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BSI Standards Publication

Plastics piping systems with structured wall pipes for soil and waste discharge (low and high temperature) inside buildings — Unplasticized poly(vinyl chloride) (PVC-U)

Part 2: Guidance for the assessment of conformity

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National foreword

This Published Document is the UK implementation of CEN/TS 1453-2:2017. It supersedes DD ENV 1453-2:2001 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee PRI/88, Plastics piping systems, to Subcommittee PRI/88/1, Plastics piping for non-pressure applications.

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This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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English Version

Plastics piping systems with structured wall pipes for soil and waste discharge (low and high temperature) inside buildings - Unplasticized poly(vinyl chloride) (PVC-U) - Part 2: Guidance for the assessment of conformity

Systèmes de canalisations en plastique avec des tubes à paroi structurée pour l'évacuation des eaux-vannes et des eaux usées (à basse et à haute température) à l'intérieur des bâtiments - Poly(chlorure de vinyle) non plastifié (PVC-U) - Partie 2: Guide pour l'évaluation de la conformité

Kunststoff-Rohrleitungssysteme mit Rohren mit profilierter Wandung zum Ableiten von Abwasser (niedriger und hoher Temperatur) innerhalb von Gebäuden - Weichmacherfreies Polyvinylchlorid (PVC-U) - Teil 2: Empfehlungen für die Beurteilung der Konformität

This Technical Specification (CEN/TS) was approved by CEN on 30 November 2016 for provisional application.

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European foreword

This document (CEN/TS 1453-2:2017) has been prepared by Technical Committee CEN/TC 155 "Plastics piping systems and ducting systems", the secretariat of which is held by NEN.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes ENV 1453-2:2000.

Compared with ENV 1453-2:2000, the following changes have been made:

a) use of the template drafted by CEN/TC 155/WG 21 for assessment of conformity documents (change of "Terms and definitions" and addition of 1 column "Sampling procedures" in Tables);

b) introduction of "Limits of addition of PVC reprocessed and recycled material" in a separate table (Table 2);

c) deletion of all requirements for TPE seals as they are no longer required;

d) addition of an informative Annex A: Basic test matrix.

EN 1453, *Plastics piping systems with structured wall pipes for soil and waste discharge (low and high temperature) inside buildings — Unplasticized poly(vinyl chloride) (PVC-U)*, consists of the following Parts:

— Part 1: Specifications for pipes and the system

— Part 2: Guidance for the assessment of conformity (the present Technical Specification)

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this Technical Specification: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

Figures 1 and 2 are intended to provide general information on the concept of testing and organization of those tests used for the purpose of the assessment of conformity. For each type of test, i.e. type test (TT), batch release test (BRT), process verification test (PVT) and audit test (AT), this part of EN 1453 details the applicable characteristics to be assessed and the frequency and sampling of testing.

A typical scheme for the assessment of conformity of materials (formulations), pipes, fittings, valves or assemblies by manufacturers is given in Figure 1.

