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**Thermoplastics piping systems for  
non-pressure applications — Test  
method for resistance to elevated  
temperature cycling**

*Systèmes de canalisations thermoplastiques pour applications  
sans pression — Méthode d'essai de résistance à des cycles de  
température élevée*

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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 13257:2010), which has been technically revised. The major modifications to the previous edition are:

- revision of the Scope to delete the references to application areas "B", "BD" and "UD";
- addition in the Scope of the range of nominal outside diameters of components to which this method is applicable;
- addition of a definition for "sagging";
- complete review of [Clause 6](#), Test assemblies, in particular distinction between test assemblies including pipes with integral sockets and fittings with socket and spigot ([Figure 1](#)) and test assemblies including pipes without integral socket and fittings with sockets ([Figure 2](#)) for components  $d_n \geq 40$  mm;
- in [Clause 7](#), addition of [Figure 4](#) to illustrate the measuring point of the column of water.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

# Thermoplastics piping systems for non-pressure applications — Test method for resistance to elevated temperature cycling

## 1 Scope

This document specifies a test method for determining the resistance to elevated temperature cycling of thermoplastics piping systems for non-pressure applications, inside buildings or buried in the ground within the building structure.

This document is applicable to piping systems with components of nominal outside diameters up to and including 200 mm.

Although limited to nominal outside diameters up to and including 200 mm, the test results may be extrapolated to products of larger nominal outside diameters from the same range.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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/TS 7024:2005, *Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings — Thermoplastics — Recommended practice for installation*

## 3 Terms and definitions and symbols

### 3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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/>

#### 3.1.1

##### **nominal outside diameter**

$d_n$

specified diameter assigned to a nominal size (DN/OD or DN/ID)

Note 1 to entry: It is expressed in millimetres.

#### 3.1.2

##### **sagging**

$S_g$

deformation of the pipe occurring from the test conditions, which is measured after the test at a defined location in vertical direction downwards

Note 1 to entry: It is expressed in millimetres.

### 3.1.3

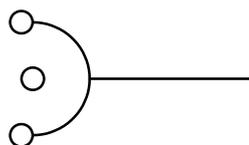
#### expansion gap

distance between the bottom of a socket and the spigot of the inserted component allowing expansion of the system

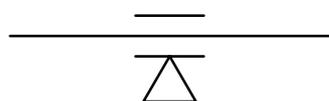
Note 1 to entry: Adapted from ISO/TS 7024:2005, definition 3.2.4.

## 3.2 Symbols

For the purposes of this document, the symbols given in ISO/TS 7024 and the following apply:



ring seal socket



guide brackets (for free movement of pipe)



anchor brackets (for fixed point)

## 4 Principle

A test assembly of pipes and fittings is subjected to a given pattern of thermal cycling by using hot and cold water alternately for a given number of cycles during which the leaktightness of joints is verified by inspection and sagging of the pipe is checked against a limit after the test.

## 5 Apparatus

**5.1 Thermometer or other temperature measuring device**, capable of measuring with an accuracy of 0,5 °C or better. The resolution of the thermometer or the temperature measuring device shall be 0,1 °C or better. The thermometer or the temperature measuring device shall be capable of recording the relevant temperature, with a reaction time less than or equal to 20 s, from 20 °C to 90 °C.

**5.2 Timer**, with an accuracy of 1 s.

**5.3 Cold water source**, capable of supplying at the inlet of the test assembly, every 4 min, the following quantities of water at  $(15 \pm 5)$  °C (see 7.3):

- for Programme A,  $(30 \pm 0,5)$  l in  $(60 \pm 2)$  s;
- for Programme B,  $(15 \pm 0,5)$  l in  $(60 \pm 2)$  s.

**5.4 Hot water source**, capable of supplying at the inlet of the test assembly, every 4 min, the following volumes of water at  $(93 \pm 2)$  °C (see 7.3):

- for Programme A,  $(30 \pm 0,5)$  l in  $(60 \pm 2)$  s;
- for Programme B,  $(15 \pm 0,5)$  l in  $(60 \pm 2)$  s.

However, in order to improve the reproducibility, it is recommended that the hot water temperature is maintained at  $(93 \pm 1)$  °C.

