EN 134736 â€“ 2 // Structured-Wall Piping Systems of Unplasticized Poly(viny1 chloride) (PVC-U), Polypropylene (PP) and Polyethylene (PE)- Corrugated Pipes-Testing Equipment

Description

4 Material

The material shall be one of the following: unplasticized poly(viny1 chloride) (PVC-U), polypropylene (PP) or polyethylene (PE), to which are added additives needed to facilitate the manufacture of components conforming to this document, including the relevant annexes.

4.2 PVC-U

Table 1 — Compound / formulation of PVC-U pipes and injection-moulded fittings

Characteristic	Requirements	Test parameters		Test method
Resistance to internal pressure [a b c]	No failure during the test period	End caps	Type A or Type B	EN ISO 1167-1 and EN ISO 1167-2
		Orientation	Free	
		Number of test pieces	3	
		Test temperature	60 °C	
		Circumferential stress - pipe compound / formulation	10 MPa	
		- fitting compound / formulation	6,3 MPa	
		Conditioning period	Shall conform to EN ISO 1167-1	
		Type of test	Water-in-water	
		Test period	1 000 h	

[a] This requirement does not apply to the specified intermediate layer of a Type A1 pipe.

[b] For the extrusion compounds for the internal and external layers of a multilayer pipe, this test shall be carried out in the form of a solid wall pipe made from the relevant compound / formulation.

[c] For injection-moulding compounds, this test shall be carried out in the form of an injection-moulded or extruded sample in solid wall pipe form made from the relevant compound / formulation.

4.3 PP

Table 2 — Compound / formulation characteristics of PP pipes and injection-moulded fittings

Characteristic	Requirements	Test parameters		Test method
Resistance to internal pressure, 140 h [a b c]	No failure during the test period	End caps Test temperature Orientation Number of test pieces Circumferential stress Conditioning period Type of test Test period	Type A or Type B 80 °C Free 3 4,2 MPa Shall conform to EN ISO 1167-1 Water-in-water 140 h	EN ISO 1167-1 and EN ISO 1167-2
Resistance to internal pressure 1000 h [a b c]	No failure during the test period	End caps Test temperature Orientation Number of test pieces Circumferential stress Conditioning period Type of test Test period	Type A or Type B 95 °C Free 3 2,5 MPa Shall conform to EN ISO 1167-1 Water-in-water 1 000 h	EN ISO 1167-1 and EN ISO 1167-2
Melt mass-flow rate	≤ 1,5 g/10 min	Temperature Loading mass	230 °C 2,16 kg	EN ISO 1133-1:2011
Thermal stability, OIT [d]	≥ 8 min	Temperature	200 °C	EN ISO 11357-6

[a] This requirement does not apply to the specified intermediate layer of a Type A1 pipe.
[b] For the extrusion compounds for the internal and external layers of a multilayer pipe, this test shall be carried out in the form of a solid wall pipe made from the relevant material(s).
[c] For injection-moulding compounds this test shall be carried out in the form of an injection-moulded, or extruded sample in solid wall pipe form made from the relevant material.
[d] This requirement is only valid for pipes and fittings intended to be jointed in field by fusing or welding.

4.4 PE

Table 3 — Compound / formulation characteristics of PE pipes and injection-moulded fittings

Characteristic	Requirements	Test parameters		Test method
Resistance to internal pressure 165 h [a,b,c]	No failure during the test period	End caps	Type A or Type B	EN ISO 1167-1 and EN ISO 1167-2
		Test temperature	80 °C	
		Orientation	Free	
		Number of test pieces	3	
		Circumferential stress	4,0 MPa	
		Conditioning period	Shall conform to EN ISO 1167-1	
		Type of test	Water-in-water	
		Test period	165 h	
Resistance to internal pressure 1 000 h [a,b,c]	No failure during the test period	End caps	Type A or Type B	EN ISO 1167-1 and EN ISO 1167-2
		Test temperature	80 °C	
		Orientation	Free	
		Number of test pieces	3	
		Circumferential stress	2,8 MPa	
		Conditioning period	Shall conform to EN ISO 1167-1	
		Type of test	Water-in-water	
		Test period	1 000 h	

