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BSI Standards Publication

Plastics piping systems for non-pressure underground drainage and sewerage — Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE)

Part 4: Guidance for the assessment of conformity

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National foreword

This Published Document is the UK implementation of CEN/TS 13476-4:2013. It supersedes DD CEN/TS 13476-4:2008 which is withdrawn.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.

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

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Plastics piping systems for non-pressure underground drainage and sewerage - Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) - Part 4: Guidance for the assessment of conformity

Systèmes de canalisations en plastique pour les branchements et les collecteurs d'assainissement sans pression enterrés - Systèmes de canalisations à parois structurées en poly(chlorure de vinyle) non plastifié (PVC-U), polypropylène (PP) et polyéthylène (PE) - Partie 4: Guide pour l'évaluation de la conformité

Kunststoff-Rohrleitungssysteme für erdverlegte drucklose Abwasserkanäle und -leitungen - Rohrleitungssysteme mit profilierter Wandung aus weichmacherfreiem Polyvinylchlorid (PVC-U), Polypropylen (PP) und Polyethylen (PE) - Teil 4: Empfehlungen für die Beurteilung der Konformität

This Technical Specification (CEN/TS) was approved by CEN on 10 June 2012 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.

CEN members are required to announce the existence of this CEN/TS in the same way as for an EN and to make the CEN/TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the CEN/TS) until the final decision about the possible conversion of the CEN/TS into an EN is reached.

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Foreword

This document (CEN/TS 13476-4:2013) 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 CEN/TS 13476-4:2008.

The main changes with respect to the previous edition are listed below:

- updating of the references in Clause 2 and Bibliography;
- updating of the definitions in Clause 3;
- Specification of PVC reprocessable and recycling material Table 2;
- deletion of Table 3, Compound specification PP masterbatch;
- deletion of Table 5, Compound specification PE masterbatch;
- changing Table 8, by deletion of column "P";
- deletion of 4.2.3.2, Preliminary type testing;
- deletion of 4.2.3.3, Initial type testing;
- deletion of Table 11, Specification of use of reprocessable and recyclable material that shall require the production to be considered at least as one batch;
- deletion of Table 12, Material characteristics that require BRT.

EN 13476 consists of the following Parts under the general title *Plastics piping systems for non-pressure underground drainage and sewerage — Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE)*:

— *Part 1: General requirements and performance characteristics*;

— *Part 2: Specifications for pipes and fittings with smooth internal and external surface and the system, Type A*;

— *Part 3: Specifications for pipes and fittings with smooth internal and profiled external surface and the system, Type B*;

— *Part 4: Guidance for the assessment of conformity* (this Technical Specification).

According to the CEN-CENELEC Internal Regulations, the national standards organisations 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, 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. For each type of test, i.e. type testing (TT), batch release test (BRT), process verification test (PVT), and audit test (AT), this part of EN 13476 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 compounds/formulations, pipes, fittings, joints or assemblies by manufacturers is given in Figure 1.

