

**Translation from Finnish**  
**Legally binding only in Finnish and Swedish**

**1/20**

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

**on the type approval of PE pipes intended for water supply and sewerage 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 polyethylene pipes (hereinafter *PE pipes*) for water supply and sewerage systems intended for conducting pressurised household water and sewage in a building and on property. This Decree covers PE pipes with a nominal size of DN/OD 16-DN/OD 225.

This Decree covers three PE pipe structure types: single layer pipes, co-extruded pipes, and pipes with a protective skin.

### **Section 2**

#### *Definitions*

For the purposes of this Decree:

- 1)  $p$  means the test pressure;
- 2)  $\delta$  means the hoop stress;
- 3)  $d_{em}$  means the mean outside diameter of a test piece.

### **Section 3**

#### *Establishment of conformity*

Type approval can be used to demonstrate that the PE pipes comply with the essential technical requirements laid down in section 117c of the Land Use and Building Act (132/1999), as it is in Act (958/2012), and thereunder.

## **Section 4**

### *Material*

An accredited testing laboratory shall test the melt mass-flow rate of the raw material compound before and after processing the raw material. The accredited testing laboratory shall test the oxidation stability time of the PE pipe and the light resistance of a non-black colour pipe.

Where the PE pipe manufacturer uses a ready-made raw material compound in the production of PE pipes, an accredited testing laboratory shall establish the content, dispersion, and average original particle size of the carbon black in the raw material compound of a black PE pipe and the properties of slow crack growth in the PE pipe material by testing or on the basis of the raw material compound test reports provided by the manufacturer. Where the PE pipe manufacturer mixes the raw material compound during the production of PE pipes, the accredited testing laboratory shall test the content, dispersion, and average original particle size of the carbon black in the raw material compound of a black PE pipe and the properties of slow crack growth in the PE pipe material.

When determining the content of carbon black in the raw material compound of a PE pipe, polymer shall be evaporated from the sample under a nitrogen atmosphere and at an elevated temperature. The remaining carbon black shall be weighed. The dispersion of carbon black or blue due shall be determined by examining a strip cut from the wall of the PE pipe microscopically. The uniformity of dispersion shall be compared to reference images. Carbon black shall be tested for the average original particle size. The properties of slow crack growth in the pipe material shall be tested at an elevated temperature by a hydrostatic test measuring the internal pressure resistance of a pipe grooved on four sides in longitudinal direction.

## **Section 5**

### *Surface properties*

An accredited testing laboratory shall examine the inner and outer surfaces, colour, and the ends of the PE pipe visually without magnification.

## **Section 6**

### *Dimensions*

An accredited testing laboratory shall examine the structure and dimensions of the PE pipes.

## Section 7

### *Suitability for conducting household water*

The manufacturer shall submit information on the raw materials used in the production of PE pipes to an accredited testing laboratory. With regard to PE pipes, this means the raw material used on the wall and, with regard to co-extruded PE pipes, all raw materials used.

An accredited testing laboratory shall carry out a chemical analysis on the PE pipes. In the chemical analysis, the test water is let stand in the pre-treated test pieces in room temperature (23±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 PE pipes. In the sensory evaluation, the accredited testing laboratory shall let the test water stand in the rinsed test pieces 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.

## Section 8

### *Long-term strength and pressure resistance*

The long-term strength of the material of a PE pipe shall be demonstrated with a material rating test carried out by an accredited testing laboratory. In the rating test, the rupture stress of the pipe shall be determined at a pressure in line with the intended use and in three temperatures. Of the three temperatures, the lowest is 20 degrees Celsius, the highest 80 degrees Celsius and the third in the range of 30-70 degrees Celsius. Based on the stress – strain curves obtained in the rating tests, the testing laboratory shall determine the lower stress confidence limit which, when rounded down to the nearest integer, provides the minimum required strength, MRS. The nominal pressure (PN) of the pipe is based on the MRS, the design coefficient (C), and the ratio of the nominal outside diameter to the nominal wall thickness (SDR).

$$PN = \frac{20 \times MRS}{C \times (SDR - 1)}$$

An accredited testing laboratory shall carry out pressure tests on PE pipes in accordance with Table 1.2 of Appendix 1 when the polyethylene material is assigned a specific strength rating. The test pressure in bar shall be determined using the parameters of Table 1.

$$p = 10\sigma \frac{2 \times e_{min}}{d_{em} - e_{min}}$$

*Table 1. Pressure test parameters.*

Rating of material	Temperature, °C	Hoop stress, MPa	Minimum duration of the test, h
PE 80	20	10.0	100

PE 100		12.0	
PE 80	80	4.5	165 <sup>a</sup>
PE 100		5.4	
PE 80	80	4.0	1000
PE 100		5.0	
<sup>a</sup> During a 165-hour pressure test under the manufacturer's own supervision, a brittle fracture occurring in less than 165 hours is a pipe failure, but if the fracture is a ductile fracture, the pipe must be retested under the selected lower hoop stress. The stress shall be selected from Table 2.			