**5.5 Plugs or other closures**, to seal, temporarily, the water outlet (see 7.1 and 7.4).

**5.6 Device**, capable of measuring pipe sagging as shown in [Figures 1](#) to [3](#), as applicable, to an accuracy of 0,1 mm.

**5.7 Brackets**, comprising anchor brackets (for fixed points) capable of restraining piping components and guide brackets capable of supporting piping components without inhibiting longitudinal movement (see [Clause 6](#) and [Figures 1](#) to [3](#)).

The brackets shall be chosen according to the documentation of the pipe and/or fitting manufacturer.

**5.8 Supporting element**, intended to support the test assembly, consisting of a firm wall or frame, using both anchor and guide brackets.

## 6 Test assembly

### 6.1 General

Unless otherwise specified in the product standard, the test assembly shall comprise a vertical branch and two adjacent horizontal branches, in accordance with [Figures 1](#) and [2](#) (for  $d_n \geq 40$  mm) or [Figure 3](#) (for  $d_n < 40$  mm).

[Figures 1](#) to [3](#) are also applicable for other types of joints (e.g. cemented joints, welded joints, lip seal joints).

It is not permitted to compensate axial misalignment with additional fittings.

Appropriate reduction fitting may be introduced for DN changes, provided that the invert level is maintained.

Injection moulded components in the horizontal branch shall be assembled such that the weld lines are in the invert, if possible.

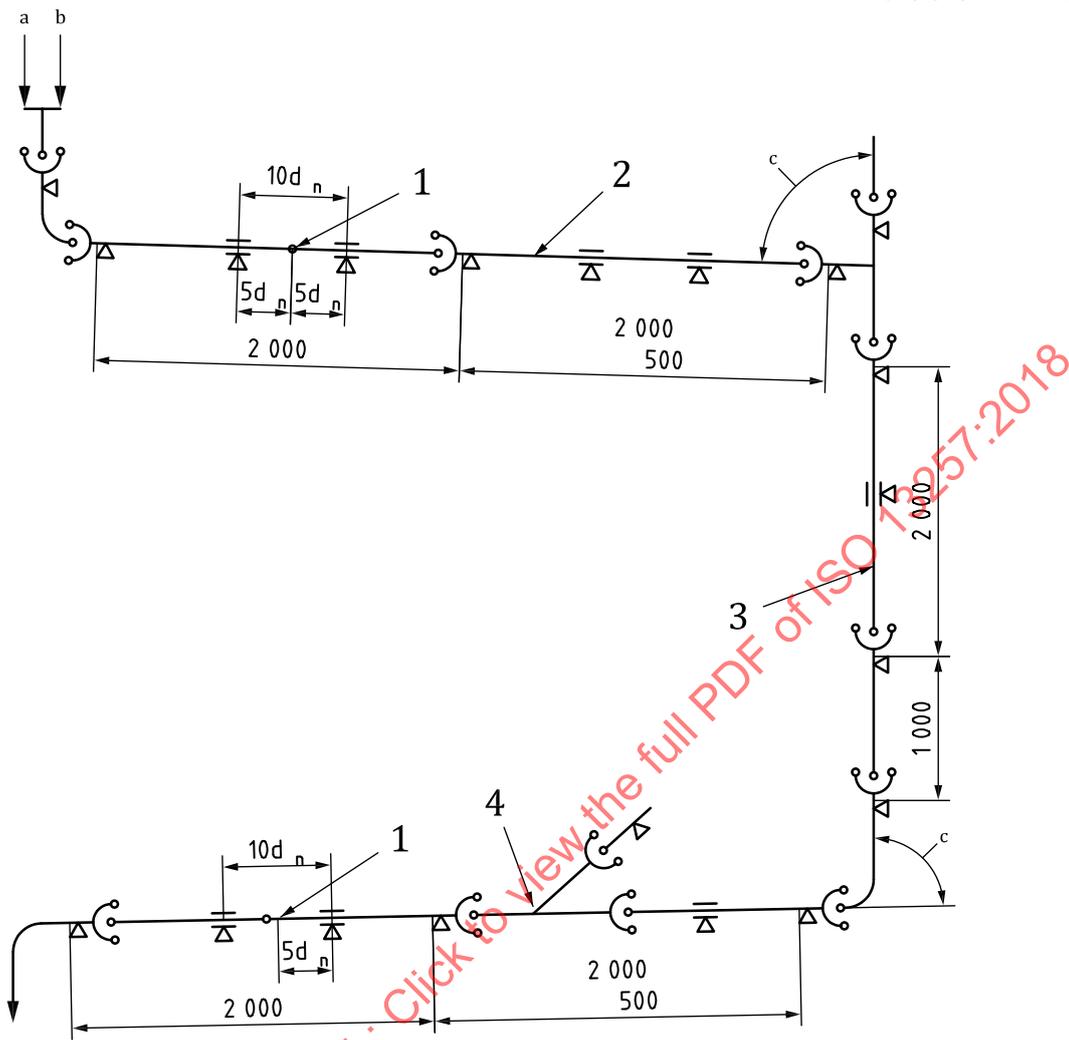
All lengths have a tolerance of  $\pm 10$  mm in [Figures 1](#), [2](#) and [3](#).

