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Thermoplastics piping systems for non-pressure underground drainage and sewerage — Test method for resistance to combined temperature cycling and external loading

Systèmes de canalisations thermoplastiques pour branchements et collecteurs d'assainissement enterrés sans pression — Méthode d'essai de la résistance à un cycle de température et de charge externe combinés

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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 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 13260 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)*.

Thermoplastics piping systems for non-pressure underground drainage and sewerage — Test method for resistance to combined temperature cycling and external loading

1 Scope

This International Standard specifies two methods for testing pipes and fittings or joints for plastics piping systems intended for use in underground drainage and sewerage systems for their resistance to deformation and leakage, when subjected to sustained external loading in conjunction with the passage of hot water.

Method A involves temperature cycling, by passing hot water and cold water alternately, and is applicable to pipes and associated fittings having a mean outside diameter $d_{em} \leqslant 190$ mm.

Method B involves passing hot water only, except at intervals specified for measurement of internal deflection, and is applicable to pipes and associated fittings having a mean outside diameter 190 mm $< d_{em} \leqslant 510$ mm.

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 48, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

3 Principle

A test piece comprising a pipe or an assembly of pipe(s) and fitting(s) is placed on a 100 mm gravel bed and covered with gravel to 600 mm above the crown of the pipe confined by a box of specified dimensions. Depending on the nominal size of the largest pipe or joint under test, a constant vertical load is applied via the gravel and either a specified number of cycles of hot and cold water or just hot water is passed through the test piece. The deformation of the test piece, as indicated by vertical deflection or internal diametric compression, is measured.

For sizes having a mean outside diameter $d_{em} \leqslant 190$ mm, hot and cold water is passed through the test piece and air may be blown through the test piece during the intervals between stages (Method A).

For pipes with a mean outside diameter $190 < d_{em} \leqslant 510$ mm a constant flow of hot water is passed through the test piece (Method B).

Vertical deflection of the test piece is measured. The test piece is checked at the end of the test for cracking, for local deflection in the bottom of the main channel and for leakage at the joints.

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

a) if appropriate, the limits of the temperature of the water flowing out (see 7.2.2);

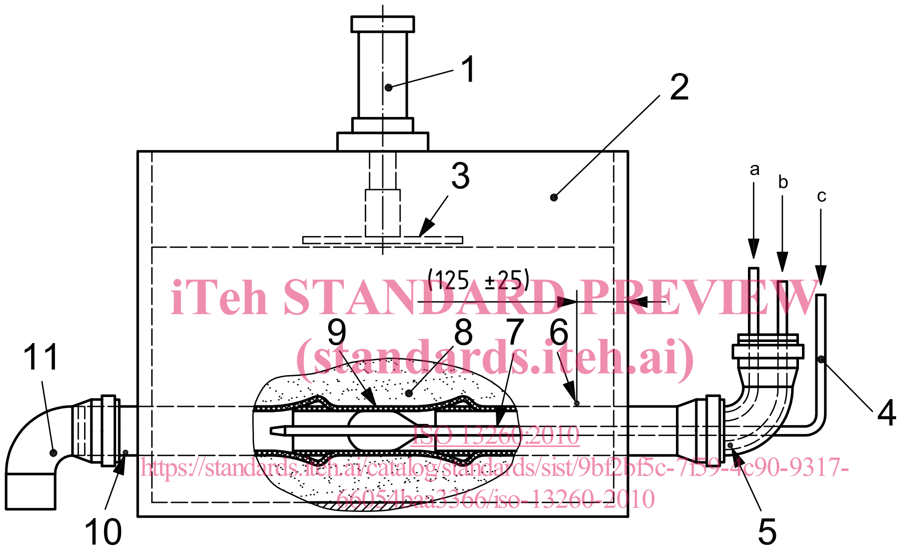
b) if appropriate, the duration of the flow (see 7.2.2);

c) the percentage, x, of d_i for the calculation of the diameter of the hard ball, in accordance with 7.3.3.

4 Apparatus

4.1 Gravel-filled box, to accommodate a test piece as shown in Figures 1, 2 and 3, with dimensions depending on the size of the test piece as given in Table 1 and with a horizontal base.

