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

**Part 7:
Guidance for the assessment of
conformity**

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

Partie 7: Guide pour l'évaluation de la conformité



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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.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of document:

- an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;
- an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

ISO/TS 21003-7 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 155, *Plastics piping systems and ducting systems*, in collaboration with 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*.

This Technical Specification can be used to support elaboration of national third-party certification procedures for products conforming to the applicable part(s) of ISO 21003.

It forms part of a system standard for multilayer piping systems of a particular material for a specified application. System standards are supported by separate standards on test methods to which reference is made throughout the system standard. The system standards are consistent with general standards on functional requirements and on recommended practice for installation.

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

For ancillary equipment, separate standards can apply.

For guidance on installation, reference is made to separate documents.

NOTE 2 Guidance on installation of plastics piping systems made from various materials intended to be used for hot and cold water installations is given in ENV 12108 ^[1].

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 the following:

ISO 15874, *Plastics piping systems for hot and cold water installations — Polypropylene (PP)* (identical to EN ISO 15874)

ISO 15875, *Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X)* (identical to EN ISO 15876)

ISO 15876, *Plastics piping systems for hot and cold water installations — Polybutylene (PB)* (identical to EN ISO 15876)

ISO 15877, *Plastics piping systems for hot and cold water installations — Chlorinated poly(vinyl chloride) (PVC-C)* (identical to EN ISO 15877)

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

Introduction

ISO 21003 specifies the requirements for multilayer piping systems. The 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 product 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 are specified in ISO 21003-2 and ISO 21003-3. Characteristics relating to fitness for purpose (mainly for joints) are covered in ISO 21003-5.

This Technical Specification gives guidance for the assessment of conformity of materials, components, joints and assemblies and it is intended to be used by certification bodies, inspection bodies, testing laboratories and manufacturers.

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

Part 7: Guidance for the assessment of conformity

1 Scope

This Technical Specification is applicable, in conjunction with the other parts of ISO 21003 (see Foreword), to 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 gives guidance for the assessment of conformity, to be included in the manufacturer's quality plan as part of the quality system.

It includes:

- requirements for materials, components, joints and assemblies given in the applicable part(s) of ISO 21003;
- requirements for the manufacturer's quality system (e.g. ISO 9001 [2]);
- definitions and procedures to be used if third-party certification is involved.

NOTE If third-party certification is involved, it is recommended that the certification body be accredited to ISO/IEC Guide 65 [3] or ISO/IEC 17021 [4], as applicable.

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 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 3951-1, *Sampling procedures for inspection by variables — Part 1: Specification for single sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection for a single quality characteristic and a single AQL*

ISO 17456:2006, *Plastics piping systems — Multilayer pipes — Determination of long-term strength* (identical to EN ISO 17456:2006)

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

ISO 21003-2:2008, *Multilayer piping systems for hot and cold water installations inside buildings — Part 2: Pipes* (identical to EN ISO 21003-2:2008)

ISO/TS 21003-7:2008(E)

ISO 21003-3:2008, *Multilayer piping systems for hot and cold water installations inside buildings — Part 3: Fittings* (identical to EN ISO 21003-3:2008)

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

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

3 Definitions, symbols and abbreviated terms

For the purposes of this Technical Specification, the definitions, symbols and abbreviated terms given in ISO 21003-1:2008 apply, together with the following.

3.1 Definitions

3.1.1

certification body

impartial body, governmental or non-governmental, possessing the necessary competence and authority to carry out certification of conformity according to given rules of procedure and management

3.1.2

inspection body

impartial organization or company, approved by a certification body as possessing the necessary competence to verify and/or to carry out initial type testing, audit testing and inspection of the manufacturer's factory production control in accordance with the relevant standard

3.1.3

testing laboratory

laboratory which measures, tests, calibrates or otherwise determines the characteristics of the performance of materials and products

3.1.4

quality system

organizational structure, responsibilities, procedures, processes and resources for implementing quality management

NOTE An example of a quality system is ISO 9001 [2].