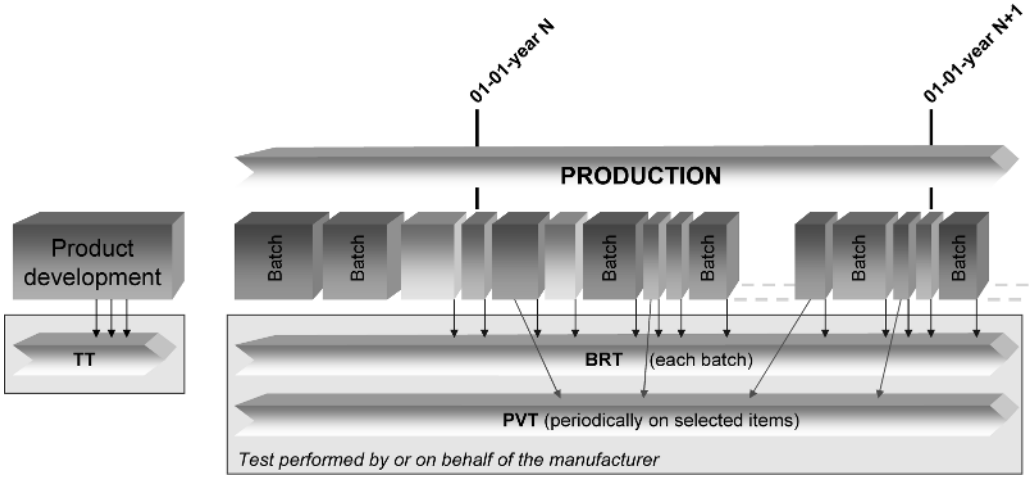

Figure 1 — Typical scheme for the assessment of conformity by a manufacturer

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

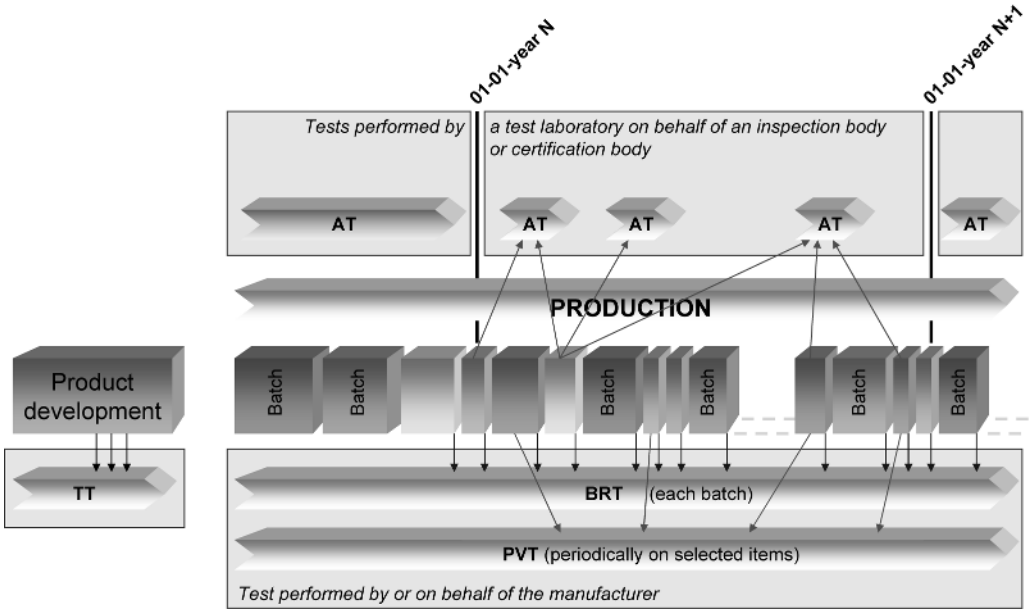

Figure 2 — Typical scheme for the assessment of conformity by a manufacturer, including a third-party certification

1 Scope

This Technical Specification gives guidance for the assessment of conformity of compounds / formulations, products and assemblies in accordance with the applicable part(s) of EN 13476-1, EN 13476-2 and EN 13476-3 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.

It is recommended that the quality management system conforms to or is no less stringent than the relevant requirements to EN ISO 9001:2008 [1].

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

In conjunction with EN 13476-1, EN 13476-2 and EN 13476-3 (see Foreword) this document is applicable to *Plastics piping systems for non-pressure underground drainage and sewerage — Structural-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE)*:

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

— 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 de 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 13476-1:2007, *Plastics piping systems for non-pressure underground drainage and sewerage — Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) — Part 1: General requirements and performance characteristics*

EN 13476-2:2007, *Plastics piping systems for non-pressure underground drainage and sewerage — Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) — Part 2: Specifications for pipes and fittings with smooth internal and external surface and the system, Type A*

EN 13476-3:2007+A1:2009, *Plastics piping systems for non-pressure underground drainage and sewerage — Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) — Part 3: Specifications for pipes and fittings with smooth internal and profiled external surface and the system, Type B*

3 Terms and definitions

For the purposes of this document, the following terms and definitions given in EN 13476-1:2007, EN 13476-2:2007 and EN 13476-3:2007+A1:2009 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 13476, 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 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 9001:2008 [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 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 formulation/ compound 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 manufacturer on formulation/compound or 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 formulation/compound 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 formulation / compound, 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 compositions compounds/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
compound / formulation
clearly defined homogenous 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

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

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 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 is the sample size.

3.19
group
collection of similar products from which samples are selected for testing purposes

3.20
component
product manufactured out of a specific composition compound/formulation, brought to the market as part of another product or as a spare part

3.21
joint
connection between two products

3.22
assembled product
assembled final product using two or more single parts

3.23
thermoplastics fabricated fitting
fitting produced from pipe and/or from injection-moulded fittings by thermoforming, solvent-cementing or welding

3.24
assembly
product that can be dismantled into a set of components

EXAMPLE A test piece consisting of various products.

