INTERNATIONAL STANDARD

ISO 10508

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Thermoplastics pipes and fittings for hot and cold water systems

Tubes et raccords en matières thermoplastiques destinés aux systèmes d'eaux chaude et froide

Reference number
ISO 10508:1995(E)

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.

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.

International Standard ISO 10508 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 2, *Plastics pipes and fittings for water supplies*.

Annexes A, B and C form an integral part of this International Standard. Annexes D, E and F are for information only.

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Introduction

The mechanical properties required are outlined in the relevant product standard.

Only thermoplastics pipes and their associated fittings are dealt with in this International Standard and for these purposes crosslinked polyethylene is to be considered as a thermoplastics material.

NOTES

1 Not all plastics formulations allow for extended outside storage of pipes or fittings. The user should contact the manufacturer of the pipe or fitting before considering long-term external storage.

2 Plastics pipes and plastics fittings should only be directly connected to a heat-generating source when recommended by the pipe or fittings manufacturer.

Thermoplastics pipes and fittings for hot and cold water systems

1 Scope

This International Standard specifies the performance requirements for hot and cold water pressure systems which use plastics pipes and plastics or metal fittings.

Acceptance of any pipe(s) and/or fitting(s) made from a specific grade of material is subject to the relevant product standard and the requirements detailed in this International Standard.

It establishes a classification system for common service conditions for pressurized hot and cold water systems. It gives a basis for evaluation and design of thermoplastics pipes and fittings in relation to the system performance requirements.

It applies to plastics pipe systems used in association with buildings to carry water under operating pressures of 4 bar, 6 bar or 10 bar[1] for:

a) distribution of hot and cold water including potable water;

b) transportation of hot water for heating.

This International Standard does not apply to systems for fire fighting and heating systems which do not use water as a heating medium.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 3458:1976, *Assembled joints between fittings and polyethylene (PE) pressure pipes — Test of leakproofness under internal pressure.*

ISO 3501:1976, *Assembled joints between fittings and polyethylene (PE) pressure pipes — Test of resistance to pull out.*

ISO 3503:1976, *Assembled joints between fittings and polyethylene (PE) pressure pipes — Test of leakproofness under internal pressure when subjected to bending.*

ISO 7686:1992, *Plastics pipes and fittings — Opacity — Test method.*

ISO/TR 9080:1992, *Thermoplastics pipes for the transport of fluids — Methods of extrapolation of hydrostatic stress rupture data to determine the long-term hydrostatic strength of thermoplastics pipe materials.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 operating temperature, T_o: A temperature or a combination of temperatures of the transported water for which the system has been designed.

3.2 maximum operating temperature, T_{max}: An exceptional high operating temperature occurring for short periods only.

1) 1 bar = 0,1 MPa

3.3 malfunction temperature, T_m: An excessive temperature that may occur when the control device malfunctions.

NOTE 3 This may occur up to a total of 100 h over a period of 50 years.

3.4 cold water temperature, T_c: The temperature of the cold water transported (taken to be 20 °C).

3.5 operating pressure, p_o: The pressure of the transported water for which the system has been designed.

3.6 treated water: Water containing additives approved by the plastics pipe and fittings manufacturer and systems suppliers.

4 Classification of service conditions

The performance requirements are formulated for five different classes and are shown in table 1. Each class relates to a field of application and for a design period of 50 years. The derivation of the temperature-time profiles is given in annex D. These applications are given as a guideline and are not binding. In countries with extreme weather conditions other classes may be preferred.

For applications not given in table 1 the choice of the proper classification shall be agreed by the parties concerned.

All materials coming into contact with water intended for human consumption up to a temperature of 80 °C shall not present any health risk.

All systems of components for use with and in contact with potable water shall meet the water quality and health regulations operating in the country of use.

