INTERNATIONAL STANDARD

ISO 17467-2

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Plastics piping systems for the supply of gaseous fuels — Unplasticized polyamide (PA-U) piping systems jointed by solvent cement —

Part 2: Pipes

Systèmes de canalisations en matières plastiques pour la distribution de combustibles gazeux — Systèmes de canalisations en polyamide non plastifié (PA-U) avec assemblage par collage —

Partie 2: Tuyauteries

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 17467-2 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*, Subcommittee SC 4, *Plastics pipes and fittings for the supply of gaseous fuels*.

This first edition of ISO 17467-2 cancels and replaces the first edition of ISO 15439-2:2007, which has been technically revised.

ISO 17467 consists of the following parts, under the general title *Plastics piping systems for the supply of gaseous fuels — Unplasticized polyamide (PA-U) piping systems jointed by solvent cement*:

— *Part 1: General*

— *Part 2: Pipes*

— *Part 3: Fittings*

Introduction

Thin wall thickness unplasticized polyamide (PA-U) pipes and solvent cement joints are used typically for low pressures, while thicker wall thickness pipes and butt fusion, electrofusion or mechanical joints are typically used for high pressures.

For technical and safety reasons, it is not possible to mix the components of the two types of piping system (thin wall thickness pipes cannot be jointed by butt fusion or mechanical joints and vice versa). In particular, solvent cement joints must not be used for jointing for high pressure piping systems.

So for the time being, the standardisation programme dealing with unplasticized polyamide (PA-U) piping systems for the supply of gaseous fuels is split into two series of International Standards, with one series (ISO 17467) covering piping systems the components of which are connected by solvent cement jointing and the other (ISO 16486) the components of which are connected by fusion jointing and/or mechanical jointing. When more experience will be gained from the field, it might be reasonable to merge ISO 17467 series and ISO 16486 series in one single series applicable to PA-U piping systems.

A similar series (ISO 17135) of International Standards for fusion and mechanically jointed plasticized polyamide (PA-P) piping systems is in preparation.

Plastics piping systems for the supply of gaseous fuels — Unplasticized polyamide (PA-U) piping systems jointed by solvent cement —

Part 2: Pipes

1 Scope

This part of ISO 17467 specifies the physical and mechanical properties of pipes made from unplasticized polyamide (PA-U) in accordance with Part 1, intended to be buried and used for the supply of gaseous fuels for maximum operating pressure up to and including 4 bar.

It also specifies the test parameters for the test methods to which it refers.

In addition, this part of ISO 17467 lays down dimensional characteristics and requirements for the marking of pipes.

2 Normative references

The following referenced documents are indispensable for the application 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 161-1, *Thermoplastics pipes for the conveyance of fluids — Nominal outside diameters and nominal pressures — Part 1: Metric series*

ISO 291, *Plastics — Standard atmospheres for conditioning and testing*

ISO 307, *Plastics — Polyamides — Determination of viscosity number*

ISO 1167-1, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 1: General method*

ISO 1167-2, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 2: Preparation of pipe test pieces*

ISO 2505, *Thermoplastics pipes — Longitudinal reversion — Test method and parameters*

ISO 3126, *Plastics piping systems — Plastics components — Determination of dimensions*

ISO 3127, *Thermoplastics pipes — Determination of resistance to external blows — Round-the-clock method*

ISO 4065, *Thermoplastics pipes — Universal wall thickness table*

ISO 6259-1, *Thermoplastics pipes — Determination of tensile properties — Part 1: General test method*

ISO 6259-3, *Thermoplastics pipes — Determination of tensile properties — Part 3: Polyolefin pipes*

ISO 11922-1:1997, *Thermoplastics pipes for the conveyance of fluids — Dimensions and tolerances — Part 1: Metric series*

ISO 13477, *Thermoplastics pipes for the conveyance of fluids — Determination of resistance to rapid crack propagation (RCP) — Small-scale steady-state test (S4 test)*

ISO 13479, *Polyolefin pipes for the conveyance of fluids — Determination of resistance to crack propagation — Test method for slow crack growth on notched pipes*

ISO 13480, *Polyethylene pipes — Resistance to slow crack growth — Cone test method*

ISO 17467-1:2012, *Plastics piping systems for the supply of gaseous fuels — Unplasticized polyamide (PA-U) piping systems jointed by solvent cement — Part 1: General*

3 Terms and definitions, symbols and abbreviated terms

For the purposes of this document, the terms and definitions, symbols and abbreviated terms given in ISO 17467-1 apply.