Characteristic	Requirements	Test parameters		Test method
Melt mass-flow rate	≤ 1,6 g/10 min	Temperature Loading mass	190 °C 5 kg	EN ISO 1133-1:2011
Thermal stability, OIT [d]	≥ 20 min	Temperature	200 °C	EN ISO 11357-6
Reference density	≥ 930 kg/m^3	Shall conform to EN ISO 1183-1		EN ISO 1183-1

[a] This requirement does not apply to the specified intermediate layer of a Type A1 pipe.
[b] For the extrusion compounds for the internal and external layers of a multilayer pipe this test shall be carried out in the form of a solid wall pipe made from the relevant material(s).
[c] For injection-moulding compounds this test shall be carried out in the form of an injection-moulded, or extruded sample in solid wall pipe form made from the relevant material.
[d] This requirement is only valid for pipes and fittings intended to be jointed in field by fusing or welding.

8 Physical characteristics

8.1 Unplasticized poly(viny1 chloride) (PVC-U)

8.1.1 Physical characteristics of PVC-U pipes

When tested in accordance with the test methods as specified in Table 8 using the indicated parameters, the pipe shall have physical characteristics conforming to the requirements given in Table 8.

Table 8 — Physical characteristics of PVC-U pipes

Characteristic	Requirements	Test parameters		Test
Vicat softening temperature (VST) [a]	VST ≥ 79 °C	Shall conform to ISO 2507-1		ISO 2507-1
Resistance to dichloromethane [b]	No attack	Test temperature Immersion time	15 °C 30 min	ISO 9852
Longitudinal reversion [e]	≤ 5 % The pipe shall show no delamination cracks or bubbles [d]	Temperature heating time [c] for: $e \leq 10$ mm $e > 10$ mm	(150 ± 2) °C 30 min 60 min	ISO 12091

[a] Not applicable to the foamed part of a pipe. If e_4 is less than 1,8 mm, the test shall be carried out on a profile extruded from the material. Indirect testing may be carried out using the pipe sample.

[b] Only applicable to pipes with a wall thickness $e_4 > 3$ mm or $e_5 > 3$mm . Not applicable to the foamed part of a pipe. Profiles for spirally wound pipes may be tested before winding.

[c] For the wall thickness, e, the maximum measured wall thickness of the pipe shall be taken.

[d] Bubbles in the foamed structure are exempt from this requirement.

[e] Not applicable for A 2 pipes.

8.1.2 Physical characteristics of PVC-U fittings

When tested in accordance with the test methods as specified in Table 9 using the indicated parameters, the fitting shall have physical characteristics conforming to the requirements given in Table 9.

Table 9 — Physical characteristics of PVC-U injection moulded fittings

Characteristic	Requirements	Test parameters		Test
Vicat softening temperature (VST) [a]	For application UD : VST ≥ 78 °C; U : VST ≥ 77 °C	Shall conform to ISO 2507-1		ISO 2507-1
Effect of heating [a c]	[b]	Test temperature heating time for: $e \leq 3$ mm $3 < e \leq 10$ mm $10 < e \leq 20$ mm	(150 ± 2) °C 15 min 30 min 60 min	Method A of EN ISO 580, air

[a] Only applicable to injection-moulded fittings and injection-moulded components for fabricated fittings.

[b] a) Within a radius of 15 times the wall thickness around the injection point(s), the depth of cracks, delamination or blisters shall not exceed 50 % of the wall thickness at that point.
b) Within a distance of 10 times the wall thickness from the diaphragm zone, the depth of cracks, delamination or blisters shall not exceed 50 % of the wall thickness at that point.
c) Within a distance of 10 times the wall thickness from the ring gate the length of cracks running through the overall thickness of the wall shall not exceed 50 % of the wall thickness at that point.
d) The weld line shall not have opened more than 50 % of the wall thickness at that line.
e) In all other parts of the surface the depth of cracks and delaminations shall not exceed 30 % of the wall thickness at that point. Blisters shall not exceed a length of 10 times the wall thickness.

[c] Test pieces to be cut to fit available oven.

8.2 Polypropylene (PP)

8.2.1 Physical characteristics of PP pipes

When tested in accordance with the test methods as specified in Table 10 using the indicated parameters, the pipe shall have physical characteristics conforming to the requirements given in Table 10.

