DIN EN ISO 15875-2 Plastics Piping Systems for Hot and Cold Water Installations –Crosslinked Polyethylene (PE-X) – Pipes – Testing Equipment

Description

5 General characteristics

5.2 Opacity
Crosslinked polyethylene pipes that are declared to be opaque shall not transmit more than 0,2 % of visible light, when tested in accordance with EN 578.

7 Mechanical characteristics

When tested in accordance with the test method as specified in Table 7 using the indicated parameters, the pipe shall withstand the hydrostatic (hoop) stress without bursting. In the case of pipes with (a) barrier 1ayer(s) the test shall be carried out on test pieces without the barrier 1ayer(s)-

Table 7 — Mechanical characteristics of pipes

Characteristic	Requirement	Test parameters for the individual tests				Test method
		Hydrostatic (hoop) stress MPa	Test temp. °C	Test period h	Number of test pieces	
Resistance to internal pressure	No failure during the test period	12,0 [a]	20	1	3	EN 921 of 1994
		4,8	95	1	3	
		4,7	95	22	3	
		4,6	95	165	3	
		4,4	95	1000	3	
		Test parameters for all tests				
		Sampling procedure	[b]			
		Type of end cap	Type a)			
		Orientation of test piece	Not specified			
		Type of test	Water-in -water			

[a] The test stress is above the minimum expected strength curve as the real short term stress at 20 °C is higher than the strength curve.
[b] The sampling procedure is not specified. For guidance see CEN ISO/TS 15875-7 [4].

8 Physical and chemical characteristics

When tested in accordance with the test methods as specified in Table 8 using the indicated parameters, the pipe shall conform to the requirements given in this table.

Table 8 — Physical and chemical characteristics of pipes

Characteristic	Requirement	Test parameters		Test method
		Parameter	Value	
Longitudinal reversion	≤ 3 %	Temperature Duration of exposure for: $e_n \leq 8$ mm 8 mm < $e_n \leq 16$ mm $e_n > 16$ mm Number of test pieces	120 °C 1 h 2 h 4 h 3	Method B of EN 743:1994 (oven test)
Thermal stability by hydrostatic pressure testing	No bursting during the test period	Sampling procedure End cap Orientation Type of test Hydrostatic (hoop) stress Test temperature Test period Number of test pieces	[a] Type a) Not specified Water-in-air 2,5 MPa 110 °C 8760 h 1	EN 921:1994
Crosslinking - peroxide - silan - electron beam - azo	 ≥ 70 % ≥ 65 % ≥ 60 % ≥ 60 %	Shall conform to EN 579		EN 579

[a] The sampling procedure is not specified. For guidance see CEN ISO/TS 15875-7 [4].

9 Performance requirements

When pipes conforming to this standard are jointed to each other or components conforming to EN ISO 15875-3 [5], the pipes and the joints shall conform to EN ISO 15875-5.

EN ISO 15875-5 Test equipment will be as below items:

4 Fitness for purpose of the joints and the piping system

4.1 General

When tested in accordance with the applicable test methods as specified in Table 1, using the indicated parameters given in 4.2 to 4.7, as applicable, the joints and the piping system shall have characteristics conforming to the requirements given in the applicable clauses.
For the tests described the fittings shall be connected to the pipe with which they are intended to be used.
Table 1 specifies the tests applicable for each different type of jointing system covered by this standard.

Table 1 — Joint tests

Test	Jointing system [a]		Test parameters	Test method
	EF	M		
Internal pressure test	Y	Y	Shall conform to 4.2	EN 921
Bending test	N	Y	Shall conform to 4.3	EN 713
Pull-out test	N	Y	Shall conform to 4.4	EN 712
Thermal cycling test	Y	Y	Shall conform to 4.5	EN 12293
Pressure cycling test	N	Y	Shall conform to 4.6	EN 12295
Vacuum test	N	Y	Shall conform to 4.7	EN 12294

[a] EF : Electrofusion joint
M : Mechanical joint
Y : denotes test applicable
N : denotes test not applicable

4.2 Internal pressure test

When tested in accordance with EN 921 using the test parameters given in Table 2 for the relevant classes the joint assemblies shall not leak.