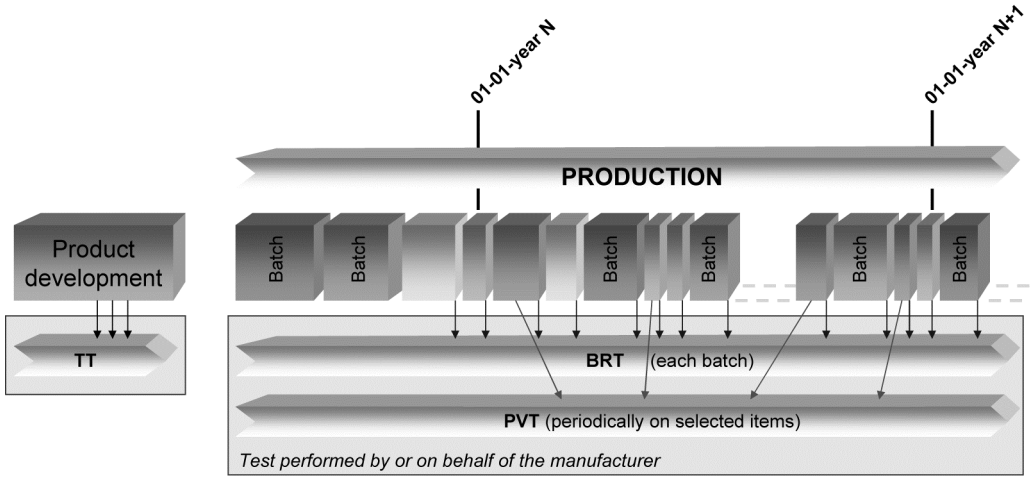

Figure 1 — Typical scheme for the assessment of conformity by a manufacturer

A typical scheme for the assessment of conformity of materials (formulations), pipes, fittings, valves or assemblies by manufacturers, including certification, is given in Figure 2.

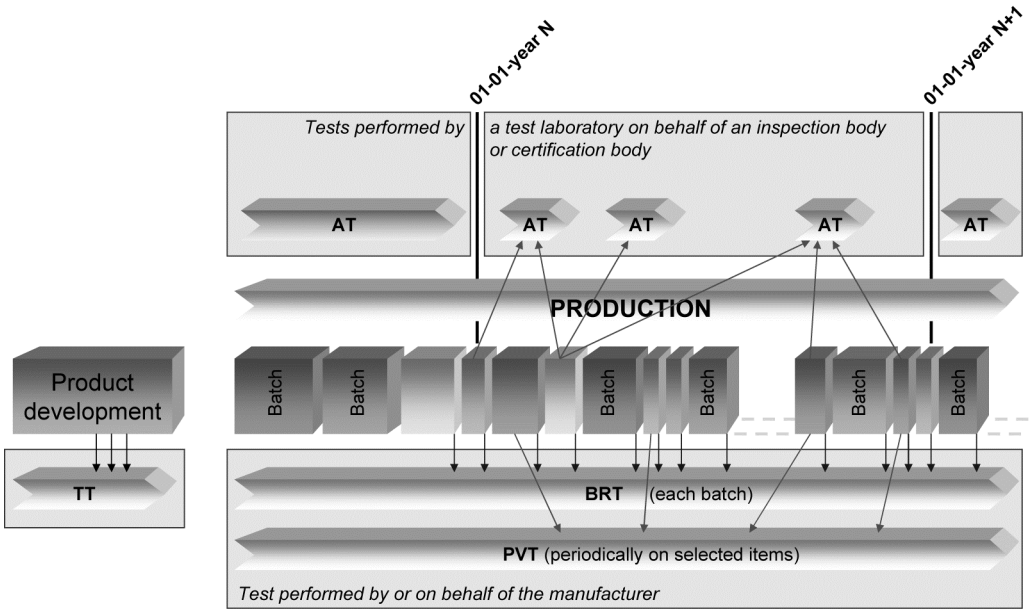

Figure 2 — Typical scheme for the assessment of conformity by a manufacturer, including certification

1 Scope

This Technical Specification gives guidance for the assessment of conformity of formulations, products and assemblies in accordance with EN 1453-1 intended to be included in the manufacturer's quality plan as part of the quality management system and for the establishment of certification procedures.

It is recommended that the quality management system conforms to or is no less stringent than the relevant requirements to EN ISO 9001 [1].

If certification is involved, it is recommended that the certification body is preferably compliant with EN ISO/IEC 17065 [5] or EN ISO/IEC 17021 [3], as applicable.

In order to help the reader, a basic test matrix is given in Annex A, Table A.1.

In conjunction with EN 1453-1, this document is applicable to piping systems made of unplasticized poly(vinyl chloride) (PVC-U) intended to be used for the following purposes:

— for soil and waste discharge systems (low and high temperature) inside buildings (application area code "B");

This is reflected in the marking of products by "B".