4 Material

The pipes shall be made from virgin PA-U material. Own and external reprocessable materials and recyclable material shall not be used.

The compound from which the pipes are made shall conform to ISO 17467-1.

5 Appearance

When viewed without magnification, the internal and external surfaces of pipes shall be smooth, clean and free from scoring, cavities and other surface defects which may affect pipe performance. The pipe ends shall be cut cleanly and square to the axis of the pipe.

6 Geometrical characteristics

6.1 Measurement of dimensions

Dimensions shall be measured in accordance with ISO 3126 at (23 ± 2) °C, after being conditioned for at least 4 h. The measurement shall not be made less than 24 h after manufacture.

6.2 Mean outside diameters, out-of-roundness and their tolerances

The mean outside diameters of the pipe d_{em} and their tolerances shall conform to Table 1.

For maximum mean outside diameter, grade B tolerances, conforming to ISO 11922-1, shall apply.

The maximum absolute out-of-roundness is not applicable for this part of ISO 17467 because the socket re-rounds the pipe spigot when solvent cement jointed.

Table 1 — Mean outside diameters

Dimensions in millimetres

Nominal outside diameter	Mean outside diameter	
d_n	$d_{em,min}$	$d_{em,max}$
12	12,0	12,2
16	16,0	16,3
18	18,0	18,2
20	20,0	20,3
23	23,0	23,2

Table 1 *(continued)*

Nominal outside diameter	Mean outside diameter	
25	25,0	25,3
32	32,0	32,3
40	40,0	40,4
50	50,0	50,4
63	63,0	63,4
75	75,0	75,5
90	90,0	90,6
110	110,0	110,7
125	125,0	125,8
140	140,0	140,9
160	160,0	161,0
180	180,0	181,1
200	200,0	201,2
225	225,0	226,4
250	250,0	251,5

6.3 Wall thicknesses and tolerances

6.3.1 Minimum wall thickness

The minimum wall thickness e_{min} shall conform to Table 2. Small diameter pipes are characterized by wall thickness. Large diameter pipes are characterized by SDR.

The use of any SDR derived from the pipe series S given in accordance with ISO 4065 and ISO 161-1 is permitted.

NOTE To minimize the possibility of damage to small diameter gas pipes by external influences, the use of pipes with a wall thickness not less than 1,0 mm, even if this is a higher value than according to the minimal SDR value, can be considered.

Table 2 — Minimum wall thickness

Dimensions in millimetres

Nominal outside diameter	Minimum wall thickness	
	e_{min}	
d_n	SDR 26	SDR 33
12	1,0	1,0
16	1,0	1,0
18	1,0	1,0
20	1,0	1,0
23	1,0	1,0
25	1,0	1,0
32	1,3	1,0

Table 2 *(continued)*

Nominal outside diameter	Minimum wall thickness e_{min}	
40	1,6	1,3
50	1,9	1,6
63	2,5	2,0
75	2,9	2,3
90	3,5	2,8
110	4,3	3,4
125	4,9	3,8
140	5,4	4,2
160	6,2	4,9
180	7,0	5,5
200	7,7	6,1
225	8,7	6,9
250	9,7	7,6

6.3.2 Tolerances on the wall thickness at any point

The tolerances on the wall thickness at any point shall conform to Grade V of ISO 11922-1:1997. The maximum permissible variation between the nominal wall thickness e_n and the wall thickness at any point e shall conform to Table 3.

Table 3 — Tolerances on wall thickness at any point

Dimensions in millimetres

Minimum wall thickness e_{min}		Permitted positive deviation
>	⩽	
1,0	1,5	0,2
1,5	2,5	0,3
2,5	3,5	0,4
3,5	4,4	0,5
4,4	5,0	0,6
5,0	6,4	0,7
6,4	7,5	0,8
7,5	8,0	0,9
8,0	9,0	1,0
9,0	10,0	1,1
10,0	11,0	1,2

7 Mechanical characteristics

7.1 Conditioning

Unless otherwise specified by the applicable test method, the test pieces shall be conditioned for at least 16 h at 23 °C and 50 % relative humidity in accordance with ISO 291 before testing in accordance with Table 4.

