

**Translation from Finnish**

**Legally binding only in Finnish and Swedish**

**4/19**

## **Decree of the Ministry of the Environment**

### **on the Type Approval of Multilayer Pipes and Their Fittings Intended for Water Supply Systems of Buildings**

By decision of the Ministry of the Environment, the following is enacted pursuant to section 6, subsection 3; section 9, subsection 2; and section 10, subsection 3 of the Act on the Type Approval of Certain Construction Products (954/2012):

#### Section 1

##### *Scope of application*

This Decree applies to the requirements of type approval of multilayer pipes and their fittings of water supply systems intended for conducting household water and domestic hot water in a building and on property. This Decree covers multilayer pipes of nominal sizes DN 16–DN 110 and their fittings.

In accordance with the material of the layers of a multilayer pipe, the distinctive letters M and P shall be used for multilayer pipes (hereinafter *M-pipes and P-pipes*). The wall of an M-pipe is comprised of polymeric layers and at least one metallic layer. A P-pipe has at least two polymeric layers.

#### Section 2

##### *Definition*

*The nominal diameter of a fitting for a multilayer pipe* means the nominal outside diameter of the multilayer pipe to be connected.

#### Section 3

##### *Establishment of conformity*

Type approval can be used to demonstrate that multilayer pipes and their fittings comply with the essential technical requirements laid down for them in section 117 c of the Land Use and Building Act (132/1999), as amended by Act (958/2012), and thereunder.

## Section 4

### *Suitability for conducting household water*

The manufacturer shall submit to an accredited testing laboratory information on the raw materials used in the manufacture of multilayer pipes. With regard to P-pipes, this means all polymeric layers and, with regard to M-pipes, the polymeric layers inside the metal layer as well as adhesive layers.

An accredited testing laboratory shall carry out a chemical analysis on the multilayer pipes. In the chemical analysis, test water is let stand in pre-treated test pieces in room temperature ( $23 \pm 2$  degrees Celsius) for 72 hours. The standing-water test shall be repeated three times.

An accredited testing laboratory shall carry out a sensory evaluation of the multilayer pipes. In the sensory evaluation, the accredited testing laboratory shall let rinsed test pieces stand in the test water in room temperature for 24 hours. The standing-water test shall be repeated four times. A sensory evaluation shall be carried out on the fourth test water of the standing-water test with regard to defect odour and taste caused by substances that may have migrated from the pipes to the water.

An accredited testing laboratory shall inspect the information on the material of a fitting for the multilayer pipe. The accredited testing laboratory shall test the concentration of lead dissolved into test water from the manufacturing material of the fitting with a 26-week long dissolution test, or the dissolution of lead and cadmium from the fitting with a 10-day test in accordance with Appendix 1.

## Section 5

### *Surface properties*

An accredited testing laboratory shall examine the surfaces and outer appearance of the multilayer pipes and the fittings visually without magnification.

An accredited testing laboratory shall test the light transmittance of a P-pipe if the P-pipe transmits light.

## Section 6

### *Structure and dimensions*

An accredited testing laboratory shall examine the structure and dimensions of multilayer pipes and fittings. They shall conform to the information notified by the manufacturer on the dimensions, structure, layer thickness and tolerances of the pipes and the fittings.

## Section 7

### *Long-term strength*

An accredited testing laboratory shall perform classification tests on the long-term hydrostatic strength of multilayer pipes. In the classification test, the ultimate tensile strength of the pipe shall be determined at different pressures, temperatures and intervals.

## Section 8

### *Heat resistance of pipe layers*

An accredited testing laboratory shall test the heat resistance of the inner and outer layers of a multilayer pipe in accordance with Table 1. The heat resistance of the inner layer shall be tested in a corresponding manner as a pipe made of the material of the inner layer with a test period of 8,760 hours. The wall thickness of the test samples may be at most double in comparison with the wall thickness of the smallest inner layer. The hoop stress of the test samples used in the pressure test is 50 percent of the hoop stress of a pipe made of corresponding material. The pipe may not break during the test. The heat resistance of the outer layer shall be determined with a pipe bending test or computationally.