### 6.2 Assembly for pipes with integral socket (for $d_n \geq 40$ mm)

Pipes with an integral socket and fittings with socket and spigot shall be tested according to [Figure 1](#).

### 6.3 Assembly for pipes without integral sockets (for $d_n \geq 40$ mm).

Pipes without integral socket and fittings with sockets shall be tested according to [Figure 2](#).



**Key**

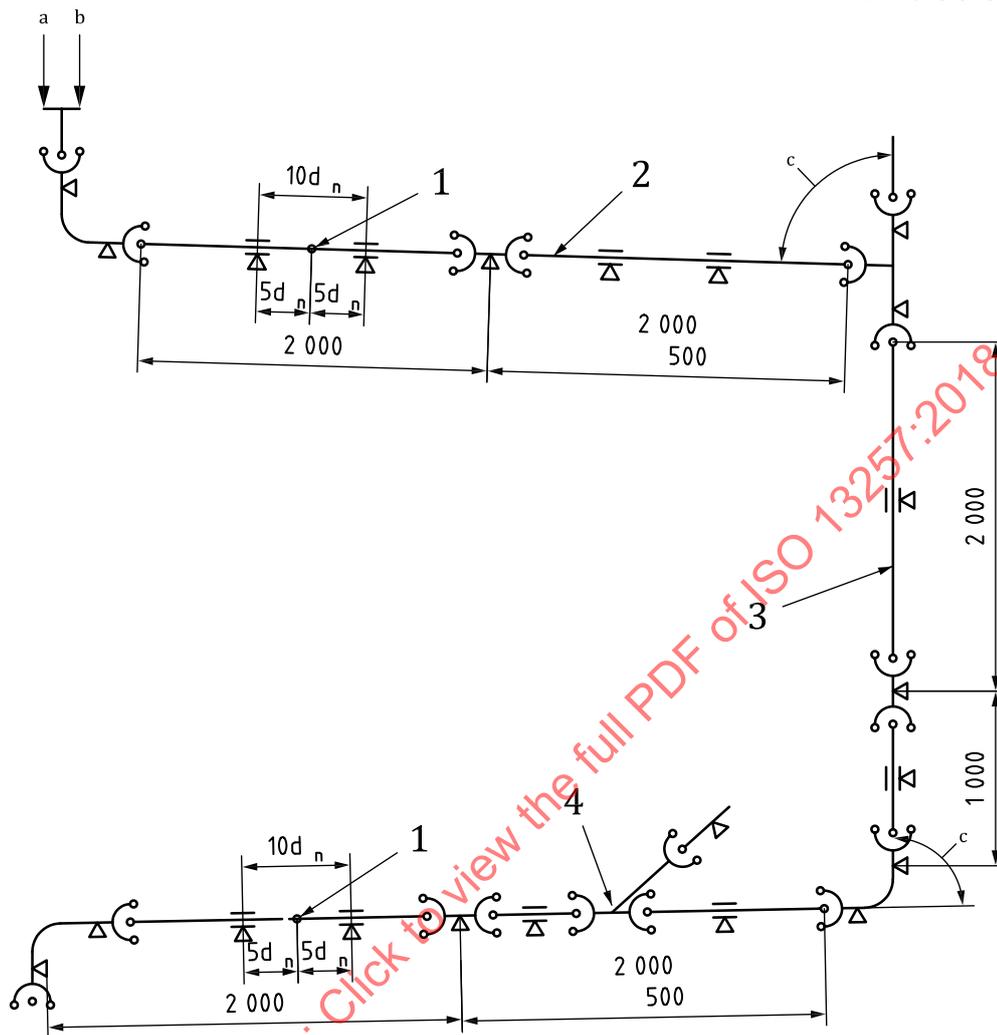
- |   |  |   |  |
|---|--|---|--|
| 1 | sagging measuring point (see 6.4)  | a | Hot water.   |
| 2 | pipe: $d_n = 40$ mm or $d_n = 50$ mm   | b | Cold water.  |
| 3 | pipe: $75 \text{ mm} \leq d_n \leq 160$ mm   | c | Angle $\alpha: 85^\circ \leq \alpha \leq 89^\circ$ . |
| 4 | pipe: $75 \text{ mm} \leq d_n \leq 160$ mm for piping systems intended to be used inside building, with an additional branch $45^\circ$ or $90^\circ$                                    |   |  |
|   | pipe: $75 \text{ mm} \leq d_n \leq 200$ mm for piping systems intended to be used buried in the ground within the building structure, with an additional branch $45^\circ$ or $90^\circ$ |   |  |

