
**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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Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Abbreviated terms and symbols	4
4.1 Abbreviated terms	4
4.2 Symbols	5
5 General	5
6 Testing and inspection	5
6.1 Grouping	5
6.1.1 General	5
6.1.2 Pressure groups	5
6.1.3 Size groups	6
6.1.4 Fitting groups	6
6.2 Type testing	6
6.3 Batch release test	15
6.4 Process verification tests (PVTs)	16
6.5 Audit tests (AT)	17
6.6 Indirect testing (IT)	17
6.7 Test records	18
Annex A (informative) Interchangeability of different material grades — Testing of alternative material grades for a layer in a multilayer M-pipe (second sourcing)	19
Bibliography	31

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).

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).

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.

This document was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 155, *Plastics piping systems and ducting systems*, in collaboration with ISO Technical Committee TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 2, *Plastics pipes and fittings for water supplies*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO/TS 21003-7:2008), which has been technically revised. It also incorporates the Amendment ISO/TS 21003-7:2008/Amd1:2010.

The major technical changes are:

- New definition of the terms “material”, “material grade” and “compound”;
- Revision of 6.2 “type testing”;
- Addition of Annex A “Interchangeability of different material grades — Testing of an alternative material grades for a layer in a Multilayer M-Pipe (second sourcing)”.

A list of all parts in the ISO 21003 series can be found on the ISO website.

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.

Introduction

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

This document is a part of a System Standard for plastics piping systems of a particular material for a specified application. There are a number of such System Standards.

At the date of publication of this document, System Standards for piping systems of other plastics materials used for the same application are the following:

- ISO 15874, *Plastics piping systems for hot and cold water installations — Polypropylene (PP)*
- ISO 15875, *Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X)*
- ISO 15876, *Plastics piping systems for hot and cold water installations — Polybutene (PB)*
- ISO 15877, *Plastics piping systems for hot and cold water installations — Chlorinated poly (vinyl chloride) (PVC-C)*
- ISO 22391, *Plastics piping systems for hot and cold water installations — Polyethylene of raised temperature resistance (PE-RT)*

They are supported by separate standards on test methods to which references are made throughout the System Standard.

The System Standards are consistent with general standards on functional requirements and on recommended practice for installation.

Figures 1 and 2 are intended to provide general information on the concept of testing and organisation of those tests used for the purpose of the assessment of conformity. For each type of test, i.e. type testing (TT), batch release test (BRT), process verification test (PVT), and audit test (AT), this document details the applicable characteristics to be assessed as well as the frequency and sampling of testing.

A typical scheme for the assessment of conformity of materials, compounds, pipes, fittings, valves, joints or assemblies by product manufacturers is given in Figure 1

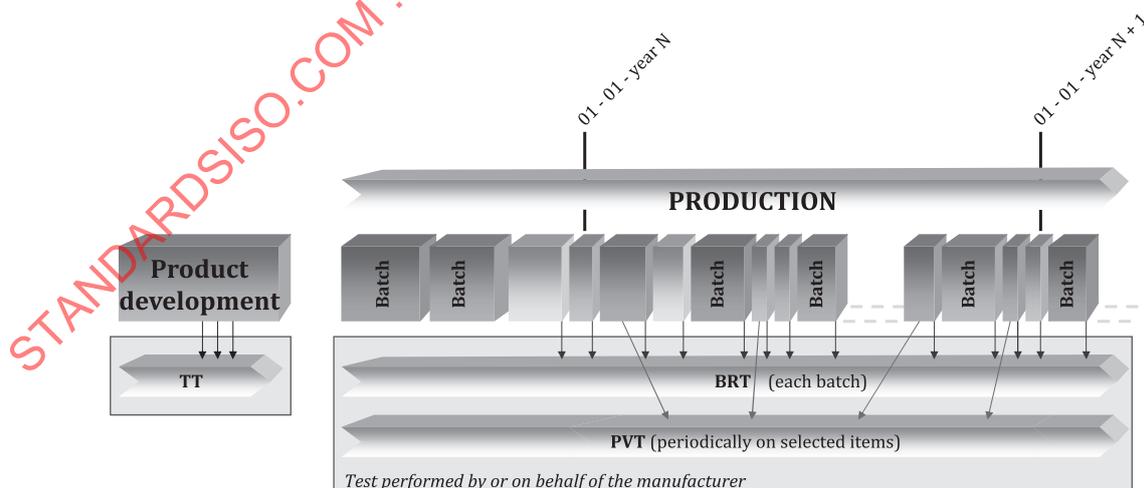


Figure 1 — Typical scheme for the assessment of conformity by a product manufacturer

A typical scheme for the assessment of conformity of compounds, pipes, fittings, joints or assemblies by manufacturers, including certification, is given in Figure 2.

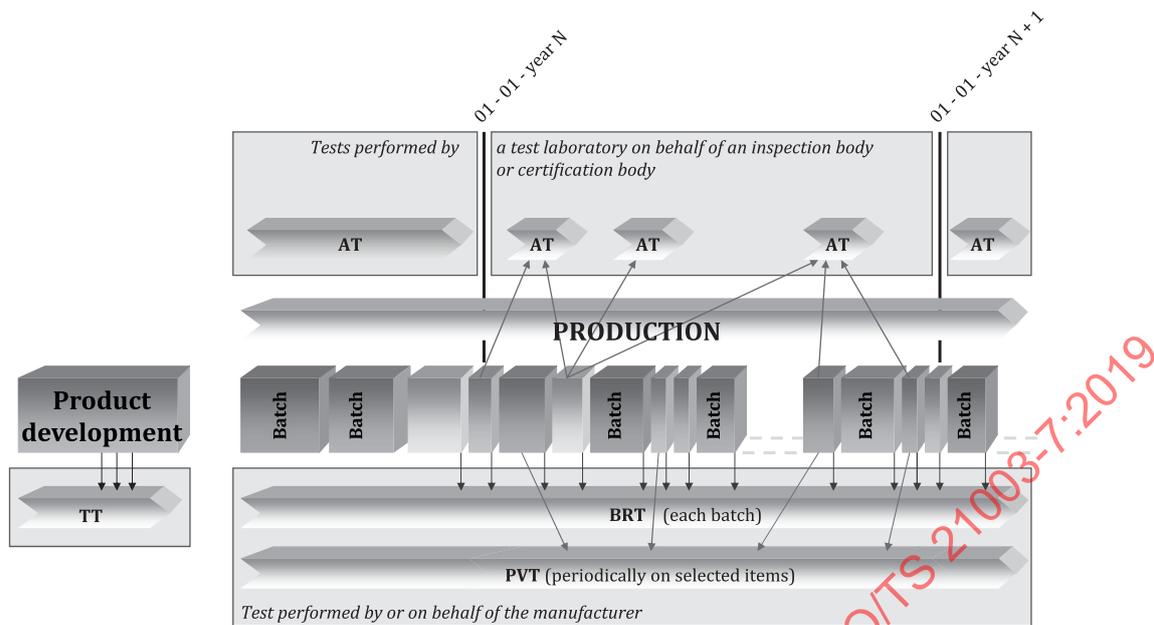


Figure 2 — Typical scheme for the assessment of conformity by product a manufacturer, including certification.