3.25
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.

3.26
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

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 13476, the abbreviation of the English term (AQL) is adopted.

Abbreviation	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 Materials, compounds, formulations, products, joints and assemblies shall conform to the requirements given in EN 13476-1, EN 13476-2 and EN 13476-3.

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 to EN ISO 9001:2008 [1].

6 Testing and inspection

6.1 Material specification PVC

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 is changed, this variation in formulation constitutes a change in material.

The use of reprocessable and/or recyclable material with agreed specification 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 his quality plan.

Table 1 — Material specification PVC compound

Ingredients	Type	Band
PVC resin	Nominal K value: as specified	+/- 3 units
Type and content of stabiliser or masterbatch	1) OBS (Organic Based Stabilisers) 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 parts for $X_2 > 0{,}2$
Mineral modifiers	1) $CaC0_3$ 2) others	X_3: $^{0}_{-6}$ parts $X_{4,1}$: $^{0}_{-50}$ % $X_{4,n}$: $^{0}_{-50}$ %
Impact modifiers	All	X_5: ± 1 part
Flow agents	All	X_6: ± 25 % for $X_6 \leq 2$ X_6: ± 0,5 parts for $X_6 > 2$
Pigments		No requirement
Others	To be separately specified by the manufacturer	$X_{7,1}$: ± 12,5 % $X_{7,n}$: ± 12,5 %

Table 2 — Specification of PVC reprocessable and recycling material

Ingredients	Type	Band
External reprocessable and recyclable material from pipes and fittings	With an agreed specification [a] All layers	X_8: $^{0}_{-X_8}$ [b] See limitations in B.2.1 of EN 13476-2:2007 or EN 13476-3:2007+A1:2009.
	Without an agreed specification [a]	X_9: $^{0}_{-X_9}$ [b] See limitations in B.3.1 of EN 13476-2:2007 or EN 13476-3:2007+A1:2009.
External reprocessable and recyclable material not from pipes and fittings	With an agreed specification [a] Intermediate layer	X_8: $^{0}_{-X_8}$ [b] See limitations in B.2.2 of EN 13476-2:2007.

[a] The specification shall be declared by the manufacturer to the certification body.
[b] Provided the tolerances of Table 1 are still met.

6.2 Material specifications PP

For the purposes of this Technical Specification, the material specification consists of a compound comprising a PP compound with specific trade name and additives with specified dosage level.

When a masterbatch is used, it shall be considered as a change of compound, if the type of carrier of the pigment is changed.

In case the content of the mineral modifier by mass is higher than the measured content by mass at the Type testing or a new type of mineral modifier is used, the compound shall be considered as a new material.

The use of reprocessable and/or recyclable material with the agreed specification shall be considered as a change in compound when the change in addition exceeds the tolerance bands given in Table 3.

Table 3 — Specification of PP reprocessable and recycling material

Ingredients	Type	Band
External reprocessable and recyclable material from pipes and fittings	With an agreed specification [a] All layers	X_3: $^{0}_{-X3}$ See limitations in D.2.1 of EN 13476-2:2007 or EN 13476-3:2007+A1:2009.
	Without an agreed specification [a] Intermediate layer	X_4: $^{0}_{-X4}$ See limitations in D.3.1 of EN 13476-2:2007.

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

6.3 Material specifications PE

For the purposes of this Technical Specification, the material specification consists of a compound comprising a PE compound with specific trade name and additives with specified dosage level.

When a masterbatch is used, it shall be considered as a change of compound, if the type of carrier of the pigment is changed.

In case the content of the mineral modifier by mass is higher than the measured content by mass at the Type testing or a new type of mineral modifier is used, the compound shall be considered as a new material.

The use of reprocessable and/or recyclable material with the agreed specification shall be considered as a change in compound when the change in addition exceeds the tolerance bands given in Table 4.

Table 4 — Specification of PE reprocessable and recycling material

Ingredients	Type	Band
External reprocessable and recyclable material from pipes and fittings	With an agreed specification [a] All layers	X_3: $^{0}_{-X3}$ See limitations in F.2.1 of EN 13476-2:2007 or EN 13476-3:2007+A1:2009.
	Without an agreed specification [a] Intermediate layer	X_4: $^{0}_{-X4}$ See limitations in F.3.1 of EN 13476-2:2007.
PE Rotational moulded fittings and other components		
External reprocessable and recyclable material from pipes and fittings and from not pipes and fittings	With or without an agreed specification	X_5: $^{0}_{-X5}$ See limitations in F.4 of EN 13476-2:2007 and EN 13476-3:2007+A1:2009.
[a] The specification shall be declared by the manufacturer to the certification body.		

