TECHNICAL SPECIFICATION

ISO/TS 23818-3

First edition
2021-03

Assessment of conformity of plastics piping systems for the rehabilitation of existing pipelines —

Part 3: Unplasticised poly(vinyl chloride) (PVC-U) material

Évaluation de la conformité des systèmes de canalisations en plastique destinés à la réhabilitation des réseaux existants —

Partie 3: Matériau poly(chlorure de vinyle) non-plastifié (PVC-U)

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 8, *Rehabilitation of pipeline systems.*

A list of all parts in the ISO 23818 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

System standards dealing with the following applications are either available or in preparation for pipeline rehabilitation:

— ISO 11296, *Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks*;

— ISO 11297, *Plastics piping systems for renovation of underground drainage and sewerage networks under pressure*;

— ISO 11298, *Plastics piping systems for renovation of underground water supply networks*;

— ISO 11299, *Plastics piping systems for renovation of underground gas supply networks*;

— ISO 21225, *Plastics piping systems for the trenchless replacement of underground pipeline networks*.

These system standards are distinguished from those for conventionally installed plastics piping systems by the requirement to verify certain characteristics in the as-installed condition, after site processing. This is in addition to specifying requirements for plastics piping system components as manufactured.

For the assessment of conformity, three Technical Specifications for pipe systems of distinctive materials are applicable:

ISO/TS 23818-1, *Assessment of conformity of plastics piping systems for the rehabilitation of existing pipelines — Part 1: Polyethylene (PE) material*;

ISO/TS 23818-2[1)], *Assessment of conformity of plastics piping systems for the rehabilitation of existing pipelines — Part 2: Resin-fibre composite (RFC) material*;

ISO/TS 23818-3 (this document), *Assessment of conformity of plastics piping systems for the rehabilitation of existing pipelines — Part 3: Unplasticized poly (vinyl chloride) (PVC-U) material*.

These three documents cover the system standards, as presented in Table 1.

1) Under preparation. Stage at the time of publication: ISO/DTS 23818-2:2021.

Table 1 — Structure of Technical Specifications for Assessment of Conformity

Technical Specification	Material	Technique	Application			
			Non-pressure drainage and sewerage networks	Drainage and sewerage networks under pressure	Water supply networks	Gas supply networks
ISO/TS 23818-1	PE	LINING WITH CONTINUOUS PIPES, CLOSE-FIT PIPES AND SPIRALLY WOUND PIPES	ISO 11296-2 ISO 11296-3 ISO 11296-7	ISO 11297-2 ISO 11297-3	ISO 11298-2 ISO 11298-3	ISO 11299-2 ISO 11299-3
		TRENCHLESS REPLACEMENT USING PIPE BURSTING, PIPE EXTRACTION, HORIZONTAL DRILLING AND IMPACT MOLING	ISO 21225-1 ISO 21225-2	ISO 21225-1 ISO 21225-2	ISO 21225-1 ISO 21225-2	ISO 21225-1 ISO 21225-2
ISO/TS 23818-2[a]	RFC	LINING WITH CURED-IN-PLACE PIPES (CIPP)	ISO 11296-4	ISO 11297-4	ISO 11298-4	
ISO/TS 23818-3	PVC-U	LINING WITH CLOSE-FIT PIPES AND SPIRALLY WOUND PIPES	ISO 11296-3 ISO 11296-7			

[a] Under preparation. Stage at the time of publication: ISO/DTS 23818-2:2021.

The format of the three Technical Specifications is in line with Technical Specifications for assessment of conformity to other system standards, apart from presenting the detailed requirements for Inspection and Testing in two annexes, for non-pressure applications and pressure applications (where applicable) respectively. For this document, covering only non-pressure applications, the format is schematically represented in Figure 1.

