PD CEN/TS 1401-2:2012

BSI Standards Publication

Plastics piping systems for non-pressure underground drainage and sewerage — Unplasticized poly(vinyl chloride) (PVC-U)

Part 2: Guidance for assessment of conformity

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National foreword

This Published Document is the UK implementation of CEN/TS 1401-2:2012. It supersedes DD ENV 1401-2:2001, which is withdrawn.

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

A list of organizations represented on this committee can be obtained on request to its secretary.

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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Plastics piping systems for non-pressure underground drainage and sewerage - Unplasticized poly(vinyl chloride) (PVC-U) - Part 2: Guidance for assessment of conformity

Systèmes de canalisations en plastique pour les branchements et les collecteurs d'assainissement enterrés sans pression - Poly(chlorure de vinyle) non plastifié (PVC-U) - Partie 2 : Guide pour l'évaluation de la conformité

Kunststoff-Rohrleitungssysteme für erdverlegte drucklose Abwasserkanäle und -leitungen - Weichmacherfreies Polyvinylchlorid (PVC-U) - Teil 2: Empfehlungen für die Beurteilung der Konformität

This Technical Specification (CEN/TS) was approved by CEN on 6 September 2011 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

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Foreword

This document (CEN/TS 1401-2:2012) 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 1401-2:2000.

Compared with ENV 1401-2:2000, 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) Addition of an informative Annex A: Basic test matrix.

EN 1401, *Plastics piping systems for non-pressure underground drainage and sewerage — Unplasticized poly(vinyl chloride) (PVC-U)*, consists of the following Parts:

— *Part 1: Specifications for pipes, fittings and the system*;

— *Part 2: Guidance for the assessment of conformity*.

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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, 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 organisation of those tests used for the purpose of the assessment of conformity. This part of EN 1401 details the applicable characteristics to be assessed as well as the frequency and sampling of testing for each type of test, i.e. type testing (TT), batch release test (BRT), process verification test (PVT) and audit test (AT).

A typical scheme for the assessment of conformity of compounds/formulations, pipes, fittings, assemblies by manufacturers is given in Figure 1.

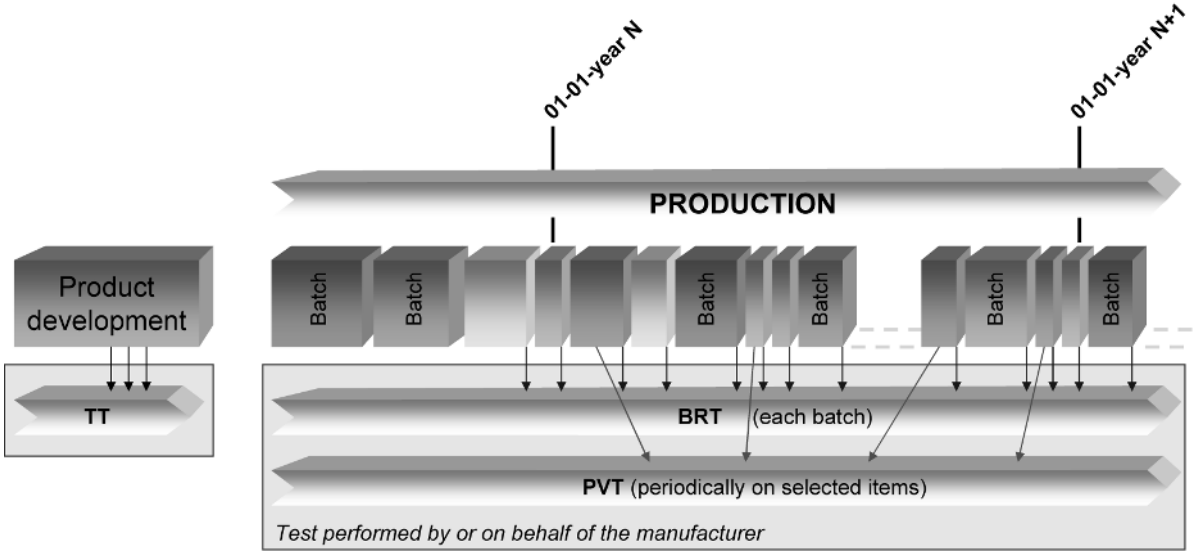

Figure 1 — Typical scheme for the assessment of conformity by a manufacturer

A typical scheme for the assessment of conformity of compounds/formulations, pipes, fittings, assemblies by manufacturers, including a third-party certification, is given in Figure 2.

