INTERNATIONAL STANDARD

ISO 21003-3

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Multilayer piping systems for hot and cold water installations inside buildings —

Part 3: Fittings

Systèmes de canalisations multicouches pour installations d'eau chaude et froide à l'intérieur des bâtiments —

Partie 3: Raccords

Reference number
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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 21003-3 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*.

ISO 21003 consists of the following parts, under the general title *Multilayer piping systems for hot and cold water installations inside buildings*:

— *Part 1: General*

— *Part 2: Pipes*

— *Part 3: Fittings*

— *Part 5: Fitness for purpose of the system*

— *Part 7: Guidance for the assessment of conformity* [Technical Specification]

NOTE ISO 21003 does not include a Part 4: *Ancillary equipment*, or a Part 6: *Guidance for installation*.

Introduction

The system standard of which this is Part 3 specifies the requirements for a multilayer piping system.

The multilayer piping system is intended to be used for hot and cold water installations inside buildings.

In respect of potentially adverse effects on the quality of water intended for human consumption caused by the products covered by ISO 21003:

— no information is provided as to whether the products may be used without restriction in any of the member states of the EU or EFTA;

— it should be noted that, while awaiting the adoption of verifiable European criteria, existing national regulations concerning the use and/or the characteristics of these products remain in force.

Requirements and test methods for materials and components other than fittings are specified in ISO 21003-1 and ISO 21003-2. Characteristics for fitness for purpose (mainly for joints) are covered in ISO 21003-5. ISO/TS 21003-7 gives guidance on the assessment of conformity.

This part of ISO 21003 specifies the characteristics of fittings.

Other system standards which, at the date of publication of this part of ISO 21003, had been published for plastics piping systems used for the same application are listed in Annex A.

Multilayer piping systems for hot and cold water installations inside buildings —

Part 3: Fittings

1 Scope

This part of ISO 21003 specifies the characteristics of fittings for multilayer piping systems intended to be used for hot and cold water installations inside buildings for the conveyance of water — whether or not the water is intended for human consumption (domestic systems) or for heating systems — under specified design pressures and temperatures appropriate to the class of application (see Table 1 of ISO 21003-1:2008).

It also specifies the test parameters for the test methods referred to in this part of ISO 21003.

ISO 21003 is a reference product standard. It is applicable to multilayer pipes, fittings, their joints, and also to joints with components made of other plastics and non-plastics materials intended to be used for hot and cold water installations. This part of ISO 21003 is intended for use only in conjunction with all the other parts of ISO 21003.

This part of ISO 21003 covers fusion, solvent-cemented and mechanical fittings for a range of service conditions (application classes) and design pressures. It is not applicable for values of design temperature, T_D, maximum design temperature, T_{max}, and malfunction temperature, T_{mal}, in excess of those in Table 1 of ISO 21003-1:2008.

NOTE 1 It is the responsibility of the purchaser or specifier to make the appropriate selections from these aspects, taking into account their particular requirements and any relevant national regulations and installation practices or codes.

The polymeric materials used for the stress-designed layers are the following: polybutylene (PB), polyethylene of raised temperature resistance (PE-RT), crosslinked polyethylene (PE-X), polypropylene (PP) and chlorinated poly(vinyl chloride) (PVC-C).

The PE-X used shall be fully crosslinked and shall comply with the requirements of the relevant reference product standard (ISO 15875).

NOTE 2 For the purposes of ISO 21003, crosslinked polyethylene (PE-X) as well as adhesives are considered as thermoplastic materials.

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 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 1167-1, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 1: General method*

ISO 1167-2, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 2: Preparation of pipe test pieces*

ISO 1167-3, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 3: Preparation of components*

ISO 1167-4, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 4: Preparation of assemblies*

ISO 3126, *Plastics piping systems — Plastics components — Determination of dimensions*

ISO 7686, *Plastics pipes and fittings — Determination of opacity*

ISO 9080, *Plastics piping and ducting systems — Determination of the long-term hydrostatic strength of thermoplastics material in pipe form by extrapolation*

ISO 15874-3, *Plastics piping systems for hot and cold water installations — Polypropylene (PP) — Part 3: Fittings*

ISO 15875-3, *Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X) — Part 3: Fittings*

ISO 15876-3, *Plastics piping systems for hot and cold water installations — Polybutylene (PB) — Part 3: Fittings*

ISO 15877-3, *Plastics piping systems for hot and cold water installations — Chlorinated poly(vinyl chloride) (PVC-C) — Part 3: Fittings*