Table 10 — Physical characteristics of PP pipes

Characteristic	Requirements	Test parameters		Test method
Longitudinal reversion [c]	≤ 2 %; The pipe shall show no delaminations, cracks or bubbles [b]	Temperature heating time [a] for: $e \leq 10$ mm $e > 10$ mm	(150 ± 2) °C 30 min 60 min	ISO 12091

[a] For the wall thickness, *e*, the maximum measured wall thickness of the pipe shall be taken.

[b] Bubbles in the foamed structure are exempt from this requirement.

[c] Not applicable for A 2 pipes.

8.2.2 Physical characteristics of PP fittings

When tested in accordance with the test method as specified in Table 11 using the indicated parameters, the fittings shall have physical characteristics conforming to the requirements given in Table 11.

Table 11 — Physical characteristics of PP injection moulded components

Characteristic	Requirements	Test parameters		Test method
Effect of heating [a]	[b]	Test temperature heating time [c] for: $e \leq 3$ mm $3 < e \leq 10$ mm $10 < e \leq 20$ mm	(150 ± 2) °C 15 min 30 min 60 min	Method A of EN ISO 580, air

[a] Only applicable to injection-moulded fittings and injection-moulded components for fabricated fittings.

[b] The depth of cracks, delamination or blisters shall not be more than 20 % of the wall thickness around the injection point(s). No part of the weld line shall open to a depth of more than 20 % of the wall thickness.

[c] For the wall thickness, *e*, the maximum measured wall thickness of the fitting shall be taken.

8.3 Polyethylene (PE)

8.3.1 Physical characteristics of PE pipes

When tested in accordance with the test methods as specified in Table 12 using the indicated parameters, the pipe shall have physical characteristics conforming to the requirements given in Table 12.

Table 12 — Physical characteristics of PE pipes

Characteristic	Requirements	Test parameters		Test method
Longitudinal reversion [c]	≤ 3 %; The pipe shall show no delaminations, cracks or bubbles [b]	Temperature heating time [a] for: $e \leq 10$ mm $e > 10$ mm	(110 ± 2) °C 30 min 60 min	ISO 12091

[a] For the wall thickness, *e*, the maximum measured wall thickness of the pipe shall be taken.

[b] Bubbles in the foamed structure are exempt from this requirement.

[c] Not applicable for A 2 pipes.

8.3.2 Physical characteristics of PE fittings

When tested in accordance with the test method as specified in Table 13 using the indicated parameters, the fitting shall have physical characteristics conforming to the requirements given in Table 13.

Table 13 — Physical characteristics of PE injection moulded components

Characteristic	Requirements	Test parameters		Test
Effect of heating [a]	[b]	Test temperature heating time [c] for: $e \leq 3$ mm $3 < e \leq 10$ mm $10 < e \leq 20$ mm	(110 ± 2) °C 15 min 30 min 60 min	Method A of EN ISO 580, air

[a] Only applicable to injection-moulded fittings and injection-moulded components for fabricated fittings.

[b] The depth of cracks, delamination or blisters shall not be more than 20 % of the wall thickness around the injection point(s). No part of the weld line shall open to a depth of more than 20 % of the wall thickness.

[c] For the wall thickness, *e*, the maximum measured wall thickness of the fitting, shall be taken.

9 Mechanical characteristics

9.1 Mechanical characteristics of pipes

9.1.1 General requirements

When tested in accordance with the test methods as specified in Table 14 using the indicated parameters, the pipe shall have mechanical characteristics conforming to the requirements given in Table 14.