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

Part 7: Guidance for the assessment of conformity

1 Scope

This document gives requirements and guidance for the assessment of conformity of compounds, products, and assemblies in accordance with the applicable part(s) of ISO 21003 intended to be included in the manufacturer's quality plan as part of the quality management system and for the establishment of certification procedures.

In conjunction with the other parts of ISO 21003 (see Foreword), this document is applicable to multilayer piping systems intended to be used for hot and cold water installations within buildings for the conveyance of water, whether or not intended for human consumption (domestic systems) and for heating systems, under design pressures and temperatures appropriate to the class of application (see ISO 21003-1:2008, Table 1).

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

ISO 21003-1, *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 installations inside buildings — Part 2: Pipes*

ISO 21003-3, *Multilayer piping systems for hot and cold water installations inside buildings — Part 3: Fittings*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21003-1, ISO 21003-3 and the following 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 <http://www.iso.org/obp>

**3.1
certification body**

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

Note 1 to entry: A certification body is preferably compliant with ISO/IEC 17065.

**3.2
inspection body**

body that performs inspection

Note 1 to entry: An inspection body can be an organization, or part of an organization.

Note 2 to entry: An inspection body is preferably compliant with ISO/IEC 17020^[3].

[SOURCE: ISO/IEC 17020:2012^[3], 3.5]

**3.3
testing laboratory**

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

Note 1 to entry: A testing laboratory is preferably compliant with ISO/IEC 17025.

**3.4
quality management system**

part of a management system with regard to quality

Note 1 to entry: Requirements for quality management systems are given in ISO 9001^[4].

[SOURCE: ISO 9000:2015 ^[6], 3.5.4, modified — Note 1 to entry has been added]

**3.5
quality plan**

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

**3.6
type testing**

TT
testing performed to prove that the compound, component, product, joint or assembly is capable of conforming to the requirements given in the relevant standard

Note 1 to entry: The type test results remain valid until there is a change in the compound or product or assembly provided that the process verification tests are done regularly.

**3.7
batch release test**

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

**3.8
process verification test**

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

Note 1 to entry: Such tests are not required to release batches of materials, compound, components or products and are carried out as a measure of process control

3.9
audit test
AT

test performed by a test laboratory on behalf of an inspection body or certification body to confirm that the material, compound, components, product, 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 management system

3.10
indirect test
IT

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

3.11
witness test
WT

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

3.12
material

composition grouped by families, expressed by generic names used in material standards, e.g. PP-H, PB-R, PE-RT Type II, PE-Xa, aluminium alloy type 8006

3.13
material grade

material with a defined specification from a material manufacturer

3.14
alternative material grade

material grade available for the production of a multilayer pipe, but different from the one used in the type test (second sourcing)

Note 1 to entry: The pipe manufacturer might have alternative material grades for the inner layer, inner adhesive layer, metal layer, outer adhesive layer and/or outer layer of the multilayer pipe.

3.15
compound

clearly defined homogeneous mixture of base polymer with additives, i.e. antioxidants, pigments, stabilizers and others, at a dosage level necessary for the processing and the intended use of the final product

3.16
batch of material grade

clearly identified quantity of a given homogeneous materials or compound manufactured under uniform conditions and defined and identified by the materials or compound manufacturer

3.17
product

pipe, fitting, or valve of a clearly identified type intended to be a part of a piping system, which the manufacturer puts on the market

3.18
product batch

clearly identified collection of units or products, manufactured consecutively or continuously under the same conditions, using the same compounds conforming to the same specifications

Note 1 to entry: The production batch is defined and identified by the product manufacturer.

3.19

lot

clearly identifiable sub-division of a batch for inspection purposes

3.20

sample

one or more units or products drawn from the same production batch or lot, selected at random without regard to their quality

Note 1 to entry: The number of products in the sample is the sample size.

3.21

group

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

3.22

component

product manufactured out of a specific material or compound, brought to the market as part of another product or as a spare part

Note 1 to entry: For drinking water application, components may be considered as products and be individually approved (e.g. o-ring, gasket) or they are tested as an integral part of a product (e.g. in a valve).

3.23

joint

connection between two or more products

3.24

assembly/assembled product

product consisting of two or more parts

3.25

sampling plan

specific plan, which defines the test and the number of units or products or assemblies to be inspected

3.26

product type

generic description of a product

EXAMPLE A pipe or fitting or valve or their main parts, of the same design, from a particular compound.

3.27

cavity

<moulding> space within a mould to be filled to form the moulded product

EXAMPLE That part of an injection mould which gives the form to the injection-moulded product.

4 Abbreviated terms and symbols

4.1 Abbreviated terms

To avoid misunderstanding, the abbreviated terms in this clause are defined as being the same in each language. For the same reason, the terms are given in the three languages, English, French and German.

	EN	FR	DE
AT	audit test	essai d'audit	Überwachungsprüfung
BRT	batch release test	essai de libération de campagne de fabrication	Freigabepfung einer Charge
IT	indirect test	essai indirect	indirekte Prüfung

	EN	FR	DE
PVT	process verification test	essai de vérification du procédé de fabrication	Prozessüberprüfung
TT	type test	essai de type	Typprüfung
WT	witness testing	essai témoin	Prüfung unter Aufsicht

4.2 Symbols

- I_0 Material grade used in the inner layer of the initial type-tested M-pipe
- A_{i0} Material grade used in the inner adhesive layer of the initial type-tested M-pipe
- M_0 Material grade used in the metal layer of the initial type-tested M-pipe
- A_{o0} Material grade used in the outer adhesive layer of the initial type-tested M-pipe
- O_0 Material grade used in the outer layer of the initial type-tested M-pipe
- I_1 Alternative material grade to be introduced in the inner layer
- A_{i1} Alternative material grade to be introduced in the inner adhesive layer
- M_1 Alternative material grade to be introduced in the metal layer
- A_{o1} Alternative material grade to be introduced in the outer adhesive layer
- O_1 Alternative material grade to be introduced in the outer layer

5 General

Compounds, products and assemblies shall conform to the requirements given of ISO 21003 (all parts).

Products and assemblies shall be produced by the manufacturer under a quality management system, which includes a quality plan.

6 Testing and inspection

6.1 Grouping

6.1.1 General

For the purposes of this document, the groups specified in 6.1.2 to 6.1.4 apply.

6.1.2 Pressure groups

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

Table 1 — Pressure groups

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

6.1.3 Size groups

Three size groups are defined for pipes and fittings, as given in [Table 2](#).

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	$d_n > 63$

6.1.4 Fitting groups

Two groups of fittings having a similar design are defined, as given in [Table 3](#).