Dimensions in millimetres



Key

1 loading device
2 box
3 loading plate
4 cold water sensor
5 inlet hot water sensor
6 upper surface sensor
7 cold water spray (sparge pipe)
8 filling material
9 test sample
10 outlet hot water sensor (for Method B only)
11 water outlet (sealable)

[a] Air inlet.
[b] Hot water inlet.
[c] Cold water inlet.

Figure 1 — Typical box loading test (BLT) apparatus

Table 1 — Box dimensions

Dimensions in millimetres

	Mean outside diameter pipe/fitting d_{em}	Inside box width[a] l_1	Minimum length of box l_2
Method A	$\leqslant 190$	$600 < l_1 \leqslant 990$	1 200
Method B	$190 < d_{em} \leqslant 205$	$790 < l_1 \leqslant 1\,005$	1 300
	$205 < d_{em} \leqslant 255$	$805 < l_1 \leqslant 1\,055$	1 500
	$255 < d_{em} \leqslant 320$	$855 < l_1 \leqslant 1\,120$	1 500
	$320 < d_{em} \leqslant 410$	$920 < l_1 \leqslant 1\,210$	1 500
	$410 < d_{em} \leqslant 510$	$1\,010 < l_1 \leqslant 1\,310$	1 500

[a] The inside box width shall be determined on the basis of a clearance of (350 ± 100) mm between the side of the pipe/fitting and the side of the box. The inside box width should be adjustable by closing the gap using plywood sheeting or brickwork as a spacer.

The inside walls of the box shall be vertical ±3 mm and shall have an inside smooth surface, e.g. plywood or flat sheet.

The box shall be constructed and reinforced such that, when under load, it shall not deflect more than 3,0 mm at any point.

The pipe line shall pass through the walls of the box via holes sealed in such a way as to impose minimal restraint on the assembly (see Clause 5), e.g. by flexible closed cell sponge collars. The test assembly of pipes or pipes and fittings shall be placed with a fall of between 1:100 and 1:75 to the horizontal base, such that in the case of Method A, conditions alternate between discharges of hot and cold water or in the case of Method B, water at a constant temperature can be passed through the assembly while it is subjected to a constant force acting through the gravel.

The box shall be constructed such that it can accommodate a total height of gravel of 600 mm above the crown of the pipe.

Dimensions in millimetres and prior to load being applied

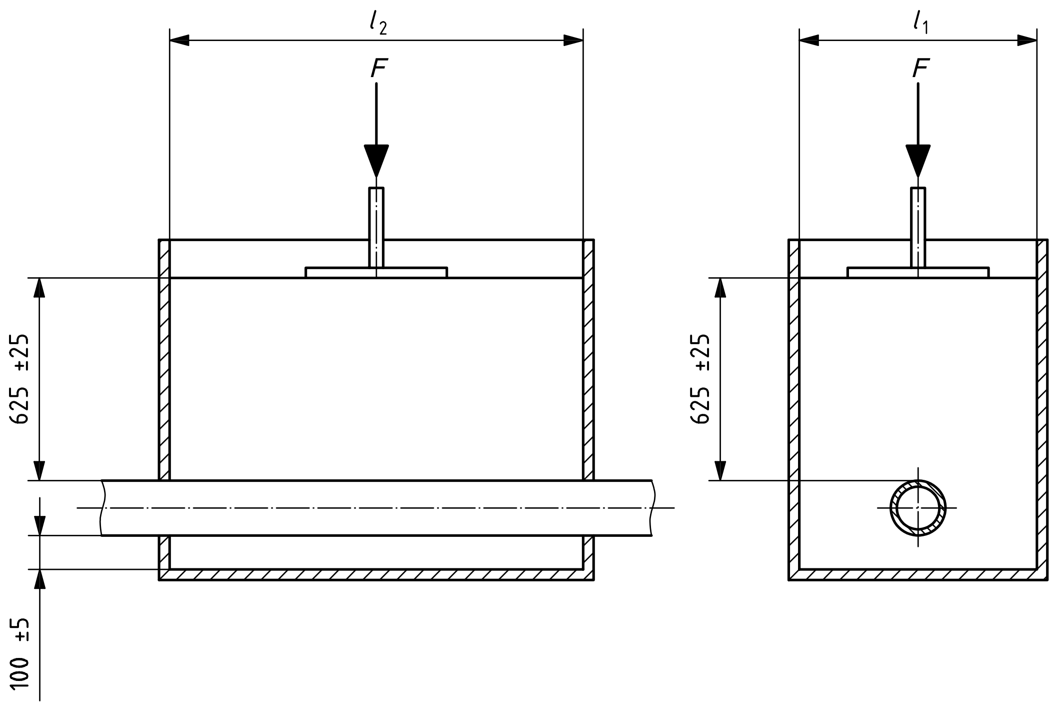
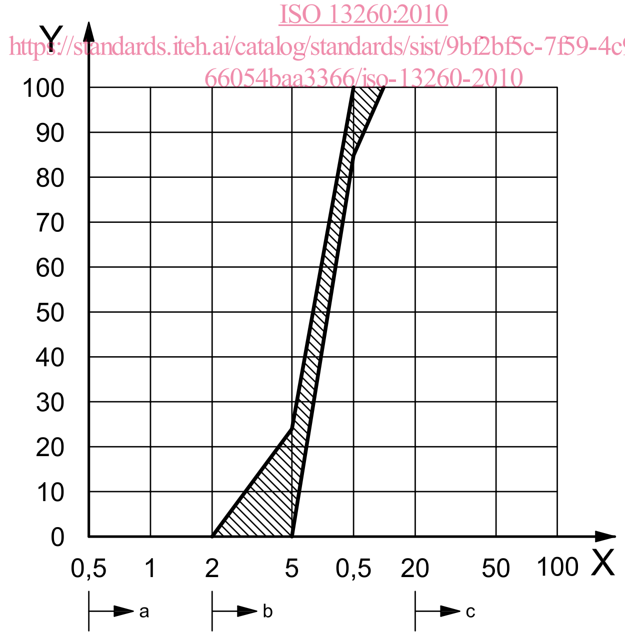