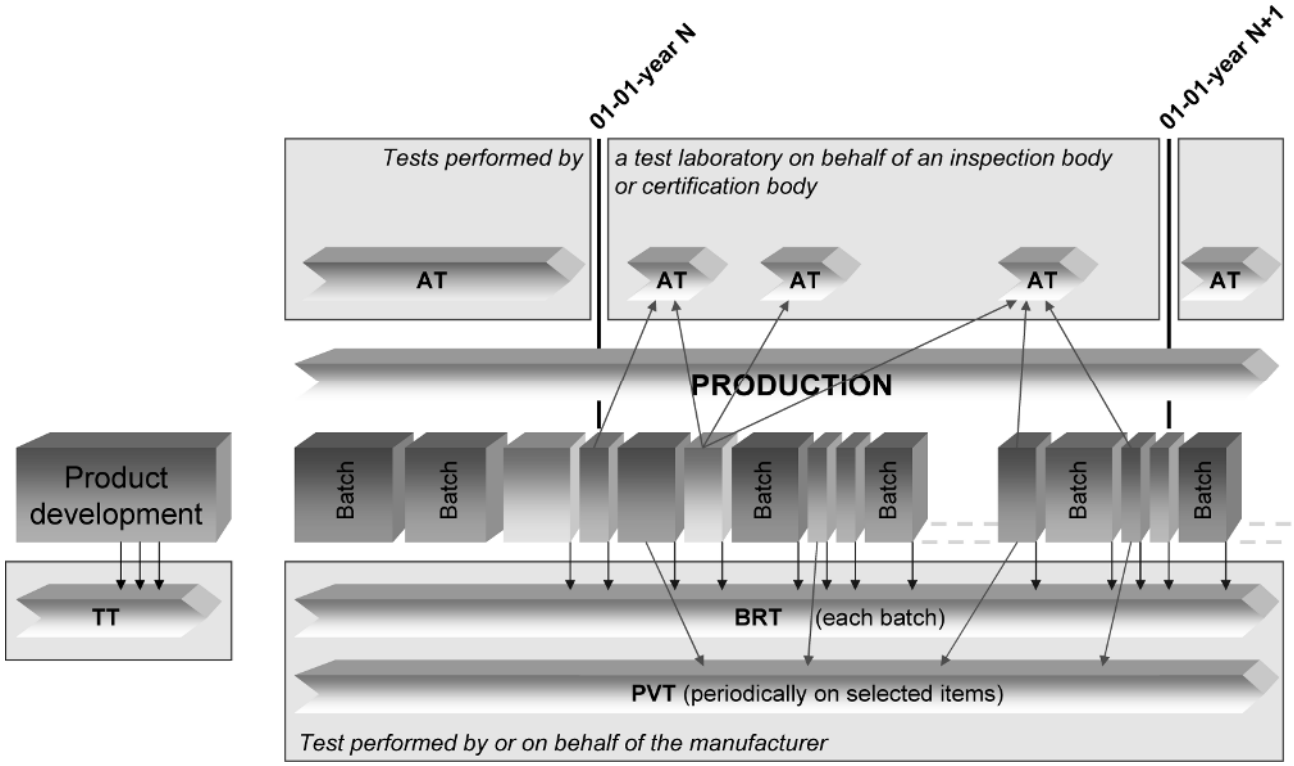

Figure 2 — Typical scheme for the assessment of conformity by a manufacturer, including a third-party certification

1 Scope

This Technical Specification gives guidance for the assessment of conformity of compounds/formulations, products and assemblies in accordance with EN 1401-1. It applies to those compounds/formulations, products and assemblies intended to be included in the manufacturer's quality plan as part of the quality management system and for the establishment of third-party certification procedures.

