Testing Equipment for Electrofusion Fittings EN 12201-3 , EN 1555-3 (Gas and Water)

Description

Testing according to EN 12201-3 for Water Fittings

7.3 Requirements

when tested in accordance with the test methods as specified in Table 4 using the parameters given in Table 4G the fitting shall have mechanical characteristics conforming to the requirements given in Table 4.

Table 4 — Mechanical characteristics

Characteristics	Requirements	Test parameters		Test method
		Parameters	Value	
Hydrostatic strength at 20 °C	No failure during test period of any test pieces	End caps Conditioning period Number of test pieces [b] Type of test Test temperature Test period Circumferential (hoop) stress [c] for: PE 80 PE 100	Type A [a] EN ISO 1167-1 Shall conform to EN ISO 1167-1 3 Water- in- water 20 °C 100 h 10,0 MPa 12,0 MPa	EN ISO 1167-1 and EN ISO 1167-4
Hydrostatic strength at 80 °C	No failure during test period of any test pieces	End caps Conditioning period Number of test pieces [b] Type of test Test temperature Test period Circumferential (hoop) stress [c] for: PE 80 PE 100	Type A [a] Shall conform to EN ISO 1167-1 3 Water-in-water 80 °C 165 h [d] 4,5 MPa 5,4 MPa	EN ISO 1167-1 and EN ISO 1167-4
Hydrostatic strength at 80 °C	No failure during test period of any test pieces	End caps Conditioning period Type of test Test temperature Number of test pieces [b] Test period Circumferential (hoop) stress [c] for: PE 80 PE 100	Type A [a] Shall conform to EN ISO 1167-1 Water-in-water 80 °C 3 1000 h 4,0 MPa 5,0 MPa	EN ISO 1167-1 and EN ISO 1167-4
Decohesive resistance for electrofusion socket fittings	Length of initiation rupture ≤ L_2/3 in brittle failure	Test temperature Number of test pieces [b]	23 °C Shall conform to ISO 13954 or ISO 13955	ISO 13954 ISO 13955
Cohesive strength of electrofusion saddle fittings	Ld ≤ 50% and Ad ≤ 25 %, brittle failure	Test temperature Number of test pieces [b]	23 °C Shall conform to ISO 13956	ISO 13956
Tensile strength for butt fusion fittings - spigoted fittings	Test to failure: – ductile: pass – brittle: fail	Test temperature Number of test pieces [b]	23 °C Shall conform to ISO 13953	ISO 13953
Impact resistance of tapping tees	No failure, no leaks	Test temperature Mass of striker Height Conditioning period: in air in liquid	(0 ± 2) °C (2 500 ± 20) g (2 000 ± 10) mm 4 h 2 h	EN 1716

[a] Type B end caps may be used for batch release tests for diameters ≥ 500 mm.
[b] The number of test pieces given indicate the quantity required to establish a value for the characteristic described in the table. The number of test pieces required for factory production control and process control should be listed in the manufacturer's quality plan (for guidance see CEN/TS 12201-7 [2]).
[c] The stress shall be calculated using the nominal dimensions of the pipe used in the test assembly.
[d] Premature ductile failures are not taken into account. For retest procedure see 7.4.

According to above table you need below equipment for the target size range of your fittings:

- Hydrostatic pressure test unit (2, 4 or 8 stations)
- Water tank 80C

- Water tank for 20C (standard water tank+chiller)
- SS304 end caps according to the target size range
- Crush test for socket fittings (Crush tester+tensile tester & special fixture)
- Cohesive strength tester for saddles
- Tensile strength tester for butt fusion fittings (tensile tester + CNC sample milling machine)
- Impact tester for tapping tees

7.3.1 Hydrostatic pressure test unit (2, 4 or 8 stations)

The pressure test unit has 3 options of 2, 4, or 8 separate pressure stations, depending on the volume of the test. The maximum pressure of 100 bar will be enough for this application.

Hydrostatic Pressure Test Unit

7.3.2 Water tank 80C

Water tanks have different size ranges. Standard water tanks are used for temperatures up to 95C. For electrofusion fittings, the requested temperature is 80C.