Table 3 — Fitting groups

Fitting group	Type of fitting
1	Elbows, tees, reducers, couplers, end caps
2	Unions, flange adaptors, transition fitting, adaptor pieces and/or their plastics parts and others

6.2 Type testing

Relevant TTs shall be carried out on new systems and whenever there is a change in design, compound, production site or 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 6](#) to [Table 10](#), as applicable.

Conditions considered as leading to a change of compound (M) of M-pipes and P-pipes are given in [Tables 4](#) and [5](#). [Tables 4](#) and [5](#) offer a wide range of changes.

NOTE 1

- Example 1: A change of the inner layer material from PE-Xa to PERT Type II
- Example 2: A change of the metal layer material from an aluminium alloy type 8006 to a different aluminium alloy type or even to a steel alloy.
- Example 3: A change of a material grade used for the inner layer to another material grade from another raw material supplier.

The relevant characteristics to be tested in case of change of compound of M-pipes and P-pipes are given in [Tables 6](#), [7](#) and [10](#) in columns M1 –M5, as applicable.

However, combinations of such compound changes are not covered by [Tables 6](#), [7](#) and [10](#). In case of a combination of compound changes of a pipe, a full type testing is required, if [Annex A](#) (see below) is not applicable.

A special case, similar to change of compound, but with a different intention is described in [Annex A](#). [Annex A](#) defines the testing of second sourcing material grades. It describes a qualified test scheme to test the interchangeability of a currently used material grade for a layer of an initial type-tested multilayer pipe by an alternative material grade intended to be used for this layer of this pipe. The testing does not only ensure the interchangeability of a material grade for one layer, it covers also all possible combinations, which can occur in the production later on, when for each layer the initial material grade and a positive tested alternative material grade can be used.

The characteristics to be tested in case of change of compound (M) of plastic fittings are listed in [Table 8](#) in columns M1 – M2 and in [Table 10](#) in column MF, as applicable.

NOTE 2 The characteristics to be tested are applicable also for plastic fittings made of other polymer material (e.g. PPSU, PSU, PVDF) than those materials specified in the relevant product standards.

The relevant characteristics to be tested in case of change of a metal fitting are given in [Tables 9](#) and [10](#), as applicable. A change of material of metal fittings without any change of design in those areas, which are relevant to the joint performance, requires no testing as specified in ISO 21003-5.

Table 4 — Conditions considered to lead to a change of compound (M) for M-pipes

Type of change	Conditions
Change of inner layer ^a (M1)	Defined in Part 7 of the relevant reference product standard where for M-pipes in this document only the specific “M1A” change (change of polymer) is applicable. All other “M” changes in the relevant reference product standards for the inner layer compound are assumed to be covered in accordance with parts 7 of those relevant product standard (on mono layer pipes).
Change of inner adhesive layer ^b (M2)	Change of supplier Change of formulation Change of chemical nature
Change of metal (M3)	Change of supplier Change of alloy/composition Change of welding system
Change of outer adhesive layer ^c (M4)	Change of supplier Change of formulation Change of chemical nature
Change of outer layer ^d (M5)	Change of supplier Change of formulation Change of chemical nature
<p>^a Inner layers are the layers in direct contact with the conveyed fluid and all other (stress designed) layers on the inner side of the metal layer.</p> <p>^b Inner adhesive layers are all layers applied as thin bonding layers on the inner side of the metal layer.</p> <p>^c Outer adhesive layers are all layers applied as thin bonding layer on the outer side of the metal layer.</p> <p>^d Outer layers are all layers applied on the outer side of the metal layer which could be non-stress designed layers. For stress designed outer layers the M1 procedure applies.</p>	

Table 5 — Conditions considered to lead to a change of compound (M) for P-pipes

Type of change	Conditions
Change of inner layer ^a (M1)	Defined in Part 7 of the relevant reference product standard where for M-Pipes in this document only the specific “M1A” change (change of polymer) is applicable. (For PVC-C M1 applies.) All other “M” changes for the inner layer compound are assumed to be covered in accordance with the parts 7 of the relevant product standard (on mono layer pipes).
Change of inner adhesive layer ^b (M2)	Change of supplier Change of formulation Change of chemical nature
Change of application (functional) layer (M3)	Change of supplier Change of formulation Change of chemical nature
Change of outer adhesive layer ^c (M4)	Change of supplier Change of formulation Change of chemical nature
Change of (outer) plastics layer ^d (M5)	Change of supplier Change of formulation Change of chemical nature
<p>^a Inner layers are the layers in direct contact with the conveyed fluid and all other (stress designed) layers on the inner side of the functional layer.</p> <p>^b Inner adhesive layers are all layers applied as thin bonding layers on the inner side of the functional layer.</p> <p>^c Outer adhesive layers are all layers applied as thin bonding layers on the outer side of the functional layer.</p> <p>^d Outer layers are all layers applied on the outer side of the functional layer which could be non-stress designed layers. For stress designed outer layers the M1 procedure applies.</p>	

For the purposes of defining a change in design, the following characteristics are relevant:

- a) dimensions;
- b) geometry of the product;
- c) 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 exceed the defined specifications, the relevant characteristics given in [Table 6](#) to [Table 10](#), as applicable, shall be retested.

In case of extension of the product range (E), the relevant characteristics given in [Table 6](#) to [Table 10](#), as applicable, shall be tested.

In case of a change of production site of a product (pipe / fitting) (P), the relevant characteristics given in column P of [Table 6](#) to [Table 10](#), as applicable, shall be tested.

NOTE 1 As an exception, no testing is required in case of changes (M, E) for a product (pipes/fittings) manufactured at an alternative production site provided that these changes (M, E) have been evaluated according to this document for the same product (pipe/fitting) at an equivalent and evaluated production site and provided that the production process of the product is equivalent.

NOTE 2 In case of a change of a production site of a material grade, the supplier has to ensure that the material grade is identical. Additional testing of products (pipes/fitting) is not required.