NOTE 1 In this test assembly, joints with elastomeric ring seals are given as examples.

NOTE 2 Where both distances 2 000 mm and 500 mm are indicated, any distance between 500 mm and 2 000 mm is allowed.

**Figure 1 — Test assembly for piping systems with components  $d_n \geq 40$  mm — Pipes with integral socket and fittings with socket and spigot**

Dimensions in millimetres



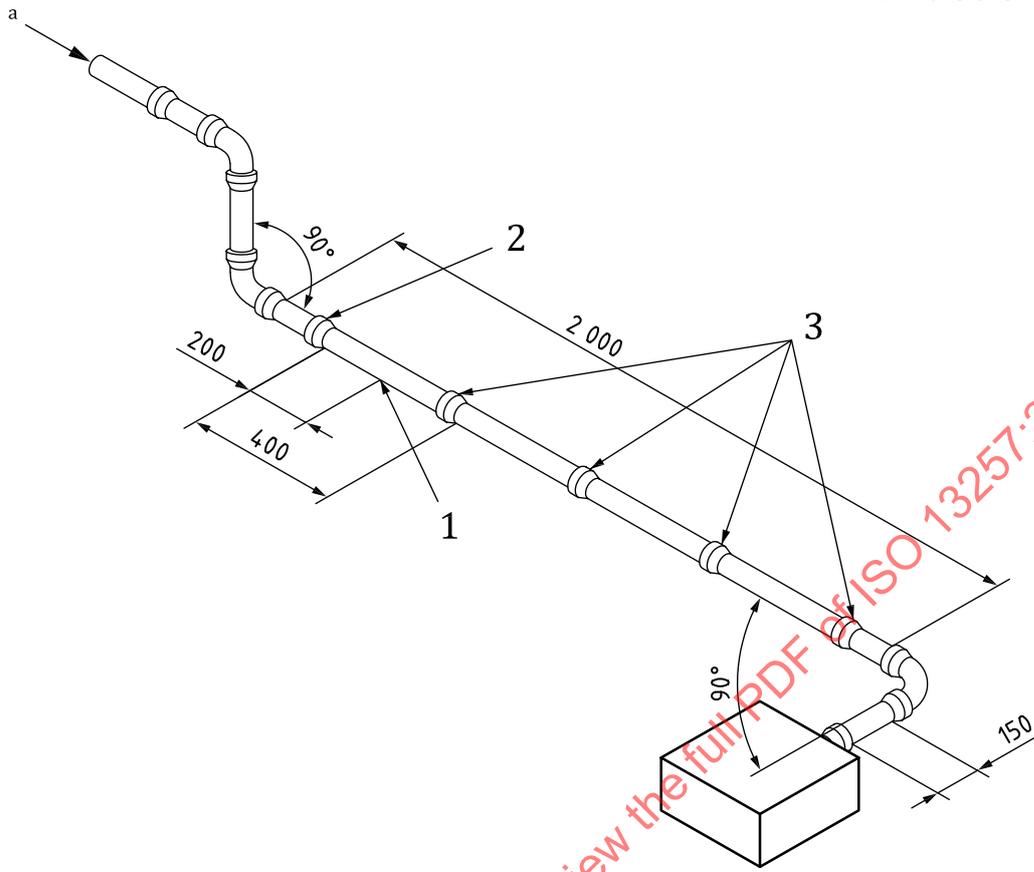
**Key**

- |   |  |   |   |
|---|--|---|---|
| 1 | sagging measuring point (see 6.4)  | a | Hot water.  |
| 2 | pipe: $d_n = 40 \text{ mm}$ or $d_n = 50 \text{ mm}$   | b | Cold water.   |
| 3 | pipe: $75 \text{ mm} \leq d_n \leq 160 \text{ mm}$   | c | Angle $\alpha$ : $85^\circ \leq \alpha \leq 89^\circ$ . |
| 4 | pipe: $75 \text{ mm} \leq d_n \leq 160 \text{ mm}$ for piping systems intended to be used inside building, with an additional branch $45^\circ$ or $90^\circ$                                    |   |   |
|   | pipe: $75 \text{ mm} \leq d_n \leq 200 \text{ mm}$ for piping systems intended to be used buried in the ground within the building structure, with an additional branch $45^\circ$ or $90^\circ$ |   |   |

NOTE 1 In this test assembly, joints with elastomeric ring seals are given as examples.

NOTE 2 Where both distances 2 000 mm and 500 mm are indicated, any distance between 500 mm and 2 000 mm is allowed.

**Figure 2 — Test assembly for piping systems with components  $d_n \geq 40 \text{ mm}$  — Pipes without integral socket and fittings with sockets**



**Key**

- 1 sagging measuring point
- 2 anchor bracket (for fixed point)
- 3 guide bracket
- a Water inlet.