Hot Water Bath for Hydrostatic Pressure Testing

7.3.3 Water tank for 20C (standard water tank+chiller)

for 20C tests, you need a standard water tank with a heat exchanger and a chiller unit connected to that for control the temperature at 20C. The water tank is as above 7.3.2. Chiller will be as below:

Chiller for hydrostatic water tank

The chillers manufactured in AHP PLASTIK MAKINA have different capacities like 2, 3, 5, 7, 10 Tons of chilling. The proper size will be selected according to requested size of water tank. To see how these 3 above items (Pressure unit+water tank+chiller) will be connected together please check below video:

https://youtu.be/q7tq18XZQ1A?si=ervry4lm2FwIvAmR

7.3.4 SS304 end caps according to the target size range

End caps for this sector are type A end caps according to ISO 1167. The material for end caps is SS304. there are two types of end caps. for small sizes up to 90 or 110mm each end cap is with 3 pieces. one cap and two clamps. for big sizes of end caps bigger than 110mm, each end cap has 4 pieces. one cap, one ring, and two or four clamps.

End Caps (Clamp Set for Creep-Life Testing Of Polymer Pipes)

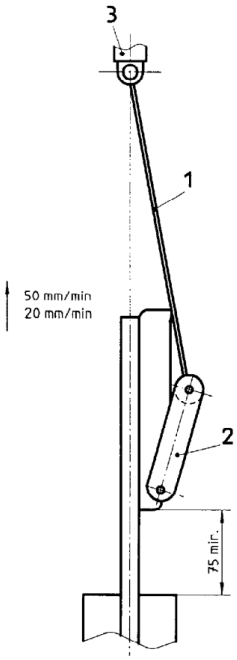
7.3.5 Crush test for socket fittings (Crush tester+tensile tester & special fixture)

Crush test for the small size of up to 225mm socket electrofusion fittings done by hydraulic crush tester as below:

Crush Squeeze Tester for PE Pipes and EF Fittings

For big sizes of electrofusion sockets, test is done using a tensile tester and special fixture:

Universal Tensile Compression Tester (UTM)



Fixture for crush testing of big size socket EF fittings

7.3.6 Cohesive strength tester for saddles

This test is done on a hydraulic crush tester with a special fixture. It is depicted on 7.3.5. Check videos on our YouTube channel.

7.3.7 Tensile strength tester for butt fusion fittings (tensile tester + CNC sample milling machine)

The tensile test is depicted in 7.3.5. CNC sample milling machine is as below:

CNC Milling for Tensile Sample Preparation

7.3.8 Impact tester for tapping tees

Impact tester for tapping Tees

7.4 Retest in case of failure at 80 C

A fracture in a brittle mode in less than 165 h shall constitute a failure. However, if a sample in the 165 h test fails in a ductile mode in less than 165 h a retest shall be performed at a selected lower stress in order to achieve the minimum required time for the selected stress obtained from the line through the stress/time points given in Table 5.

Table 5 — Test parameters for the retest of the hydrostatic strength at 80 °C

PE 80		PE 100	
Stress	Test period	Stress	Test period
MPa	h	MPa	h
4,5	165	5,4	165
4,4	233	5,3	256
4,3	331	5,2	399
4,2	474	5,1	629
4,1	685	5,0	1 000
4,0	1 000		

7.5 Pressure drop

If required the manufacturer shall declare the pressure drop of a fitting for sizes up to 63 when determined in accordance with ISO 4059:1978.

7.6 Performance requirements

When 6.2.2 b- applies electrofusion socket fittings shall also be in accordance with Table 6.

Table 6 — Performance requirements

Characteristics	Requirement	Test parameters		Test method
		Parameter	Value	
Short-term internal pressure resistance	Failure pressure shall be greater than pressure equivalent of 2 × MRS calculated for thickest-walled pipe for which fitting has been designed.	End caps Orientation Conditioning time Type of test Minimum pressure: PE 80 pipe, SDR 11 PE 100 pipe, SDR 11 Pressure increase rate Test temperature	Type A of EN ISO 1167-1 Free 12 h Water-in-water 32 bar 40 bar 5 bar/min 20 °C	Annex D
Resistance to tensile load	No leakage or failure of the fusion joint after 25% elongation of the pipe	Test temperature	23 °C	Annex E
1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2				

8 Physical characteristics

8.1 Conditioning

Unless otherwise specified by the applicable test method, the test pieces shall be conditioned at (23 Â± 2) Â°C before testing in accordance with Table 7.

8.2 Requirements

When tested in accordance with the test methods as specified in Table 7 using the indicated parameters, the fittings shall have physical characteristics conforming to the requirements given in Table 7.