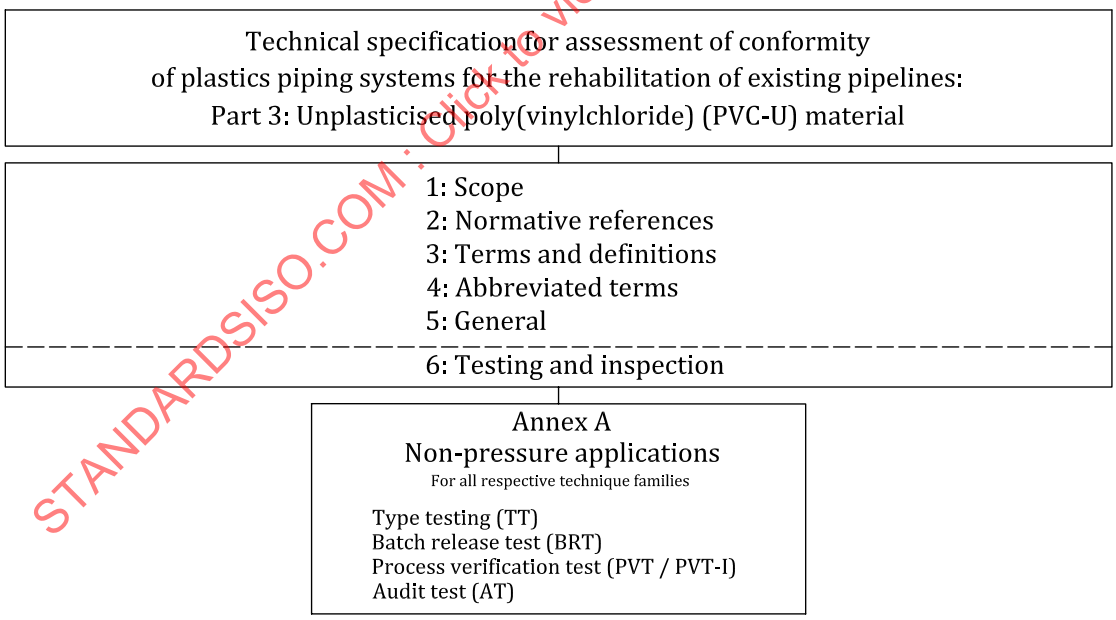

Figure 1 — Format of the Technical Specifications for conformity assessment

Figures 2 and 3 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 testing (TT), batch release test (BRT), process verification test (PVT), and audit test (AT), this document details the applicable characteristics to be assessed as well as the frequency and sampling of testing.

A typical scheme for the assessment of conformity of PVC-U pipes, fittings, joints or assemblies by manufacturers is given in Figure 2.

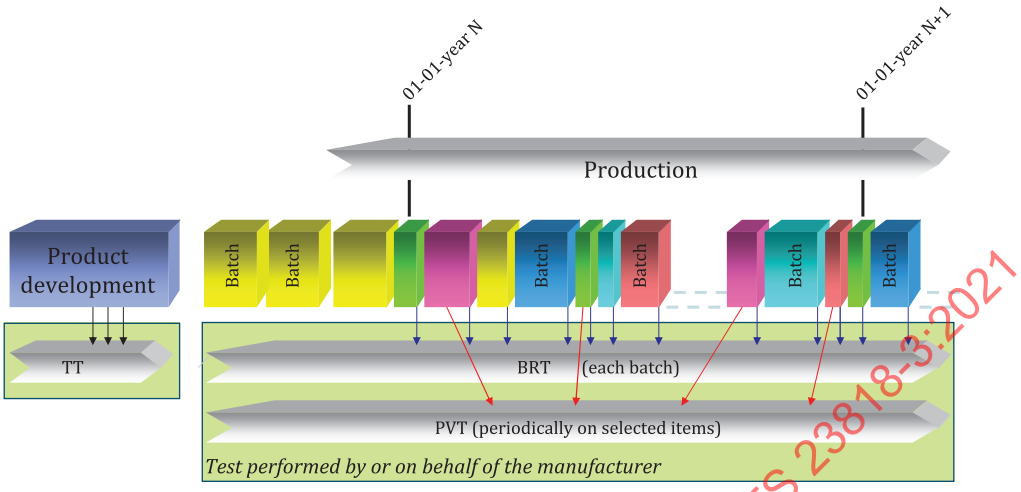

Figure 2 — Typical scheme for the assessment of conformity by a manufacturer

A typical scheme for the assessment of conformity of PVC-U pipes, fittings, joints or assemblies by manufacturers, including certification, is given in Figure 3.