6.4 External reprocessable and recycled materials - validation

In addition to fulfilling all the relevant requirements in EN 13476-1, EN 13476-2 and EN 13476-3, a control of the documentation showing that the additional requirements for such materials in the agreed specification are fulfilled shall be carried out at Type testing and Audit testing.

6.5 Grouping

6.5.1 General

For the purposes of this Technical Specification, the groups specified in 6.5.2 and 6.5.3 apply.

6.5.2 Size groups

Three size groups are defined for pipes and fittings, as given in Table 5.

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

Table 5 — Definition of size groups

Size group number	DN/OD or DN/ID
1	≤ 200
2	> 200 and ≤ 500
3	> 500 and $\leq 1\,200$

6.5.3 Fitting groups

Three groups of fittings each having a similar design are defined, as given in Table 6.

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

Table 6 — Fitting groups

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

Push fit fittings and fusion fittings shall be considered separately for each group.

6.6 Type testing

Relevant TT's shall be carried out whenever there is a change in design, material (virgin, reprocessable and/or recyclable material) or production method, other than routine in-process adjustments, and whenever there is an extension of the product range.

Type tests, to be 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 Tables 7, 8 and 9 as applicable.

Table 7 — Characteristics of pipes that require type testing

Characteristic	Reference to clauses and tables of:		Testing relevant to [a]				Sampling procedure	
	EN 13476-2:2007	EN 13476-3:2007+A1:2009	N	D	M	E	Manufacturer	Certification body [b]
PVC content	4.2.1	4.2.1	+	–	+	–	one calculation or determination/ compound	one calculation or determination/
PP content	4.3.1	4.3.1	+	–	+	–	one calculation or determination/ compound	one calculation or determination/compou
PE content	4.4.1	4.4.1	+	–	+	–	one calculation or determination/compound	one calculation or determination/
Reprocessable and recyclable material (see CEN/TS 13476-4:2013, 6.4)	Annex B, D,F	Annex B, D, F	+	-	+	-	once per compound	once per compound
Melt mass-flow rate (MFR-value)	Table 2 or 3	Table 2 or 3	+	–	+	–	once per compound	once per compound
Resistance to internal pressure [c]	Table 1, 2 or 3	Table 1, 2 or 3	+	–	+	–	once per compound	once per compound
Thermal stability (OIT) [d]	Table 2 or 3	Table 2 or 3	+	–	+	–	once per compound	once per compound
Density	Table 3	Table 3	+	–	+	–	once per compound	once per compound
Appearance	6	6	+	+	+	+	once per size	once per size group
Colour	6	6	+	–	+	+	once per size	once per size group
Geometrical characteristics	7.2; Tables 5, 6, 7 and 8	7.2; Tables 5, 6, and 7	+	+	–	+	once per size/ stiffness class	once per size group/stiffness class
Vicat softening temperature	Table 9	Table 8	+	–	+	–	once per compound/ formulation	once per compound/formulation
Resistance to dichloromethane	Table 9	Table 8	+	–	-	+	once per size/compound/ formulation	once per size group
			-	-	+	-	once per compound/ formulation	once per compound/formulation
Longitudinal reversion Type A1 and A2 pipes	Table 9, 11 or 13	Not applicable	+	-	-	+	once per size	once per size group
Oven test, Type B pipes	Not applicable	Table 8, 10 or 12	+	+	+	+	once per size	once per size group
Impact strength (round the clock method)	Table 15 or Annex G as applicable	Table 14 or Annex G as applicable	+	-	-	+	once per size/ compound	once per size group
			-	-	+	-	once per compound	once per compound
Impact strength (staircase method) [e]	Annex H if applicable	Annex H if applicable	+	-	-	+	once per size/ compound	once per size group/
			-	-	+	-	once per compound	once per compound
Ring stiffness	Table 15	Table 14	+	+	+	+	once per size/stiffness class/ compound	once per size group/stiffness class/
Ring flexibility	Table 15 or Annex I as applicable	Table 14 or Annex I as	+	+	+	+	once per size/stiffness class/ compound	once per size group/stiffness class/
Creep ratio [f]	Table 15	Table 14	+	+	+	+	once per design family /compound	once per design family
Tensile strength of seam	Table 15	Table 14	+	+	+	+	once per size/compound	once per size group/compound

[a] N: new system
D: change of design (only for characteristics affected by the change)
M: change of compound
E: extension of the product range (except the products already covered by the minimum sampling procedure)

[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] To be tested in pipe form with an optional diameter.