The test pressure, pJ, for a given time to failure and test temperature shall be determined by the following equation:

$$p_J = p_D \times \frac{\sigma_P}{\sigma_{DP}}$$

where

p_J is the hydrostatic test pressure, in bars, to be applied to the joint assembly during the test period;

σ_p are the hydrostatic stress values, in megapascals, of the pipe material corresponding to time to failure/test temperature points given in Table 2;

σ_{DP} are the design stress values, in megapascals, for the pipe material as determined for each class and listed in Table A.2 of EN ISO 15875-2:2003;

p_D is the design pressure of 4 bar , 6 bar, 8 bar or 10 bar, as applicable.

Table 2 — Derivation of test pressure p_J

	Application class J			
	Class 1	Class 2	Class 4	Class 5
Max. Design temperature, T_{max}, in °C	80	80	70	90
Design stress of pipe material, σ_{DP}, in MPa	3,85	3,54	4,00	3,24
Test temperature [a] , T_{test}, in °C	95 [a]	95 [a]	80	95
Test duration, t, in h	1000	1000	1000	1000
Hydrostatic stress of pipe material, σ_P, in MPa	4,4	4,4	5,2	4,4
Test pressure, p_J, in bars, for a design pressure, p_D, of: 4 bar	5,8 [b]	5,8 [b]	6,9 [b]	5,8 [b]
6 bar	6,9	7,5	7,8	8,2
8 bar	9,2	10,0	10,4	10,9
10 bar	11,5	12,5	13,0	13,6
Number of test pieces	3	3	3	3

[a] Generally the highest test temperature is taken to be (T_{max} + 10) °C with an upper limit of 95 °C. However to match existing test facilities the highest test temperature for classes 1 and 2 is also set at 95 °C. The hydrostatic stresses given correspond to the given test temperatures.
[b] The 20 °C, 10 bar, 50 years, cold water requirement, being higher, determines this value (see clause 4 of EN ISO 15875-1:2003).

In special circumstances, if joint tests according to this clause cause leaks resulting from deformations induced by differential elongation, a test pressure may be determined from the stress and creep data (relative to a design period of 50 years) for the different materials used.

4.3 Bending test

When tested in accordance with EN 713 to the applicable pressure for the 20 °C, 1 h condition given in Table 3, using a bending radius equal to the minimum radius of bending for the pipes as recommended by the system supplier, the joint assembly shall not leak.
This test is only applicable to pipes of nominal diameter greater than or equal to 32 mm.

Table 3 — Test parameters for bending test

	Application class			
	Class 1	Class 2	Class 4	Class 5
Max. design temperature, T_{max}, in °C	80	80	70	90
Design stress of pipe material, σ_{DP}, in MPa	3,85	3,54	4,00	3,24
Test temperature, T_{test}, in °C	20	20	20	20
Test duration, t, in h	1	1	1	1
Hydrostatic stress of pipe material, σ_P, in MPa	12	12	12	12
Test pressure, p_J, in bars, for a design pressure, p_D, of: 4 bar	15,8 [a]	15,8 [a]	15,8 [a]	15,8 [a]
6 bar	18,7	20,4	18,0	22,3
8 bar	25,0	27,2	24,0	29,7
10 bar	31,2	33,9	30,0	37,1
Number of test pieces	3	3	3	3

[a] The 20 °C, 10 bar, 50 years, cold water requirement, being higher, determines this value (see clause 4 of EN ISO 15875-1:2003).

