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(JXPA/JPIF/JSA)

**Crosslinked polyethylene (PE-X)
pipes for water supply**

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Reference number : JIS K 6787 : 2004 (E)

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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 6787 : 1997** 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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Crosslinked polyethylene (PE-X) pipes for water supply

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

Portions sidelined or underlined with dots are the matters modified from the original International Standard. The list of modification with its explanation is given in annex 6 (informative).

1 Scope This Standard specifies the crosslinked polyethylene (PE-X) pipes to be mainly used for indoor piping (hereafter referred to as “pipes”) for water works of which the working pressure is not more than 0.75 MPa. However, the crosslinked polyethylene pipes shall be in accordance with **JIS K 6769**.

Remarks : 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 6769 *Crosslinked polyethylene (XPE) pipes*

JIS K 6788 *Crosslinked polyethylene (XPE) pipe fittings 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 6922-1 *Plastics—Polyethylene (PE) moulding and extrusion materials—Part 1 : Designation system and basis for specifications*

JIS K 6922-2 *Plastics—Polyethylene (PE) moulding and extrusion materials—Part 2 : Preparation of test specimens and determination of properties*

- JIS K 7161 *Plastics—Determination of tensile properties Part 1 : General principles*
- 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*
- ISO 1167: 1996 *Thermoplastics pipes for the conveyance of fluids—Resistance to internal pressure—Test method*

3 Definitions For the purposes of this Standard, the definitions given in **JIS K 6900** and the following definitions apply.

- a) **crosslinked polyethylene pipes** The pipes of which the whole are composed of crosslinked polyethylene shall be the single wall pipes, and the pipes of which the inside is composed of crosslinked polyethylene layer and the outside is composed of non-crosslinked polyethylene layers (hereafter referred to as “non-crosslinked layer”) shall be the double wall pipes (hereafter referred to as “pipes”).
- b) **working pressure** The pressure of water under the ordinary using condition, which means the maximum working pressure or hydrostatic pressure.
- c) **ordinary temperature** Temperature condition, that is $20\text{ }^{\circ}\text{C} \pm 15\text{ }^{\circ}\text{C}$, which is achieved after the temperature at standard condition specified in **JIS Z 8703** is decided as $20\text{ }^{\circ}\text{C}$ and its tolerance is decided as grade 15 temperature ($\pm 15\text{ }^{\circ}\text{C}$) specified in 3.1 of **JIS Z 8703**.
- d) **gel content** When the sample is extracted by xylene specified in **JIS K 8271**, the unextracted residue is regarded as the gel part. The gel content means the rate of the mass of this gel part to the mass before extracted by xylene.
- e) **nominal diameter** The designated numerical value in which the inside diameter is made the standard.
- f) **nominal outside diameter** The designated numerical value in which the outside diameter is made the standard.

4 Classification and symbols The classification and symbols of pipes shall be classified by structure, and in accordance with table 1.

Table 1 Classification and symbols of pipes

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

Remarks 1 The pipes of class M is the pipe to be jointed using the fitting of class M specified in **JIS K 6788**, while the pipe of class E is the pipe using the fitting of class E specified in **JIS K 6788**.

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

5 Performance The performance of pipes shall be tested in accordance with 9.3 to 9.8 and conformed to the requirements in table 2.

Table 2 Performance of pipes

Performance item		Performance	Applicable subclause
Tensile strength at yield point		16.0 MPa min. Class E of pipes shall be free from the peeling between non-crosslinked layer and crosslinked layer and other abnormality after tensile test.	9.3
Pressure resistance property		No leakage and other abnormality.	9.4
Hot internal pressure creep property		No leakage and other abnormality.	9.5
Leaching property ⁽¹⁾	Turbidity	2 degree max.	9.6
	Chromaticity	5 degree max.	
	Consumption of potassium permanganate ⁽²⁾	10 mg/L max.	
	Total organic matter (TOC) ⁽²⁾	5 mg/L max.	
	Loss of residual chlorine	0.7 mg/L max.	
	Odour	Not abnormal	
	Taste		
Chlorine water resistance		No water bubbles	9.7
Gel content ⁽³⁾		65 % min.	9.8

Notes ⁽¹⁾ The test temperature shall be ordinary temperature. Turbidity, chromaticity, and consumption of potassium permanganate, TOC and loss of residual chlorine shall be obtained from the difference from the blank test value.