[d] Only applicable for components for fused joints.

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

[f] By design family is understood designs with the same ratio (within the same wall construction) between the neutral diameter of the pipe wall and the max. distance to the outer or inner profile

Table 8 — Characteristics of fittings that require type testing

Characteristic	Reference to clauses and tables of:		Testing relevant to [a]					Sampling procedure	
	EN 13476-2:2007	EN 13476-3:2007+A1:2009	N	D	M	P	E	Manufacturer	Certification body [b]
PVC content	4.2.1	4.2.1	+	–	+	–	–	one calculation or determination/compound	one calculation or determination/compound
PP content	4.3.1	4.3.1	+	–	+	–	–	one calculation or determination/compound	one calculation or determination/compound
PE content	4.4.1	4.4.1	+	–	+	–	–	one calculation or determination/compound	one calculation or determination/compound
Reprocessable and recyclable material (see CEN/TS 13476-4:2013,6.4)	Annex B, D,F	Annex B, D,F	+	-	+	-	-	once per compound	once per compound
Melt mass-flow rate (MFR-value) [c]	Table 2, 3 or 4	Table 2, 3 or 4	+	–	+	–	–	once per compound	once per compound
Resistance to internal pressure [c d]	Table 1, 2, 3 or 4	Table 1, 2, 3 or 4	+	–	+	–	–	once per compound	once per compound
Thermal stability (OIT) [c]	Table 2, 3 or 4	Table 2, 3 or 4	+	–	+	–	–	once per compound	once per compound
Density	Table 3 or 4	Table 3 or 4	+	–	+	–	–	once per compound	once per compound
Appearance	6	6	+	+	+	-	+	once per each fitting	once per fitting group
Colour	6	6	+	–	+	-	+	once per each fitting	once per fitting group
Geometrical characteristics	7.2; Tables 5, 6, 7 and 8	7.2; Tables 5, 6, and 7	+	+	–	+	+	once per each fitting	once per size group and per fitting group
Vicat softening temperature [c]	Table 10	Table 9	+	–	+	–	–	once per compound/formulation	once per compound/formulation
Effect of heating	Table 10, 12, 14 as applicable	Table 9, 11, 13 as applicable	+	+	-	+	+	once per each fitting	once per fitting group
			-	-	+	-	-	once per size group/fitting group	once per compound
Stiffness	Table 17	Table 16	+	+	+	–	+	once per size group/fitting group 1 and 2 largest	once per fitting group 1 and 2; largest degree of bend for the size, 45 °

								degree of bend for the size, 45 ° branch /stiffness class	branch
Impact strength (drop test)	Table 17	Table 16	+	+	+	+	-	once per size group/fitting group	once per fitting group
Flexibility or mechanical strength [e]	Table 17	Table 16	+	+	–	+	+	once per each fitting	once per fitting group/stiffness class

[a] N: new system
D: change of design (only for characteristics affected by the change)
M: change of compound
P: change of production method (only for characteristics affected by the change)
E: extension of the product range (except the products already covered by the minimum sampling procedure)

[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 to be repeated for fittings compound when the compound is the same as for pipes and already tested for that purpose.

[d] To be tested in pipe form with an optional diameter.

[e] Only for fabricated fittings made from more than one piece. Sealing ring retaining mean is not considered as a piece.

Table 9 — Characteristics of fitness for purpose of the system that require type testing

Characteristic	Reference to clauses and tables of:		Testing relevant to: [a]				Sampling procedure	
	EN 13476-2:2007	EN 13476-3:2007+A1:2009	N	D	M	E	Manufacturer	Certification body [b]
Tightness of elastomeric sealing ring joints	Table 18	Table 17	+	+	+ [c]	+	once per size/joint design [d]	one size per joint design [d]
Resistance to combined temperature cycling and external loading [e]	Table 18	Table 17	+	+	+	+	once/size group/fitting group 1 and 2/ joint design, lowest stiffness class [d]	once/size group/fitting group 1 and 2/ joint design, lowest stiffness class [d]
Elevated temperature cycling [e]	Table 18	Table 17	+	+	+		once per compound/formulation per joint design on the lowest produced stiffness class [d]	once per compound/formulation per joint design on the lowest produced stiffness class [d]
Long-term performance of TPE-seals	Table 18	Table 17	+	+	+ [c]	+	one sample /sealing ring compound/ size group/joint design [d]	one sample /sealing ring compound/ size group/joint design [d]
Tensile test of welded or fused joint	Table 18	Table 17	+	+	+	+	once per jointing method /size group	once per jointing method /size group