For the bending test, the pipe shall be thermally aged for one year at a temperature of 110 degrees Celsius. The bending test may not cause cracks in the pipe.

For the computational assessment, an accredited testing laboratory shall, with a tensile test of the test specimens, determine the effect of thermal ageing on the elongation at break of the material for a period of over 50 years. The test specimens shall be manufactured of the material of the outer layer and they shall be thermally aged in material-specific temperatures.

Table 1. Test values of M-pipes and P-pipes in heat resistance testing.

Pipe type		Test temperature °C	Hoop stress MPa	
M-pipes		110	50 % of the hoop stress of a pipe made of corresponding material	
P-pipes	PE-X	110	2.5	
	PE-RT	Type 1	110	1.9
		Type 2	110	2.3
	PVC-C	Type 1	95	3.6
		Type 2	100	2.4
	PB	110	2.4	
	PP-H	110	1.9	
	PP-B	110	1.4	
	PP-R	110	1.9	
PP-RCT	110	2.6		

## Section 9

### *Delamination*

An accredited testing laboratory shall test the adhesive strength between the metal foil and the inner layer of an M-pipe in a tensile test apparatus, where the metal foil of the pipe is pulled perpendicularly to the inner layer.

The delamination test shall be carried out before and after a temperature variation test. A visual inspection shall be carried out of P-pipes and a delamination test on M-pipes.

## Section 10

### *Material of a multilayer pipe fitting*

An accredited testing laboratory shall analyse the chemical composition of the metal parts of the metal fittings for multilayer pipes that come into contact with water. The composition shall correspond to the composition stated by the manufacturer.

An accredited testing laboratory shall test the long-term strength, heat resistance and pressure resistance of plastic fittings for multilayer pipes. The same tests shall be applied to the testing of a multilayer pipe fitting as of multilayer pipes. On the basis of the test results, it shall be possible to estimate in a reliable manner that the service life of plastic fittings for multilayer pipes in standard operating conditions is at least the same as the service life of multilayer pipes.

## Section 11

### *Corrosion resistance of metal parts*

An accredited testing laboratory shall measure the dezincification resistance of a multilayer pipe fitting if the zinc content of the composition of the fitting exceeds 15 per cent.

An accredited testing laboratory shall test the occurrence of internal stress of the brass parts of multilayer pipe fittings with a stress corrosion resistance test. In the test, no cracks that are visible with a ten-fold magnification may appear in the parts.

## Section 12

### *Seals*

The manufacturer shall submit to an accredited testing laboratory test reports on the resistance of the seals of the fittings. The accredited testing laboratory shall verify the equivalence of the seal material specified by the manufacturer with the seals used in the products. The test method applied may be either an IR analysis or a thermogravimetric analysis. In type testing, the suitability of the seals as an element of the system shall be tested as part of the systems tests of multilayer pipe fittings.

## Section 13

### *Operability of a multilayer piping system*

An accredited testing laboratory shall test the multilayer piping system with the tests presented in Table 2. The connections may not leak in the tightness tests. The connections may not become detached in the tensile tests.

Table 2. Piping system tests.

Test	Temperature °C	Test pressure bar	Test time or number of cycles
Tightness			
in excess pressure	95±2	10 x c <sup>a)</sup>	1,000 h
in bending	23±2	10 x c <sup>a)</sup>	1 h
in temperature variation	90/20 <sup>b)</sup>	10	5,000/2,500 cycles <sup>c)</sup>
in pressure cycling	23±2	0,5/15,0 <sup>d)</sup>	10,000 cycles
in underpressure	23±2	-0.8	1 h
Tensile test <sup>e)</sup>	23±2 95±2	- -	1 h 1 h
<p>a) Coefficient c (c=1-2) is estimated on the basis of the long-term strength tests.  b) 90/20 °C, duration 15/15 min, (30 min/cycle)  c) d<sub>n</sub> ≤ 63 mm: 5,000 cycles, d<sub>n</sub> &gt; 63 mm: 2,500 cycles  d) (30±5) cycles/minute  e) Force <math>F = A \times \pi \times d_n^2 \times p_D / 4</math>  where  F is force (N),  d<sub>n</sub> is the nominal outside diameter (mm) of the pipe  p<sub>D</sub> is the dimensioning pressure 1.0 MPa (10 bar)  coefficient A is 1.5 in the test temperature 23 °C and 1 in the temperature 95 °C</p>			

#### Section 14

##### *Marking*

An accredited testing laboratory shall inspect the markings of a multilayer pipe and the fittings.