4.4 Pull-out test

When tested in accordance with EN 712 using the parameters given in Table 4, the joint assemblies shall withstand the pull-out force, without being separated.
The force, F, shall be calculated from the following equation:

$$F = \frac{\pi}{4} \times d_n^{\,2} \times p_D$$

where:

F is the force, expressed in newtons (N);

d_n is the nominal outside diameter of the pipe, expressed in millimetres (mm);

p_D is the design pressure of 4, 6, 8 or 10 bar, as applicable, expressed in megapascals. In the case of the classification 'All classes' the design pressure shall be 10 bar, expressed in megapascals (MPa).

Table 4 — Test parameters for pull-out test

	All application classes	Application class			
		Class 1	Class 2	Class 4	Class 5
Max design temperature, T_{max}, in °C	—	80	80	70	90
Test temperature, in °C	23	90	90	80	95
Test period, in h	1	1	1	1	1
Pull-out force, in N	$1{,}5 \times F$	F	F	F	F
Number of test pieces	3	3	3	3	3

4.5 Thermal cycling test

When tested in accordance with EN 12293 using the parameter given in Table 5 the pipes, fittings or joints, as applicable, shall withstand the test without leakage.
The test for flexible pipes shall only be used when the manufacturer declares that the pipe can be bent to the configuration shown. The bending radius shall not be smaller than the minimum declared bending radius. In all other cases the test for rigid pipes shall apply.

Table 5 — Test parameters for thermal cycling

	Application class			
	Class 1	Class 2	Class 4	Class 5
Max design temperature, T_{max}, in °C	80	80	70	90
Highest test temperature, in °C	90	90	80	95
Lowest test temperature, in °C	20	20	20	20
Test pressure, in bars	p_D	p_D	p_D	p_D
Number of cycles [a]	5000	5000	5000	5000
Number of test pieces	One set of fittings in accordance with the configuration shown in EN 12293.			
[a] Each cycle shall comprise $15\,^{+1}_{0}$ min at the highest test temperature and $15\,^{+1}_{0}$ min at the lowest (i.e. the duration of one cycle is $30\,^{+2}_{0}$ min).				

The tensile stress, ?t , used to calculate the pre-stress force required in EN 12293 shall be 1,8 MPa.

NOTE The tensile stress is calculated, using the following equation:

$$\sigma_t = \alpha \times \Delta T \times E$$

where:

σ_t is the tensile stress, expressed in megapascals (MPa);

α is the coefficient of thermal expansion, expressed in reciprocal kelvins (1/K);

ΔT is the temperature difference, expressed in kelvins (K);

E is the modulus of elasticity, expressed in megapascals (MPa).

In this standard the following values apply:

$\alpha = 1{,}5 \times 10^{-4}\ K^{-1}$;

$\Delta T = 20$ K;

$E = 600$ MPa.

4.6 Pressure cycling test

When tested for leaktightness under pressure cycling in accordance with EN 12295 using the parameters given in Table 6, the pipes, fittings or joints, as applicable, shall not leak.

Table 6 — Test parameters for pressure cycling

Characteristics	Requirement	Test parameters			Test method
Pressure cycling	No leakage	Test temperature	23 °C		EN 12295
		Number of test pieces	3		
		Frequency of test cycles	(30 ± 5) cycles per min		
		Number of cycles	10 000		
		Test pressure limits for a design pressure of:	Upper limit	Lower limit	
		4 bar	6,0 bar	0,5 bar	
		6 bar	9,0 bar	0,5 bar	
		8 bar	12,0 bar	0,5 bar	
		10 bar	15,0 bar	0,5 bar	

4.7 Leaktightness under vacuum

When tested the leaktightness under vacuum in accordance with EN 12294 using the parameters given in Table 7, the change in vacuum pressure shall not be greater than 0,05 bar.

Table 7 — Test parameters for leaktightness under vacuum

Characteristics	Requirements	Test parameters		Test method
Leaktightness under vacuum	Change in vacuum pressure ≤ 0,05 bar	Test temperature	23 °C	EN 12294
		Test duration	1 h	
		Test pressure	–0,8 bar	
		Number of test pieces	3	

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