[a] N: new system
D: change of design (only for characteristics affected by the change)
M: change of compound
E: extension of the product range (except the products already covered by the minimum sampling procedure)

[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] Change of elastomeric material

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

[e] See Clause 10, Table 18 of EN 13476-2:2007 and Clause 10, Table 17 of EN 13476-3:2007+A1:2009.

6.7 Batch release tests

Those characteristics specified in EN 13476-1, EN 13476-2 and EN 13476-3 and listed in Tables 10 and 11 shall be subject to BRT with the minimum sampling frequency as given in Tables 10 and 11, as applicable.

Table 10 — Characteristics of pipes and minimum sampling frequencies for BRT

Characteristic	Reference to clauses and tables of:		Minimum sampling frequency
	EN 13476-2:2007	EN 13476-3:2007+A1:2009	
Appearance/colour	6	6	once per 8 h and start up
Mean outside diameter and mean inside diameter	Tables 5, 6 and 7 7.2.3	Tables 5 and 6 7.2.3	once per 8 h and start up
Wall thickness	Table 6 7.2.5	Tables 5 and 7 7.2.5	once per 8 h and start up
Length of pipe and where required chamfer	7.2.2	7.2.2	once per 8 h and start up
Socket dimensions [a]	Table 6 7.2.4	Table 5 7.2.4	once per 8 h and start up
Spigot dimensions [a]	Tables 5, 6 and 7 7.2.4	Table 5, 6 7.2.4	once per 8 h and start up
Impact resistance [b] (round-the-clock method) PVC-U	Table 15 or Annex G as applicable	Table 14 or Annex G as applicable	once per 24 h and start up
Impact resistance [b] (round-the-clock method) PE, PP	Table 15 or Annex G as applicable	Table 14 or Annex G as applicable	once per week and start up
Impact resistance [b] (Stair case method) PVC-U	Annex H if applicable	Annex H if applicable	once per 24 h and start up
Ring stiffness	Table 15	Table 14	start up
Ring flexibility	Table 15 or Annex I as applicable	Table 14 or Annex I as applicable	start up
Tensile strength of seam	Table 15	Table 14	start up
Longitudinal reversion, Type A1 and A2 pipes	Table 9, 11 or 13	not applicable	once per week and start up
Oven test, Type B pipes	not applicable	Tables 8, 10 and 12	once per week and start up
Marking	Table 19	Table 18	once per 8 h and start up

[a] For dimensions which are influenced by the process.

[b] Pipes marked with ❄ (ice crystal) shall be tested with the stair case method and do not have to be tested with the round the clock method.

Table 11 — Characteristics of fittings and minimum sampling frequencies for BRT

Characteristic	Reference to clauses and tables of		Minimum sampling frequency
	EN 13476-2:2007	EN 13476-3:2007+A1:2009	
Appearance/colour	6	6	once per cavity per 8 h and start up
Wall thicknesses [a]	7.2.5	Table 5 7.2.5	once per cavity per 8 h and start up
Spigot dimensions [a]	Table 5,6 7.2.3; 7.2.4	Table 5 7.2.4	once per cavity per 8 h and start up
Socket dimensions [a]	Table 6 7.2.4	Table 5 7.2.4	once per cavity per 8 h and start up
Effect of heating only for PVC-U.	Table 10	Table 9	once per cavity per 24 h and start up
Water tightness [b]	Table 18	Table 17	once per fitting per 8 h
Marking	Table 18	Table 19	once per cavity at start up

[a] 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 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 to Tables 10 and 11, 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 13476-1, EN 13476-2 and EN 13476-3. Release all products produced before that point and reject the products produced after that point;

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

6.8 Process verification tests

Those characteristics specified in EN 13476-1, EN 13476-2 and EN 13476-3 and listed in Table 12, shall be subject to PVT’s with the minimum sampling frequency given in Table 12, as applicable, if not type tested or audit tested in the same period.