3.1.5

quality plan

document setting out the specific quality practices, resources and sequence of activities relevant to a particular product or range of products

3.1.6

type testing

TT

testing performed to verify that the material, component, joint or assembly is capable of conforming to the requirements given in the relevant standard

3.1.7

preliminary type testing

PTT

type testing carried out by or on behalf of the manufacturer

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

3.1.8**initial type testing****ITT**

type testing carried out by or on behalf of a certification body for certification purposes

3.1.9**batch release test****BRT**

test performed by or on behalf of the manufacturer on a batch of components, which has to be satisfactorily completed before the batch can be released

3.1.10**process verification test****PVT**

test performed by or on behalf of the manufacturer on materials, components, joints or assemblies at specific intervals to confirm that the process continues to be capable of producing components which conform to the requirements given in the relevant standard

NOTE Such tests are not required to release batches of components and are carried out as a measure of process control.

3.1.11**audit test****AT**

test performed by or on behalf of a certification body to confirm that the material, component, joint or assembly continues to conform to the requirements given in the relevant standard and to provide information to assess the effectiveness of the quality system

3.1.12**indirect test****IT**

test performed by or on behalf of the manufacturer, different from the test specified for that particular characteristic, having previously verified its correlation with the test specified

3.1.13**witness testing****WT**

testing accepted by a certification body for initial type testing and/or audit testing, which is carried out by or on behalf of the manufacturer and supervised by a representative of the certification body qualified in testing

3.1.14**material or compound batch**

clearly identifiable quantity of a particular material or compound

3.1.15**production batch**

clearly identifiable collection of units, manufactured consecutively or continuously under the same conditions, using material or compound conforming to the same specification

3.1.16**lot**

clearly identifiable sub-division of a batch for inspection purposes

3.1.17**sample**

one or more units of product drawn from a batch or lot, selected at random without regard to their quality

NOTE The number of units of product in the sample is the sample size.

3.1.18

acceptance quality limit

AQL

worst tolerable process fraction nonconforming when a continuing series of lots is submitted for acceptance sampling

NOTE 1 See ISO 2859-1 and ISO 3951-1.

NOTE 2 The designation of an AQL does not imply that a manufacturer has the right knowingly to supply any nonconforming unit of product.

3.1.19

inspection level

relationship between the lot or batch size and the sample size

NOTE See ISO 2859-1.

3.1.20

group

collection of similar components from which samples are selected for testing purposes

3.2 Abbreviated terms

NOTE 1 To avoid misunderstandings, the following abbreviations have been kept the same in each language. For the same reason, the corresponding terms are given here in three languages (en: English, fr: French, de: German).

NOTE 2 In the French language the abbreviation AQL for “acceptance quality limit” is NQA. However, for the purposes of this Technical Specification, the same abbreviation (AQL) is used for all three languages.

AQL en: acceptance quality limit
fr: niveau de qualité acceptable
de: annehmbare Qualitätsgrenzlage

AT en: audit test
fr: essai d'audit
de: Überwachungsprüfung

BRT en: batch release test
fr: essai de libération de campagne de fabrication
de: Freigabepfung einer Charge

IT en: indirect test
fr: essai indirect
de: indirekte Prüfung

ITT en: initial type testing
fr: essai de type initial
de: Erst-Typprüfung

PTT en: preliminary type testing
fr: essai de type préliminaire
de: vorausgehende Typpfung

PVT en: process verification test
fr: essai de vérification du procédé de fabrication
de: Prozeßüberprüfung

TT en: type test
fr: essai de type
de: Typpfung

WT en: witness testing
 fr: essai témoin
 de: Prüfung unter Aufsicht

4 Requirements

4.1 General

4.1.1 Materials, components, joints and assemblies shall conform to the requirements given in ISO 21003-1, ISO 21003-2, ISO 21003-3 and ISO 21003-5, as applicable.

4.1.2 Components and/or assemblies shall be produced by the manufacturer under a quality system which includes a quality plan.

4.2 Testing and inspection

4.2.1 Grouping

For the purposes of this Technical Specification, the following groups apply.

4.2.1.1 Pressure groups

Two pressure groups are defined, as given in Table 1.

For testing purposes, one individual operating pressure, p_{oper} , shall be selected from each group.

Table 1 — Pressure groups

Pressure group	Operating pressure, p_{oper} bar
1	4; 6
2	8; 10

4.2.1.2 Size groups

Three size groups are defined for pipes and fittings, as given in Table 2.

For testing purposes, one individual nominal diameter, d_n , shall be selected from each group.

Table 2 — Size groups

Size group	Nominal diameter, d_n mm
1	$10 \leq d_n \leq 26$
2	$26 < d_n \leq 63$
3	$63 < d_n$

4.2.1.3 Fitting groups

Four groups of fittings having a similar design are defined, as given in Table 3.

