.

d) Inspect the test piece and record the location of the rupture (e.g. in the pipe or the saddle, between the wires or the fusion interface), the type of rupture, and whether or not a brittle fracture surface is observed. Typical ruptures are characterized in Figures 5 and 6.

NOTE 2 It is common practice that, when no separation takes place in the fusion interface (e.g. rupture in the pipe or in the saddle), the test result is considered as 0 % brittle decohesion regarding e), f), g) and h). In this case, an alternative test arrangement of this International Standard (see Figure 1, 2, 3 or 4) can be applied or, for instance, the strip-bend test according to ISO 21751.

e) Measure and record the maximum brittle fracture length in radial direction of the fusion zone, l, and the overall length of the fusion zone at the same location, y.

f) Calculate the percentage decohesion, L_d, using Equation (1):

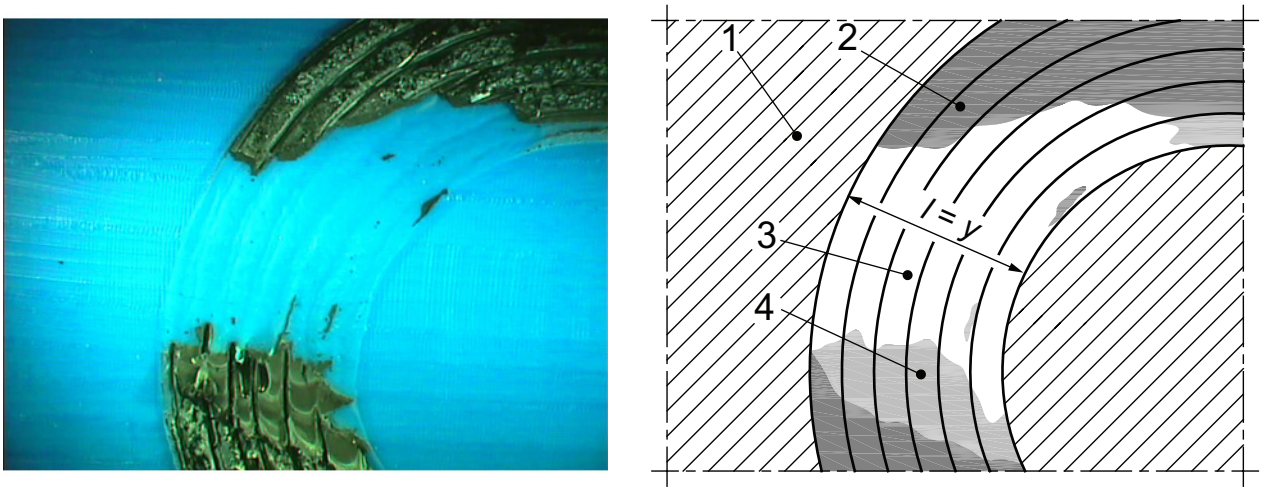
$$L_d = \frac{l}{y} \times 100\ (\%) \tag{1}$$

g) Measure and record the brittle area of the fusion zone (A).

h) Calculate the percentage decohesion, A_d, using Equation (2):

$$A_d = \frac{A}{A_{nom}} \times 100\ (\%) \tag{2}$$

where A_{nom} is the theoretical total fusion zone, as declared by the manufacturer or measured on the fitting.

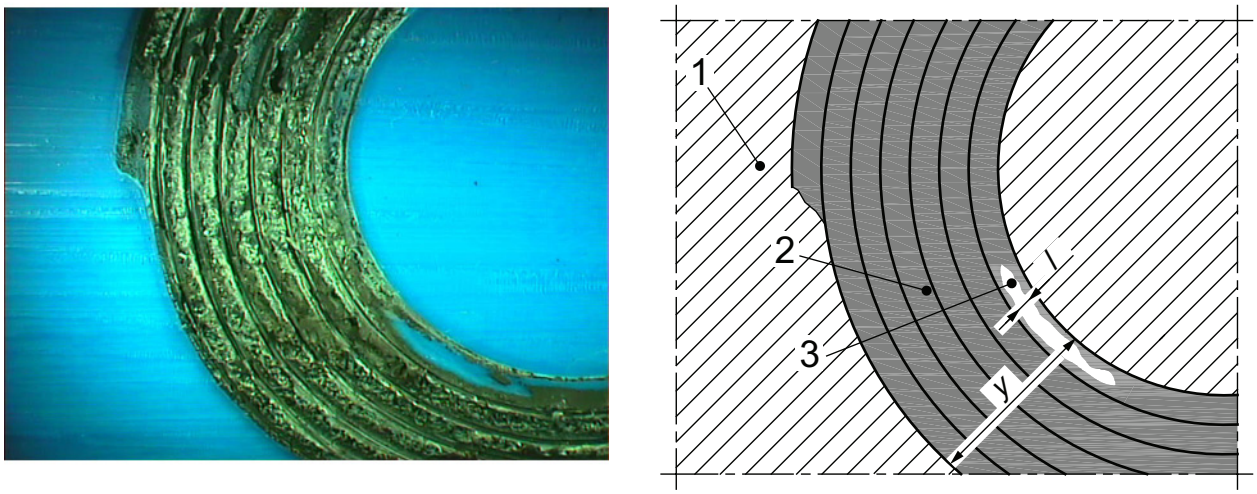


Key

1 pipe surface
2 ductile fracture
3 brittle fracture with no adhesion at fusion interface
4 brittle fracture between electrofusion wires

l maximum brittle fracture length
y overall length of the fusion zone

Figure 5 — Typical brittle fracture at the fusion interface



Key

1 pipe surface
2 ductile fracture
3 brittle fracture between electrofusion wires

l maximum brittle fracture length
y overall length of the fusion zone

Figure 6 — Typical ductile fracture in the plane of the wires

8 Test report

The test report shall include the following information:

a) reference to this International Standard, i.e. ISO 13956:2010;

b) full identification of the components tested;

c) nominal size of the saddle;

d) dimensions of the pipes, including nominal diameter, thickness or SDR, MRS;

e) fusion conditions of the test pieces;

f) test temperature;

g) speed of testing;

h) number of test pieces subjected to testing;

i) testing mode, tensile (type A1 or A2), compression (type B) or type C, as applicable;

j) of each test piece, the type of failure, i.e. brittle or ductile, and details of its appearance including, when applicable, decohesion at interface, tearing between wires, yielding of the pipe or saddle. As from $L_d \geqslant 25$ % or $A_d \geqslant 12$ %, it is recommended to include pictures of the relevant fracture surface;

k) percentage decohesion, L_d and A_d;

l) observations made during and after the test;

m) any factors which could have affected the results, such as any incidents or any operational details not specified in this International Standard;

n) identification of test laboratory;

o) date of the test.

Annex A
(informative)

Recommended condition

It is recommended that the percentage of decohesion for each individual test piece fulfil the following requirement: $L_d \leqslant 50$ % and $A_d \leqslant 25$ %.

Bibliography

[1] ISO 21751, *Plastics pipes and fittings — Determination of cohesive resistance — Strip-bend test for electrofusion assemblies*[1)]

1) Under preparation.

ICS 23.040.60

Price based on 10 pages