Table 12 — Characteristics and minimum sampling frequencies for PVT

	Characteristic	Reference to clauses and tables of:		Minimum sampling frequency
		EN 13476-2:2007	EN 13476-3:2007+A1:2009	
Pipes	Resistance to internal pressure [a]	Table 1, 2 or 3	Table 1, 2 or 3	once/ year /compound currently used
	MFR	Table 2, 3 or 4	Table 2, 3 or 4	once/year/compound currently used
	Thermal stability	Table 2 or 3	Table 2 or 3	once/year/compound currently used
	Vicat softening temperature	Table 9	Table 8	once/year/compound/formulation currently used
Fittings	Resistance to internal pressure [a b]	Table 1, 2, 3 or 4	Table 1, 2, 3 or 4	once/2 years /compound currently used
	MFR [b]	Table 2, 3 or 4	Table 2, 3 or 4	once/year/compound currently used
	Thermal stability [b c]	Table 2, 3 or 4	Table 2,3 or 4	once/year/compound currently used
	Vicat softening temperature [b]	Table 10	Table 9	once/year/compound/formulation currently used
	Effect of heating, only PP and PE	Table 12 or 14	Table 11 or 13	once year/fitting group
	Flexibility or mechanical strength (only fabricated fittings)	Table 17	Table 17	once year/fitting group /stiffness class
The system	Tightness of elastomeric sealing ring joints	Table 18	Table 17	once/2 years/size group/joint design [d]
	Elevated temperature cycling [e]	Table 18	Table 17	once/ 3 years/joint design/lowest SN and compound/formulation currently used [d]
	Long-term performance of TPE-seals	Table 18	Table 17	once/2 years/seal compound/ size group
	Tensile test of welded or fused joint	Table 18	Table 17	once/2 years/size group/joint method

[a] To be tested in pipe form with an optional diameter.

[b] Not to be repeated for fittings compound when the compound is the same as for pipes and already tested for that purpose.

[c] Only applicable for components for fused joints.

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

[e] See Clause 10, Table 18 of EN 13476-2:2007 and Clause 10, Table 17 of EN 13476-3:2007+A1:2009.

If the product does not conform to the requirements in respect of any characteristic given in Table 12, 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, as applicable.

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

6.9 Audit tests

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

Those characteristics specified in EN 13476-1, EN 13476-2 and EN 13476-3 and listed in Table 13 are intended to be audit tested with the minimum sampling frequency as given in Table 13, as applicable.

Table 13 — Characteristics and minimum sampling frequencies for AT

	Characteristic	Reference to clauses and tables of:		Minimum sampling frequency
		EN 13476-2:2007	EN 13476-3:2007+A1:2009	
Pipes	PVC content	4.2.1	4.2.1	once/year/compound/formulation currently used
	PP content	4.3.1	4.3.1	once/year/compound currently used
	PE content	4.4.1	4.4.1	once/year/compound currently used
	Reprocessable and Recyclable material (see CEN/TS 13476-4:2013, 6.4)	Annex B, D, F	Annex B,D.F	Once/year/type of recyclate currently used (check of documentation)
	Resistance to internal pressure [a]	Table 1, 2 or 3	Table 1, 2 or 3	once/ 3 years
	Thermal stability [b]	Table 2 or 3	Table 2 or 3	once/year/compound currently used
	Density	Table 3	Table 3	once/year/compound currently used
	Appearance/colour	6	6	once/year/size group
	Geometrical characteristics	7.2; Tables 5, 6, 7, 8	7.2; Tables 5, 6, 7	once/year/size group
	Vicat softening temperature	Table 9	Table 8	once/year/compound/formulation currently used
	Resistance to dichloromethane	Table 9	Table 8	once/year/size group
	Longitudinal reversion, type A1 and A2 pipes	Table 9, 11 or 13	not applicable	once/year/size group
	Oven test, type B pipes	not applicable	Table 8, 10 or 12	once/year/size group
	Impact resistance (round-the-clock method)	Table 15 or Annex G as applicable	Table 14 or Annex G as applicable	once/year/size group
	Impact resistance (staircase method) [c]	Annex H if applicable	Annex H if applicable	once/year/size group
	Ring stiffness	Table 15	Table 14	once/year/size group
	Ring flexibility	Table 15 or Annex I if applicable	Table 14 or Annex I if applicable	once/year/size group
	Creep ratio	Table 15	Table 14	once/year/design family
	Tensile strength of seam	Table 15	Table 14	once/year/size group
	Marking	Table 19	Table 18	once/year/size group
Fittings	PVC content	4.2.1	4.2.1	once/year/compound/formulation currently used
	PP content	4.3.1	4.3.1	once/year/compound currently used
	PE content	4.4.1	4.4.1	once/year/compound currently used
	Resistance to internal pressure [a d]	Table 1, 2, 3 or 4	Table 1, 2, 3 or 4	once/3 years
	Thermal stability [b d]	Table 2, 3 or 4	Table 2,3 or 4	once/year/compound currently used
	Density	Table 3 or 4	Table 3 or 4	once/year/compound currently used
	Appearance/colour	6	6	once/year/size group/fitting group
	Geometrical characteristics	7.2; Tables 5, 6, 7, 8	7.2; Tables 5, 6, 7	once/year/size group/fitting group
	Vicat softening temperature [d]	Table 10	Table 9	once/year/compound/formulation currently used
	Effect of heating	Table 10, 12 or 14	Table 9, 11 or 13	once/year/size group
	Impact strength, drop test	Table 17	Table 16	once/2 years/size group/fitting group
	Stiffness	Table 17	Table 17	once/2 years/size group/fitting group 1 and 2 largest degree of bend for the size, 45 ° branch
	Flexibility or mechanical strength [e]	Table 17	Table 17	once/year/size group
	Marking	Table 20	Table 17	once/year/size group/fitting group
The system	Tightness of elastomeric sealing ring joints	Table 18	Table 17	once/year/one size/joint design
	Elevated temperature cycling	Table 18	Table 17	once/3 years/joint design on the lowest produced stiffness class [f]