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

Characteristic	Reference to part and (sub) clause of ISO 21003: 2008	Conditions requiring test ^a								Sampling procedure		
		N	M1	M2	M3	M4	M5	P	E	Manufacturer	Certification body ^{b,c}	
Influence on water intended for human consumption	Part 1, 6.2	According to national regulations										
Appearance	Part 2, 6.1	+	+	+	+	+	+	+	+	+	1 test piece of each diameter and pressure group	1 test piece of 1 diameter/ size group and pressure group
Opacity	Part 2, 6.2	+	+d	1 test piece with the smallest wall thickness produced	1 test piece with the smallest wall thickness produced							
Dimensions	Part 2, 8.2	+	+	+	+	+	+	+	+	+	1 test piece of each diameter and pressure group	1 test piece of 1 diameter/ size group and pressure group
Long-term strength of M-pipes	Part 2, 9.1	+	+e	+h	+e	+h	+h	+h	+e	+	See ISO 17456:2006, 6.2.3, 6.2.4 and 6.2.5 as applicable	Evaluation checked by certification body. 3 test pieces of 1 diameter/ size group and pressure group, according to ISO 17456:2006, 6.2.5
Thermal durability of M-pipes, inner layer	Part 2, 10.2.1	+	+	-	-	-	-	-	-	+g	1 test piece per compound	1 test piece per compound
Thermal durability of M-pipes, outer layer	Part 2, 10.2.2	+	-	-	-	-	-	+	-	+f	1 test piece per compound	1 test piece per compound
Strength of weld line	Part 2, Clause 11	+	-	-	+	-	-	-	-	-	1 test piece per similar construction type	1 test piece per similar construction type
Delamination of M-pipes	Part 2, 12.2	+	+	+	+	-	-	+	-	-	1 test piece per similar construction type	1 test piece per similar construction type
Oxygen permeability	Part 2, Clause 13	+	-	-	+	-	-	-	-	-	1 test piece per similar construction type	1 test piece per similar construction type
Physical and chemical characteristics	Part 2, Clause 14	+	+	-	+	-	+	-	-	-	1 test piece per similar construction type	1 test piece per similar construction type
Marking	Part 2, Clause 16	+	+	-	+	-	+	+	+	+	1 sample of each diameter	1 test piece of 1 diameter/ size group and pressure group

Table 6 (continued)

Characteristic	Reference to part and (sub) clause of ISO 21003:2008	Conditions requiring test ^a								Sampling procedure	
		N	M1	M2	M3	M4	M5	P	E	Manufacturer	Certification body ^{b,c}
<p>^a N: new product, i.e. full type testing; M1: change of the material grade of the inner layer; M2: change of the material grade of the inner adhesive layer; M3: change of the material grade of the metal layer; M4: change of the material grade of the outer adhesive layer; M5: change of the material grade of the outer layer; P: change of production place E: extension of product range; +: test to be carried out.</p> <p>^b Recommended sampling procedure for a testing laboratory working for a certification body.</p> <p>^c Recommended sampling procedure for a testing laboratory working on behalf of a certification body. Testing undertaken in manufacturer's laboratory shall be taken into account, by prior agreement with the certification body.</p> <p>^d Only if change of (coloured) compound has influence on the total pipe opacity.</p> <p>^e In case of change to identical polymer material (e.g. PE-Xb to PE-Xb or PE-RT Type II to PE-RT Type II) or metal materials with same specifications having similar physical properties, the confirmation testing in accordance with ISO 17456:2006, 6.2.4., applies. If this confirmation testing leads to a lower pressure level than the current lowest pressure lines in the same dimension group, the relevant dimensions shall be fully tested in accordance with ISO 17456:2006, 6.2.3. In case of change to a different polymer material (e.g. PE-Xa to PE-Xc or PP-R to PP-H) or changing from aluminium alloy (e.g. type 8006 to type 8011) or even from an aluminium alloys to e.g. a steel alloy type the complete testing in accordance with ISO 17456:2006, 6.2.3, applies.</p> <p>^f To be performed in case the outer layer compound is only tested in accordance with ISO 21003-2:2008, Annex C and the new dimension has a thinner outer layer wall thickness than the previous tested dimensions.</p> <p>^g Only relevant if the extension contains M-pipes with a thinner inner layer compared to the original pipes.</p> <p>^h Testing according to ISO 17456:2006, 6.2.5 "control point tests".</p>											

Table 7 — P-pipes: Characteristics of P pipes that require type testing (TT)

Characteristic	Reference to part and (sub) clause of ISO 21003:2008	Conditions requiring test ^a								Sampling procedure		
		N	M1	M2	M3	M4	M5	P	E	Manufacturer	Certification body ^{b,c}	
Influence on water intended for human consumption	Part 1, 6.2	According to national regulations										
Appearance	Part 2, 6.1	+	+	+	+	+	+	+	+	+	1 test piece per diameter and pressure group	1 test piece of 1 diameter/ size group and pressure group
Opacity	Part 2, 6.2	+	+d	1 test piece with the smallest wall thickness produced	1 test piece with the smallest wall thickness produced							
Dimensions	Part 2, 8.2	+	+	+	+	+	+	+	+	+	1 test piece per diameter and pressure group	1 test piece of 1 diameter/ size group and pressure group
Long-term strength of P-pipes	Part 2, 9.1	+	+e	+g	+e	+g	+g	+e	+	+	See ISO 17456:2006, 6.2.3, 6.2.4 and 6.2.5 as applicable	Evaluation checked by certification body. 3 test pieces of 1 diameter/ size group and pressure group, according to ISO 17456:2006, 6.2.5

Table 7 (continued)

Characteristic	Reference to part and (sub) clause of ISO 21003:2008	Conditions requiring test ^a								Sampling procedure	
		N	M1	M2	M3	M4	M5	P	E	Manufacturer	Certification body ^{b,c}
Thermal durability of P-pipes	Part 2, 10.1	+	+	-	-	-	-	-	-	1 test piece per compound	1 test piece per compound
	Part 2, 10.2.2	+	-	-	-	-	+	-	-	1 test piece per compound	1 test piece per compound
Delamination of P-pipes	Part 2, 12.1	+	-	+	+	+	-	+	-	1 test piece per similar construction type	1 test piece per similar construction type
Oxygen permeability	Part 2, Clause 13	+	-	-	+	-	-	-	-	1 test piece per similar construction type	1 test piece per similar construction type
Physical and chemical characteristics	Part 2, Clause 14	+	+	-	-	-	-	-	-	1 test piece per similar construction type	1 test piece per similar construction type
Marking	Part 2, Clause 16	+	+	-	+	-	+	+	+	1 test piece per diameter and pressure group	1 test piece of 1 diameter/ size group and pressure group

^a N: new product, i.e. full type testing
M1: change of the material grade of the inner layer;
M2: change of the material grade of the inner adhesive layer;
M3: change of the material grade of the metal layer;
M4: change of the material grade of the outer adhesive layer;
M5: change of the material grade of the outer layer;
P: change of production place;
E: extension of product range;
+: test to be carried out.

^b Recommended sampling procedure for a testing laboratory working for a certification body.

^c Recommended sampling procedure for a testing laboratory working on behalf of a certification body. Testing undertaken in manufacturer's laboratory shall be taken into account, by prior agreement with the certification body.

^d Only if change of (colored) compound has influence on the total pipe opacity.

^e In case of change of layer thicknesses or change to identical polymer material (e.g. PE-Xb to PE-Xb or PE-RT Type II to PE-RT Type II) the confirmation testing in accordance with ISO 17456:2006, 6.2.4 applies. If this confirmation testing leads to a new pressure level then the current pressure lines in the same dimension group, the relevant dimensions shall be fully tested in accordance with ISO 17456:2006, 6.2.3. In case of change to a different polymer material (e.g. PE-Xa to PE-Xc or PP-R to PP-H) the complete testing in accordance with ISO 17456:2006, 6.2.4, applies.