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1453-1:2017, *Plastics piping systems with structured-wall pipes for soil and waste discharge (low and high temperature) inside buildings — Unplasticized poly(vinyl chloride) (PVC-U) — Part 1: Specifications for pipes and the system*

3 Terms and definitions

For the purposes of this Technical Specification, the terms and definitions given in EN 1453-1 and the following apply.

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 EN ISO/IEC 17065 [5].

3.2
inspection body
body, that performs inspection

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

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

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: In the context of this part of EN 1453, the materials and products can be subjected to type testing, batch release testing, process verification testing, audit testing and witness testing, as applicable.

Note 2 to entry: A testing laboratory is preferably compliant with EN ISO/IEC 17025 [5].

3.4
quality management system
management system to direct and control an organization with regard to quality

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

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 formulation, 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 material 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 formulations or products, which needs to be satisfactorily completed before the batch can be released

3.8
process verification test
PVT
test performed by, or on behalf of the manufacturer on formulation, products or joints or assemblies at specific intervals to confirm that the process continues to be capable of producing products which conform to the requirements given in the relevant standard

Note 1 to entry: Such tests are not required to release batches of formulations or products; rather they 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 formulation, 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
generic term for formulations grouped by families, expressed by generic names, e.g. polypropylene, stainless steel, brass or EPDM

Note 1 to entry: Definition from European Commission, Directorate-General for Enterprise and Industry, Sub-group on Product Testing Procedures (EC, DG ENT and IND, SG PTP)

3.13
formulation
clearly defined homogenous mixture of base polymer with additives, i.e. anti-oxidants, pigments, stabilizers and others, at a dosage level necessary for the processing and the intended use of the final product

Note 1 to entry: The term “compound” is sometime used with similar meaning as “formulation”.

3.14
material batch
clearly identified quantity of a given homogeneous formulation manufactured under uniform conditions and defined and identified by the formulation manufacturer

3.15
product
pipe or fitting of a clearly identified type intended to be a part of a piping system which the manufacturer puts on the market

3.16
product batch
clearly identified collection of products, manufactured consecutively or continuously under the same conditions, using the same formulation conforming to the same specification

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

3.17
sample
one or more products drawn from the same production batch, selected at random without regard to their quality

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

3.18
group
collection of similar products from which samples are selected for testing purposes

Note 1 to entry: Similar products are products which are not identical, but may be grouped for testing one or several characteristics, such as products having different diameters.

3.19
component
product manufactured out of a specific formulation, brought to the market as part of another product or as a spare part

3.20
joint
connection between two products

3.21
assembly
product that can be dismantled into a set of components

EXAMPLE A test piece consisting of various products.

3.22
sampling plan
specification of the type of sampling to be used in combination with the operational specification of the entities or increments to be taken, the samples to be constituted and the measurements or tests to be made

EXAMPLE A specific plan which indicates the number of units of products or assemblies to be inspected.

3.23
product type
generic description of a product

EXAMPLE A pipe or its main parts, of the same design, from a particular formulation.

4 Abbreviated terms

To avoid misunderstanding, the abbreviations 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	Freigabeprüfung einer Charge
IT	indirect test	essai indirect	indirekte Prüfung
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

5 General

5.1 Formulation, products, joints and assemblies shall conform to the requirements given in EN 1453-1.

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

It is recommended that the quality management system conforms to or is no less stringent than the relevant requirements in EN ISO 9001 [1].

6 Testing and inspection

6.1 Material specification

For the purposes of this Technical Specification, the material specification consists of a formulation which defines PVC resin and additives and their dosage levels.

The dosage level of ingredients of a formulation shall not exceed the tolerance bands given in Table 1. If any level exceeds the dosage band or if a type (see Table 1) is changed, this variation constitutes a change in formulation.

The use of reprocessed and/or recycled material shall be considered as a change in formulation when the change in addition exceeds the tolerance bands given in Table 2.

The values of the parts *X* added to 100 parts by mass of PVC shall be specified by the manufacturer in the quality plan.