#### Section 15

##### *Type testing*

For type approval, an accredited testing laboratory shall type test the multilayer pipes and their fittings in accordance with the extent of testing presented in Tables 2.1–2.5 of Appendix 2. For type testing, the manufacturer shall, in addition to the samples, submit product and raw-material information.

#### Section 16

##### *Quality control relating to type approval*

The certifying body for quality control shall verify that the multilayer pipes and their fittings comply with the requirements of type approval and also meet the conditions set in the decision on type approval.

The certifying body for quality control shall carry out an initial inspection of the production, an on-going control of the internal production quality control as well as the selection of random samples of products and their testing once annually or more frequently if the products do not meet the type-approval requirements. The extent of the testing of random samples is presented in Table 3.1 of Appendix 3.

The manufacturer's internal production quality control shall cover at least the inspections and tests presented in Tables 4.1-4.3 of Appendix 4.

#### Section 17

#### *Entry into force*

This Decree enters into force on 1 January 2020.

Helsinki, 11 April 2019

Minister of the Environment, Energy and Housing Kimmo Tiilikainen

Senior Specialist Tomi Marjamäki

## **Dissolution of heavy metals - test method**

Dissolution of heavy metals (lead and cadmium) shall be tested on an unused fitting with a ten-day test.

### Test solution

The test solution (synthetic potable household water) shall be prepared by weighing 50 milligrams of NaCl, 50 milligrams of Na<sub>2</sub>SO<sub>4</sub> and 50 milligrams of CaCO<sub>3</sub> (all p.a. quality) per litre of distilled and /or deionized water. The solution shall be stirred and CO<sub>2</sub> shall be bubbled therein until all CaCO<sub>3</sub> has dissolved. After that air shall be bubbled into the solution while stirring it until the pH value has reached 7.0± 0.1. Since CaCO<sub>3</sub> dissolves very slowly, it must be ensured that all CaCO<sub>3</sub> has dissolved before air is bubbled; if not, the solution will not stabilize.

The test solution may also be prepared by weighing 50 milligrams of NaCl, 50 milligrams of Na<sub>2</sub>SO<sub>4</sub> and 37 milligrams of Ca(OH)<sub>2</sub> (all p.a. quality) per litre of distilled and /or deionized water. The solution shall be stirred until Ca(OH)<sub>2</sub> is almost dissolved and CO<sub>2</sub> shall be bubbled therein until the pH value is below five. After that air shall be bubbled into the solution while stirring it until the pH value has reached 7.0± 0.1. This preparation method will make the dissolution of the salts easier.

The synthetic potable household water shall be prepared either immediately before each water replacement or it shall be ensured that the solution is clear and that its pH value is 7.0 ± 0.1 at least in connection with the water replacements on days four, eight and nine. A blank sample shall be taken in connection with the water replacements on days 8 and 9.

### Analysis apparatus

An atomic absorption spectrometer equipped with a graphite furnace or another sufficiently sensitive measuring instrument. The limit of determination shall be at least 0.1 micrograms per litre for lead (Pb) and 0.02 micrograms per litre for cadmium (Cd).

### Test method

The sample shall be degreased with pure ethanol for those parts that come into contact with potable household water. After that, tap water shall be run through the sample for one hour at the flow rate corresponding to the flow rate of 1-2 meters per second in the fitting. Stoppers made of colourless polyethylene or covered with a polyethylene coating shall be used in the flow orifices of the sample. The stoppers may also be made of other material as long as no cadmium or lead is dissolved therefrom. The sample shall be immediately rinsed with synthetic potable household water by filling it halfway and shaking it for approximately 30 seconds, after which the water is poured off. Immediately after that the sample shall be filled with synthetic potable household water so that no air remains inside it and its flow orifices are equipped with stoppers.