ISO 21003-1:2008, *Multilayer piping systems for hot and cold water installations inside buildings — Part 1: General*

ISO 21003-2, *Multilayer piping systems for hot and cold water installation inside buildings — Part 2: Pipes*

ISO 21003-5, *Multilayer piping systems for hot and cold water installations inside buildings — Part 5: Fitness for purpose of the system*

ISO 22391-3:—[1)], *Plastics piping systems for hot and cold water installations — Polyethylene of raised temperature resistance (PE-RT) — Part 3: Fittings*

EN 681-1, *Elastomeric seals — Materials requirements for pipe joint seals used in water and drainage applications — Part 1: Vulcanized rubber*

EN 681-2, *Elastomeric seals — Materials requirements for pipe joint seals used in water and drainage applications — Part 2: Thermoplastic elastomers*

EN 1254-3, *Copper and copper alloys — Plumbing fittings — Part 3: Fittings with compression ends for use with plastics pipes*

EN 10088-1, *Stainless steels — Part 1: List of stainless steels*

EN 10226-1, *Pipe threads where pressure tight joints are made on the threads — Part 1: Taper external threads and parallel internal threads — Dimensions, tolerances and designation*

1) To be published. (Revision of ISO 22391-3:2007)

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21003-1 and the following apply.

3.1
fitting
piping system component which connects two or more pipes and/or fittings together without any further function

NOTE 1 Examples of mechanical fittings are compression fittings, crimped fittings, flanged fittings, flat seat union fittings and push fittings.

NOTE 2 Examples of fusion fittings are socket fusion fittings, electrofusion fittings, fittings with incorporated inserts and solvent-cemented fittings.

4 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviated terms given in ISO 21003-1 apply.

5 Material characteristics

5.1 Plastics fitting materials specified in reference product standards

When applicable, the material characteristics shall be evaluated in accordance with the relevant reference product standards (see Annex A).

Clean own reprocessable material (excluding PE-X) which is the same as the virgin material may be added to that virgin material. External reprocessable material shall not be used.

5.2 Plastics fitting materials not specified in reference product standards

The fitting material in the form of injection-moulded tubular test pieces or extruded pipe shall be evaluated by the method given in ISO 9080, or equivalent, by internal pressure testing carried out in accordance with the relevant parts of ISO 1167. In addition, the thermal stability shall be evaluated at 110 °C for 1 year.

If evaluation using the method given in ISO 9080, or equivalent, is available from long-term internal pressure tests on extruded pipes of the same compound as used for the fitting, the hydrostatic stress levels shall be determined at the test temperatures and for the test times given in Table 1.

Table 1 — Determination of the control points for testing fitting materials

	All application classes	Application class			
		Class 1	Class 2	Class 4	Class 5
Maximum design temperature, T_{max}, in °C	—	80	80	70	90
Test temperature, T_{test}, in °C	20	95 [a]	95 [a]	80	95
Test duration, in h	1	1 000	1 000	1 000	1 000

[a] Conducted at 95 °C to suit existing test facilities.

It is recommended that the nominal diameter of the injection-moulded tubular test pieces be in the range of nominal diameters of fittings normally produced by the manufacturer.

5.3 Metallic fitting material

Metallic material for fittings intended to be used with components conforming to ISO 21003-5 shall conform to the requirements given in EN 1254-3 or EN 10088-1, as applicable.

5.4 Influence on water intended for human consumption

All materials of the multilayer piping system, when in contact with water which is intended for human consumption, shall not affect the quality of the drinking water and shall be in compliance with national regulations.

6 General characteristics

6.1 Appearance

When viewed without magnification, the internal and external surfaces of fittings shall be smooth, clean and free from any scoring, cavities and other surface defects that would prevent conformance with this part of ISO 21003. The material shall contain no visible impurities. Slight variations in colour are permitted. Each end of the fitting shall be square to the fitting axis.

6.2 Opacity

Fittings that are declared to be opaque shall not transmit more than 0,2 % of visible light, when tested in accordance with ISO 7686. The test shall be carried out on the fitting with the smallest wall thickness in the manufacturer's range.

7 Geometrical characteristics

7.1 General

7.1.1 Measurement

Dimensions shall be measured in accordance with ISO 3126.

7.1.2 Nominal diameters

The nominal diameter(s), d_n, of a fitting shall correspond to, and be designated by, the nominal inside or outside diameter(s) of the pipe, conforming to ISO 21003-2, for which they are designed.