Table 1 — Formulation specification

Ingredients	Type	Band
PVC resin	Nominal K value as specified by the manufacturer:	±3 units
Type of stabilizer or master batch	1) OBS (Organic Based Stabilizers) 2) Ca-Zn 3) Sn 4) Ca-Sn 5) Others	X_1 : ± 25 %
Lubricants	All	X_2 : ± 50 % for $X_2 \leq 0,2$ X_2 : ± 0,1 part for $X_2 > 0,2$
Fillers	1) $CaCO_3$ 2) Others	X_3 : ± 3 parts X_4 : ± 25 %
Impact modifiers	All	X_5 : ± 1 part
Flow agents	All	X_6 : ± 25 % for $X_6 \leq 2$ X_6 : ± 0,5 part for $X_6 > 2$

Ingredients	Type	Band
Pigments	No requirements	-
Others	To be separately specified by the manufacturer	$X_{7,n}$: ± 25 %

Table 2 — Limits of addition of PVC reprocessed and recycled material

Ingredients	Type	Band
External reprocessed and recycled material	With an agreed specification [a]	≤ X_8 [b]
External reprocessed and recycled material	Not covered by an agreed specification	≤ X_9 [b]

[a] The specifications shall be declared by the manufacturer to the certification body.

[b] See specifications in EN 1453–1.

6.2 Grouping

6.2.1 General

For the purposes of this Technical Specification, the groups specified in 6.2.2 apply.

6.2.2 Size groups

Three size groups are defined for pipes, as given in Table 3.

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

Table 3 — Size groups

Size group	Nominal diameter, d_n mm
1	$d_n < 75$
2	$75 \leq d_n < 200$
3	$200 \leq d_n \leq 315$

6.3 Type testing

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

Type tests, which are carried out when a change of the production site occurs, depend on the extent of the change. Therefore relevant type tests should be defined individually by the manufacturer.

Type tests shall demonstrate that the products conform to all requirements for the characteristics given in Table 4 and Table 5, as applicable.

Table 4 — Characteristics of pipes that require type testing (TT)

Characteristic	Reference to clause or subclause of EN 1453–1:2017	Conditions requiring test [a]				Sampling procedure	
		N	D	M	E	Manufacturer	Certification body [b]
PVC content [c]	4.1	+	-	+	-	One calculation per formulation	One calculation per formulation
Appearance	5.1	+	-	+	+	Once per size	Once per size group
Colour	5.2	+	-	+	+	Once per size	Once per size group
Geometrical characteristics	6.2 and 6.3 – Tables 1 to 6	+	+	-	+	Once per size	Once per size group
Impact resistance (round-the-clock method)	7.1 – Table 7	+	-	-	+	Once per size per formulation	Once per size group
		-	-	+	-	Once per formulation	Once per formulation
Impact resistance (staircase method) [d]	7.2 – Table 9	+	-	-	+	Once per size per formulation	Once per size group
		-	-	+	-	Once per formulation	Once per formulation
Vicat Softening Temperature (VST)	8 – Table 10	+	-	+	-	Once per formulation	Once per formulation
Longitudinal reversion	8 – Table 10	+	-	-	+	Once per size	Once per size group
Degree of gelation [e]	8 – Table 10	+	-	-	+	Once per size per formulation	Once per size group
		-	-	+	-	Once per formulation	Once per formulation

[a] N : new system;
D : change in design;
M : change of formulations;
E : extension of the product range (except the products already covered by the scheme of sampling procedure);
+ : test to be carried out.

[b] Recommended sampling procedure for a testing laboratory working on behalf of a certification body. Testing undertaken in a manufacturer laboratory shall be taken into account, provided prior acceptance by the certification body.

[c] Done by calculation using Table 1.

[d] Only for pipes marked with ice-crystal symbol, in accordance with EN 1453–1:2017, 7.2. If the test is required, the round-the-clock method is not necessary.

[e] Characteristic only applicable in accordance with EN 1453–1:2017, Table 10, table footnote c, to be assessed on one method only.