Table 14 — Mechanical characteristics of pipes

Characteristic	Requirements	Test parameters		Test
Ring stiffness	≥ relevant SN	Shall conform to EN ISO 9969		EN ISO 9969
Impact strength at 0 °C [a] (Round the clock method)	TIR ≤ 10 %	Test temperature	(0 ± 1) °C	ISO 3127
		Conditioning medium	Water or air	
		Type of striker	d90	
		Mass of striker for : $d_{im\,max} \leq 100$	0,5 kg	
		$100 < d_{im\,max} \leq 125$	0,8 kg	
		$125 < d_{im\,max} \leq 160$	1,0 kg	
		$160 < d_{im\,max} \leq 200$	1,6 kg	
		$200 < d_{im\,max} \leq 250$	2,0 kg	
		$250 < d_{im\,max} \leq 315$	2,5 kg	
		$315 < d_{im\,max} \leq 1200$	3,2 kg	
		Fall height of striker for : $d_{im\,max} \leq 110$	1 600 mm	
		$d_{im\,amx} > 110$	2 000 mm	
Impact strength at 0°C [a]		$d_{im\,max} > 1200$ fall height of striker. mass of striker	2 000 mm 3,2 / 4,8 kg	Annex K
Ring flexibility 30 [b]	Shall conform to 9.1.2	Deflection Length of test piece	30 % of d_n As specified in EN ISO 9969.	EN ISO 13968
Creep ratio [d]	PVC-U: ≤ 2,5 at 2 years extrapolation. PP and PE: ≤ 4 at 2 years extrapolation	Shall conform to EN ISO 9967		EN ISO 9967
Tensile strength of seam [c]	Shall conform to 9.1.3	Rate of movement	15 mm/min	ISO 13262

[a] In countries where a less stringent impact resistance test is permitted, Annex G may be applied instead of the impact test at 0 °C (for details see national Foreword).
In countries where a more stringent impact resistance test is required, Annex H applies in addition to the impact test at 0 °C (for details see national Foreword).

[b] In countries where a less stringent ring flexibility test is permitted, Annex I may be applied instead of the metho given in this table (for details see national Foreword).

[c] Only applicable to spirally formed pipes.

[d] Not applicable for pipes greater than DN/ID or DN/OD 1200.

9.1.2 Ring flexibility

When tested in accordance with the test method as described in Table 15 using the indicated parameters and visually inspected without magnification, a) and b) shall be conformed to during the test:

a) there shall be no decrease of the measured force;

b) there shall be no cracking in any part of the wall structure. For spirally formed pipes, tears initiated along the cut of a rib shall not be considered as a failure if less than 0,075dem mm or 75 mm, whichever is smaller; and

C) to e) shall be conformed to after the test:

C) there shall be no wall delamination with the exception of possible delamination between the outside and inside wall of double wall pipes occurring in reduced welding zone in the ends of the test piece;

d) there shall be no other types of rupture in the test piece;

e) permanent buckling in any part of the structure of the pipe wall, including depressions and craters, shall not occur in any direction.

9.1.3 Tensile strength of seams (Type A.2)

When tested in accordance with Table 14 the minimum required tensile strength of the seam shall conform to Table 15.

Table 15 — Minimum tensile strength of seam

Nominal size DN/ID or DN/OD	Minimum tensile strength N
DN < 400	380
400 ≤ DN < 600	510
600 ≤ DN < 800	760
DN ≥ 800	1 020

9.2 Mechanical characteristics of fittings

The mechanical characteristics of solid-wall fittings are described in the relevant product standards (EN 1401-1, EN 1852-1, or EN 12666-1) or prEN 13476-3.

For other fitting designs, the following apply:

When tested in accordance with the test methods as specified in Table 16 using the indicated parameters, the fitting shall have mechanical characteristics conforming to the requirements given in

Table 16.

Table 16 — Mechanical characteristics of fittings

Characteristic	Requirements	Test parameters		Test method
Stiffness [a] [c]	≥ relevant SN	Shall conform to ISO 13967		EN ISO 13967
Impact test [c]	No cracks through the wall; jumped off sealing elements shall be able to be restored into the correct position manually	Test temperature Drop height for: $d_e \leq 125$: $d_e > 125$: Position of impact	0 °C 1 000 mm 500 mm Mouth of the socket	ISO 13263
Mechanical strength or flexibility [b]	No signs of splitting, cracking, separation and/or leakage	EITHER		
		Test period Minimum moment for: $d_e \leq 250$ $d_e > 250$	15 min $0{,}15[DN]^3 \times 10^{-6}$ kNm 0,01[DN] kNm	ISO 13264
		OR		
		Minimum displacement	170 mm	ISO 13264

[a] When a fitting according to this standard has the same wall construction as a corresponding pipe, the stiffness of the fitting, because of its geometry, is equal to or greater than that of the pipe. Such fittings can be classified with the same stiffness class as that pipe without testing the stiffness.