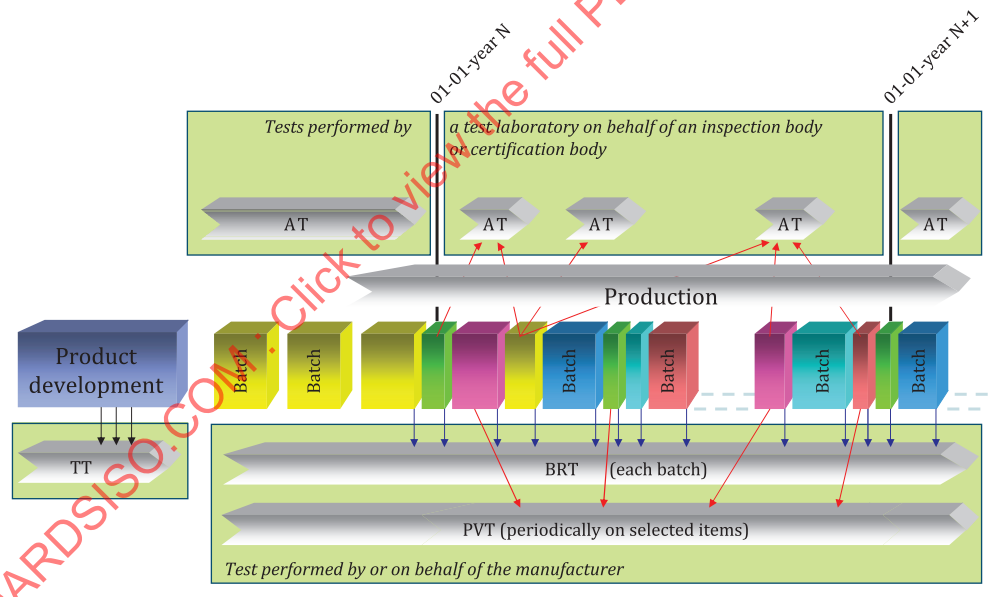

Figure 3 — Typical scheme for the assessment of conformity by a manufacturer, including certification

Assessment of conformity of plastics piping systems for the rehabilitation of existing pipelines —

Part 3:
Unplasticised poly(vinyl chloride) (PVC-U) material

1 Scope

This document provides a scheme for the assessment of conformity of PVC-U products and assemblies for the rehabilitation of existing pipelines, in accordance with the applicable parts of ISO 11296 and intended to be included in the manufacturer's quality plan as part of the quality management system and for the establishment of certification procedures.

NOTE In order to help the reader, summary tables of overall scheme requirements are provided in Annex C.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1043-1, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics*

ISO 1628-2, *Plastics — Determination of the viscosity of polymers in dilute solution using capillary viscometers — Part 2: Poly(vinyl chloride) resins*

ISO 4435:2003, *Plastics piping systems for non-pressure underground drainage and sewerage — Unplasticized poly(vinyl chloride) (PVC-U)*

ISO 11296-1, *Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks — Part 1: General*

ISO 11296-3:2018, *Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks — Part 3: Lining with close-fit pipes*

ISO 11296-7:2019, *Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks — Part 7: Lining with spirally-wound pipes*

EN 1401-1, *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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11296-3, ISO 11296-7 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1 Assessment of conformity

3.1.1
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 should preferably operate in accordance with ISO/IEC 17021-1 or ISO/IEC 17065.

3.1.2
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 should preferably operate in accordance with ISO/IEC 17020 or ISO/IEC 17021-1.

[SOURCE: ISO/IEC 17020:2012, 3.5, modified — Note 2 to entry added.]

3.1.3
testing laboratory
laboratory which measures, tests, calibrates or otherwise determines the characteristics of the performance of *materials* (3.1.13) and products

Note 1 to entry: In the context of this document, the materials and products can be subjected to *type testing* (3.1.6), *batch release test* (3.1.7), *process verification test* (3.1.8), *audit test* (3.1.10), and *witness test* (3.1.12), as applicable.

Note 2 to entry: A testing laboratory should preferably operate in accordance with ISO/IEC 17025.

3.1.4
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 ISO 9001.

3.1.5
quality plan
document setting out the specific quality practices, resources and sequence of activities relevant to a particular product or range of products

3.1.6
type testing
TT
testing performed to prove that the *material* (3.1.13), pipe, *joint* (3.1.21) or *assembly* (3.1.22) is capable of conforming to the requirements given in the relevant standard

Note 1 to entry: The type test results should remain valid until there is a change in the material or product or assembly provided that the process *verification tests* (3.1.8) are performed regularly.

3.1.7
batch release test
BRT
test performed by or on behalf of the manufacturer on a batch of PVC-U products, which has to be satisfactorily completed before the batch can be released

Note 1 to entry: A batch can either be a *material batch* (3.1.14) or a *product batch* (3.1.16).

[SOURCE: ISO/TS 23818-1:2020, 3.1.8, modified — "PE" changed to "PVC-U" and Note 1 to entry added.]

3.1.8
process verification test
PVT
test performed by or on behalf of the manufacturer on PVC-U products 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 products and are carried out as a measure of process control.

3.1.9
process verification test at the "I" stage
PVT-I
test performed by or on behalf of the manufacturer or installer at specific intervals during the installation process to confirm that the process as specified in the installation manual continues to be capable of producing installed products which conform to the requirements given in the relevant standard

Note 1 to entry: Such tests are not required to release batches of products and are carried out as a measure of process control.