Table 7 — Physical characteristics

Characteristics	Requirements	Test parameters		Test method
		Parameters	Value	
Melt mass-flow rate (MFR) for PE 80, and PE 100	Change of MFR by processing ± 20 % [b]	Load Test temperature Test period Number of test pieces [a]	5 kg 190 °C 10 min Shall conform to EN ISO 1133	EN ISO1133
Oxidation induction time	≥ 20 min	Test temperature Test environment Specimen weight Number of test pieces [a]	200 °C [c] Oxygen (15 ±2) mg 3	ISO 11357-6
Effect on water quality [d]	National regulations apply			

[a] The number of test pieces given indicate the quantity required to establish a value for the characteristic described in the table. The number of test pieces required for factory production control and process control should be listed in the manufacturer's quality plan; for guidance see CEN/TS 12201-7 [2].
[b] Value as measured on the fitting relative to the value measured on the compound used.
[c] Test may be carried out as an indirect test at 210 °C or 220 °C providing that there is clear correlation of the results to those at 200 °C: in cases of dispute the reference temperature shall be 200 °C.
[d] Test methods, parameters and requirements for all properties are under preparation. Until these European Standards are published National Regulations apply (see Introduction).

- Melt Flow Index Tester (MFI, MFR)
- Differential Scanning Calorimeter (DSC, OIT)

Testing according to EN 1555-3 for Gas Applications

7 Mechanical characteristics

7.1 General

The technical descriptions of the manufacturer shall include the following information:

a) field of application:

1) pipe and fitting temperature limits;

2) pipe series or SDRs;

3) out of roundness (ovality);

b) assembly instructions;

c) fusion instructions:

1) fusion parameters with limits;

d) data for saddles and tapping tees:

1) the means of attachment (tools and/or under clamp);

2) the need to maintain the under clamp in position in order to ensure the performances of the assembly. In the event of modification of the fusion parameters, the manufacturer shall ensure that the joint conforms to EN 1555-5.

NOTE Sample test assemblies should take account of manufacturing tolerances, assembly tolerances and ambient temperature variations at which the fittings can be used. The manufacturer should take due consideration of the recommended practices for installation of PE fittings, given in EN 12007-2:2000 [1]. Fittings shall be tested using pipes, which conform to EN 1555-2. Jointed pipe and fitting test pieces shall be assembled in accordance with the technical instructions of the manufacturer and take into account the extreme conditions of utilization described in EN 1555-5. The sample test assemblies shall take account of manufacturing and assembly tolerances. In the event of modification of the jointing parameters, the manufacturer shall ensure that the joint conforms to the requirements given in 7.2.

7.2 Requirements

Unless otherwise specified by the applicable test method, the test pieces shall be conditioned at (23 Â± 2) Â°C before testing in accordance with Table 4.

When tested in accordance with the test methods as specified in Table 4 using the indicated parameters, the fittings shall have mechanical characteristics conforming to the requirements given in Table 4, as applicable to the following types of fitting:

(A) electrofusion socket fitting;

(B) electrofusion saddle fitting;

(C) spigot end fitting.

For mechanical fittings, the requirements of ISO 10838-1, ISO 10838-2 or ISO 10838-3, shall apply.

NOTE The ISO 10838 series of standards may be replaced by a new standard in the future.

Table 4 — Mechanical characteristics

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Hydrostatic strength (20 °C, 100 h)	No failure during test period of any test piece	End caps Orientation Conditioning time Number of test pieces [a] Type of test Circumferential (hoop) stress in pipe [b] for: PE 80 PE 100 Test period Test temperature	Type A of EN ISO 1167-1:2006 Free Shall conform to EN ISO 1167-1 3 Water-in-water 10,0 MPa 12,0 MPa 100 h 20 °C	EN ISO 1167-1 and EN ISO 1167-4,
Hydrostatic strength (80 °C, 165 h)	No failure during test period of any test piece [c]	End caps Orientation Conditioning time Number of test pieces [a] Type of test Circumferential (hoop) stress in pipe [b] for: PE 80 PE 100 Test period Test temperature	Type A of EN ISO 1167-1:2006 Free Shall conform to EN ISO 1167-1 3 Water-in-water 4,5 MPa 5,4 MPa 165 h 80 °C	EN ISO 1167-1 and EN ISO 1167-4
Hydrostatic strength (80 °C, 1 000 h)	No failure during test period of any test piece	End caps Orientation Conditioning time Number of test pieces [a] Type of test Circumferential (hoop) stress in pipe [b] for: PE 80 PE 100 Test period Test temperature	Type A of EN ISO 1167-1:2006 Free Shall conform to EN ISO 1167-1 3 Water-in-water 4,0 MPa 5,0 MPa 1 000 h 80 °C	EN ISO 1167-1 and EN ISO 1167-4
Decohesive resistance (A)	Length of initiation rupture ≤ L_2/3 in brittle failure	Test temperature Number of test pieces [a]	23 °C Shall conform to ISO 13954 and ISO 13955	ISO 13954 ISO 13955
Evaluation of ductility of fusion joint interface (B)	Surface of rupture Ld ≤ 50% and Ad ≤25 %, brittle failure	Test temperature Number of test pieces [a]	23 °C Shall conform to ISO/FDIS 13956	ISO/FDIS 13956
Tensile strength for butt fusion (C)	Test to failure: ductile - pass brittle - fail	Test temperature Number of test pieces [a]	23°C Shall conform to ISO 13953	ISO 13953
Impact resistance (B)	No failure, no leakage	Test temperature Falling height Mass of the striker Number of test pieces [a]	0 °C 2 m 2,5 kg 1	EN 1716
Pressure drop (B)	Air flow rate (value indicated by the manufacturer)	Test medium Test pressure Pressure drop: for $d_n \leq 63$ mm for $d_n > 63$ mm Number of test pieces [a]	Air source 25 mbar 0,5 mbar 0,1 mbar 1	EN 12117