^f In case the outer layer compound is tested in accordance with ISO 21003-2:2008, 10.1 this aspect is expected to be covered by this test.

^g Testing according to ISO 17456:2006, 6.2.5 "control point tests".

Table 8 — Plastic fittings: Characteristics of plastic fittings that require type testing (TT)

Characteristic	Reference to part and clause or subclause of ISO 21003: 2008	Conditions requiring test ^a						Sampling procedure	
		N	D	M1	M2	E	P	Manufacturer	Certification body ^{b,c}
Influence on water intended for human consumption	Part 1, 6.2	According to national regulations							
Hydrostatic stress properties of material	Part 3, 5.1 and 5.2	+ ^e	-	+ ^e	+ ^e	-	-	1 evaluation per compound	Evaluation checked by certification body
Thermal stability	Part 3, 5.1 and 5.2	+	-	+	+	-	-	1 test piece per compound	Report checked by certification body
Appearance	Part 3, 6.1	+	+	+	+	+	-	5 test pieces/ size group/fitting group ^f	5 test pieces of 1 diameter/ size group/ fitting group

Table 8 (continued)

Characteristic	Reference to part and clause or subclause of ISO 21003: 2008	Conditions requiring test ^a						Sampling procedure	
		N	D	M1	M2	E	P	Manufacturer	Certification body ^{b,c}
Opacity	Part 3, 6.2	+	+d	+d	+d	-d	-	1 test piece with the smallest wall thickness produced	1 test piece with the smallest wall thickness produced
Dimensions	Part 3, Clause 7	+	+	+	+	+	-	5 test pieces/ size group/fitting group ^f	5 test pieces of 1 diameter/ size group/ fitting group
Resistance to internal pressure	Part 3, Clause 8	+	+	+	+	+	+	3 test pieces/ size group/ fitting group for the relevant design pressure and appropriate class of application ^f	3 test pieces of 1 diameter/ size group/ fitting group for the relevant design pressure and appropriate class of application
Physical and chemical characteristics	Part 3, Clause 9	+	+	+	+	+	+	1 test piece per size group and fitting group	Evaluation checked by certification body
Marking	Part 3, Clause 11	+	+	+	-	+	-	5 test piece/ size group/ fitting group ^f	5 test piece of 1 diameter/ size group/ fitting group

^a Materials of the reference product standards are covered in Part 7 of those standards.
N: new product
D: change in design;
M1: change of polymer;
M2: change of additive package;
E: extension of product range;
P: change of production site of the pipes and fittings made of the same compounds to an existing product location, provided that the production process is equivalent;
+: test to be carried out.

^b Recommended sampling procedure for a testing laboratory working for a certification body.

^c Recommended sampling procedure for a testing laboratory working on behalf of a certification body. Testing undertaken in manufacturer's laboratory shall be taken into account, by prior agreement with the certification body.

^d Only if change of (colored) compound has influence on the total fitting opacity.

^e For 5.2 of Part 3: If the raw material supplier has evaluated the hydrostatic stress properties in accordance with ISO 9080[5], or equivalent, the manufacturer of the fittings shall check conformity.

^f Shall contain fittings from each cavity. The minimum number of samples shall be at least one from each cavity.

Table 9 — Metal fittings: Characteristics of metal fittings that require type testing (TT)

Characteristic	Reference to part and clause or subclause of ISO 21003:2008	Conditions requiring test ^a					Sampling procedure	
		N	D	M1	P	E	Manufacturer	Certification body ^{b,c}
Influence on water intended for human consumption	Part 1, 6.2	According to national regulations						
Material:	Part 3, 5.3	+	-	+	+	-	1 evaluation per alloy	Evaluation checked by certification body
Sealing elements according to EN 681-1	Part 3, 9.3	+	+	+	-	+	1 evaluation acc. to EN 681-1:2006-11, Table 3	Evaluation checked by certification body
Appearance	Part 3, 6.1	+	+	+	+	+	5 test pieces/size group/fitting group	5 test pieces of 1 diameter/size group/fitting group
Dimensions	Part 3, 7.3	+	+	+	+	+	5 test pieces/size group/fitting group	5 test pieces of 1 diameter/size group/fitting group
Minimum wall thickness	Part 3, 7.3 EN 1254-3, 4.3.3	+	+	+	-	+	3 test pieces/size group/fitting group for the relevant design pressure and appropriate class of application	3 test pieces of 1 diameter/size group/fitting group for the relevant design pressure and appropriate class of application
Marking	Part 3, Clause 11	+	+	+	+	+	5 test piece/size group/fitting group	5 test piece of 1 diameter/size group/fitting group
<p>^a N: new product; D: change in design; M1: change of alloy; P: change of production site (same product); E: extension of product range; +: test to be carried out.</p> <p>^b Recommended sampling procedure for a testing laboratory working for a certification body.</p> <p>^c Recommended sampling procedure for a testing laboratory working on behalf of a certification body. Testing undertaken in manufacturer's laboratory shall be taken into account, by prior agreement with the certification body.</p>								

Table 10 — Piping system, consisting of pipe (M-pipe, P-pipe) and fitting (plastic and/or metal): Characteristics of fitness for purpose of the system that require type testing

[1] Characteristic	[2] Reference to part, clause of ISO 21003: 2008	[3] Conditions requiring test ^a											[4] Sampling procedure	
		N	De	MF	M1	M2	M3	M4	M5	E	P	[5] Manufacturer	[6] Certification body ^b	
Resistance to internal pressure	Part 5, 5.2	+	+d	+c,d			+c,d			+d	-	3 test pieces per diameter and jointing system for the relevant design pressure and appropriate application class	3 test pieces of 1 diameter per size group and jointing system for the relevant design pressure and appropriate application class	
Leaktightness under internal pressure and bending	Part 5, 5.3	+	+d	+c,d			+c,d			+d	-	3 test pieces per diameter and jointing system for the relevant design pressure and appropriate application class	3 test pieces of 1 diameter per size group and jointing system for the relevant design pressure and appropriate application class	
Resistance to pull-out	Part 5, 5.4	+	+d	+c,d	+c,d		+c,d		+c,d	+d	-	3 test pieces per diameter and jointing system for the relevant design pressure and appropriate application class	3 test pieces for the smallest and largest diameter per size group and jointing system for the relevant design pressure and appropriate application class	
Resistance to thermal cycling	Part 5, 5.5	+	+d	+c,d	+c,d	+c,d	+c,d	+c,d	+c,d	+d	-	1 assembly per diameter and jointing system for the relevant design pressure and appropriate application class	1 assembly per diameter and jointing system for the relevant design pressure and appropriate application class	
Resistance to pressure cycling	Part 5, 5.6	+	+d	+c,d						+d	-	3 test pieces per diameter and jointing system for the relevant design pressure and appropriate application class	3 test pieces of 1 diameter per size group and jointing system for the relevant design pressure	
Leaktightness under vacuum	Part 5, 5.7	+	+d	+c,d						+d	-	3 test pieces per diameter and jointing system for the relevant design pressure and appropriate application class	3 test pieces of 1 diameter per size group and jointing system for the relevant design pressure	