For testing purposes, one individual fitting shall be selected from each group.

Table 3 — Fitting groups

Fitting group	Type of fitting
1	Bends
2	Elbows, tees
3	Reducers, couplers, end caps
4	Unions, flange adaptors, adaptor pieces and/or their plastics parts, plus others

4.2.2 Type testing (TT)

4.2.2.1 General

Relevant type tests shall be carried out whenever there is a change in design, in material and/or in the production method, other than routine in-process adjustments, and/or whenever there is an extension of the product range.

Type tests shall demonstrate that the products conform to all requirements for the characteristics given in Table 5 to Table 8, as applicable. The material characteristics of stress-designed materials shall be evaluated in accordance with the reference product standard.

Conditions considered as leading to a change of material are given in Table 4.

Table 4 — Conditions considered to lead to a change of material

Type of material change	Conditions
Change of stress-designed material (M1)	Defined in Part 7 of the relevant reference product standard For PE-RT, see Annex A
Change of non-stress-designed material (M2)	Change of supplier Change of formulation and/or additives Change of polymer type
Change of metal (M3)	Change of supplier Change of alloy/composition Change of welding system
Change of adhesive (M5)	Change of supplier Change of formulation Change of chemical nature

For the purposes of defining a change of construction type (M4), the following characteristics are relevant:

- dimensions;
- geometry of the component;
- jointing system.

In the manufacturer's quality plan, the geometry, the dimensions and the dimensional tolerances shall be specified at least in accordance with and in addition to the requirements given in the relevant part(s) of ISO 21003.

If one or more of these characteristics exceeds the defined specifications, the relevant characteristics given in Table 5 to Table 8, as applicable, shall be retested. If third-party certification is involved, retesting shall be agreed between the certification body and the manufacturer.

Table 5 — Characteristics of M-pipes that require type testing (TT)

Characteristic	Reference to part and clause or subclause of ISO 21003:2008	Conditions requiring test ^a							Sampling procedure
		I	M1	M2	M3	M4	M5	E	
Influence on water intended for human consumption	Part 1, 6.2	+	+	+	–	+	+	–	In accordance with national regulations
Appearance	Part 2, 6.1	+	+	+	+	+	+	+	One test piece per d_n and pressure group
Opacity	Part 2, 6.2	+	+	+	–	+	+	–	One test piece with the smallest wall thickness produced
Dimensions	Part 2, 8.2	+	+	+	+	+	+	+	One test piece per d_n and pressure group
Long-term strength of M-pipes	Part 2, 9.1	+	+	–	+	+	+ ^b	+	One test per size group, see ISO 17456
Thermal durability of M-pipes, inner layer	Part 2, 10.2.1	+	+	–	–	+ ^c	–	–	One test piece per similar construction type
Thermal durability of M-pipes, outer layer	Part 2, 10.2.2	+	+	+	–	+	–	–	One test piece per similar construction type
Strength of weld line	Part 2, Clause 11	+	–	–	+	+	–	–	One test piece per similar construction type
Delamination of M-pipes	Part 2, 12.2	+	+	–	+	+ ^d	+	–	One test piece per similar construction type
Oxygen permeability	Part 2, Clause 13	+	–	+	–	+ ^e	–	–	One test piece per similar construction type
Physical and chemical characteristics	Part 2, Clause 14	+	–	+	+	–	+	–	One test piece per similar construction type
Marking	Part 2, Clause 16	+	+	+	+	+	+	+	One test piece per d_n and pressure group
^a I: initial type test in case of new system; M1: change of stress-designed material; M2: change of non-stress-designed material; M3: change of metal; M4: change of construction type; M5: change of adhesive; E: extension of product range; +: test to be carried out. ^b Validation only. ^c Based on a relatively small wall thickness. ^d Thickness of adhesive layer. ^e Thickness of barrier layer.									