**Figure 3 — Test assembly for piping systems with components  $d_n < 40$  mm**

**6.4 Mounting**

The mounting of the test assembly shall be carried out in accordance with the manufacturer's instructions and any applicable recommended practice for installation.

The test assembly shall be mounted as close as possible to a firm frame or wall, using both anchor and guide brackets, according to [Figures 1 to 3](#).

It is recommended that the horizontal branches are supported by brackets in a vertical position.

The firm frame or wall shall ensure a correct alignment of pipes and fittings to prevent any additional stress on the test samples. The firm frame or wall shall provide the same angles as the fittings, especially in the connection area of the stack with horizontal parts.

The temperature shall be measured at a maximum distance of 0,5 m from the assembly inlet.

The sagging measurement point shall be located in the middle of free length of the pipe. This point becomes the midpoint between the guide brackets separated by  $10d_n$ , as shown in [Figures 1 and 2](#), or the brackets separated by 400 mm, as shown in [Figure 3](#), as applicable.

Care shall be taken to prevent fittings in the lowest position from supporting the weight of the whole vertical stack in order to avoid additional stresses.

## 6.5 Anchoring

When supporting pipes with integral sockets, anchor brackets shall be located directly on, below or behind the sockets of each pipe length.

Where supporting fittings, anchor brackets shall be fixed on the socket.

When located below or behind the sockets, the anchor bracket shall be placed at a distance as small as possible and not more than the value of  $d_n$  from the base of the socket.

Guide brackets for adjacent horizontal assemblies shall be placed at a distance of not less than  $10d_n$  apart, with a maximum distance of 1,5 m.