^a N: new system due to a new product (pipe or fitting), i.e. full type testing;
D: change in design of the pipe or fitting;
MF: change of material grade of the plastic fitting material (see M1A change of the relevant parts 7);
M1: change of the material grade of the inner layer of the pipe;
M2: change of the material grade of the inner adhesive layer of the pipe;
M3: change of the material grade of the metal layer of the M-pipe; change of functional layer material of the P-pipe;

Table 10 (continued)

[1] Characteristic	[2] Reference to part, clause of ISO 21003:2008	[3] Conditions requiring test ^a											[4] Sampling procedure	
		N	D ^e	MF	M1	M2	M3	M4	M5	E	P	[5] Manufacturer	[6] Certification body ^b	
M4: change of the material grade of the outer adhesive layer of the pipe; M5: change of the material grade of the outer layer of the pipe; E: extension of the product range of the pipe or fitting (except the products already covered by the scheme of sampling procedure); P: change of production site of the pipe or fitting; +: test to be carried out.														
^b Recommended sampling procedure for a testing laboratory working for a certification body. Testing undertaken in manufacturer's laboratory shall be taken into account, by agreement with the certification body.														
^c Test shall be made on one product diameter per size group and jointing system for the relevant design pressure and appropriate application class.														
^d In case more than one pipe-fitting combination needs to be tested, a combination of the different connections can be tested in one test construction (per pipe dimension), provided that the number of the tested connections remains conform to the corresponding test standard and there is a maximum of tests on 2 different pipe-fitting combinations in one test construction.														
^e For fittings made of metal the column D is applicable only, if the change of design is made in the fitting area which is relevant for the jointing.														

6.3 Batch release test

For the BRT the characteristics with the minimum sampling frequency shall be tested according to [Tables 11](#) and [12](#), as applicable.

Table 11 — Characteristics of pipes and minimum sampling frequencies for BRTs

Characteristic	Reference to part and clause or subclause of ISO 21003:2008	Minimum sampling frequency
Appearance	Part 2, 6.1	1 test piece at start up and at least every 8 h per machine
Outside diameter	Part 2, 8.2	1 test piece at start up and at least every 8 h per machine
Wall thickness	Part 2, 8.2	1 test piece at start up and at least every 8 h per machine
Resistance to internal pressure (95 °C, 22 h)	Part 2, 9.1	1 test piece per 24 h per machine
or		1 test piece per week per machine
Resistance to internal pressure (95 °C, 165 h) ^a		
Degree of crosslinking (PE-X)	Part 2, Clause 14	1 test piece per 24 h per machine
Melt flow rate (PB, PP, PE-RT)	Part 2, Clause 14	1 test piece per 24 h per machine
Marking	Part 2, Clause 16	1 test piece at start up and at least every 8 h per machine

^a In case of dispute testing at 95 °C and 165 h shall be done.

Table 12 — Characteristics of plastic fittings and minimum sampling frequencies for BRTs

Characteristic	Reference to part and clause or subclause of ISO 21003:2008	Minimum sampling frequency ^a
Appearance	Part 3, 6.1	1 test piece at start-up, then at least every 8 h per machine
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	1 test piece at start-up, then at least every 8 h per machine
Resistance to internal pressure (20 °C, 1 h) <i>Or</i> Resistance to internal pressure (95 °C, 1 000 h)	Part 3, 8.3	1 test piece/ batch, but at least every 10 days per machine
Marking	Part 3, Clause 14	1 test piece/ batch, but at least every 10 days per machine

^a For multiple cavity moulds, a rotating sampling procedure between the cavities for testing during the shifts shall be considered. The manufacturer shall give details in his quality plan accordingly.

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 [Tables 11](#) and [12](#), as applicable, 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 be given in the manufacturer's quality plan.

6.4 Process verification tests (PVTs)

For the PVT the characteristics with the minimum sampling frequency shall be tested according to [Tables 13](#) and [14](#), as applicable.

Table 13 — Characteristics of pipes and minimum sampling frequencies for PVTs

Characteristic	Reference to part and clause or subclause of ISO 21003:2008	Minimum sampling frequency
Resistance to internal pressure (95 °C, 1 000 h)	ISO 17456:2006: 6.2.5	One test piece per year per d_n and e_n

Table 14 — Characteristics of plastic fittings and minimum sampling frequencies for PVTs

Characteristic	Reference to part and clause or subclause of ISO 21003:2008	Minimum sampling frequency
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 [Tables 14](#) and [15](#), as applicable, the retest procedure detailed in the manufacturer's quality plan shall be performed.

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, as well as to verify the characteristics given in [Table 12](#) to [Table 13](#), as applicable.

A test performed as an AT does not need to be repeated as a PVT.

6.5 Audit tests (AT)

ATs are performed if certification is involved only.

Table 15 — Characteristics of pipes and minimum sampling frequencies for ATs

Characteristic	Reference to part and clause or subclause of ISO 21003:2008	Minimum sampling frequency
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)	ISO 17456:2006: 6.2.5	Three test pieces per year per size group
Marking	Part 2, Clause 16	Three test pieces per year per size group

Table 16 — Characteristics of plastic fittings and minimum sampling frequencies for ATs

Characteristic	Reference to part and clause or subclause of ISO 21003:2008	Minimum sampling frequency
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

Table 17 — Characteristics for fitness for purpose of the piping system and minimum sampling frequencies for ATs

Characteristic	Reference to part and subclause of ISO 21003:2008	Minimum sampling frequency
Pressure test (1 000 h)	Part 5, 5.2	one assembly ^a per size group and jointing system per year
^a Different types of fittings from group 1 and 2 of the same system may be tested in the same assembly.		

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.

6.6 Indirect testing (IT)

Generally, testing shall be performed using the test methods referred to in ISO 21003 (all parts).

ITs may be used for BRT characteristics as given in [Tables 11](#) and [12](#). Indirect testing shall not be used for TTs, PVTs or ATs.

The indirect test method used and the correlation or safe relationship of the indirect testing to the specified testing shall be documented in the manufacturer's quality plan. The continuing validity of the indirect testing shall be checked at regular intervals.

In cases of dispute, the BRT as specified in [Tables 11](#) and [12](#) shall be used

If certification is involved, the IT could be accepted by a certification body.

6.7 Test records

Unless otherwise specified all records shall be maintained for a minimum of ten years in accordance with the information given in the quality management system.