Table 6 — Characteristics of P-pipes that require type testing (TT)

Characteristic	Reference to part and clause or subclause of ISO 21003:2008	Conditions requiring test ^a						Sampling procedure
		I	M1	M2	M4	M5	E	
Influence on water intended for human consumption	Part 1, 6.2	+	+	+	+	+	–	In accordance with national regulations
Appearance	Part 2, 6.1	+	+	+	+	+	+	One test piece per d_n and pressure group
Opacity	Part 2, 6.2	+	+	+	+	+	–	One test piece with the smallest wall thickness produced
Dimensions	Part 2, 8.2	+	+	+	+	+	+	One test piece per d_n and pressure group
Long-term strength of P-pipes	Part 2, 9.1	+	+	–	+	+ ^b	+	One test per pressure group per similar construction type, see ISO 17456
Thermal durability of P-pipes	Part 2, 10.1	+	+	–	+	–	–	One test piece per similar construction type
Delamination of P-pipes	Part 2, 12.1	+	+	+	+ ^c	+	–	One test piece per similar construction type
Oxygen permeability	Part 2, Clause 13	+	–	+	+ ^d	–	–	One test piece per similar construction type
Physical and chemical characteristics	Part 2, Clause 14	+	–	+	–	+	–	One test piece per similar construction type
Marking	Part 2, Clause 16	+	+	+	+	+	+	One test piece per d_n and pressure group
^a I: initial type test in case of new system; M1: change of stress-designed material; M2: change of non-stress-designed material; M4: change of construction type; M5: change of adhesive; E: extension of product range; +: test to be carried out. ^b Validation only. ^c Thickness of adhesive layer. ^d Thickness of barrier layer.								

Table 7 — Characteristics of plastic fittings that require type testing (TT)

Characteristic ^a	Reference to part and clause or subclause of ISO 21003:2008	Conditions requiring test ^b					Sampling procedure
		I	D	M1	M2	E	
Influence on water intended for human consumption	Part 1, 6.2	+	–	+	+	–	In accordance with national regulations
Hydrostatic stress properties of material ^c	Part 3, 5.1 and 5.2	+	–	+	+ ^c	–	One evaluation per material
Thermal durability	Part 3, 5.1 and 5.2	+	–	+	+	–	One test piece per material
Appearance	Part 3, 6.1	+	–	+	+	+	One test piece per d_n and fitting group
Opacity	Part 3, 6.2	+	–	+	+	–	One test piece with the smallest wall thickness produced
Geometrical characteristics	Part 3, Clause 7	+	+	+	+	+	One test piece per d_n and fitting group
Resistance to internal pressure	Part 3, Clause 8	+	+	+	+	+	One test piece per size group and fitting group for the relevant design pressure and appropriate application class
Physical and chemical characteristics	Part 3, Clause 9	+	–	+	+	+	One test piece per size group and fitting group
Marking	Part 3, Clause 11	+	–	+	–	+	One test piece per d_n and fitting group
<p>^a Materials of the reference product standards are covered in Part 7 of those standards. PE-RT is covered in Annex A.</p> <p>^b I: initial type test; D: change in design; M1: change of polymer; M2: change of additive package; E: extension of product range; +: test to be carried out.</p> <p>^c For 5.2 of Part 3: If the material supplier has evaluated the hydrostatic stress properties in accordance with ISO 9080 [5], or equivalent, the manufacturer of the fittings shall check conformity.</p>							

Table 8 — Characteristics of fitness for purpose of the system that require type testing (TT)

Characteristic	Reference to part and clause or subclause of ISO 21003:2008	Conditions requiring test ^a									Sampling procedure
		I			D			E			
		SC	M	F	SC	M	F	SC	M	F	
Resistance to internal pressure	Part 5, 5.2	+	+	+	+	+	+	+	+	+	In accordance with national regulations
Leaktightness under internal pressure and with bending	Part 5, 5.3	+	+	+	+	+	+	+	+	+	One test piece per d_n and pressure group
Resistance to pull-out	Part 5, 5.4	+	+	+	+	+	+	+	+	+	One test piece with the smallest wall thickness produced
Resistance to thermal cycling	Part 5, 5.5	+	+	+	+	+	+	+	+	+	One test piece per d_n and pressure group
Resistance to pressure cycling	Part 5, 5.6	+	+	+	+	+	+	+	+	+	One test per pressure group per similar construction type, see ISO 17456
Leaktightness under vacuum	Part 5, 5.7	+	+	+	+	+	+	+	+	+	One test per pressure group per similar construction type, see ISO 17456

^a I: initial type test in case of new system;
D: change in design;
E: extension of product range;
SC: solvent -cemented fittings;
M: mechanical fittings;
F: fusion fittings;
+: test to be carried out.