3.1.10
audit test
AT
test performed by a test laboratory on behalf of an *inspection body* (3.1.2) or *certification body* (3.1.1) to confirm that the product, continues to conform to the requirements given in the relevant standard

3.1.11
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

3.1.12
witness test
WT
test accepted by an *inspection body* (3.1.2) or a *certification body* (3.1.1) for *type testing* (3.1.6) and/or *audit test* (3.1.10), which is carried out by or on behalf of the manufacturer and supervised by a representative of the inspection or certification body, competent in testing

3.1.13
material
generic term for compositions 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, Subgroup on Product Testing Procedures (EC, DG ENT and IND, SG PTP).

3.1.14
material batch
clearly identified quantity of a given homogeneous compound manufactured under uniform conditions and defined and identified by the compound manufacturer

3.1.15
product
pipe, fitting, or valve of a clearly identified type intended to be a part of a piping system which the manufacturer puts on the market

3.1.16
product batch
clearly identified collection of products, manufactured consecutively or continuously under the same conditions, using the same compound conforming to the same specification

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

3.1.17
lot
clearly identifiable sub-division of a batch for inspection purposes

3.1.18
sample
one or more products drawn from the same production batch or *lot* (3.1.17), selected at random without regard to their quality

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

3.1.19
group
collection of similar products from which *samples* (3.1.18) are selected for testing purposes

3.1.20
component
product manufactured out of a specific composition compound brought to the market as part of another product or as a spare part.

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

3.1.21
joint
connection between two products

3.1.22
assembly
product that can be dismantled into a set of *components* (3.1.20)

EXAMPLE A test piece consisting of various products.

3.1.23
cavity
(moulding) space within a mould to be filled to form the moulded product

3.2 Rehabilitation, general

3.2.1
rehabilitation
measures for restoring or upgrading the performance of existing systems, including *renovation* (3.2.2), *repair* (3.2.4) and *replacement* (3.2.3)

3.2.2
renovation
work incorporating all or part of the original fabric of the pipeline, by means of which its current performance is improved

3.2.3
replacement
construction of a new pipeline, on or off the line of an existing pipeline, where the function of the new pipeline system incorporates that of the old

3.2.4
repair
rectification of local damage

3.2.5
characteristic
property, dimension or other feature of a *material* (3.1.13) or *component* (3.1.20)

3.2.6
"M" stage
stage as manufactured, i.e. before any subsequent site processing of *components* (3.1.20) associated with the particular *renovation* (3.2.2) technique

3.2.7
"I" stage
stage as installed, i.e. in final configuration after any site processing of *components* (3.1.20) associated with the particular *renovation* (3.2.2) technique

3.2.8
nominal size
DN
numerical designation of the size of a *component* (3.1.20), which is a convenient round number approximately equal to the inside or outside diameter in millimetres

3.2.9
nominal size
DN/OD
numerical designation of the size of a component related to the outside diameter

[SOURCE: ISO 4427-1:2019, 3.1.1, modified — Note 1 to entry deleted.]

3.2.10
nominal outside diameter
d_n
specified outside diameter, in millimetres, assigned to a nominal size DN/OD

4 Abbreviated terms

To avoid misunderstanding, the assessment of conformity abbreviated terms in this clause are defined as being the same in each language. For the same reason, the terms are given in 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
PVT-I	process verification test at the "I" stage	essai de vérification du procédé d'installation	Einbauprozessprüfung
TT	type test	essai de type	Typprüfung
WT	witness test	essai témoin	Prüfung unter Aufsicht

Furthermore, the abbreviated terms given in ISO 1043-1 and the following apply.

PE polyethylene

PVC-U unplasticized poly(vinyl chloride)

RFC resin fibre composite

5 General

Materials, products, joints and assemblies shall conform to the requirements given in applicable parts of ISO 11296.

Where these product standards include clauses entitled 'Regional requirements', in countries of the single European market, conformity shall be assessed against certain different normative references (EN equivalents of ISO standards where not yet merged as EN/ISO standards), as specified in the product standards.

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 ISO 9001 or a similar management system.

The production of representative "I" stage samples for type testing shall conform to the requirements given in ISO 11296-1.

6 Testing and inspection

6.1 Grouping

6.1.1 General

For the purposes of this document, the groups specified in 6.1.2 and 6.1.3 apply.

6.1.2 Size groups

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

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

Table 2 — Size groups

Size group	Nominal outside diameter, d_n mm
1	$d_n < 200$
2	$200 \leq d_n < 500$
3	$500 \leq d_n < 1\,200$
4	$d_n \geq 1\,200$

6.1.3 Fitting groups

Two groups of fittings are defined, as given in Table 3.

