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(JXPA/JPIF/JSA)

Crosslinked polyethylene (PE-X) pipes

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee, as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Cross Linked Polyethylene Pipe Association (JXPA)/The Japan Plastics Industry Federation (JPIF)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14. Consequently **JIS K 6769 : 1999** is replaced with this Standard.

This revision has been made based on **ISO 15875-2 : 2003 *Plastics piping systems for hot and cold water installations—Crosslinked polyethylene (PE-X)—Part 2 : Pipes*** for the purposes of making it easier to compare this Standard with International Standard; to prepare Japanese Industrial Standard conforming with International Standard; and to propose a draft of an International Standard which is based on Japanese Industrial Standard.

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In the event of any doubts arising as to the contents,
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Crosslinked polyethylene (PE-X) pipes

Introduction This Japanese Industrial Standard has been prepared based on **ISO 15875-2** *Plastics piping systems for hot and cold water installations—Crosslinked polyethylene (PE-X)—Part 2 : Pipes* published in 2003 with some modifications of the technical contents.

Portions given sidelines or dotted underlines are the matters modified from the original International Standard. The list of modifications with their explanations is given in annex 6 (informative).

1 Scope This Standard specifies the crosslinked polyethylene pipes (hereafter referred to as “pipes”) to be mainly used for the conveyance of water of 95 °C or lower in temperature.

- Remarks 1 The crosslinked polyethylene pipes for water supply shall be in accordance with **JIS K 6787**.
- 2 The International Standard corresponding to this Standard is as follows.

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

ISO 15875-2 : 2003 *Plastics piping systems for hot and cold water installations—Crosslinked polyethylene (PE-X)—Part 2 : Pipes* (MOD)

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS B 7502 *Micrometer callipers*

JIS B 7507 *Vernier, dial and digital callipers*

JIS K 0050 *General rules for chemical analysis*

JIS K 6770 *Crosslinked polyethylene (XPE) pipe fittings*

JIS K 6787 *Crosslinked polyethylene (XPE) pipes for water works*

JIS K 6796 *Pipes and fitting made of crosslinked polyethylene (PE-X)—Estimation of the degree of crosslinking by determination of the gel content*

JIS K 6900 *Plastics—Vocabulary*

JIS K 7162 *Plastics—Determination of tensile properties Part 2 : Test conditions for moulding and extrusion plastics*

JIS K 8001 *General rule for test methods of reagents*

JIS K 8005 *Reference materials for volumetric analysis*

JIS K 8051 *3-Methyl-1-butanol*

JIS K 8271 *Xylene*

JIS K 8637 *Sodium thiosulfate pentahydrate*

JIS K 8659 *Starch, soluble*

JIS K 8913 *Potassium iodide*

JIS S 3200-1 *Equipment for water supply service—Test methods of hydrostatic pressure*

JIS S 3200-7 *Equipment for water supply service—Test methods of effect to water quality*

JIS Z 8401 *Guide to the rounding of numbers*

JIS Z 8703 *Standard atmospheric conditions for testing*

3 Definitions For the main terms used in this Standard, the definitions in **JIS K 6900** apply, and the rest of the terms are as follows:

- a) **crosslinked polyethylene pipe** A pipe of which all body is composed of crosslinked polyethylene shall be a single layer pipe. A pipe of which the inside is composed of a crosslinked polyethylene layer and of which the outside is composed of a non-crosslinked polyethylene layer (hereafter referred to as “non-crosslinked layer”) shall be a double wall pipe (hereafter referred to as “pipes”).
- b) **ordinary temperature** The temperature condition at which the temperature of the standard condition specified in **JIS Z 8703** is 20 °C and the tolerance thereof is the temperature grade 15 (± 15 °C) in 3.1 of **JIS Z 8703**, that is, 20 °C ± 15 °C.
- c) **gel content** When the sample is extracted with xylene specified in **JIS K 8271**, the residual portion unextracted is called the gel part. The gel content is the ratio of the mass of this gel part to the mass before extracted.
- d) **nominal diameter** The designated numerical value based on the inside diameter as the reference.
- e) **nominal outside diameter** The designated numerical value based on the outside diameter as the reference.

4 Classification and symbols The class and symbols shall be classified by the maximum working pressure and structure, and be in accordance with table 1 and table 2.