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

NOTE 2 If third-party certification is involved, it is recommended that the certification body is accredited to either EN 45011 [2], EN 45012 [3] or EN ISO/IEC 17021 [4], as applicable.

NOTE 3 In order to help the reader, a basic test matrix is given in Annex A.

In conjunction with EN 1401-1 (see Foreword), this Technical Specification is applicable to piping systems made of unplasticized poly(vinyl chloride) (PVC-U) used for the following puposes:

— for non pressure underground drainage and sewerage outside the building structure (application area code "U"), reflected in the marking of products by "U";

— for non-pressure underground drainage and sewerage for both buried in ground within the building structure (application area code "D") and outside the building structure (application area code "U"), reflected in the marking of products by "UD".

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 1401-1:2009, *Plastics piping systems for non-pressure underground drainage and sewerage — Unplasticized poly(vinyl chloride) (PVC-U) — Part 1: Specifications for pipes, fittings and the system*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1401-1:2009 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 accredited to EN 45011 [2].

3.2
inspection body
impartial organisation or company approved by the 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

Note 1 to entry: An inspection body is preferably accredited to EN ISO/IEC 17020 [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: In the context of this part of EN 1401, the materials and products can be subjected to type testing, batch release testing, process verification testing, audit testing and/or witness testing, as applicable.

Note 2 to entry: A testing laboratory is preferably accredited to EN ISO/IEC 17025 [6].

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 verify that the material, 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 compound/formulation 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 compound/formulation, products, 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 compound/formulation 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 compound/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 compounds/formulations grouped by families, expressed by generic names, e.g. polypropylene, stainless steel, brass or EPDM

[SOURCE: European Commission, Directorate-General for Enterprise and Industry, Sub-group on Product Testing Procedures (EC, DG ENT and IND, SG PTP).]

3.13
compound/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

3.14
material batch
clearly identified quantity of a given homogeneous compound/formulation manufactured under uniform conditions and defined and identified by the compound/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 compound/formulation conforming to the same specification

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

3.17
lot
clearly identifiable sub-division of a batch set apart for inspection purposes

3.18
sample
one or more 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 are the sample size.

3.19
acceptable quality limit
AQL
quality level that is the worst tolerable process average when a continuing series of lots is submitted for acceptance sampling

Note 1 to entry: See ISO 2859-1, ISO 3951-1 [8], ISO 3951-2 [9], ISO 3951-3 [10] and ISO 3951-5 [11].

Note 2 to entry: The designation of an AQL does not imply that a manufacturer has the right, knowingly, to supply any non-conforming unit of product.

3.20
inspection level
relationship between the lot or batch size and the sample size

Note 1 to entry: See ISO 2859-1.

3.21
limiting quality
(acceptance sampling) quality level, when a lot is considered in isolation, which, for the purposes of acceptance sampling inspection, is limited to a low probability of acceptance

Note 1 to entry: See ISO 2859-2 [7].

3.22
group
collection of similar products from which samples are selected for testing purposes

3.23
component
product manufactured out of a specific compound/formulation, brought to the market as part of another product or as a spare part

3.24
joint
connection between two products

3.25
assembled product
assembled final product using two or more single parts

3.26
thermoplastics fabricated fitting
fitting produced from pipe and/or from injection-moulded fittings by thermoforming, solvent-cementing or welding

3.27
assembly
product that can be dismantled into a set of components

EXAMPLE A test piece consisting of various products.

3.28
sampling plan
specification of the type of sampling to be used combined 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.

3.29
product type
generic description of a product

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

3.30
cavity
(moulding) space within a mould to be filled to form the moulded product

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

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.

EXAMPLE In the French language the abbreviation for the French equivalent of "acceptable quality level" (AQL) is NQA, however for the purposes of this part of EN 1401, the abbreviation of the English term (AQL) is adopted.

	EN	FR	DE
AQL	acceptance quality limit	niveau de qualité acceptable	annehmbare Qualitätsgrenzlage
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 Materials, compounds/formulations, products, joints and assemblies shall conform to the requirements given in EN 1401-1.

5.2 Products shall be produced by the manufacturer under a quality management system which includes a quality plan (including specifications on joints and assemblies).