Table 3 — Fitting groups

Fitting group	Type of fitting
1	lateral connection collars
2	external branch saddles

6.2 Type testing

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

Type tests to be carried out when there is a change of the production site, depend on the extent of the change, and should therefore be defined individually by the manufacturer and certification body.

Other change conditions characteristics to be type tested and sampling procedures are specified in:

— A.1, TT for products applied to underground non-pressure drainage and sewerage networks.

The following abbreviated terms are used to identify change conditions requiring new type testing in the respective tables of Annex A1.

N : new system;

D : change in design;

M : change of material;

E : extension of the product range.

The detailed specifications of these change conditions provided in Annex B shall be observed.

6.3 Batch release tests

Characteristics to be batch release tested and sampling procedures are specified in:

— A.2, BRT for products applied to underground non-pressure drainage and sewerage networks.

6.4 Process verification tests

Process verification tests include tests conducted at the “M” stage (PVT) and, where applicable, tests carried out at the “I” stage (PVT-I).

If a sample or process parameter does not conform to the requirements of the installation process given in applicable parts of ISO 11296 or ISO 4435, the relevant retest procedure detailed in the manufacturer’s quality plan should be performed.

For countries of the single European Market, ISO 4435 is replaced by EN 1401-1.

NOTE Failure to meet the required installation process parameters does not necessarily preclude successful installation.

Characteristics to be process verification tested and sampling procedures are specified in:

— A.3, PVT and PVT-I for products applied to underground non-pressure drainage and sewerage networks

6.5 Audit tests

Characteristics to be audit tested and sampling procedures are specified in:

— A.4, AT for products applied to underground non-pressure drainage and sewerage networks

6.6 Indirect tests

Generally, testing shall be performed using the test methods specified in the relevant parts of ISO 11296.

Indirect testing may be used for BRT characteristics as given in Table A.3 and Table A.4. Indirect testing shall not be used for TTs, PVTs and 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 A.3 and A.4 shall be used.

If certification is involved, the IT shall be undertaken in a manner that is acceptable to the certification body.

6.7 Test records

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

Samples at "I" stage may be taken from either actual or simulated installations. The method of sampling shall be recorded in all cases.

Annex A
(normative)

Test procedures for plastics piping systems for the rehabilitation of networks for underground non-pressure drainage and sewerage

A.1 Type testing

For the purposes of this document, the material specification consists of a compound /formulation comprising a PVC-U compound/formulation with specific trade name and additives with known dosage level.

Type tests shall demonstrate that the products conform to all requirements for the characteristics given in Table A.1 or Table A.2, as applicable.

Table A.1 — Characteristics of pipes that require type testing (TT)

Characteristic	Reference to applicable part(s) [clause(s) in 2018 or 2019 editions] of ISO 11296	Conditions requiring test [a]				Sampling procedure	
		N	D	M	E	Manufacturer	Certification body [b]
Appearance	Parts 3, 7 [5.2]	+	+	+	+	Once per size group	Once per size group
Colour	Parts 1, 3 [5.2]	+		+	+	Once per size group	Once per material
E-modulus (tensile)	Parts 3, 7 [5.3]	+		+		Once per material	Once per material
Longitudinal tensile strength	Part 3 [5.3 or, 8.5]	+		+		Once per size group	Once per material
	Part 7 [5.3]	+		+		Once per material	Once per material
Tensile strength of a locked seam	Part 7 [8.5]	+	+	+	+	Once per size	Once per size group
Elongation at break	Part 3 [5.3]	+	+	+	+	Once per size group	Once per size group
	Part 7 [5.3]	+		+		Once per material	Once per material
Impact strength	Part 3 [5.3]	+	+	+	+	Once per size group	Once per size group
	Part 7 [5.3]	+		+		Once per material	Once per material
Geometrical characteristics	Parts 3, 7 [5.4, 8.4]	+	+		+	Once per size group	Once per size group
Ring stiffness	Parts 3, 7 [8.5]	+	+	+	+	Once per material	Once per material
Marking	Parts 1, 3, 7 [5.8]	+		+		Once per size	By checking the test results of the manufacturer
Creep ratio	Parts 3, 7 [8.5]	+	+	+		Once per material	Once per material
Adhesives	Part 7 [8.9]	+	+	+	+	Once per size group	Once per size group
Vicat softening temperature	Part 3, 7 [5.6]	+		+		Once per material	Once per material
Longitudinal reversion	Part 3 [5.6]	+	+	+	+	Once per size group	Once per size group

[a] Explanation in subclause 6.2 and Annex B; + : test to be carried out.