7.2 Requirements

When tested in accordance with the test methods as specified in Table 4 using the indicated parameters, the pipe shall have mechanical characteristics conforming to the requirements given in Table 4.

Table 4 — Mechanical characteristics

Characteristic	Requirements	Test parameters		Test method
Hydrostatic strength (20 °C, 1 000 h)	No failure during the test period of any test piece	End caps	Type a)	ISO 1167-1 ISO 1167-2
		Orientation	Free	
		Conditioning time	6 h	
		Type of test	Water-in-water	
		Circumferential (hoop) stress:		
		PA-U 11 160 and PA-U 12 160 [a]	19,0 MPa	
		PA-U 11 180 and PA-U 12 180 [a]	20,0 MPa	
		Test period	1 000 h	
		Test temperature	20 °C	

[a] For material classification and designation, see ISO 17467-1:2012, 5.3.

[b] $P_{c,s4,REF}$ is the value of the critical pressure determined in the S4 test on the pipe according to ISO 17467-1:2012, Table 2, from the batch whose full-scale critical pressure p_c was determined in ISO 17467-1.

[c] For pipes of d_n < 90 mm, the value of critical pressure, $P_{c,S4,REF}$, determined on a pipe of d_n 90 mm or d_n 110 mm according to ISO 17467-1:2012, Table 2, shall be taken as the reference value.

NOTE These pressure levels are calculated to give nominal pipe hydrostatic levels of either 9 MPa in PA-U 11 160 and PA-U 12 160 materials or 10 MPa in PA-U 11 180 and PA-U 12 180 materials by using the following equation:

$$p = \frac{20\sigma}{SDR - 1}$$

where

σ is the hydrostatic stress, in megapascals;

SDR is the standard dimension ratio.

Table 4 *(continued)*

Characteristic	Requirements	Test parameters		Test method
Hydrostatic strength (80 °C, 165 h)	No failure during the test period of any test piece	End caps	Type a)	ISO 1167-1 ISO 1167-2
		Orientation	Free	
		Conditioning time	6 h	
		Type of test	Water-in-water	
		Circumferential (hoop) stress:		
		PA-U 11 160 and PA-U 12 160 [a]	10,0 MPa	
		PA-U 11 180 and PA-U 12 180 [a]	11,5 MPa	
		Test period	165 h	
		Test temperature	80 °C	
Elongation at break	≥ 200 %	Test speed	25 mm/min	ISO 6259-1 ISO 6259-3
Resistance to external blows (Round-the-clock method)	No fracture in any test piece	Conditioning time	4 h	ISO 3127
		Number of test pieces	6	
		Type of test	Air	
		Test temperature	(– 20 ± 2) °C	
		Type of striker	d25	
		Striker mass and drop height	As specified in Table 5	
Resistance to slow crack growth for $e \leq 5$ mm (Cone test)	$v \leq 10$ mm/day			ISO 13480

[a] For material classification and designation, see ISO 17467-1:2012, 5.3.

[b] $P_{c,s4,REF}$ is the value of the critical pressure determined in the S4 test on the pipe according to ISO 17467-1:2012, Table 2, from the batch whose full-scale critical pressure p_c was determined in ISO 17467-1.

[c] For pipes of $d_n \leq 90$ mm, the value of critical pressure, $P_{c,S4,REF}$, determined on a pipe of d_n 90 mm or d_n 110 mm according to ISO 17467-1:2012, Table 2, shall be taken as the reference value.

NOTE These pressure levels are calculated to give nominal pipe hydrostatic levels of either 9 MPa in PA-U 11 160 and PA-U 12 160 materials or 10 MPa in PA-U 11 180 and PA-U 12 180 materials by using the following equation:

$$p = \frac{20\sigma}{\mathrm{SDR} - 1}$$

where

σ is the hydrostatic stress, in megapascals;

SDR is the standard dimension ratio.