The synthetic potable household water shall be let stand in the sample for 24 hours, after which it is emptied, the amount of water is measured and the sample is refilled. The synthetic potable household water in the sample shall be replaced after days 1, 2, 3, 4, 7, 8 and 9. It shall

be checked that the amount of water emptied from the sample remains constant ( $\pm 10$  per cent).

The water samples replaced after days 8 and 9 (test period of 9 and 10 days) shall be analysed for cadmium and lead. The measured concentrations deducted with the equivalent concentrations in the blank samples shall be indicated in the results (micrograms per litre). In addition, the total amounts of cadmium and lead (in micrograms) derived from the concentrations and the water volume of the sample as well as the water volume of the sample in litres shall be indicated.

**Tests used in the type testing of multilayer pipes and their fittings**

Table 2.1. Size grouping of multilayer pipes and their fittings.

Size group	1	2	3
Nominal outside diameter, $d_n$ , mm	$16 \leq d_n \leq 26$	$26 < d_n \leq 63$	$d_n > 63$

Table 2.2. Fitting groups of multilayer pipes.

Fitting group	Fitting type
1	Bends, T-branches
2	Adapters, reducers, plugs
3	Manifolds
4	Other fittings

Table 2.3. The properties, extent of testing and the samples to be tested in the type tests of M-pipes.

Property	Extent of testing <sup>1)</sup>							Samples to be tested
	T	M 1	M 2	M 3	M 4	M 5	L	
Suitability for conducting household water	+	+	+	-	+	+	-	3 samples
Outer appearance	+	+	+	+	+	+	+	all samples
Dimensions	+	+	+	+	+	+	+	1 sample/size/all sizes
Long-term strength	+	+	+	+	+	+	+	1 sample/size group
Heat resistance, inner layer	+	+	-	-	+	-	-	1 sample/same structure type
Heat resistance, outer layer	+	+	+	-	+	-	-	1 sample/same structure type
Strength of weld	+	-	-	+	+	-	-	1 sample/same structure type
Delamination	+	+	-	+	+	+	-	1 sample/same structure type
Physical and chemical properties	+	+	+	+	+	+	+	1 sample/same structure type
<sup>1)</sup> T: type testing M1: change in material affecting the strength of structure M2: change in material not affecting the strength of structure M3: change in metal M4: change in structure M5: change in adhesive L: expansion of product range + test to be carried out								

Table 2.4. The properties, extent of testing and the samples to be tested in the type tests of P-pipes.

Property	Extent of testing <sup>1)</sup>						Samples to be tested
	T	M 1	M 2	M 4	M 5	L	
Suitability for conducting household water	+	+	+	+	+	-	3 samples
Outer appearance	+	+	+	+	+	+	all samples
Transparency	+	+	+	+	+	-	1 sample, smallest wall thickness
Dimensions	+	+	+	+	+	+	1 sample/size/all sizes
Long-term strength	+	+	+	+	+	-	One assessment/all sizes
Heat resistance	+	+	+	-	-	+	1 sample/same structure type
Delamination	+	+	+	-	-	+	10 samples/same structure type
Physical and chemical properties	+	+	+	+	+	+	1 sample/same structure type
<sup>1)</sup> T: type testing M1: change in material affecting the strength of structure M2: change in material not affecting the strength of structure M4: change in structure M5: change in adhesive L: expansion of product range + tests to be carried out, - to be supplemented							

Table 2.5. The properties and samples to be tested in the type testing of fittings for multi-layer pipes where the material and the structure of the fittings for multilayer pipes of different sizes are the same.