All systems which satisfy the conditions specified in table 1 for one of the five classes shall also be suitable for the transportation of cold water for a period of 50 years at a temperature of 20 °C and an operating pressure of 10 bar. This shall be demonstrated by using the standard extrapolation method specified in ISO/TR 9080, or another appropriate extrapolation method.

When the specified service life is less than 50 years all the times given in table 1 shall be reduced by a proportionate amount, except for the time for malfunction, which shall remain at 100 h.

Table 1 — Classification of service conditions

Class	T_o		T_{max}		T_m		Example of application
	°C	time[1] years	°C	time years	°C	time h	
1 [2]	60	49	80	1	95	100	Hot water supply (60 °C)
2 [2]	70	49	80	1	95	100	Hot water supply (70 °C)
3 [3]	30 40	20 25	50	4,5	65	100	Low-temperature underfloor heating
4	40 60	20 25	70	2,5	100	100	Underfloor heating and low-temperature radiators
5 [4]	60 80	25 10	90	1	100	100	High-temperature radiators

1) Where more than one figure for time and associated temperature appears for any class they should be aggregated. Note that systems do not always operate continuously throughout the design period, so that times of operation do not necessarily add up to 50 years for a service life of 50 years. Any balancing time required (to make the time equal to the service life) shall be at a temperature of 20 °C.

2) Depending upon international, national or local regulations.

3) Only allowed when the malfunction temperature cannot rise above 65 °C.

4) This International Standard is only applicable to sealed systems which do not have values of T_o, T_{max} and T_m in excess of those stated for class 5.

All heating installations should only use water or treated water as the transfer fluid. When considering problems of material compatibility such as oxygen permeation, advice should be sought from the manufacturer.

The thermal stability of the material used for the pipes or fittings shall conform to the requirements of the relevant product standard, for the intended application.

When the pipes are stated to be opaque they shall meet the requirements of ISO 7686.

5 Dimensions

5.1 Calculation

The appropriate class shall be determined for each intended application. Using the standard extrapolation method or another appropriate extrapolation method, the maximum allowable stress relative to a design period of 50 years shall be calculated by applying Miner's rule (see also annex E) with appropriate factors (see 5.2).

The lowest value of either

a) $\frac{\sigma}{p_o}$

where

σ is the design stress of the particular class;

p_o is the operating pressure of 4 bar, 6 bar or 10 bar;

or

b) $\frac{\sigma_1}{p_1}$

where

σ_1 is the design stress (incorporating a factor) at 20 °C relative to a design period of 50 years;

p_1 is the design pressure of 10 bar;

shall be determined. This lowest value shall then be used to determine the minimum design wall thickness by solving the following equation:

$$\frac{\sigma}{p} = \frac{d - e}{2e}$$

where

$\frac{\sigma}{p}$ is taken from a) or b);

d is the nominal outside diameter;

e is the minimum design wall thickness.

5.2 Factors

When calculating the maximum allowable hoop stress, the factors to be applied to the T_o, T_{max} and T_m components of the temperature profile and to T_c are detailed in the relevant product standard.

6 Fittings

6.1 The plastics material from which a fitting is made shall be approved for its application by testing the material in pipe form, and then applying ISO/TR 9080 or another appropriate extrapolation method. The material shall meet the control points as given in the product standard of that plastics material.

6.2 The plastics fittings made from these materials shall be approved by testing based on the material properties as established under 6.1. These test requirements shall take into account the end-use application and the type of fitting.

7 Fitness for purpose

7.1 Hydrostatic pressure resistance of fittings and joint assemblies

When tested in accordance with ISO 3458 there shall be no leakage from pipes, fittings or joints when subjected to the following conditions:

a) an internal hydraulic pressure equal to 1,5 times the operating pressure p_o for a period of at least 1 h at 20 °C ± 2 °C;

b) an internal hydraulic pressure for a period of 1 000 h at 95 °C ± 2 °C (for accelerated ageing) of a value determined by dividing the 1 000 h expected stress level for the pipe material by $(d - e)/2e$ (see clause 5).