It is recommended that the quality management system conforms to or is no less stringent than the relevant requirements to 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 material 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 in formulation constitutes a change in material.

The use of reprocessed and/or recycled material (which is referred to as "reprocessable and recyclable material" in EN 1401-1 until further revision) 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 stabiliser or master batch	1) Pb 2) Ca-Zn 3) Sn 4) Ca-Sn n) 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 $X_6 > 2$
Pigments	No requirement	-
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 [a]	With an agreed specification [b]	≤ X_8 [c]
External reprocessed and recycled material [a]	Not covered by an agreed specification	≤ X_9 [d]

a This is referred to as "reprocessable and recyclable material" in EN 1401-1.
b The specifications shall be declared by the manufacturer to the certification body.
c See specifications in A.3 of EN 1401-1:2009.
d See specifications in A.4 of EN 1401-1:2009.

6.2 Grouping

6.2.1 General

For the purposes of this Technical Specification, the groups specified in 6.2.2 and 6.2.3 apply.

6.2.2 Size groups

Three size groups are defined for pipes and fittings, 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 outside diameter, d_n mm
1	$d_n \leq 200$
2	$200 < d_n \leq 500$
3	$500 < d_n \leq 1\ 000$

6.2.3 Fitting groups

Three groups of fittings each having a similar design are defined, as given in Table 4.

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

Table 4 — Fitting groups

Fitting group	Type of fitting
1	Bends
2	Branches
3	Other fittings

6.3 Type testing

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

NOTE Type tests, to be carried out when there has been a change of the production site, 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 5 to Table 7, as applicable.

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

Characteristic	Reference to part, clause or subclause of EN 1401-1:2009	Conditions requiring test [a]				Sampling procedure	
		N	D	M	E	Manufacturer	Certification body [b]
PVC content [c]	4.1	+	-	+	-	One calculation per compound/formulation	One calculation per compound/formulation
Resistance to internal pressure	4.2 – Table 1	+	-	+	-	Once per compound/formulation with one optional dimension	Once per compound/formulation with one optional dimension
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 6.4 – Tables 3 to 8	+	+	-	+	Once per size	Once per size group
Impact resistance (round-the-clock method)	7.1.1 – Table 9	+	-	-	+	Once per size per compound/formulation	Once per size group
		-	-	+	-	Once per compound/formulation	Once per compound/formulation
Impact resistance (staircase method) [d]	7.1.2 – Table 10	+	-	-	+	Once per size per compound/formulation	Once per size group
		-	-	+	-	Once per compound/formulation	Once per compound/formulation
Vicat Softening Temperature (VST)	8.1 – Table 12	+	-	+	-	Once per compound/formulation	Once per compound/formulation
Longitudinal reversion	8.1 – Table 12	+	-	-	+	Once per size	Once per size group
Degree of gelation	8.1 – Table 12	+	-	-	+	Once per size per compound/formulation	Once per size group
		-	-	+	-	Once per compound/formulation	Once per compound/formulation

a N : new system;
D : change in design;
M : change of compound/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 Done by calculation using Table 1.

d Only for pipes intended also to be installed at temperatures below -10 °C. If the test is required, then the round-the-clock method is not necessary.

Table 6 — Characteristics of fittings that require type testing (TT)

Characteristic	Reference to part, clause or subclause of EN 1401-1:2009	Conditions requiring test [a]					Sampling procedure	
		N	D	M	P	E	Manufacturer	Certification body [b]
PVC content [c]	4.1	+	-	+	-	-	One calculation per compound/formulation	One calculation per compound/formulation
Resistance to internal pressure	4.3 – Table 2	+	-	+	-	-	Once per compound/formulation with one optional dimension	Once per compound/formulation with one optional dimension
Appearance	5.1	+	-	-	+	+	Once per each fitting	Once per fitting group
Colour	5.2	+	-	-	+	+	Once per each fitting	Once per fitting group
Geometrical characteristics	6.3 – 6.4 – 6.5 Tables 3 to 8	+	+	-	+	+	Once per each fitting	Once per size group and per fitting group
Mechanical strength or flexibility [d]	7.2 – Table 11	+	+	-	+	+	Once per each fitting	Once per fitting group
Drop test	7.2 – Table 11	+	+	+	+	-	Once per size group per fitting group	Once per fitting group
Vicat Softening Temperature (VST)	8.2 – Table 13	+	-	+	-	-	Once per compound/formulation	Once per compound/formulation
Effect of heating [e]	8.2 – Table 13	+	+	-	+	+	Once per each fitting	Once per fitting group
		-	-	+	-	-	Once per size group per fitting group	Once per compound/formulation
Watertigthness [d]	8.2 – Table 14	+	+	-	+	+	Once per each fitting	Once per fitting group