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Annex A (informative)

Interchangeability of different material grades — Testing of alternative material grades for a layer in a multilayer M-pipe (second sourcing)

A.1 General

Exchanging a material grade by a different material grade even of the same material may have an influence on the basic properties and characteristics of a multilayer pipe. In such cases, it is necessary to test its interchangeability. A qualified test scheme to test the interchangeability of a currently used material grade for a layer of an initial type-tested multilayer pipe by an alternative material grade intended to be used for this layer of this pipe is described in this annex.

This abridged method therefore serves not to determine a specific profile of the properties of a new construction, but rather is intended exclusively for the evaluation of alternative material grades for an already ISO 21003 tested multilayer M-pipe. Furthermore, this [Annex A](#) is not applicable for any dimensional changes (including respective tolerance limits), explicitly neither of inner or outer diameters nor layer thicknesses of any layer.

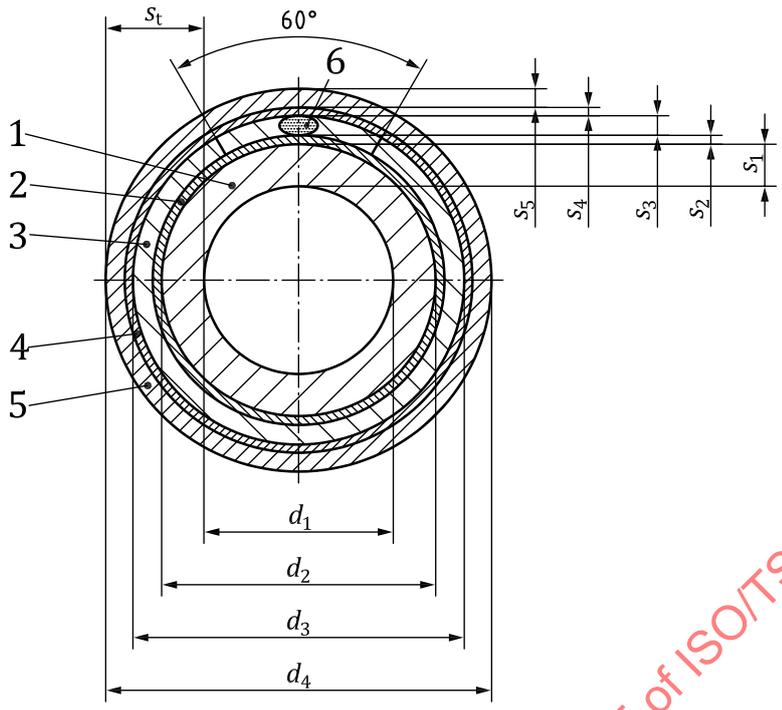
For this method of interchangeability testing, the initial type tested multilayer pipe is always the starting point. The testing does not only ensure the interchangeability of a material grade for one layer, it covers also all possible combinations, which can occur in the production later on, when for each layer the initial material grade and a positive tested alternative material grade can be used.

Since multilayer pipes are only implementable in combination with system-related fittings according to the ISO 21003 series, the interchangeability testing covers also system tests.

Due to the complexity of this issue, the described method is limited to multilayer M-pipes in the 5-layer construction, consisting of inner layer, inner adhesive layer, metal layer, outer adhesive layer and outer layer. Furthermore, this method is limited to one alternative material grade per layer, only.

For third party certification purposes the final testing program, also if necessary beyond the limitation to one alternative material grade per layer, shall be made in agreement in a case-to-case situation with the certification body.

According to the rules of this [Annex A](#), the marking of the pipe shall be unchanged when an alternative material grade is used in one or more layers.



- Key**
- d_1 inner diameter
 - d_2 diameter of inner layer
 - d_3 diameter metal layer
 - d_4 outer diameter of pipe
 - 1 inner layer
 - 2 adhesive layer, inner
 - 3 metal layer
 - 4 adhesive layer, outer
 - 5 outer layer
 - 6 weld line
 - s layer thickness
 - s_t wall thickness

Figure A.1 — Layer structure

A.2 Method

A.2.1 General and requirements for application of this method

The basis for using the method on a multilayer M-pipe is proof of a positive test according to the ISO 21003 series.

According to this method, only one alternative material grade shall be introduced for each layer.

In the case that for several layers an alternative material grade each is introduced at the same time, the proper approach is to proceed as if the alternative material grade for each layer were introduced one after the other.

A.2.2 Interchangeability testing

When introducing an alternative material grade for a layer, the testing of the interchangeability starts with the basic test according to lines 1 and 2 of [Tables A.2](#) to [A.6](#), as applicable.

If, when introducing an alternative material grade for a layer, there is already an alternative material grade for one or several other layers, then the respective additional tests shall be performed. The additional tests are given in [Tables A.2](#) to [A.6](#), as applicable. The test specimens for these additional tests fixed in [Tables A.2](#) to [A.6](#) ensure that all the possible combinations of material grades in the different layers, which can occur in production later on, are covered.

A.2.3 Method for the introduction of an alternative material grade at the inner layer

The alternative material grade for the inner layer shall correspond to the material used for the inner layer of the initial type-tested M-pipe. The same material according to [Table A.1](#) used in the inner layer of the initial type-tested M-pipe has to be selected for the alternative material grade.

Table A.1 — Materials for the inner layer of an M-pipe

Standard	Material
PP as per ISO 15874-2	PP-B
	PP-H
	PP-R
	PP-RCT
PE-X as per ISO 15875-2	PE-Xa
	PE-Xb
	PE-Xc
PE-RT as per ISO 22391-2	PE-RT Type I
	PE-RT Type II
PB as per ISO 15876-2	PB-H
	PB-R
PVC-C as per ISO 15877-2	PVC-C Type I
	PVC-C Type II

NOTE Practical examples to show what is meant:

- The material used in the inner layer of the initial type-tested M-pipe is a PP-R. The alternative material grade shall only be a PP-R again.
- The material used in the inner layer of the initial type-tested M-pipe is a PE-Xb. The alternative material grade shall only be a PE-Xb again.
- This method covers not to introduce an alternative material grade of PE-Xc instead of a PE-Xa grade at the inner layer of the initial type-tested M-pipe.
- This method covers not to introduce an alternative material grade of PB-R instead of a PP-H grade at the inner layer of the initial type-tested M-pipe.

Testing an alternative material grade for the inner layer is conducted according to [Table A.2](#).

The scope of the basic test is described in [Table A.2](#) in Line 1 as well as the composition of the respective test specimen in Line 2.

In case of an already existing alternative material grade for the inner adhesive layer, additional tests are required according to [Table A.2](#), line 3 with test specimen described in line 4. In case of an already existing alternative material grade for the metal layer, additional tests are required according to [Table A.2](#), line 3 with test specimen described in line 5. If there are already alternative material grades

for both the inner adhesive layer and the metal layer, then the additional tests are to be conducted according to [Table A.2](#) line 3 with test specimens fixed in Lines 4, 5 and 6.