Table 5 — Characteristics of fitness for purpose of the system that require type testing (TT)

Characteristic	Reference to clause or subclause of EN 1453–1:2017	Conditions requiring test [a]				Sampling procedure	
		N	D	M	E	Manufacturer	Certification body [b]
Watertightness [c]	9 - Table 11	+	+	-	+	Once per size per joint design [d]	One size per joint design [d]
Airtightness [c]	9 - Table 11	+	+	-	+	Once per size per joint design [d]	One size per joint design [d]
Elevated temperature cycling	9 - Table 11	+	+	+	-	Once per formulation per joint design on the smallest produced wall thickness [d]	Once per formulation per joint design on the smallest produced wall thickness [d]

[a] N : new system;
D : change in design;
M : change of formulation;
E : extension of the product range (except the products already covered by the scheme of sampling procedure);
+ : test to be carried out.

[b] Recommended sampling procedure for a testing laboratory working on behalf of a certification body. Testing undertaken in a manufacturer laboratory shall be taken into account, provided prior acceptance by the certification body.

[c] Not required for solvent cement joints.

[d] Joint design at least includes: seal design, groove geometry and seal hardness (±5 IRHD).

6.4 Batch release tests

Those characteristics specified in EN 1453-1 and listed in Table 6 shall be subjected to BRTs with the minimum sampling frequency as given in Table 6.

Table 6 — Characteristics of pipes and minimum sampling frequencies for BRTs

Characteristic	Reference to clause or subclause of EN 1453–1:2017	Minimum sampling frequency
Appearance/colour	5	Once at start up and then every 8 h
Mean outside diameter	6.2.1 – Table 1	Once at start up and then every 8 h
Length of pipe	6.2.3	Once at start up and then every 8 h
Chamfer [a]	6.2.4	Once at start up
Wall thickness	6.2.5 – Table 2	Once at start up and then every 8 h
Socket dimensions [b]	6.3 – Tables 3 to 6	Once at start up and then every 8 h

Characteristic	Reference to clause or subclause of EN 1453–1:2017	Minimum sampling frequency
Impact resistance (round-the-clock method)	7.1 – Table 7 and Table 8	Once at start up and then every 24 h [c]
Impact resistance (staircase method) [d]	7.2 – Table 9	Once at start up and then every 24 h [c]
Longitudinal reversion	8 – Table 10	Once at start up and then every 24 h
Degree of gelation [e]	8 – Table 10	Once at start up and then every 24 h
Marking	12.2 – Table 12	Once at start up and then every 8 h

[a] If a chamfer is required.

[b] Only for dimensions which are influenced by the process.

[c] Once every 8 h when external reprocessed or recycled material not covered by an agreed specification (see EN 1453–1:2017, B.3.1) is used.

[d] Only for pipes marked with ice-crystal symbol, in accordance with EN 1453–1:2017, 7.2. If this test is carried out, the round-the-clock method is not necessary.

[e] Characteristic only applicable in accordance with EN 1453–1:2017, Table 10, table footnote c, to be assessed on one method only.

The manufacturer shall specify a batch in the quality plan.

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

If a product fails in respect of any characteristic given in Table 6 the batch shall be rejected or the retest procedures shall be performed for the characteristic on which the product failed.

The retest procedure shall be as follows:

Find the last product and the first product which conforms to the requirements as specified in EN 1453-1. Release all products produced before and after these points and reject the products produced between these points.

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

6.5 Process verification tests

Those characteristics specified in EN 1453-1 and listed in Table 7 and Table 8 shall be subject to PVTs with the minimum sampling frequency given in Table 7 and Table 8, as applicable, if not type tested in the same period.

Table 7 — Characteristics of pipes and minimum sampling frequencies for PVTs

Characteristic	Reference to clause or subclause of EN 1453–1:2017	Minimum sampling frequency
Vicat Softening Temperature (VST)	8 – Table 10	Once per year per formulation currently used

Table 8 — Characteristics for fitness for purpose and minimum sampling frequencies for PVTs

Characteristic	Reference to clause or subclause of EN 1453–1:2017	Minimum sampling frequency
Watertightness [a]	9 – Table 11	Once per 3 years per size group per joint design [b]
Airtightness [a]	9 – Table 11	Once per 3 years per size group per joint design [b]
Elevated temperature cycling	9 – Table 11	Once per 5 years per joint design on the formulation currently used [b]

[a] Not required for solvent cemented joints.