a N : new system;
D : change in design;
M : change of compound/formulation;
P : change of production method;
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 fabricated fittings made from more than one piece. A sealing ring retaining mean is not considered as a piece.

e Only for injection-moulded parts.

Table 7 — Characteristics of fitness for purpose of the system that require type testing (TT)

Characteristic	Reference to part, clause or subclause of EN 1401-1:2009	Conditions requiring test [a]				Sampling procedure	
		N	D	M	E	Manufacturer	Certification body [b]
Tightness of elastomeric sealing ring joints	9 – Table 15	+	+	-	+	Once per size per joint design [c]	One size per joint design [c]
Elevated temperature cycling only for UD applications [d]	9 – Table 15	+	+	+	-	Once per compound/formulation per joint design [c] on the smallest produced stiffness class	Once per compound/formulation per joint design [c] on the smallest produced stiffness class

[a] N : new system;
D : change in design;
M : change of compound/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] Joint design at least includes: seal design, groove geometry and seal hardness (± 5 IHRD).

[d] Only for d_n less than or equal to 200 mm.

6.4 Batch release tests

Those characteristics specified in EN 1401-1 and listed in Table 8 to Table 10 shall be subject to BRTs with the minimum sampling frequency as given in Table 8 to Table 10, as applicable.

Table 8 — Characteristics of pipes and minimum sampling frequencies for BRTs

Characteristic	Reference to part, clause or subclause of EN 1401-1:2009	Minimum sampling frequency
Appearance/colour	5.1/5.2	Once at start up and then every 8 h
Mean outside diameter	6.2.1 – Table 3	Once at start up and then every 8 h
Wall thickness	6.2.5 – Table 4	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
Socket dimensions [b]	6.4 – Tables 5, 6, 7 and 8	Once at start up and then every 8 h
Impact resistance (round-the-clock method)	7.1.1 – Table 9	Once at start up and then every 24 h
Impact resistance (staircase method) [d]	7.1.2 – Table 10	Once at start up and then every 24 h
Longitudinal reversion	8.1 – Table 12	Once at start up and then every 24 h
Degree of gelation	8.1 – Table 12	Once at start up and then every 24 h
Marking	12.2 – Table 16	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 per 8 h when external reprocessable or recyclable material not covered by an agreed specification (see A.2.3.1 of EN 1401-1:2009) is used.
d If this test is carried out, the round-the clock method is not necessary.

Table 9 — Characteristics of injection-moulded fittings and minimum sampling frequencies for BRTs

Characteristic	Reference to part, clause or subclause of EN 1401-1:2009	Minimum sampling frequency
Appearance/colour	5.1/5.2	Once per cavity at start up and then every 8 h
Wall thickness	6.3.3 – Tables 4 and 6	Once at start up per cavity
Spigot dimensions [a]	6.3 – Table 3	Once per cavity at start up and then every 8 h
Socket dimensions [a]	6.3 – Tables 5, 7 and 8	Once per cavity at start up and then every 8 h
Effect of heating	8.2 – Table 13	Once per cavity at start up and then every 24 h
Marking	12.3 – Table 17	Once per cavity at start up

a Only for dimensions which are influenced by the process.