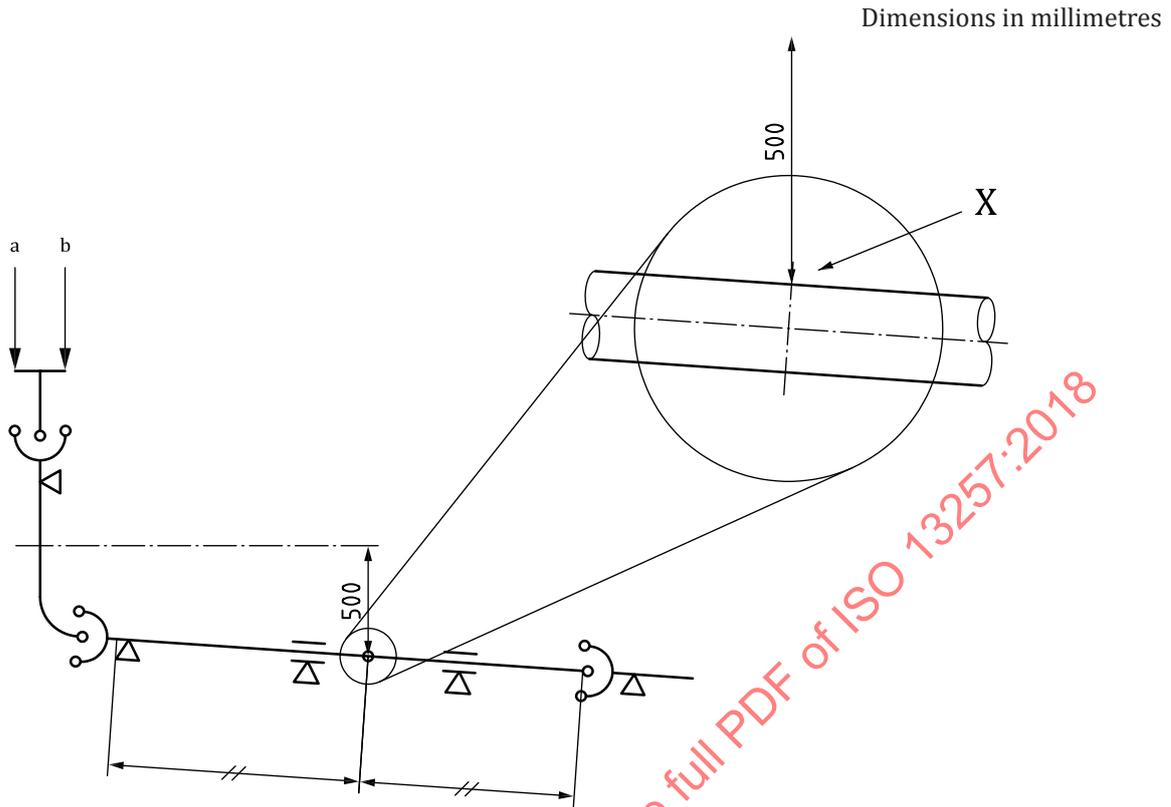
For adjacent horizontal lines, the unsupported distance shall not be in excess of  $10d_n$  otherwise additional support shall be added.

Mounting and supporting shall avoid obstacle to expansion between fixed points. Therefore an expansion gap shall be left in all sockets, except when connecting to spigot end of fittings, according to manufacturer's guidance. For solvent welded assemblies, the expansion gap can be provided by introducing an expansion coupler.

The inlet of hot water into the test assembly shall be direct, i.e. there shall be no heat-absorbing intermediate pieces.

## 7 Procedure

**7.1** Fill the test assembly with water, at a temperature not exceeding 20 °C, to a head of 500 mm above the pipe at the centreline of the upper horizontal pipe (see [Figure 4](#)).



**Key**

- X base of the 500 mm water column
- a Hot water.
- b Cold water.

NOTE In this test assembly, joints with elastomeric ring seals are given as examples.

**Figure 4 — Measurement point of the column of water**

Leave for a minimum period of 15 min and then visually check for, and record, any leaks.

**7.2** If any leaks are observed, check and rectify the joint assembly (see [Clause 6](#)) and repeat the watertightness test given in [7.1](#).

If any further leaks are observed, stop the test and report the observations in accordance with [Clause 8](#).

If no further leaks are observed, proceed in accordance with [7.3](#) to [7.4](#).

**7.3** While monitoring the test assembly for any signs of leaks or changes of appearance, subject the test assembly to the passage of hot and cold water for 1 500 cycles of either Programme A or Programme B (according to [5.3](#) and [5.4](#)), as applicable, as follows. In case of dispute, maintain the temperature at  $(20 \pm 5) ^\circ\text{C}$ .

Programme A (nominal flow rate 30 l/min), for components with  $d_n \geq 40$  mm:

- a)  $(30 \pm 0,5)$  l of water at  $(93 \pm 2) ^\circ\text{C}$ , measured at the point of inlet, over a period of  $(60 \pm 2)$  s;
- b) rest and drain period of  $(60 \pm 2)$  s;
- c)  $(30 \pm 0,5)$  l of water at  $(15 \pm 5) ^\circ\text{C}$ , measured at the point of inlet, over a period of  $(60 \pm 2)$  s;
- d) rest and drain period of  $(60 \pm 2)$  s;