<b>Property</b>	<b>Samples to be tested</b>
<b>Surfaces and outer appearance</b>	All samples
Nominal size and dimensions	1 pc/size, all sizes
<b>Metal fittings</b>	
Composition of material	1 pc, 1 size
Dissolution of heavy metals	1–2 pcs / d <sub>n</sub> 28 mm or the nearest size
Dezincification resistance	1 pc, 1 size
Stress corrosion	3 pcs/size, 1 size
<b>Plastic fittings</b>	
Suitability for conducting household water	Assessment on the basis of composition data
Long-term strength	1 assessment/material
Heat resistance	1 sample/material
Transparency	1 sample/smallest wall thickness
Pressure resistance	3 samples/size/fitting group
Physical and chemical properties	2 samples/ size group, 1 assessment/ seal material
<b>Piping system</b>	
Tightness in excess pressure	3 samples/size, 2 sizes/size group
in bending	3 samples/size, 2 sizes/size group
in temperature variation	2 samples/size
in pressure cycling	3 samples/size
in underpressure	3 samples/size, 2 sizes/size group
Tensile stress resistance	3 samples/size

### Verification of the quality control of multilayer pipes and their fittings

The certifying body for quality control shall check that the materials of type tested products conform to the materials notified to the type approval body by the manufacturer. With regard to metal alloys, the designation of the alloy and, with regard to other raw materials, the type and commercial designation.

Table 3.1. The properties to be tested in the verification of quality control of multilayer pipes and their fittings and the testing frequency when the fittings for multilayer pipes of different sizes are of identical material and structure.

Property	Testing frequency
<b>Pipes</b>	
Food contact material	3 samples/material/year
Outer appearance	3 samples/size group/material/year
Dimensions	3 samples/size group/material/year
Pressure resistance, 95 °C ≥ 1,000 h	3 samples/size group/material/year
Delamination	3 samples/size group/material/year
Markings	3 samples/size group/year
<b>Fittings for a multilayer pipe</b>	
Composition of material	1 pc/1-2 years
Dezincification resistance of brass	Need for testing to be assessed on the basis of material composition
Outer appearance	3 samples/size group/year
Dimensions	3 samples/size group/year
Plastic fittings	3 samples/size group/fitting group/year
Pressure resistance, 95 °C ≥ 1,000 h	
Markings	All samples
Analysis of the seals of fittings	Once a year/material
<b>Piping system</b>	Each test: 3 pcs/size <sup>2</sup>
Tightness in excess pressure	sizes/year. Sizes to be tested shall be alternated annually.
Tightness in tensile stress	
Markings	All samples
Sizes to be tested shall be alternated annually	

**Internal quality control of multilayer pipes and their fittings**

Batch release test (BRT)

The process for the handling of rejected products shall be described in the quality system of the manufacturer.

Table 4.1. Properties to be tested and testing frequency of multilayer pipes and plastic fittings in the inspection of a production batch.

Product and property		Testing frequency and minimum number of samples
Pipes	Plastic fittings	
Outer appearance		At the beginning and at least once every four hours
Dimensions		At the beginning and at least once every four hours
Delamination	-	Of pipes, at the beginning and at least once every four hours, 3 samples A visual inspection for P-pipes, a visual inspection and a tensile test for M-pipes
Pressure resistance, 95 °C ≥ 22 h		Once/batch, 1 sample
Pressure resistance, 95 °C ≥ 165 h		Once/batch, 1 sample
Markings		At the beginning and at least once every four hours

Table 4.2. Internal quality control inspections of the manufacture of metal fittings for multilayer pipes and their minimum extent.

Inspection	Extent of inspection
Material acceptance inspection	Each accepted batch, all material certificates, inspections and non-conformities observed shall be recorded.
Manufacturing process	The manufacturer shall carry out at least a visual inspection and a check of dimensions and ensure that the material used in manufacture corresponds to the material notified in the type approval application.

Control of the manufacturing process (PVT, production validation test)

If the products do not meet the requirements with regard to the properties referred to in Table 4.3, a repeat test shall be carried out in accordance with the manufacturer's quality plan.

If the products do not meet the requirements in the repeat test, the manufacturing process of the product shall be inspected and corrected in accordance with the manufacturer's quality plan.

Table 4.3. The properties to be tested and the testing frequency in the manufacturing-site-specific control of the manufacturing process.

Property	Testing frequency
Pipes	
Pressure resistance, 95 °C $\geq$ 1,000 h	3 samples/pipe size/year
Plastic fittings	
Pressure resistance, 95 °C $\geq$ 1,000 h	3 samples/size group/fitting group/year