Table 10 — Characteristics of fabricated fittings and minimum sampling frequencies for BRTs

Characteristic	Reference to part, clause or subclause of EN 1401-1:2009	Minimum sampling frequency	Retest procedure
Appearance/colour	5.1/5.2	Every fitting	B
Wall thickness [a]	6.3.3 – Tables 4 and 6	Once per fitting per 8 h or AQL max: 4 % inspection level min: S3	
Spigot dimensions [a]	6.3 – Table 3	Once per fitting per 8 h or AQL max: 4 % inspection level min: S3	
Socket dimensions [a]	6.3 – Tables 5, 7 and 8	Once per fitting per 8 h or AQL max: 4 % inspection level min: S3	
Watertightness [b]	8.2 – Table 14	Once per fitting per 8 h or AQL max: 4 % inspection level min: S3	
Marking	12.3 – Table 17	Each fitting at start up	

[a] Only for dimensions which are influenced by the process.
[b] Only for fabricated fittings made from more than one piece. A sealing ring retaining mean is not considered as a piece.

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

A batch or lot shall only be released for supply when all the relevant tests and inspections have been carried out and 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 8 to Table 10, as applicable, the batch or lot 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, which conforms to the requirements as specified in EN 1401-1. Release all products produced before that point and reject the products produced after that point;

When an AQL is applied for fabricated fittings in BRTs, use a sampling procedure in accordance with ISO 2859-1 with the AQL and inspection level as specified in Table 10.

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 1401-1 and listed in Table 11 to Table 13 shall be subject to PVTs with the minimum sampling frequency given in Table 11 to Table 13, as applicable, if not type tested or audit tested by the same period.

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

Characteristic	Reference to part, clause or subclause of EN 1401-1:2009	Minimum sampling frequency
Resistance to internal pressure	4.2 – Table 1	Once per year per compound/formulation currently used
Vicat Softening Temperature (VST)	8.1 – Table 12	Once per year per compound/formulation currently used

Table 12 — Characteristics of fittings and minimum sampling frequencies for PVTs

Characteristic	Reference to part, clause or subclause of EN 1401-1:2009	Minimum sampling frequency
Resistance to internal pressure	4.3 – Table 2	Once per 2 years per compound/formulation currently used
Mechanical strength or flexibility [a]	7.2 – Table 11	Once per year per fitting group per SDR
Drop test	7.2 – Table 11	Once per year per size group per SDR per fitting group
Vicat Softening Temperature (VST)	8.2 – Table 13	Once per year per compound/formulation currently used
[a] Only for fabricated fittings made from more than one piece. A sealing ring retaining mean is not considered as a piece.		

Table 13 — Characteristics for fitness for purpose and minimum sampling frequencies for PVTs

Characteristic	Reference to part, clause or subclause of EN 1401-1:2009	Minimum sampling frequency
Tightness of elastomeric sealing ring joints	9 – Table 15	Once per 3 years per size group per SDR and joint design [a]
Elevated temperature cycling	9 – Table 15	Once per 3 years per joint design [a] on the highest SDR on the compound/formulation currently used
[a] Joint design at least includes: seal design, groove geometry and seal hardness (± 5 IHRD).		

If the product does not conform to the requirements in respect of any characteristic given in Table 11 to Table 13, 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. In this way, the characteristics given in Table 11 to Table 13, as applicable, shall also be verified.

A test performed as an AT (including WT) does not need to be repeated as a PVT.

6.6 Audit tests

ATs are performed only if a third-party certification is involved.

Those characteristics specified in EN 1401-1 and listed in Table 14 to Table 16 are intended to be subject to AT with the minimum sampling frequency as given in Table 14 to Table 16, as applicable.

Table 14 — Characteristics of pipes and minimum sampling frequencies for ATs

Characteristic	Reference to part, clause or subclause of EN 1401-1:2009	Minimum sampling frequency
PVC content [a]	4.1	Once per year per compound/formulation currently used
Resistance to internal pressure	4.2 – Table 1	Once per 3 years per compound/formulation currently used
Appearance/colour	5.1/5.2	Once per year per size group
Geometrical characteristics	6.2	Once per year per size group
Impact resistance (round-the-clock method)	7.1.1 – Table 9	Once per year per size group
Impact resistance (staircase method) [b]	7.1.2 – Table 10	Once per year per size group
Vicat Softening Temperature (VST)	8.1 – Table 12	Once per year per compound/formulation currently used
Longitudinal reversion	8.1 – Table 12	Once per year per size group
Degree of gelation	8.1 – Table 12	Once per year per size group
Marking	12.2 – Table 16	Once per year per size group

[a] Done by calculation using Table 1.