7.2 Thermal cycling

When tested in accordance with annex A (for flexible pipes) or annex B (for rigid pipes) as appropriate, there shall be no leakage from pipes, fittings or joints after completion of the following: 5 000 cycles each of duration 30 min ± 2 min at a constant internal pressure equal to the operating pressure p_o (4 bar, 6 bar or 10 bar). Each cycle shall comprise 15 min of cold water (at temperature 20 °C ± 2 °C) and 15 min

of hot water (at T_{max} + 10 °C, but not exceeding 90 °C).

7.3 Cyclic pressure shock

When tested at 23 °C ± 2 °C in accordance with annex C there shall be no leakage from pipes, fittings or joints after completing 10 000 cycles of alternate internal positive pressures of 1 bar ± 0,5 bar and 15 bar ± 0,5 bar at a frequency of at least 30 pressure cycles per minute.

7.4 Resistance to pull-out of assembled joint

When tested in accordance with ISO 3501, socket(s) of the fitting shall retain the pipe(s) when subjected to the following conditions:

a) a constant tension, calculated from a pressure of 15 bar for all service conditions, applied to the total cross-sectional area of the pipe, based on its nominal outside diameter, d, for 1 h at 23 °C ± 2 °C;

b) a constant tension, calculated from a pressure of 4 bar, 6 bar or 10 bar for the service condition, applied to the total cross-sectional area of the pipe, based on its nominal outside diameter, d, for 1 h at T_{max} + 10 °C.

7.5 Resistance to bending of assembled joint

This test shall only be conducted when pipes manufactured from materials having a modulus of elasticity, determined in flexure, less than or equal to 2 000 N/mm^2 are involved.

When tested in accordance with ISO 3503, there shall be no leakage from the joint assemblies when subjected to an internal hydraulic pressure of 15 bar for at least 1 h at 23 °C.

8 Quality control testing

Details of quality control tests are given in the appropriate product standards.

9 Appearance

The surfaces of the pipe or fitting shall be clean, smooth and free from grooving and other features that would prevent conformity to this International Standard or to the relevant product standard.

10 Marking

10.1 Pipes

Pipes which comply with this International Standard shall be indelibly marked with the following information at intervals not exceeding 1 m:

a) the manufacturer's identification, as a clear text or logo;

b) reference to this International Standard, i.e. ISO 10508:1995;

c) material identification;

d) class and design pressure;

e) nominal size and wall thickness;

f) date of manufacture or code.

10.2 Fittings

Fittings which comply with this International Standard shall be marked with the following information:

a) the manufacturer's identification, as a clear text or logo;

b) reference to this International Standard, i.e. ISO 10508:1995;

c) material identification of the fitting body;

d) class and design pressure;

e) nominal size(s);

f) date of manufacture or code.

In cases where marking of the actual component is restricted or not practicable, for example because of the size or form of the fitting, each fitting shall carry the manufacturer's identification and shall be supplied in a parcel or with a label where the parcel or label is marked with the information required in b) to f) which does not appear on the fitting.

Annex A
(normative)

Test method for resistance to thermal cycling for flexible pipes

A.1 Principle

An assembly of pipes and fittings is subjected to thermal cycling by the passage of water and then inspected for leakage.

A.2 Apparatus

The apparatus comprises means of circulating hot and cold water (alternately) through the test assembly, means of regulating the water pressure in the test assembly and means of measuring the water temperature at the inlet to and outlet from the test assembly. The equipment shall be capable of effecting each change between hot and cold sources within a specified period.

A.3 Test assembly

The test assembly shall comprise pipes and fittings jointed and clipped in accordance with the manufacturer's recommended practice.

The test assembly shall include

a) at least one pair of pre-stressed pipes linked by a straight connector, as shown in figure A.1 (see branch A) and stressed in accordance with A.4, where the free length of such combination shall be 3 m ± 5 mm;

b) at least two straight pipes, each free to move when connected as shown in figure A.1 (see branch B) and each having a free length of 300 mm ± 5 mm;

c) at least one bent pipe in accordance with figure A.1 (see branch C). Each pipe shall be supported by its ends.