Table 1 Classification by working temperature and maximum working pressure of pipes

Classification ⁽¹⁾	Working temperature °C	0 to 20	21 to 40	41 to 60	61 to 70	71 to 80	81 to 90	91 to 95
PN10	Maximum working pressure MPa	1.00	0.80	0.65	0.55	0.50	0.45	0.40
PN15	Maximum working pressure MPa	1.50	1.25	0.95	0.85	0.75	0.70	0.65

Note ⁽¹⁾ The class expresses the grade for the maximum working pressure of a pipe at 20 °C in water temperature. The numerical value next to PN shows pressure resistance, and PN10 means that the maximum working pressure of pipe at 20 °C in water temperature is 1.00 MPa, and PN15 means 1.50 MPa.

Table 2 Classification by structure of pipe

Classification	Structure	Symbol of classification
Class M	Single layer	XM
		XMND
Class E	Double layer	XE

Remarks 1 Class M shall be the pipe to be jointed by using class M fittings specified in **JIS K 6770**, and class E shall be the pipe to be jointed by using class E fittings specified in **JIS K 6770**.

2 XMND shall be the pipes designated by nominal outside diameter.

5 Performance The performance of pipes shall be tested according to **9.3** to **9.8**, and be conformed to the requirements in table 3.

Table 3 Performances

Performance item		Performance	Applicable test subclause
Tensile strength at yield point		16.0 MPa min. To be free from the separation between non-crosslinked layer and crosslinked layer and other defects after tensile test, for class E.	9.3
Pressure resistance property		To be free from leakage and other defects.	9.4
Hot internal pressure creep property		To be free from leakage and other defects.	9.5
Leaching property ⁽²⁾	Turbidity	2 degree max.	9.6
	Chromaticity	5 degree max.	
	Consumption of potassium permanganate	10 mg/L max.	
	Total organic carbon (TOC)	5 mg/L max.	
	Loss of residual chlorine	1 mg/L max.	
	Odour	No abnormality.	
	Taste		
Chlorine water resistance		No producing of bubble.	9.7
Gel content ⁽³⁾		65 % min.	9.8

Notes ⁽²⁾ The test temperature shall be 95 °C. The turbidity, chromaticity, TOC, consumption of potassium permanganate and loss of residual chlorine shall be obtained by the difference from the value of blank test. The consumption of potassium permanganate shall be applied until Mar. 31, 2005, and TOC shall be applied from Apr. 1, 2005.

⁽³⁾ The gel content specified in **JIS K 6796** shall be applied to the crosslinked layer of class M and class E.

6 Appearance and shape

6.1 Appearance The appearance of pipe shall be smooth on the outside and inside surfaces and free from defects such as flaws, fissures, twist.

For class XE, the respective cross sections of non-crosslinked layer and crosslinked layer shall be uniform in quality.

The colour of pipes shall be subject to the agreement between the parties concerned with delivery. The pipes of class XE shall have different colours so that the non-crosslinked layer can be distinguished from the crosslinked layer, as shown in figure 1.

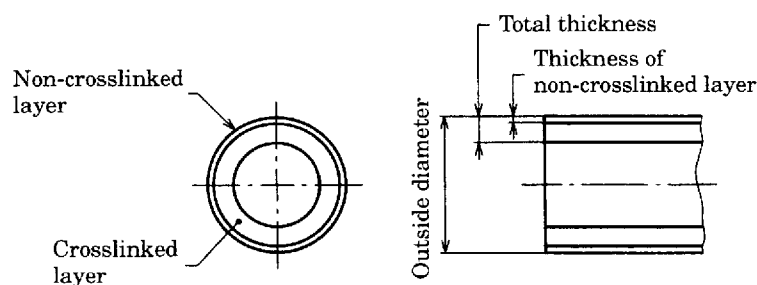


Figure 1 Structure of pipes of class XE

6.2 Shape The shape of pipes shall be practically right-circular in cross section.

7 Dimensions and tolerances thereof

7.1 Class XM pipes The dimensions and tolerances thereof for class XM pipes shall be in accordance with table 4 and table 5.

Table 4 Dimensions and tolerances thereof for class XM of PN10

Unit: mm

Nominal diameter	Outside diameter		Inside diameter		Thickness		Length		Informative	
	Basic dimension	Tolerance of mean outside diameter	Basic dimension	Tolerance of mean inside diameter	Basic dimension	Tolerance	Basic dimension (m)	Tolerance (%)	Mass per 1 m (kg/m)	Inside diameter of coil (cm)
16	21.5	±0.15	17.3	±0.25	2.10	±0.20	120	+2 0	0.120	50 min.
20	27.0		21.9	±0.30	2.55	±0.25	100		0.184	80 min.
25	34.0		27.9	±0.35	3.05				0.279	
30	42.0	±0.20	35.0	±0.40	3.50	±0.30	60		0.398	120 min.
40	48.0	±0.25	40.0	±0.45	4.00				0.520	
50	60.0	±0.30	50.3	±0.50	4.85	±0.35	50		0.790	150 min.