a The numbers of test pieces given indicate the numbers required to establish a value for the characteristic described in the table. The numbers of test pieces required for factory production control and process control should be listed in the manufacturer's quality plan. For guidance, see CEN/TS 1555-7 [2].

b The stress shall be calculated using the nominal dimensions of the pipe used in the test assembly.

c Only brittle failures shall be taken into account. If a ductile failure occurs before 165 h, the test may be repeated at a lower stress. The stress and the associated minimum test period shall be selected from Table 5 or from a line based on the stress/time points given in Table 5.

Table 5 — Circumferential (hoop) stress at 80 °C and associated minimum test period

PE 80		PE 100	
Stress MPa	Minimum test period h	Stress MPa	Minimum test period h
4,5	165	5,4	165
4,4	233	5,3	256
4,3	331	5,2	399
4,2	474	5,1	629
4,1	685	5,0	1 000
4,0	1 000	–	–

7.3 Performance requirements

Where 6.2.2 b) applies, electrofusion socket fittings shall, additionally, be in accordance with Table 6.

Table 6 — Performance requirements

Characteristics	Requirement	Test parameters		Test method
		Parameter	Value	
Short-term internal pressure resistance	Failure pressure shall be greater than pressure equivalent of 2 × MRS calculated for thickest-walled pipe for which fitting has been designed	End caps Orientation Conditioning time Type of test Minimum pressure: PE 80 pipe, SDR 11 PE 100 pipe, SDR 11 Pressure increase rate Test temperature	Type A of EN ISO 1167-1:2006 Free 12 h Water-in-water 32 bar 40 bar 5 bar/min 20 °C	Annex B
Resistance to tensile load	No leakage or failure of the fusion joint after 25% elongation of the pipe	Test temperature	23 °C	Annex C
1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2				

8 Physical characteristics

8.1 Conditioning

Unless otherwise specified by the applicable test method, the test pieces shall be conditioned at (23 Â± 2) Â°C before testing in accordance with Table 7.

8.2 Requirements

When tested in accordance with the test methods as specified in Table 7 using the indicated parameters, the fittings shall have physical characteristics conforming to the requirements given in Table 7.

Table 7 — Physical characteristics

Characteristic	Requirements	Test parameters		Test method
		Parameter	Value	
Oxidation induction time (Thermal stability)	≥ 20 min	Test temperature Number of test pieces [a] Test environment Specimen weight	200 °C [b] 3 Oxygen 15 mg ± 2 mg	ISO 11357-6:2008
Melt mass-flow rate (MFR)	After processing maximum deviation of ± 20 % of the value measured on the batch used to manufacture the fitting	Loading mass Test temperature Time Number of test pieces [a]	5 kg 190 °C 10 min Shall conform to EN ISO 1133	EN ISO 1133

a The numbers of test pieces given indicate the numbers required to establish a value for the characteristic described in the table. The numbers of test pieces required for factory production control and process control should be listed in the manufacturer's quality plan. For guidance, see CEN/TS 1555-7 [2].

b Test may be carried out at 210 °C or 220 °C providing that there is a clear correlation to the results at 200 °C; in case of dispute the reference temperature shall be 200 °C.

- Crush Squeeze Tester for PE Pipes and EF Fittings
- Hydrostatic Pressure Test Unit
- Hot Water Bath for Hydrostatic Pressure Testing
- End Caps (Clamp Set for Creep-Life Testing Of Polymer Pipes)
- Universal Tensile Compression Tester (UTM)
- Falling Weight Impact Tester
- Melt Flow Index Tester (MFI, MFR)
- Differential Scanning Calorimeter (DSC, OIT)

Precise Balance and Density Kit

Category

1. Equipment for Standards
2. Standards