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

**Part 2:
Pipes**

iTeh STANDARD PREVIEW
*Systemes de canalisations multicouches pour installations d'eau
chaude et froide à l'intérieur des bâtiments —*
(standards.iteh.ai)
Partie 2: Tubes

ISO 21003-2:2008

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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 21003-2 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

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— Part 2: Pipes

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— 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 2 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 material and components other than pipes are specified in ISO 21003-1 and ISO 21003-3. Characteristics relating to 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 pipes.

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.

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

Part 2: Pipes

1 Scope

This part of ISO 21003 specifies the characteristics of pipes 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 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.

ISO 21003 covers 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.

Solid-wall pipes with thin outer layers (applied as protection layers or barrier layers, for instance) are not covered by ISO 21003 but are specified in the Amendments to ISO 15874-2, ISO 15875-2 and ISO 15876-2. The total thickness of such outer layers, including the thickness of the adhesives used, shall be $\leq 0,4$ 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 161-1, *Thermoplastics pipes for the conveyance of fluids — Nominal outside diameters and nominal pressures — Part 1: Metric series*

ISO 527-1:1993, *Plastics — Determination of tensile properties — Part 1: General principles*

ISO 527-2:1993, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics*

ISO 2578:1993, *Plastics — Determination of time-temperature limits after prolonged exposure to heat*

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

ISO 6259-1:1997, *Thermoplastics pipes — Determination of tensile properties — Part 1: General test method*

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 10508, *Plastics piping systems for hot and cold water installations — Guidance for classification and design*

ISO 13760, *Plastics pipes for the conveyance of fluids under pressure — Miner's rule — Calculation method for cumulative damage*

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ISO 15874-2, *Plastics piping systems for hot and cold water installations — Polypropylene (PP) — Part 2: Pipes*

ISO 15875-2, *Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X) — Part 2: Pipes*

ISO 15876-2, *Plastics piping systems for hot and cold water installations — Polybutylene (PB) — Part 2: Pipes*

ISO 15877-2, *Plastics piping systems for hot and cold water installations — Chlorinated poly(vinyl chloride) (PVC-C) — Part 2: Pipes*

ISO 17454, *Plastics piping systems — Multilayer pipes — Test method for the adhesion of the different layers using a pulling rig*

ISO 17455, *Plastics piping systems — Multilayer pipes — Determination of the oxygen permeability of the barrier pipe*

ISO 17456, *Plastics piping systems — Multilayer pipes — Determination of long-term strength*

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

ISO 21003-5:2008, *Multilayer piping systems for hot and cold water installations inside buildings — Part 5: Fitness for purpose of the system*

ISO 22391-2:—¹⁾, *Plastics piping systems for hot and cold water installations — Polyethylene of raised temperature resistance (PE-RT) — Part 2: Pipes*

EN 713, *Plastics piping systems — Mechanical joints between fittings and polyolefin pressure pipes — Test method for leaktightness under internal pressure of assemblies subjected to bending*

EN 12293, *Plastics piping systems — Thermoplastics pipes and fittings for hot and cold water — Test method for the resistance of mounted assemblies to temperature cycling*

3 Terms and definitions

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

4 Symbols and abbreviated terms

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

5 Material

5.1 General

The pipe manufacturer shall declare the materials used for each layer of the multilayer pipe and the function of each layer.

The material characteristics of the stress-designed layers shall comply with the requirements of the relevant reference product standards (see Annex A).

5.2 Processable materials

Clean own reprocessable material which is the same as the virgin material may be added to that virgin material. External reprocessable material shall not be used.

5.3 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 pipes 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. The ends of each pipe shall be cut cleanly and square to the axis of the pipe.

6.2 Opacity

Multilayer pipes that are declared to be opaque shall not transmit more than 0,2 % of visible light, when tested in accordance with ISO 7686. This requirement is not relevant to M-pipes.

1) To be published. (Revision of ISO 22391-2:2007)

7 Construction

Multilayer pipes can include layers made of polymer or layers made of metal.

For example, layers may have the following purposes:

- the ability to withstand pressure;
- the ability to block or greatly reduce the permeation of oxygen or other substances through the pipe wall;
- the ability to create interlayer adhesion;
- the ability to block or greatly diminish the effect of UV and/or sunlight;
- the ability to mechanically protect all other layers (inside layer or outside layer);
- the ability to control the longitudinal expansion;
- the ability to give the multilayer pipe a colour (inside layer or outside layer).

Some characteristics can be combined in the same layer.

For P-type pipes, the pressure strength can be determined in accordance with procedure I or procedure II (see Clause 9). In cases of dispute, procedure II shall be used. For M-type pipes, the pressure strength can only be determined in accordance with procedure II.

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8 Geometrical characteristics

8.1 General

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Dimensions of multilayer pipes shall be measured in accordance with ISO 3126.

8.2 Dimensions of pipes

The outside diameter should preferably be in accordance with ISO 161-1.

The pipe manufacturer shall give detailed information related to the geometrical characteristics, including the wall thickness, with tolerances for each layer, in a technical file. All layers shall be of sufficient thickness to meet the requirements of this part of ISO 21003.

9 Pressure strength

9.1 Long-term pressure strength (p_{LPL})

The long-term pressure strength of multilayer pipes can be measured (procedure II) or calculated (procedure I), as defined in ISO 17456. Procedure I can only be used for multilayer P-pipes and validation testing shall be carried out at a minimum temperature of T_{max} given in ISO 21003-1:2008, Table 1, for $t = 8\ 760$ h at the calculated stress.

9.2 Design pressure strength (p_D)

The design pressure strength is derived from the long-term pressure strength, taking in account the application classes and the overall design coefficients given in the relevant product standards (see Annex B).

10 Thermal durability

10.1 Thermal durability of P-pipes

For P-pipes, the stress-designed layers shall be tested for thermal stability as described in the relevant reference product standards.

The wall thickness of the test pieces shall be equal to the smallest wall thickness in the diameter range.

10.2 Thermal durability of M-pipes

10.2.1 Inner layer

For M-pipes, the material of the inner layer shall be tested for thermal stability as described in the relevant reference product standard. The test pieces shall have a maximum wall thickness of $2 \times$ the thinnest wall thickness allowed for the inner layer. The stress applied in this test shall be 50 % of the stress for a 1 year test duration, in accordance with the relevant reference product standard, without ductile failure occurring.

10.2.2 Outer layer

The thermal durability of the outer layer shall be determined either on the pipe with the thinnest outer layer for each dimension group in accordance with Annex C or, provided the outer layer is a polyolefin, in accordance with Annex C or Annex D irrespective of the thickness of the outer layer.

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11 Strength of the weld line of M-pipes

The strength of the weld line is covered by the control points for the resistance to inner water pressure test in accordance with ISO 17456.

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12 Delamination

12.1 Multilayer P-pipes

Multilayer P-pipes shall comply with the requirements in Table 1.

Table 1 — Requirements for delamination

Requirement	Test pieces	Test method
No delamination	EN 12293 ^a	EN 12293, visual
^a Using the test parameters of the relevant application class (see ISO 21003-5:2008, Table 5).		

12.2 Multilayer M-pipes

Multilayer M-pipes shall comply with the requirements in Table 2.

Table 2 — Delamination resistance

Requirement	Conditioning	Test pieces	Test method
$F_{pull} \geq 15$ N/cm No delamination	Before and after conditioning in accordance with EN 12293 ^a	ISO 17454	ISO 17454
^a Using the test parameters of the relevant application class (see ISO 21003-5:2008, Table 5). To pre-stress branch A of the test piece, the reference product standard and the dimensions of the inner layer shall be used.			