[b] Recommended sampling procedure for a testing laboratory on behalf of a certification body.

[c] In case of dispute, the resistance to dichloromethane shall be used.

Table A.1 *(continued)*

Characteristic	Reference to applicable part(s) [clause(s) in 2018 or 2019 editions] of ISO 11296	Conditions requiring test [a]				Sampling procedure	
		N	D	M	E	Manufacturer	Certification body [b]
Resistance to dichloro-methane at elevated temperature (degree of gelation)	Part 3 [5.6]	+		+		Once per material	Once per material
DSC (alternative test method to resistance to dichloromethane) [c]	Part 3 [5.6]	+		+		Once per material	Once per material
Test method for water tightness in deflected condition	Part 7 [Annex A]	+	+	+	+	Once per size group	Once per size group
Installation practice compliance	Parts 3, 7 [Clause 9]	+	+	+	+	Once per size group	Once per size group

[a] Explanation in subclause 6.2 and Annex B; + : test to be carried out.

[b] Recommended sampling procedure for a testing laboratory on behalf of a certification body.

[c] In case of dispute, the resistance to dichloromethane shall be used.

Table A.2 — Characteristics of fittings that require type testing (TT)[f]

Characteristic	Reference to applicable part(s) [clause(s) in 2018 or 2019 editions] of ISO 11296	Conditions requiring test [a]				Sampling procedure	
		N	D	M	E	Manufacturer	Certification body [b]
PVC content [c]	ISO 11296-1 [Clause 6] ISO 11296-3 [Clause 6] ISO 11296-7[Clause 6]	+		+		Once per material	Once per material
Resistance to internal pressure [c]		+		+		Once per material	Once per material
Appearance		+			+	Once per fitting	Once per fitting group
Colour		+			+	Once per fitting	Once per fitting group
Geometrical characteristics		+	+		+	Once per fitting	Once per size per fitting group
Mechanical strength or flexibility [d]		+	+		+	Once per fitting	Once per fitting group
Drop test		+	+	+		Once per size group per fitting group	Once per fitting group
Vicat softening temperature		+		+		Once per material	Once per material
Effect of heating [e]		+		+		Once per size group per fitting group	Once per material
Water tightness [d]		+	+		+	Once per fitting	Once per fitting group

[a] Explanation in subclause 6.2 and Annex B; + : test to be carried out.

[b] Recommended sampling procedure for a testing laboratory.

[c] In accordance with ISO 4435:2003, 4.1.

[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.

[f] This table applies to external branch saddles of PVC-U only.

For branch saddles of PE refer to ISO/TS 23818-1.

For branch saddles of GRP and lateral connection collars of RFC, refer to ISO/TS 23818-2.

A.2 Batch release tests

Those characteristics specified in the relevant parts of ISO 11296 and listed in Table A.3 or Table A.4 shall be subject to BRTs with the minimum sampling frequency as given in Table A.3 or Table A.4, as applicable.

Table A.3 — Characteristics of pipes and minimum sampling frequencies for BRTs

Characteristic	Reference to applicable part(s) [clause(s) in 2018 or 2019 editions] of ISO 11296	Minimum sampling frequency
Appearance	Parts 3, 7 [5.2]	Once per 8 h and start up
Colour	Parts 1, 3, 7 [5.2]	Once per 8 h and start up
Diameter	Parts 3 [5.4]	Once per extrusion run
Profiled strip dimension	Part 7 [5.4]	Once per extrusion run
Wall thickness	Parts 3, 7 [5.4]	Once per 8 h and start up
Longitudinal reversion	Parts 3 [5.6]	Once per 24 h and start up
Tensile strength of a locked seam	Part 7 [8.5]	At the beginning and end of each cut length
Marking	Parts 1,3, 7 [5.8]	Once per 2 h and start up

Table A.4 — Characteristics of fittings and minimum sampling frequencies for BRTs

Characteristic	Reference to applicable part(s) [clause(s) in 2018 or 2019 editions] of ISO 11296	Minimum sampling frequency
Appearance	ISO 11296-1 [Clause 6] ISO 11296-3 [Clause 6] ISO 11296-7 [Clause 6]	Once per cavity at start up and then every 8 h
Colour		
Geometrical characteristics		
Effect of heating		Once per cavity at start up and then every 24 h
Water tightness, (fabricated fittings only)		Once for each type of fabricated fitting and then every 8h
Marking		Once per 8 h at start up

The manufacturer shall specify a batch 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 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 A.3 or A.4, 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 the applicable parts of ISO 11296.

— 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.