[b] Joint design at least includes: seal design, groove geometry and seal hardness (±5 IRHD).

If the product does not conform to the requirements in respect of any characteristics given in Table 7 and Table 8, 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 7 and Table 8, as applicable.

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

6.6 Audit tests

ATs are performed only if certification is involved.

Those characteristics specified in EN 1453-1 and listed in Table 9 to Table 10 are intended to be audit tested with the minimum sampling frequency as given in Table 9 to Table 10, as applicable.

Table 9 — Characteristics of pipes and minimum sampling frequencies for ATs

Characteristic	Reference to clause or subclause of EN 1453–1:2017	Minimum sampling frequency
PVC content [a]	4.1	Once per year per formulation currently used
Appearance/colour	5	Once per year per size group
Geometrical characteristics	6.2	Once per year per size group
Impact resistance (round the clock method)	7.1 – Table 7	Once per year per size group
Impact resistance (staircase method) [b]	7.2 – Table 9	Once per year per size group
Vicat Softening Temperature (VST)	8 – Table 10	Once per year per formulation currently used
Longitudinal reversion	8 – Table 10	Once per year per size group
Degree of gelation [c]	8 – Table 10	Once per year per size group
Marking	12.2 – Table 12	Once per year per size group

[a] Done by calculation using Table 1.

[b] Only for pipes marked with ice-crystal symbol, in accordance with EN 1453–1:2017, 7.2. If this test is required, the round-the-clock method is not necessary.

[c] Characteristic only applicable in accordance with EN 1453–1:2017, Table 10, table footnote c, to be assessed on one method only.

Table 10 — Characteristics for fitness for purpose of the system and minimum sampling frequencies for ATs

Characteristic	Reference to clause or subclause of EN 1453–1:2017	Minimum sampling frequency
Watertightness [a]	9 – Table 11	Once per year on one size
Airtightness [a]	9 – Table 11	Once per year on one size
Elevated temperature cycling	9 – Table 11	Once per 5 years per joint design [b]

[a] Test applicable for the jointing between products. Not required for solvent cemented joints.

[b] Joint design at least includes: seal design, groove geometry and seal hardness (±5 IRHD).

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.

6.7 Indirect tests

Generally, testing shall be performed using the test methods referred to in EN 1453-1.

ITs may be used for BRT characteristics as given in Table 6. 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 BRTs as specified in Table 6, as applicable, shall be used.

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

6.8 Test records

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

Annex A
(informative)

Basic test matrix

Table A.1 — Basic test matrix

Characteristic	TT	BRT	PVT	AT
Pipes				
PVC content	+			+
Appearance	+	+		+
Colour	+	+		+
Geometrical characteristics	+	+		+
Impact resistance (round-the-clock method)	+	+		+
Impact resistance (staircase method)	+	+		+
Vicat softening temperature (VST)	+		+	+
Longitudinal reversion	+	+		+
Degree of gelation	+	+		+
Marking		+		+
Fitness for purpose				
Watertightness	+		+	+
Airtightness	+		+	+
Elevated temperature cycling	+		+	+

Bibliography

[1] EN ISO 9001, *Quality management systems — Requirements (ISO 9001)*

[2] EN ISO/IEC 17020, *Conformity assessment — Requirements for the operation of various types of bodies performing inspection (ISO/IEC 17020)*

[3] EN ISO/IEC 17021, *Conformity assessment — Requirements for bodies providing audit and certification of management systems (ISO/IEC 17021)*

[4] EN ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025)*

[5] EN ISO/IEC 17065, *Conformity assessment — Requirements for bodies certifying products, processes and services (ISO/IEC 17065)*

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