Remarks 1 For the pipes of 15 or under in nominal diameter, the dimensions and tolerances of PN15 pipes in table 5 shall apply.

2 The tolerance on the mean outside diameter means a difference between the mean value of measured outside diameters (mean outside diameter) which are measured in two mutually equidistant directions at an arbitrary section and the basic dimension.

3 The tolerance on the mean inside diameter means a difference between the value obtained by subtracting two times of the mean thickness from the mean outside diameter and the basic dimension.

The mean thickness means the mean value of measured values of thickness at four positions equidistant from each other on the same section as the measuring position of outside diameter.

4 The length may be changed according to the agreement between the parties concerned with delivery.

Information : Mass is obtained by regarding the dimensions of pipe as the basic dimensions and by calculation on the assumption of the density of a material to be used for a pipe as 0.94 g/cm³.

Table 5 Dimensions and tolerances thereof for class XM of PN15

Unit: mm

Nominal diameter	Outside diameter		Inside diameter		Thickness		Length		Informative		
	Basic dimension	Tolerance of mean outside diameter	Basic dimension	Tolerance of mean inside diameter	Basic dimension	Tolerance	Basic dimension (m)	Tolerance (%)	Mass per 1 m (kg/m)	Inside diameter of coil (cm)	
5	8.0	±0.15	4.8	±0.25	1.60	±0.20	120	+2 0	0.030 2	50 min.	
7	10.0		6.8						0.039 7		
8	11.0		7.8						0.044 4		
10	13.0		9.8						0.053 9		
13	17.0		12.8		2.10				0.092 4		
15	20.0		15.1		2.45	±0.25	100		0.127		
16	21.5		16.2	2.65	0.148				80 min.		
20	27.0		20.5	3.25	0.228						
25	34.0		26.0	4.00	±0.30	0.351					
30	42.0	±0.20	32.1	±0.40	4.95	±0.35	60		0.542	120 min.	
40	48.0	±0.25	36.8	±0.45	5.60	±0.40			0.701		
50	60.0	±0.30	46.1	±0.50	6.95	±0.45	50		1.09	150 min.	

Remarks 1 The tolerance on the mean outside diameter means a difference between the mean value of measured outside diameters (mean outside diameter) which are measured in two mutually equidistant directions at an arbitrary section and the basic dimension.

2 The tolerance on the mean inside diameter means a difference between the value obtained by subtracting two times of the mean thickness from the mean outside diameter and the basic dimension.

The mean thickness means the mean value of measured values of thickness at four positions equidistant from each other on the same section as the measuring position of outside diameter.

3 The length may be changed according to the agreement between the parties concerned with delivery.

Information : Mass is obtained by regarding the dimensions of pipe as the basic dimensions and by calculation on the assumption of the density of a material to be used for a pipe as 0.94 g/cm³.

7.2 Class XE pipes The dimension and tolerances thereof for class XE pipes shall be in accordance with table 6 and table 7.

Table 6 Dimensions and tolerances thereof for class XE of PN10

Unit: mm

Nominal diameter	Outside diameter		Total thickness		Thickness of crosslinked layer		Thickness of non-crosslinked layer		Length		Informative		
	Basic dimension	Tolerance of mean outside diameter	Basic dimension	Tolerance	Basic dimension	Tolerance	Basic dimension	Tolerance	Basic dimension	Tolerance	Approx. inside diameter	Mass per 1 m	Inside diameter of coil
16	21.5	±0.15	2.40	±0.30	2.10	±0.20	0.30	+0.30 -0.10	120	+2 0	16.7	0.135	50 min.
20	27.0		2.85	±0.35	2.55	±0.25	0.35	+0.35 -0.15	100		21.3	0.203	80 min.
25	34.0		3.35		3.05		0.40	+0.40 -0.20			27.3	0.303	
30	42.0	±0.20	3.80	±0.40	3.50	±0.30	0.45	+0.45 -0.25	60		34.4	0.429	120 min.
40	48.0	±0.25	4.30		4.00		0.50	+0.50 -0.30			39.4	0.555	
50	60.0	±0.30	5.15	±0.45	4.85	±0.35	0.55	+0.55 -0.35	50		49.7	0.834	150 min.

Remarks 1 For the pipes of 15 or under in nominal diameter, the dimensions and tolerances of PN15 pipes in table 7 shall apply.

2 The tolerance on the mean outside diameter means a difference between the mean value of measured outside diameters (mean outside diameter) which are measured in mutually two equidistant directions at an arbitrary section and the basic dimension.