Figure 2 — Main dimensions of the box

The gravel shall be classified in accordance with Table 2, shall have a surface texture in accordance with Table 3, with granular composition within the range shown in Figure 3 and shall conform to the requirements of Table 4.



Key

X particle size, in millimetres

Y cumulative percentage passing

[a] Sand.

[b] Gravel.

[c] Stone.

Figure 3 — Gradation range of the gravel for box loading test

The gravel shall be washed natural material comprising hard, durable and clean particles.

It shall be dry during the preparation and completion of the test.

Table 2 — Particle shape

Classification	Description
Rounded	Fully water-worn or completely shaped by attrition
Irregular	Naturally irregular or partly shaped by attrition and having rounded edges
Angular	Possessing well-defined edges formed at the intersection of roughly planar faces
Flaky	Material of which the thickness is small relative to the other two dimensions
Elongated	Material, usually angular, in which the length is considerably larger than the other two dimensions
Flaky and elongated	Material having the length considerably larger than the width and the width considerably larger than the thickness

Table 3 — Surface texture of particles

Surface texture	Characteristics
Glassy	Conchoidal fracture
Smooth	Water-worn, or smooth due to fracture of laminated or fine-grained rock
Granular	Fracture showing more or less uniform rounded grains
Rough	Rough fracture of fine or medium-grained rock containing no easily visible crystalline constituents
Crystalline	Easily visible crystalline constituents

Table 4 — Shape of particles

Shape	Surface	Content
Rounded or irregular	Glassy or smooth	At least 85 %
Up to 15 % may fall within the other classes / textures given in Tables 2 and 3 as applicable. The particle size distribution for all particles shall conform to Figure 3.		

4.2 Compressive loading equipment, capable of applying the force, F, (see 7.1.7) by means of hydraulic or pneumatic equipment acting through a (450 ± 5) mm × (300 ± 5) mm steel plate at least 25 mm thick, or of another material of an equivalent stiffness, which shall be positioned horizontally. The 450 mm side of the plate shall be positioned parallel to the long wall of the box as shown in Figures 1, 2 and 4. Force shall be applied such that the initial applicable load is applied for a 1 min to 2 min time period and maintained to within ±1 kN.

Fixed points shall be established above each of the four corners of the loading plate to act as datum points to measure the sinking of the plate into the gravel after application of the final load (see 7.1.7).