[b] Only for fabricated fittings made from more than one piece (a sealing ring retaining component is not considered as a piece) or when the minimum wall thickness in the body, e_b, is less than $(0{,}9 \times d_{em}/51)$, $(0{,}9 \times d_{em}/41)$ (or $0{,}9 \times d_{em}/33$) for PVC, PP and PE respectively.

[c] Not required for fittings > 1 200 mm made from pipes that meets the impact and ring stiffness requirements.

10 Performance Requirements

When tested in accordance with the test methods as specified in Table 17 using the indicated parameters, the joints and the system shall have characteristics conforming to the requirements given in Table 17.

Table 17 — Performance requirements

Characteristic	Requirements	Test parameters		Test method
Tightness of elastomeric ring seal joint		Temperature Spigot deflection Socket deflection	(23 ± 2) °C 10 % 5 %	ISO 13259 Condition B
	No leakage	Water pressure	0,05 bar	
	No leakage	Water pressure	0,5 bar	
	≤ −0,27 bar	Air pressure	−0,3 bar	
Tightness of elastomeric ring seal joint		Temperature Joint deflection for: $d_e \leq 315$ $315 < d_e \leq 630$ $630 < d_e \leq 1\,200$ $d_e > 1\,200$	(23 ± 2) °C 2° 1,5° 1° 0.5°	ISO 13259 Condition C
	No leakage	Water pressure	0,05 bar	
	No leakage	Water pressure	0,5 bar	
	≤ −0,27 bar	Air pressure	−0,3 bar	
Resistance to combined temp. cycling and external Loading [b]	[a]	For $d_{im} \leq 160$ mm: Shall conform to Method A of EN ISO 13260		Method A of EN ISO 13260 (hot and cold water)
		For $d_{im} > 160$ mm: Shall conform to Method B of EN ISO 13260		Method B of EN ISO 13260 (hot water)
Elevated temperature cycling [c]	No leakage	Shall conform to ISO 13257		ISO 13257:2010, Figure 2
Water tightness [d, e]	No leakage	Water pressure Duration	0.5 bar 1 min	ISO 13254
Tensile test of welded or fused joints	No break in the joint	Minimum tensile force	Shall conform to Table 15	ISO 13262 [f]

[a] The following requirements apply:
- vertical deformation: ≤ 9 %;
- deviation from surface evenness in bottom: ≤ 3 mm;
- radius of bottom: ≥ 80 % of original;
- opening of weld line: ≤ 20 % of wall thickness;
- tightness at 0,35 bar/15 min: No leakage allowed.

[b] Only for components in accordance with this document with DN/OD ≤ 315 and DN/ID ≤ 300 and marked UD.

[c] Only for components in accordance with this document with DN/OD ≤ 200 and DN/ID ≤ 100 and marked UD.

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

[e] It is not practical to be carried out with water. Air to be considered at either positive or negative pressures.

[f] This test is applicable for all pipe and fitting constructions when jointed by fusion or welding. The test pieces shall be cut longitudinally in the fusion area. The length of the test piece shall include the joint plus a length at each end sufficient to ensure a proper grip in the tensile testing machine.

- Hydrostatic Pressure Test Unit-4S-100bar
- Hot Water Bath for Hydrostatic Pressure Testing
- Ring Stiffness Tester According to ISO 9969
- Leak Tightness Tester for PVC Pipes up to 250mm-BS EN 1277
- Leak Tightness Tester for PVC Pipes up to 400mm-ISO 13844-ISO13845-Plus Minus Pressure
- Melt Flow Index Tester (MFI, MFR)
- Differential Scanning Calorimeter (DSC, OIT)-500C
- Carbon Black Content Test Furnace (CBC Tester)
- Precise Balance and Density Kit
- HDT Vicat Tester / Computerized Model-3 Station-300C
- Dichloromethane Tester for PVC Pipes
- ISO 2505 â€“ Thermoplastics Pipes â€” Longitudinal Reversion â€” Test Method and Parameters â€“ Testing Equipment
-

Falling Weight Impact Tester-OD:630-H:2000mm

- Universal Tensile Compression Tester (UTM)
- ISO 13254 Thermoplastics Piping Systems for Non-Pressure Applications â€" Test Method for Watertightness/ Testing Equipment
-

Category

1. Equipment for Standards
2. Standards