A.3 Process verification tests

Those characteristics specified in the applicable parts of ISO 11296 and listed in Tables A.5 to A.7 shall be subject to PVTs with the minimum sampling frequency given in Tables A.5 to A.7, as applicable, if not type tested or audit tested in the same period.

Table A.5a — Characteristics of pipes and minimum sampling frequencies for PVTs

Characteristic	Reference to applicable part(s) [clause(s) in 2018 or 2019 editions] of ISO 11296	Minimum sampling frequency
E-modulus (tensile)	Parts 3, 7 [5.3]	Once per year per material currently used
Longitudinal tensile strength	Parts 3, 7 [5.3, 8.5]	Once per year per material currently used
Tensile strength of a locked seam	Part 7 [8.5]	Once per year per material currently used with one dimension
Elongation at break	Parts 3, 7 [5.3]	Once per year per material currently used
Impact strength	Parts 3, 7 [5.3]	Once per year per material currently used
Dimensions	Parts 3, 7 [5.4, 8.4]	Once per year per material currently used
Vicat softening temperature	Parts 3, 7[a] [5.6]	Once per year per material currently used
Longitudinal reversion	Part 3 [5.6]	Once per year per material currently used
[a] Once per year per applicable size group for each profile type		

Table A.5.b — Characteristics of pipes and minimum sampling frequencies for PVT-I's

Characteristic	Reference to applicable part(s) [clause(s) in 2018 or 2019 editions] of ISO 11296	Minimum sampling frequency
Dimensions	Parts 3, 7 [5.4, 8.4]	Once per year per material currently used and size group
Ring stiffness	Parts 3, 7 [8.5]	Once per year per material currently used
Adhesives	Part 7 [8.9]	Once per year per material currently used and size group
Installation practice compliance	Parts 3, 7 [Clause 9]	Once per installation

Table A.6 — Characteristics of fittings and minimum sampling frequencies for PVTs

Characteristic	Reference to applicable part(s) [clause(s) in 2018 or 2019 editions] of ISO 11296	Minimum sampling frequency
Resistance to internal pressure	Parts 3, 7 [Clause 6]	Once per 2 years per material currently used
Flexibility or mechanical strength [a]		Once per year per fitting group per SDR
Drop test		Once per year per size group per SDR per fitting group
Vicat softening temperature		Once per year per material
[a] Only for fabricated fittings made from more than one piece. A sealing ring retaining mean is not considered as a piece.		

Table A.7 — Characteristics for fitness for purpose and minimum sampling frequencies for PVTs

Characteristic	Reference to applicable part(s) [clause(s) in 2018 or 2019 editions] of ISO 11296	Minimum sampling frequency
Tightness of elastomeric sealing ring joints	Part 7 [b] [Clause 6]	Once per 2 years per size group and joint design [a]
Effect of heating		Once per 3 years per joint design [a] and material currently used / applicable series with lowest wall thickness
[a] Joint design includes at least seal design, groove geometry and seal hardness (t 5 IHRD).		
[b] Once per year per applicable size group for each profile type.		

If the product does not conform to the requirements in respect of any characteristic given in Table A.5 (a or b), Table A.6 or Table A.7 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 Tables A.5 to A.7, as applicable.

A test performed as an AT does not need to be repeated as a PVT and/or PVT-I.

A.4 Audit tests

ATs are only performed where certification is involved.

Those characteristics specified in the relevant parts of ISO 11296 and listed in Tables A.8 to A.10 are intended to be audit tested with the minimum sampling frequency as given in Tables A.8 to A.10, as applicable.

Table A.8 — Characteristics of pipes and minimum sampling frequencies for ATs

Characteristic	Reference to applicable part(s) [clause(s) in 2018 or 2019 editions] of ISO 11296	Minimum sampling frequency
Appearance	Part 3 [5.2]	Once per year per size group [a]
Colour	Parts 1, 3, 7 [5.2]	Once per year per size group [a]
E-modulus (tensile)	Parts 3, 7 [5.3]	Once per year per size group [a]
Longitudinal tensile strength	Parts 3, 7 [5.3, 8.5]	Once per year per size group [a]
Tensile strength of a locked seam	Part 7 [8.5]	Once per year per profile type
Elongation at break	Parts 3, 7 [5.3]	Once per year per size group [a]
Impact strength	Part 3, 7 [5.3]	Once per year per size group [a]
Geometrical characteristics	Parts 3, 7 [5.4, 8.4]	Once per year per size group [a]
Ring stiffness	Parts 3, 7 [8.5]	Once per year per size group [a]
Adhesives	Part 7 [8.9]	Once per year per material currently used
Vicat softening temperature	Parts 3, 7 [5.6]	Once per year per material currently used
Longitudinal reversion	Parts 3 [5.6]	Once per year per size group [a]
Resistance to dichloro-methane at elevated temp. (degree of gelation)	Part 3 [5.6]	Once per year per material currently used
DSC (alternative test method to resistance to dichloromethane)	Part 3 [5.6]	Once per year per material currently used
Test method for water tightness in deflected condition	Part 7 [Annex A]	Once per year per size group [a]
Installation practice compliance	Part 3, 7 [Clause 9]	Once per year
Marking	Parts 1, 3, 7 [5.8]	Once per year per size group [a]
[a] Only applicable to size groups produced in the current year.		