3 The length may be changed according to the agreement between the parties concerned with delivery.

Information : Mass is obtained by regarding the dimensions of pipe as the basic dimensions and by calculation on the assumption of the density of a material to be used for a pipe as 0.94 g/cm³.

Table 7 Dimensions and tolerances thereof for class XE of PN15

Unit: mm

Nominal diameter	Outside diameter		Total thickness		Thickness of crosslinked layer		Thickness of non-crosslinked layer		Length		Informative		
	Basic dimension	Tolerance of mean outside diameter	Basic dimension	Tolerance	Basic dimension	Tolerance	Basic dimension	Tolerance	Basic dimension (m)	Tolerance (%)	Approx. inside diameter (kg/m)	Mass per 1 m (cm)	Inside diameter of coil (cm)
5	8.0	±0.15	1.70	±0.30	1.40	±0.20	0.30	+0.30 −0.10	120	+2 0	4.6	0.032	50 min.
7	10.0										6.6	0.042	
8	11.0										7.6	0.047	
10	13.0		1.90		1.60						9.2	0.062	
13	17.0		2.40		2.10						12.2	0.103	
15	20.0		2.75	±0.35	2.45	±0.25					14.5	0.140	
16	21.5		2.95		2.65						15.6	0.162	
20	27.0	3.55	3.25	0.35	+0.35 −0.15	100	19.9	0.246	80 min.				
25	34.0	4.30	±0.40	4.00	±0.30		0.40	+0.40 −0.20			25.4	0.377	
30	42.0	±0.20	5.25	±0.45	4.95	±0.35	0.45	+0.45 −0.25	60		31.5	0.570	120 min.
40	48.0	±0.25	5.90	±0.50	5.60	±0.40	0.50	+0.50 −0.30			36.2	0.734	
50	60.0	±0.30	7.25	±0.55	6.95	±0.45	0.55	+0.55 −0.35	50		45.5	1.130	150 min.

Remarks 1 The tolerance on the mean outside diameter means a difference between the mean value of measured outside diameters (mean outside diameter) which are measured in two mutually equidistant directions at an arbitrary section and the basic dimension.

2 The length may be changed according to the agreement between the parties concerned with delivery.

Information : Mass is obtained by regarding the dimensions of pipe as the basic dimensions and by calculation on the assumption of the density of a material to be used for a pipe as 0.94 g/cm³.

7.3 Class XMND pipes The dimensions and tolerances thereof for class XMND shall be in accordance with table 8 and table 9.

Table 8 Dimensions and tolerances thereof for class XMND of PN10

Unit: mm

Nominal outside diameter	Outside diameter		Thickness		Length (informative)		Remarks	
	Basic dimension	Tolerance of mean outside diameter	Basic dimension	Tolerance	Basic dimension (m)	Tolerance (%)	Mass (kg/m)	Inside diameter of coil (cm)
20	20.0	+0.3 0	1.9	+0.3 0	120	+2 0	0.102	50 min.
25	25.0		2.3	+0.4 0	100		0.154	80 min.
32	32.0		2.9	+0.4 0			0.249	
40	40.0		+0.4 0	3.7			+0.5 0	0.397
50	50.0	+0.5 0	4.6	+0.6 0	60		0.617	150 min.

Remarks 1 The tolerance on the mean outside diameter means a difference between the mean value of measured outside diameters (mean outside diameter) which are measured in two mutually equidistant directions at an arbitrary section and the basic dimension.

2 The length may be changed according to the agreement between the parties concerned with delivery.

Information : Mass is obtained by regarding the dimensions of pipe as the basic dimensions and by calculation on the assumption of the density of material to be used for a pipe as 0.94 g/cm³.

Table 9 Dimensions and tolerances thereof for class XMND of PN15

Unit: mm

Nominal outside diameter	Outside diameter		Thickness		Length (informative)		Remarks	
	Basic dimen- sion	Tolerance of mean outside diameter	Basic dimen- sion	Tolerance	Basic dimen- sion (m)	Tolerance (%)	Mass (kg/m)	Inside diameter of coil (cm)
12	12.0	+0.3 0	1.4	+0.3 0	120	+2 0	0.044	50 min.
16	16.0		1.8	+0.3 0			0.075	
20	20.0		2.3	+0.4 0			0.120	
25	25.0		2.8	+0.4 0	100		0.184	80 min.
32	32.0		3.6	+0.5 0			0.302	
40	40.0		+0.4 0	4.5			+0.6 0	0.472
50	50.0		+0.5 0	5.6	+0.7 0		60	0.734

Remarks 1 The tolerance on the mean outside diameter means a difference between the mean value of measured outside diameters (mean outside diameter) which are measured in two mutually equidistant directions at an arbitrary section and the basic dimension.