4.2.2.2 Preliminary type testing (PTT)

The manufacturer shall demonstrate that the products conform to all requirements for the characteristics given in Table 5 to Table 8, as applicable.

4.2.2.3 Initial type testing (ITT)

If third-party certification is involved, the certification body shall assess the conformity of a product to all requirements for the characteristics given in Table 5 to Table 8, as applicable.

The assessment shall be performed by validation or testing, using the sampling procedure given in Table 5 to Table 8, as applicable, and grouping in accordance with 4.2.1, in an approved testing laboratory or by witness testing.

Preliminary test data, including long-term characteristics, supplied by the manufacturer and traceable to material and process and validated by the certification body, shall be taken into account for initial type testing.

4.2.3 Batch release tests (BRTs)

Those characteristics specified in ISO 21003-2:2008 and ISO 21003-3:2008 and listed in Table 9 shall be batch release tested with the minimum sampling frequency given in the table. Alternatively, the manufacturer may use the sampling procedures detailed in either ISO 2859-1 with an inspection level of S-2 or ISO 3951-1 with an inspection level of S-3, as appropriate. In any case, an AQL of not greater than 6,5 % shall be used.

Table 9 — Characteristics and minimum sampling frequencies for BRTs

Characteristic	Reference to part and clause or subclause of ISO 21003:2008	Minimum sampling frequency	Retest procedure (see text)
Pipes			
Appearance	Part 2, 6.1	One test piece per 8 h per machine	A or B
Geometrical characteristics	Part 2, 8.2	One test piece per 8 h per machine	A
Delamination	Part 2, Clause 12	One test piece per 8 h per machine	A
Either Resistance to internal pressure (95 °C, 22 h)	Part 2, 9.1	One test piece per 24 h per machine	A or B
or Resistance to internal pressure (95 °C, 165 h) ^a	Part 2, 9.1	One test piece per week per machine	A or B
Marking	Part 2, Clause 16	One test piece per 8 h per machine	A or B
Plastics fittings			
Appearance	Part 3, 6.1	One test piece per 8 h per mould cavity	A or B
Geometrical characteristics (but only those dimensions which vary by the manufacturing process and affect the function of the joint or fitting)	Part 3, Clause 7	One test piece per 8 h per mould cavity	A
Either Resistance to internal pressure (95 °C, 22 h)	Part 2, 9.1	One test piece per 24 h per machine	A or B
or Resistance to internal pressure (95 °C, 165 h) ^a	Part 2, 9.1	One test piece per week per machine	A or B
Marking	Part 3, Clause 11	One test piece per 8 h per mould cavity	A or B
^a In cases of dispute, the test shall be conducted at 95 °C with a test duration of 165 h.			

The manufacturer shall specify a batch or lot in his quality plan.

A batch or lot shall only be released for supply when all the relevant tests and inspections have been carried out at least once at the specified frequencies and the requirements have been met.

If a product fails in respect of any characteristic given in Table 9, the batch or lot shall be rejected or the retest procedure shall be performed for the characteristic on which the product failed.

The retest procedure shall conform to Table 9 and shall be either procedure A or procedure B, as follows:

Procedure A:

Find the last product which conforms to the requirements as specified in ISO 21003-2:2008 or ISO 21003-3:2008, as applicable. Release all products produced before that point and reject the products produced after that point.

Procedure B:

Use a sampling procedure in accordance with ISO 2859-1 or ISO 3951-1, as applicable, based on a maximum AQL of 4 % and a minimum inspection level of S-3.

If the retest requirements are met, release the batch or lot. If they are not met, reject the batch or lot.

Procedures for dealing with rejected products shall be detailed in the manufacturer's quality plan.

4.2.4 Process verification tests (PVTs)

Those characteristics specified in ISO 21003-2:2008 and ISO 21003-3:2008 and listed in Table 10 shall be process verification tested with the minimum sampling frequency given in Table 10.

Table 10 — Characteristics and minimum sampling frequencies for PVTs

Characteristic	Reference to part and clause or subclause of ISO 21003:2008	Minimum sampling frequency
Pipes		
Resistance to internal pressure (95 °C, 1 000 h)	6.2.5 of ISO 17456:2006	One test piece per year per d_n and e_n
Fittings		
Resistance to internal pressure (95 °C, 1 000 h)	Reference product standard and Part 3, Clause 8	One test piece per year per size group and fitting group

If a product does not conform to the requirements in respect of any characteristic given in Table 10, the retest procedure detailed in the manufacturer's quality plan shall be performed. If third-party certification is involved, the certification body shall be informed.