7.1.3 Angles

The preferred nominal angles for elbows are 45° and 90°.

7.1.4 Threads

Threads used for jointing shall conform to EN 10226-1. Where a thread is used as a fastening thread for jointing an assembly (e.g. union nuts), it shall conform to ISO 228-1, although these requirements need not apply to the threads used by the manufacturer to join component parts of a fitting together.

7.2 Dimensions of sockets for socket weld, electrofusion and solvent-cemented fittings

The principal dimensions of these types of fitting shall be in accordance with the requirements in the reference product standards.

7.3 Dimensions of metallic fittings

Metallic fittings shall conform to EN 1254-3.

8 Mechanical characteristics of plastics fittings (internal pressure test)

8.1 General

When the fitting is tested by the procedure specified in ISO 1167-1, preparing the test pieces in accordance with ISO 1167-3 and using the test parameters given in Table 2, where the test pressure is given in relation to the class of fitting and the design pressure, the fitting shall withstand the test pressure, p_F, without bursting or leakage, for the specified test duration.

The test shall be conducted as a “water-in-air” test. All fitting types shall be tested.

The test pressure shall be calculated using the following equation:

$$p_F = p_D \times \frac{\sigma_F}{\sigma_{DF}}$$

where

p_F is the hydrostatic test pressure, in bars, to be applied to the fitting body during the test period;

σ_F is the value of the hydrostatic stress, in megapascals, for the fitting body material, as determined for the appropriate service condition class from data produced in accordance with the reference product standard or ISO 9080;

σ_{DF} is the design stress value, in megapascals, for the fitting body material, as determined for the appropriate service condition class from data produced in accordance with the reference product standard or ISO 9080;

p_D is the applicable design pressure.

Fittings may be connected to the pipes with which they are intended to be used. Other methods may also be used to seal the ends of the fitting body in order that the required pressure can be applied.

8.2 Plastics fitting materials specified in reference product standards

The mechanical characteristics of such plastics fitting materials shall meet the requirements specified in the reference product standards.

8.3 Plastics fitting materials not specified in reference product standards

Materials for such fittings which are intended to be used in multilayer piping systems for the conveyance of hot and cold water within buildings, whether or not the water is intended for human consumption (domestic use) or for heating systems, shall conform to the requirements of Table 2. Use the test temperature and minimum time to failure applicable to the class of fitting and design pressure, and use the relevant values for hydrostatic stress, σ_F, and design stress, σ_{DF}, derived as in 5.2, to determine the test pressure, p_F.

Table 2 — Determination of test pressure, p_F

	Application class							
	Class 1		Class 2		Class 4		Class 5	
Maximum design temperature, T_{max}, in °C	80		80		70		90	
Design stress for fitting material, σ_{DF}, in MPa	b	b	b	b	b	b	b	b
Test temperature, T_{test}, in °C [a]	20	95	20	95	20	80	20	95
Test duration, t, in h	1	1 000	1	1 000	1	1 000	1	1 000
Hydrostatic stress for fitting material, σ_F, in MPa	b	b	b	b	b	b	b	b
Test pressure, p_F, in bars, for a design pressure, p_D, of 4 bar, 6 bar, 8 bar and 10 bar	b	b	b	b	b	b	b	b
Number of test pieces	3		3		3		3	
NOTE 1 bar = 0,1 MPa.								

[a] Generally, the highest test temperature is taken to be (T_{max} + 10) °C, with an upper limit of 95 °C. However, to suit existing test facilities, the highest test temperature for classes 1 and 2 is also specified as 95 °C. The hydrostatic stresses given correspond to the test temperatures specified.

[b] Values to be determined in accordance with ISO 9080.

9 Physical and chemical characteristics of plastics fittings

9.1 Plastics fitting materials specified in reference product standards

The relevant characteristics shall be determined.

9.2 Plastics fitting materials not specified in reference product standards

The relevant characteristics shall be determined in accordance with Table 2.

9.3 Sealing elements

As specifed in ISO 21003-5, the sealing element shall have no detrimental effect on the properties of the pipe or fitting and shall not cause the test assembly to fail.

The material of the sealing elements used in joint assemblies shall conform to EN 681-1 or EN 681-2, as applicable.

10 Performance requirements

When fittings conforming to this part of ISO 21003 are jointed to pipes conforming to ISO 21003-2, the fittings and the joints shall conform to ISO 21003-5.