[b] Only for pipes intended to be installed at temperatures below -10 °C. If the test is required, then the round-the-clock method is not necessary.

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

Characteristic	Reference to part, clause or subclause of EN 1401-1:2009	Minimum sampling frequency
PVC content [a]	4.1	Once per year per compound/formulation currently used
Resistance to internal pressure	4.3 – Table 2	Once per 3 years per compound/formulation currently used
Appearance/colour	5	Once per year per fitting group
Geometrical characteristics	6.3	Once per year per fitting group
Mechanical strength or flexibility [b]	7.2 – Table 11	Once per 2 years per size group and per fitting group
Drop test	7.2 – Table 11	Once per 2 years per size group and per fitting group
Effect of heating [c]	8.2 – Table 13	Once per year per fitting group
Vicat Softening Temperature (VST)	8.2 – Table 13	Once per year per compound/formulation currently used
Marking	12.3 – Table 17	Once per year per fitting group

[a] Done by calculation using Table 1.

[b] Only for fabricated fitting made from more than one piece.

[c] Only for injection-moulded parts.

Table 16 — Characteristics for fitness for purpose of the system and minimum sampling frequencies for ATs

Characteristic	Reference to part, clause or subclause of EN 1401-1:2009	Minimum sampling frequency
Tightness of elastomeric sealing ring joints	9 – Table 15	Once per year on one size
Elevated temperature cycling	9 – Table 15	Once per 3 years per joint design on the highest SDR [a]
[a] Joint design at least includes: seal design, groove geometry and seal hardness (± 5 IHRD).		

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

Certification bodies may accept PVTs as ATs if witnessed by them personally or by their agencies.

6.7 Indirect tests

Generally, testing should be performed using the test methods specified in EN 1401-1.

ITs may be used for BRT characteristics as given in Table 8 to Table 10. Indirect testing shall not be used for TTs, PVTs and ATs.

The indirect testing 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 8 to Table 10, as applicable, shall be used.

If third-party certification is involved, the IT shall be accepted by 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 — Survey of test regime

Characteristic	Type	BRT	PVT	AT
Pipes				
PVC content	+			+
Resistance to internal pressure	+		+	+
Appearance	+	+		+
Colour	+	+		+
Geometrical characteristics	+	+		+
Impact resistance (round the clock method)	+	+		+
Impact resistance (staircase method)	+	+		+
Vicat softening temperature (VST)	+		+	+
Longitudinal reversion	+	+		+
Degree of gelation	+	+		+
Marking		+		+
Fittings				
PVC content	+			+
Resistance to internal pressure	+		+	+
Appearance	+	+		+
Colour	+	+		+
Geometrical characteristics	+	+		+
Mechanical strength or flexibility	+		+	+
Drop test	+		+	+
Vicat softening temperature (VST)	+		+	+
Effect of heating	+	+		+
Water tightness, fabricated fittings	+	+		
Marking		+		+
Fitness for purpose				
Tightness of elastomeric sealing ring joints	+		+	+
Elevated temperature cycling	+		+	+

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

[2] EN 45011, *General requirements for bodies operating product certification systems (ISO/IEC Guide 65)*

[3] EN 45012, *General requirements for bodies operating assessment and certification/registration of quality systems (ISO/IEC Guide 62)*

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

[5] EN ISO/IEC 17020, *General criteria for the operation of various types of bodies performing inspection (ISO/IEC 17020)*

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

[7] ISO 2859-2, *Sampling procedures for inspection by attributes — Part 2: Sampling plans indexed by limiting quality (LQ) for isolated lot inspection*

[8] 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*

[9] ISO 3951-2, *Sampling procedures for inspection by variables — Part 2: General specification for single sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection of independent quality characteristics*

[10] ISO 3951-3, *Sampling procedures for inspection by variables — Part 3: Double sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

[11] ISO 3951-5, *Sampling procedures for inspection by variables — Part 5: Sequential sampling plans indexed by acceptance quality limit (AQL) for inspection by variables (known standard deviation)*

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