If the retest procedure does not confirm conformity of the product to the requirements, then the process shall be investigated and corrected in accordance with the procedures given in the manufacturer's quality plan.

4.2.5 Audit tests (ATs)

If third-party certification is involved, those characteristics specified in ISO 21003-2:2008 and ISO 21003-3:2008 and listed in Table 11 are intended to be audit tested with the minimum sampling frequency given in Table 11.

Table 11 — Characteristics and minimum sampling frequencies for ATs

Characteristic	Reference to part and clause or subclause of ISO 21003:2008	Minimum sampling frequency
Pipes		
Appearance	Part 2, 6.1	Three test pieces per year per size group
Geometric characteristics	Part 2, 8.2	Three test pieces per year per size group
Resistance to internal pressure (95 °C, 1 000 h)	6.2.5 of ISO 17456:2006	Three test pieces per year per size group
Delamination	Part 2, Clause 12	Three test pieces per year per size group
Marking	Part 2, Clause 16	Three test pieces per year per size group
Fittings		
Appearance	Part 3, 6.1	Three fittings per year per size group and fitting group
Geometrical characteristics	Part 3, Clause 7	Three fittings per year per size group and fitting group
Resistance to internal pressure (95 °C, 1 000 h)	Reference product standard and Part 3, Clause 8	Three fittings per year per size group and fitting group
Marking	Part 3, Clause 11	Three fittings per year per size group and fitting group

Certification bodies may accept process verification tests (PVTs) as audit tests (ATs) if witnessed by them or by their agencies.

The sizes, types and classes selected for tests should preferably be primarily those which have not previously been selected for audit testing. Samples should preferably be taken from the largest volume of production per group.

4.2.6 Indirect tests (ITs)

Generally, testing shall be performed using the test methods referred to in ISO 21003-1, ISO 21003-2, ISO 21003-3 and ISO 21003-5, as applicable.

Indirect testing may be used for BRT and PVT characteristics as given in Table 9 and Table 10, respectively. Indirect testing shall not be used for type testing or audit tests.

Any indirect test method used and its correlation with the test specified shall be documented in the manufacturer's quality plan.

In cases of dispute, the BRT or PVT as specified in Table 9 or Table 10, as applicable, shall be used.

If third-party certification is involved, the IT should preferably be agreed with the certification body before it is used.

Indirect testing may be utilized to reduce the frequency of use of the specified BRT and PVT, but it is not intended to completely replace these tests.

4.2.7 Inspection records and test records

Unless otherwise specified, all records shall be maintained for a minimum of ten years.

Annex A (normative)

Conditions considered as leading to a change in the case of PE-RT material and non-stressed-designed materials

Table A.1 — Conditions considered to lead to a change in the case of PE-RT material and non-stress-designed materials

Type of material change	Conditions
Change of polymer (M1)	Change of supplier Change of polymerization Change of properties of comonomers
Change of additive package, e.g. pigments, antioxidants ^a	Amount greater than ± 30 % of any individual additive Change in chemical properties or nature of additive
<p>^a In order to check the effect of a change of additive package on the hydrostatic stress properties as given in ISO 22391-2, three test pieces shall be tested at two different stress levels at 95 °C.</p> <p>The lower stress level shall be such that it gives failure times of approximately 2 500 h. All failure points shall be on or above the relevant reference curve in Figure 1 of ISO 22391-2:— for the relevant material.</p>	

Bibliography

- [1] ENV 12108, *Plastics piping systems — Guidance for the installation inside buildings of pressure piping systems for hot and cold water intended for human consumption*
- [2] ISO 9001, *Quality management systems — Requirements*
- [3] ISO/IEC Guide 65, *General requirements for bodies operating product certification systems*
- [4] ISO/IEC 17021, *Conformity assessment — Requirements for bodies providing audit and certification of management systems*
- [5] ISO 9080, *Plastics piping and ducting systems — Determination of the long-term hydrostatic strength of thermoplastics materials in pipe form by extrapolation*
- [6] *Guide for the definition of factory production control and technical specifications for construction products* (Construction Products Directive 89/106/EC)

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