	Long-term performance of TPE seals	Table 18	Table 17	once/2 years/size group
	Tensile test of welded or fused joint	Table 18	Table 17	once/ year/size group/jointing method

[a] To be tested in solid wall pipe form.
[b] Only applicable for components for fused joints.
[c] Only for pipes marked with an ice crystal. If this test is required, than the round-the-clock method is not necessary.
[d] Not to be repeated for fittings compound when the compound is the same as for pipes and already tested for that purpose.
[e] Only for fabricated fittings made from more than one piece. A sealing ring retaining component is not considered as a piece.
[f] Only applicable for application code “D” pipes and fittings.

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

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

6.10 Indirect tests

Generally, testing shall be performed using the test methods referred to EN 13476-1, EN 13476-2 and EN 13476-3.

ITs may be used for BRT characteristics as given in Tables 10 and 11. Indirect testing shall not be used for TT’s, PVT’s and AT’s.

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’s as specified in Tables 10 and 11, as applicable, shall be used.

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

6.11 Test records

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

Annex A
(informative)

Survey of test regime

Table A.1

Characteristic	TT	BRT	PVT	AT
Pipes				
Melt mass-flow rate (MFR-value)	+		+	
Resistance to internal pressure	+		+	+
Thermal stability (OIT)	+		+	+
Density	+			+
Appearance	+	+		+
Colour	+	+		+
Dimensions	+	+		+
Vicat softening temperature	+		+	+
Resistance to dichloromethane	+			+
Longitudinal reversion Type A1 and A2 pipes	+	+		+
Oven test, Type B pipes	+	+		+
Impact resistance (round the clock method)	+	+		+
Impact strength (staircase method)	+	+		+
Ring stiffness	+	+		+
Ring flexibility	+	+		+
Creep ratio	+			+
Tensile strength of seam	+	+		+
Marking	+	+		+
Fittings				
Melt mass-flow rate (MFR-value)	+		+	+
Resistance to internal pressure	+		+	+
Thermal stability (OIT)	+		+	+
Density	+			+
Appearance	+	+		+
Colour	+	+		+
Dimensions	+	+		+
Vicat softening temperature	+		+	+
Effect of heating	+	+PVC	+PP, PE	+
Stiffness	+			+
Impact strength (Drop test)	+			+
Flexibility or mechanical strength	+		+	+
Water tightness, fabricated fittings	+	+		
Marking	+	+		+
Fitness for Purpose				
Tightness of elastomeric sealing ring joints	+		+	+
Resistance to combined temperature cycling and external loading	+			-
Elevated temperature cycling	+		+	+
Long-term performance of TPE- seals	+		+	+
Tensile test of welded or fused joint	+		+	+

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[5] EN ISO/IEC 17020, *General criteria for the operation of various types of bodies performing inspection (ISO/IEC 17020)*
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[6] EN ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025)*
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[7] ISO 2859-2, *Sampling procedures for inspection by attributes — Part 2: Sampling plans indexed by limiting quality (LQ) for isolated lot inspection*

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