A.2.4 Method for the introduction of an alternative material grade at the adhesive layer

The design of a multilayer pipe as in [Figure 1](#) necessitates two adhesive layers: one inner adhesive layer, i.e. between the inner layer and metal layer, and one outer adhesive layer, i.e. between the metal and outer layers. The test for an alternative material grade is performed in relation to its use as an inner adhesive layer or an outer adhesive layer.

A.2.5 Method for the introduction of an alternative material grade at the inner adhesive layer

Testing an alternative material grade for the inner adhesive layer is done according to [Table A.3](#).

The scope of the basic test is described in [Table A.3](#) in Line 1 as well as the composition of the respective test specimen in Line 2.

In case of an already existing alternative material grade for the inner layer, additional tests are required according to [Table A.3](#), line 3 with test specimen described in line 4. In case of an already existing alternative material grade for the metal layer, additional tests are required according to [Table A.3](#), line 3 with test specimen described in line 5. If there are already alternative material grades for both the inner layer and the metal layer, then the additional tests are to be conducted according to [Table A.3](#) line 3 with test specimens fixed in Lines 4, 5 and 6.

A.2.6 Method for the introduction of an alternative material grade at the outer adhesive layer

Testing an alternative material grade for the outer adhesive layer is done according to [Table A.5](#).

The scope of the basic test is described in [Table A.5](#) in Line 1 as well as the composition of the respective test specimen in Line 2.

In case of an already existing alternative material grade for the outer layer, additional tests are required according to [Table A.5](#), line 3 with test specimen described in line 4. In case of an already existing alternative material grade for the metal layer, additional tests are required according to [Table A.5](#), line 3 with test specimen described in line 5. If there are already alternative material grades for both the outer layer and the metal layer, then the additional tests are to be conducted according to [Table A.5](#) line 3 with test specimens fixed in Lines 4, 5 and 6.

A.2.7 Method for the introduction of an alternative material grade at the metal layer

The alternative material grade for the metal layer shall correspond to the alloy type used in the initial type-tested M-pipe, i.e. the alternative material grade shall have the identical alloy designation according to the corresponding material standard. Moreover, the alternative material grade shall feature comparable mechanical characteristic values.

Practical example to show what is meant: The aluminium alloy used in the metal layer of the initial type-tested M-pipe has the designation 8006 according to EN 573-3. The alternative material grade shall only be an aluminium alloy type 8006 again.

NOTE Mechanical characteristic values for alloys are in particular tensile strength and elongation at break.

Testing an alternative material grade for the metal layer is done according to [Table A.4](#).

The scope of the basic test is explained in [Table A.4](#) in Line 1 as well as the composition of the respective test specimen in Line 2.

The scope of the required additional tests, depending on already existing alternative material grades, is described in [Table A.4](#) in two blocks, in line 3 and line 7, respectively:

In case of an already existing alternative material grade for the inner layer, additional tests are required according to [Table A.4](#), line 3 with test specimen described in line 4. In case of an already existing alternative material grade for the inner adhesive layer, additional tests are required according to [Table A.4](#), line 3 with test specimen described in line 5. If there are already alternative material grades for both the inner layer and the inner adhesive layer, then the additional tests are to be conducted according [Table A.4](#) line 3 with test specimens fixed in Lines 4, 5 and 6.

Furthermore, in case of an already existing alternative material grade for the outer layer, additional tests are required according to [Table A.4](#), line 7 with test specimen described in line 8. In case of an already existing alternative material grade for the outer adhesive layer, additional tests are required according to [Table A.4](#), line 7 with test specimen described in line 9. If there are already alternative material grades for both the outer layer and the outer adhesive layer, then the additional tests are to be conducted according [Table A.4](#) line 7 with test specimens fixed in Lines 8, 9 and 10.

A.2.8 Method for the introduction of an alternative material grade at the outer layer

The alternative material grade for the outer layer shall correspond to the material used for the outer layer of the initial type-tested M-pipe. In consequence, this includes the following: If an outer layer material of the initial type-tested M-pipe according to [Table A.1](#) is used, then the same material has to be selected for the alternative material grade.

An exception is only possible when PE-HD or PE-MD is used as outer layer material of the initial-type tested M-pipe, then also a PE-RT Type I or II may be used as an alternative material grade.

Furthermore, for the cross-linked material PE-X the type of cross-linking shall remain unchanged.

Testing an alternative material grade for the outer layer is done according to [Table A.6](#).

The scope of the basic test is explained in [Table A.6](#) in Line 1 as well as the composition of the respective test specimen in Line 2.

In case of an already existing alternative material grade for the outer adhesive layer, additional tests are required according to [Table A.6](#), line 3 with test specimen described in line 4. In case of an already existing alternative material grade for the metal layer, additional tests are required according to [Table A.6](#), line 3 with test specimen described in line 5. If there are already alternative material grades for both the outer adhesive layer and the metal layer, then the additional tests are to be conducted according [Table A.6](#) line 3 with test specimens fixed in Lines 4, 5 and 6.

A.2.9 Withdrawing an alternative material grade

It is possible to withdraw an alternative material grade for a layer, which has been positively tested according to this evaluation method at any time. This allows using the evaluation method again for a new alternative material for the respective layer.

An alternative material grade, which has been withdrawn, shall no longer be used for production of the pipe.

NOTE The initial type test and the material grades defined in each layers remain unaffected by this, i.e. material grades cannot be withdrawn from the type test.

Table A.2 — Method for the introduction of an alternative material grade for the inner layer of a multilayer M-pipe with an existing type test — Test scope and test specimens

		Test specimen with defined material grades				Line	
		Inner layer	Inner adhesive Layer	Metal layer	Outer adhesive layer	Outer layer	
Precondition: Type test ^a for multilayer pipe as per ISO 21003 series		I ₀	Ai ₀	M ₀	Ao ₀	O ₀	
Basic test:							
— Compound, pipe and system tests of Table A.7, Column I							1
— Test specimen for basic test		I ₁	Ai ₀	M ₀	Ao ₀	O ₀	2
Additional tests:							
— Only the pipe and system tests corresponding to Table A.7, Column I, three samples of one pipe dimension per dimension group and per pressure group							3
— Test specimen for the additional tests: Depending on an already existing alternative material grade at other layers, test specimens per Line 4 or Line 5 or Line 4, 5 and 6:							
Alternative material grade for:							
Existing alternative material grade at:							
Inner layer	Inner adhesive layer	I ₁	Ai ₁	M ₀	Ao ₀ or Ao ₁	O ₀ or O ₁	4
	Metal layer	I ₁	Ai ₀	M ₁	Ao ₀ or Ao ₁	O ₀ or O ₁	5
	Inner adhesive layer and metal layer	I ₁	Ai ₁	M ₁	Ao ₀ or Ao ₁	O ₀ or O ₁	6
^a Serves only for the sake of completeness. The type test per the ISO 21003 series is prerequisite for application of the evaluation method.							