Table A.9 — Characteristics of fittings and minimum sampling frequencies for ATs

Characteristic	Reference to applicable part(s) [clause(s) in 2018 or 2019 editions] of ISO 11296	Minimum sampling frequency
PVC content [c]	Parts 1, 3, 7 [Clause 6]	Once per year per material currently used
Resistance to internal pressure [a]		Once per 3 years per material currently used
Appearance		Once per year per fitting group
Colour		Once per year per fitting group
Geometrical characteristics		Once per year per fitting group
Mechanical strength or flexibility [b]		Once per 2 years per size group and per fitting group
Drop test		Once per 2 years per size group and per fitting group
Vicat softening temperature		Once per year per fitting group
Effect of heating [c]		Once per year per fitting group
Marking		Once per year per fitting group

[a] In accordance with ISO 4435:2003, 4.1.

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

[c] Only for injection-moulded parts.

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

Characteristic	Reference to applicable part(s) [clause(s) in 2018 or 2019 editions] of ISO 11296	Minimum sampling frequency
Tightness of elastomeric sealing ring joints	Part 7 [Clause 6]	Once per year on one size

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.

Annex B
(normative)

Specification of new system (N), change in design (D), change in material (M) and extension of the product range (E)

B.1 General

The objective of this annex is to define what constitutes a new product, or a change in its material or design, and which consequently requires a certain degree of reassessment of conformity.

The manufacturer shall define in the quality plan the following parameters, which have been assessed and accepted by type testing for use in production:

— processes used to manufacture the products;

— design of the products;

— materials used in the manufacturing processes.

When more than one material, design method or process has been assessed and accepted, then changing from one assessed and accepted parameter to another does not constitute a change.

B.2 New product 'N'

A product produced for the first time by any manufacturer shall be deemed to constitute a new product, classified as 'N' in the tables of Annex A.

B.3 Change in design 'D'

When any of the following conditions apply, then a change classified as (D) in the tables of Annex A is deemed to have occurred.

A change classified as (D) in the tables of Annex A is deemed to have occurred where, as a result of a change in the pipe wall structure, the following conditions apply:

— the mean value of any short-term mechanical characteristic, determined from no less than 10 tests in accordance with ISO 11296-3:2018, Table 9 or ISO 11296-7:2019, Table 6, as applicable, differs by more than one standard deviation from the corresponding value determined by the type testing of the original wall structure;

— the coefficients of variation of the tested values for the original and modified wall structures respectively are both less than 0,3.

B.4 Change in materials 'M'

For the purposes of this document, the material specification consists of a formulation which defines PVC-U resin with additives of all types, and their respective dosage levels or other defining characteristics.

When any of the following conditions apply, then a change classified as 'M' in the tables of Annex A is deemed to have occurred:

— the dosage level of any ingredient of a formulation exceeds the tolerance given for it in Table B.1;

— the type of any ingredient is changed (e.g. type of lubricant or filler);

— the nominal k-value of the PVC resin, determined in accordance with ISO 1628-2, exceeds a tolerance of ±3 units;

— the Vicat softening temperature (VST) of the material changes by more than ±2 °C;

Table B.1 — Formulation tolerances

Ingredient	Tolerance [a]
PVC content	±4 %
Stabilizer	±25 %
Lubricants	±0,1 phr
Fillers	±3 phr
Impact modifiers	±1 phr
Flow agents	±0,5 phr

[a] phr means per hundred (PVC) resin.

NOTE 1 A change of supplier does not necessarily constitute a change of formulation.

NOTE 2 *k*-value is a measure of the molecular weight of PVC based on measurements of viscosity of a PVC solution. See ISO 1628-1:2009, 3.3.6 for a detailed definition.

B.5 Extension of product range 'E'

Defined as extension of product range into a new size group as defined by Table 2.

B.6 Evaluation of test results

For initial properties, the results of the short-term tests listed in Tables A.1 and B.1 should fulfil the applicable requirements detailed in the relevant standard.