Table 2. Retest parameters at 80 °C.

PE 80		PE 100	
Hoop stress, MPa	Test period, h	Hoop stress, MPa	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	1000
4.0	1000		

### Section 9

#### *Elongation at break*

An accredited testing laboratory shall test the elongation at break of the PE pipe material using a method appropriate for polyolefin pipe material.

### Section 10

#### *Longitudinal dimensional stability*

An accredited testing laboratory shall test the longitudinal dimensional stability of the PE pipe.

### Section 11

#### *Delamination*

An accredited testing laboratory shall inspect and determine whether interlayer delamination occurs in multilayer pipes during the tests on pipes.

### Section 12

#### *Structural integrity*

An accredited testing laboratory shall test the ring stiffness of a co-extruded PE pipe. First, the ring stiffness shall be determined at 0-, 45- and 90-degree angles. After that, a buckling

test shall be carried out at the corresponding angles. The ring stiffness tests shall be repeated after a 60-minute restitution.

### **Section 13**

#### *Marking*

An accredited testing laboratory shall inspect the markings of the PE pipes.

### **Section 14**

#### *Type testing*

An accredited laboratory shall type test the PE pipes for type approval in accordance with the extent of testing presented in Appendix 1. For type testing, the manufacturer shall, in addition to the samples, submit raw-material and product information and information on the place of manufacture.

The tests and determinations shall be carried out on samples conditioned at  $23\pm 2$  degrees Celsius for at least 24 hours.

Pressure and tensile tests for PE pipes with a protective skin of a non-black colour shall be carried out after weathering the pipe surface with light corresponding to the solar spectrum with a cumulative amount of light radiation of at least 3.5 gigajoules per square metre.

### **Section 15**

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

The certifying body for quality control shall verify that the PE pipes 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 and 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 testing of random samples is presented in Table 2.1 of Appendix 2.

The manufacturer's internal production quality control shall cover at least the inspections and tests presented in Table 3.1 of Appendix 3.

### **Section 16**

#### *Entry into force*

This Decree enters into force on 1 March 2021.

Helsinki, 18 December 2020

Minister of the Environment and Climate Change Krista Mikkonen

Senior Specialist Tomi Marjamäki

**Tests used in the type testing of PE pipes**

Table 1.1. Size grouping of PE pipes.

Size group	1	2
Nominal size	DN < 75	75 ≤ DN ≤ 225

Table 1.2. Properties to be tested in the type testing of PE pipes, extent of testing and samples to be tested.

Property	Extent of testing			
	type testing	Change in the raw material compound (classification remains the same)	Expansion of size group or wall thickness series	Change of production place
Suitability for conducting household water	Once from each compound	Once from each compound	–	Once from each compound
Outer appearance	All samples to be tested			
Colour				
Dimensions				
Pressure resistance, 100 h	1 size / size group, at least two sizes <sup>a</sup>	1 size / size group 1 or 2 <sup>a</sup>	1 size from new size group or from new wall thickness series of the largest size group	1 size / size group 1 or 2 <sup>a</sup>
Pressure resistance, 1000 h				
Slow crack growth, raw material compound	1 size / size group 2	1 size / size group 2	–	–
Oxidation stability <sup>b</sup> ,	Once from each size group	1 size / size group 1 or 2	1 size from new size group or from new wall thickness series of the largest size group	Once from each size group
Change in melt-mass flow rate <sup>b, c</sup>				
Content and dispersion of carbon black	Once from each compound	Once from each compound	–	Once from each compound

Elongation at break	1 size / size group, at least two sizes <sup>d</sup>	1 size / size group 1 or 2 <sup>d</sup>	1 size from new size group or wall thickness series	1 size / size group, at least two sizes <sup>d</sup>
Longitudinal dimensional stability	1 size / size group, at least two sizes	—	1 size from new size group or wall thickness series	1 size from each size group
Delamination of a co-extruded pipe	Delamination may not occur during the tests.			
Structural strength of a co-extruded pipe after deformation	1 size / size group <sup>a</sup>			
<sup>a</sup> 3 replicates / size groups 1 and 2 <sup>b</sup> to be measured from both layers of a co-extruded pipe. <sup>c</sup> to be determined from both the raw material compound and the pipe manufactured from the same compound. The change shall be calculated. <sup>d</sup> The pipe shall be divided into at least two ( $d_n \leq 32$ ), three ( $32 < d_n \leq 63$ ) or five ( $d_n > 63$ ) strips to make rods for the tensile test. <sup>e</sup> DN 110 SDR11, 4 longitudinal grooves				

**Certification of quality control of PE pipes**

Testing of samples selected during audit testing (AT)

The certifying body for quality control shall verify that the materials of the type approved products correspond to the materials reported to the type-approval body by the manufacturer. Type and trade name with regard to raw materials and raw material compounds.