The actual dimension ratios given in figure A.2 shall be specified in the relevant product standards. If no dimension ratios are specified, the values given in figure A.2 shall apply. In this case, the free length of pipe shall be $27d$ to $28d$ (where d is the nominal outside diameter of the pipe) or, alternatively, a smaller length which enables the smallest pipe bending radius (as stated by the manufacturer) to be formed.

If the wall thickness and/or outside diameter of the pipe is such that it cannot be bent to a radius, the test procedure given in annex B shall apply.

A.4 Procedure

Prepare the assembly for testing and prime it with water so that all air is excluded.

Subject the test pieces to be prestressed to a sustained tensile stress equivalent to that induced by contraction if subjected to a temperature drop of 20 °C.

After allowing conditioning at the test temperature for at least 1 h, lock the extreme ends of the free length of branch A in position whilst under prestress. Subject the assembly to the specified cycles of hot and cold water at the pressures, temperatures and durations applicable to the class of pipe and/or fittings under test. Perform any desired tightening or adjustment of joints within the first 5 cycles.

Control the flow rate of the circulating water so that the measured temperature drop on the hot cycle from the inlet to the outlet of the test assembly does not exceed 5 °C.

NOTE 4 To minimize temperature differences, balancing valves or series connections may be necessary in parts of the circuit.

On completion of the cyclic test schedule, inspect all joints for signs of leakage.

A.5 Test report

The test report shall include the following information:

a) reference to this International Standard and test method;

b) identification of the components under test;

c) the test conditions;

d) any observations of signs of leakage;

e) the period of test (dates between which the thermal cycling test schedule was conducted).

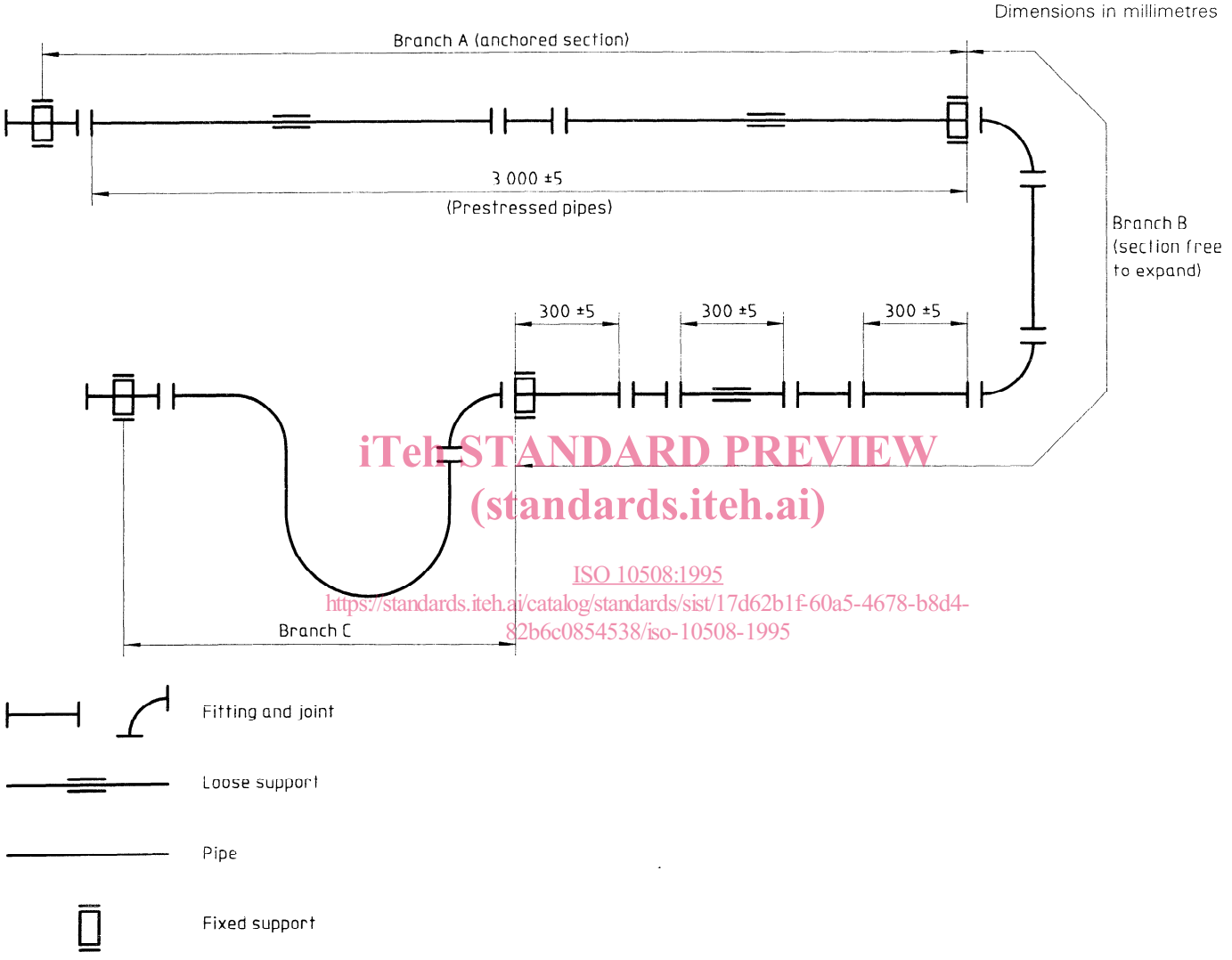
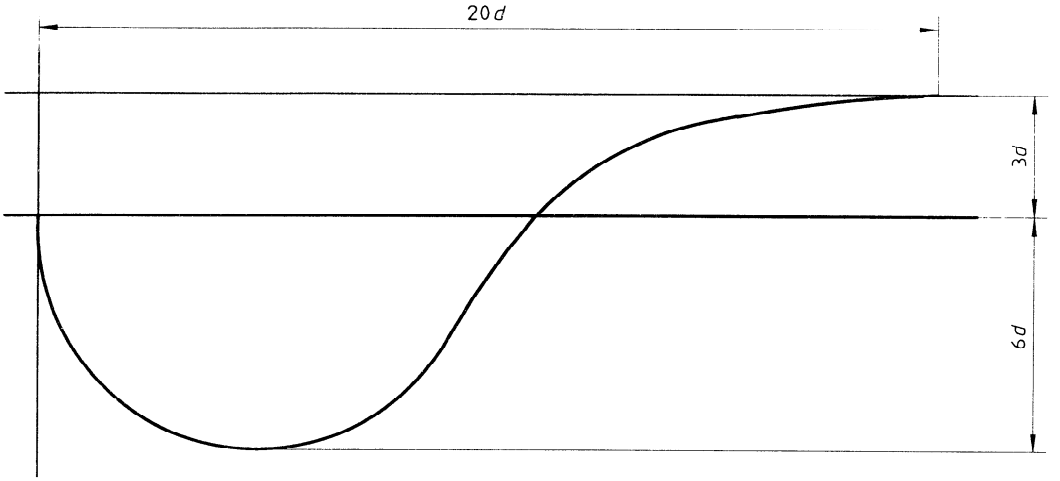


Figure A.1 — Test assembly for systems based on flexible pipes

Dimensions in millimetres



NOTE — If not otherwise specified, the free length of pipe shall be 27d to 28d (where d is the nominal outside diameter of the pipe) or, alternatively, a smaller length which enables the smallest pipe bending radius (as stated by the manufacturer) to be formed.

Figure A.2 — Configuration of bent flexible pipes for thermal cycling test