Table 2.1. Properties to be tested in the certification of quality control of PE pipes, extent of testing and samples to be tested.

<b>Property</b>	<b>Extent of testing</b>
Suitability for conducting household water	Once from each compound / year
Outer appearance	Once from each size group and compound / year
Colour	
Dimensions	
Pressure resistance, 80 °C / 1000 h <sup>a</sup>	Once / size group each wall thickness series and compound / year
Elongation at break <sup>b</sup>	Once/size group and compound/year
Oxidation stability <sup>b, c</sup>	Once/size group and compound/year
Change in melt-mass flow rate <sup>b, c</sup>	Once/size group and compound/year
Longitudinal dimensional stability	Once/size group and compound/year
Delamination of a co-extruded pipe	Delamination may not occur during the tests.
<sup>a</sup> 3 replicates / size groups 1 and 2 <sup>b</sup> The pipe shall be divided into at least two ( $dn \leq 32$ ), three ( $32 < dn \leq 63$ ) or five ( $dn > 63$ ) strips to make rods for the tensile test. <sup>c</sup> 3 replicates	

**Manufacturer's internal quality-control tests***Batch release test (BRT)*

The manufacturer's quality system shall describe the process for the handling of rejected products.

Table 3.1. The properties of PE pipes to be tested and testing frequency for batch release testing.

<b>Property</b>	<b>Extent of testing</b>
Outer appearance	At the beginning of production and after a change of material/colour. After that, continuously but recording of data is not required.
Colour	
Dimensions	At the beginning of production and after that continuously, at least every 8 hours.
Pressure resistance, 80 °C / 165 h <sup>a, c</sup>	Once/batch, at least at seven days interval
Oxidation stability <sup>b, c</sup>	
Change in melt-mass flow rate <sup>b, c</sup>	
Marking	At the beginning of production, continuously thereafter. Recording of data is not required
<sup>a</sup> one sample <sup>b</sup> 3 replicates <sup>c</sup> The manufacturer may choose either this pressure test or oxidation stability testing and melt mass-flow rate.	

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

Table 3.2. The properties to be tested of the raw material compound and testing frequency in the production-site specific monitoring of the manufacturing process when the PE pipe manufacturer itself mixes the raw material compound. The manufacturer of the raw material compound shall indicate the MRS rating PE80 or PE100.

Property					Testing frequency
Verification of rating with two pressure tests					Every other year / compound
Type	Hoop stress, MPa	Test period, h	Hoop stress, MPa	Test period, h	
PE 80	10.0	100	9.1	2500	
PE 100	12.0	100	11.1	2500	
In addition, pressure tests shall be carried out every eight years on one size in size class 1 at a temperature of 80 °C PE 80: 3.8 MPa / 5000 h and PE 100: 4.8 MPa / 5000 h. The samples must be able to withstand without breaking.					
Content and dispersion of carbon black					Once / compound / week

Table 3.3. Properties to be tested and testing frequency during the production-site specific monitoring of the manufacturing process.

Property	Testing frequency
Pressure resistance, 80 °C / 165 h <sup>a</sup>	Once / size group / compound / month
Pressure resistance, 80 °C / 1000 h <sup>a</sup>	Once /size group /compound / year
Slow crack growth, raw material compound <sup>e</sup>	Once / compound / year
Oxidation stability <sup>b, c</sup>	Once / size groups 2 / compound / three months
Change in melt-mass flow rate <sup>b, c</sup>	Once / size group / compound / three months
Longitudinal dimensional stability <sup>d</sup>	Once / size group / compound / month
Structural strength of a co-extruded pipe after deformation	Once /size group /compound / year
<sup>a</sup> one sample <sup>b</sup> If pressure resistance has been carried out as a batch release test, oxidation stability and melt mass-flow rate shall be carried out as a PVT test and vice versa. <sup>c</sup> Sample to be prepared from the inner surface of the pipe. Both layers of a co-extruded pipe shall be tested.	

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| <p><sup>d</sup> 3 replicates</p> <p>e DN 110 SDR11, 4 longitudinal grooves</p> |
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If the products do not meet the requirements with regard to the properties referred to in Tables 3.2 and 3.3, 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.