- (2) 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 layers of class M and class E.

6 Appearance and shape

6.1 Appearance The appearance of pipes shall be smooth on outside and inside surfaces and free from flaws, fissures, twist or other defects which are detrimental to use.

In addition, the respective cross sections of non-crosslinked layer and crosslinked layer for class E shall be uniform.

The colour of pipes shall be milky white for class M and light green for non-crosslinked layer of class E in figure 1, and shall be different colour so as to be discriminated.

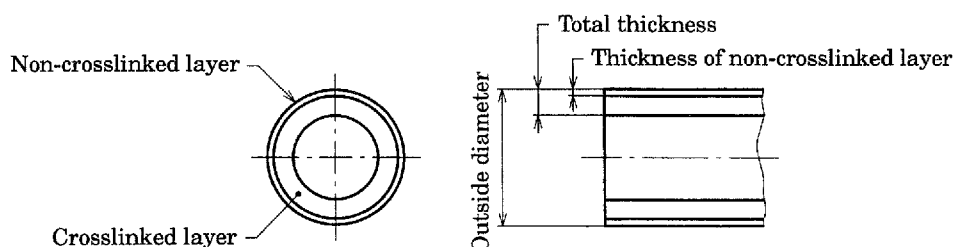


Figure 1 Structure of class E pipes

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

7 Dimensions and tolerances thereof The dimensions and tolerances thereof shall be in accordance with table 3, table 4 and table 5.

Table 3 Dimensions and tolerances thereof for XM

Unit: mm

Nominal diameter	Outside diameter		Inside diameter		Thickness		Length		Informative	
	Basic dimension	Tolerance of average outside diameter	Basic dimension	Tolerance of average inside diameter	Basic dimension	Tolerance	Basic dimension (m)	Tolerance (%)	Mass (kg/m)	Coil inside diameter (cm)
10	13.0	±0.15	9.8	±0.25	1.60	±0.20	120	+2 0	0.054	50 min.
13	17.0		12.8		2.10		0.092			
16	22.0		16.8		2.60		0.149			
20	27.0		21.2	±0.30	2.90	100	0.206		80 min.	
25	34.0		26.0	±0.35	4.00		±0.30			0.354
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		1.090	150 min.

Remarks 1 The tolerance of average outside diameter means the difference between the basic dimension and the average value of measured values of outside diameter (average outside diameter) in two directions which are mutually at equal intervals at optional cross-section.

- 2 The tolerance of average inside diameter means the difference between the basic dimension and the value in which double average thickness are subtracted from the average outside diameter.

Further, the average thickness means the average of measured values of thickness at four positions which are mutually at equal intervals at the same cross-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 : The mass is calculated so that the dimensions of pipes are regarded as the basic dimensions and the density of material to be used for pipes is regarded as 0.94 g/cm³.

Table 4 Dimensions and tolerances thereof for class XE

Unit: mm

Nominal diameter	Outside diameter		Total thickness		Thickness of crosslinked layer		Thickness of non-crosslinked layer		Length		Informative		
	Basic dimension	Tolerance of average inside diameter	Basic dimension	Tolerance	Basic dimension	Tolerance	Basic dimension	Tolerance	Basic dimension (m)	Tolerance (%)	Approximate inside diameter	Mass (kg/m)	Coil inside diameter (cm)
10	13.0	±0.15	1.90	±0.30	1.60	±0.20	0.30	+0.30 -0.10	120	+2 0	9.2	0.062	50 min.
13	17.0		2.40		2.10						12.2	0.103	
16	21.5		2.95	±0.35	2.65	±0.25					15.6	0.162	
20	27.0		3.25		±0.40		2.90	0.35	+0.35 -0.15		100	20.5	0.228
25	34.0		4.30	4.00		±0.30	0.40			+0.40 -0.20		25.4	0.377

Remarks 1 The tolerance of average outside diameter means the difference between the basic dimension and the average value of measured values of outside diameter (average outside diameter) in two directions which are mutually at equal intervals at optional cross-section.

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

Information : The mass is calculated so that the dimensions of pipes are regarded as the basic dimension and the density of material to be used for pipes is regarded as 0.94 g/cm³.

Table 5 Dimensions and tolerances thereof for XMND

Unit: mm

Nominal diameter	Outside diameter		Thickness		Length (informative)		Remarks	
	Basic dimension	Tolerance of average outside diameter	Basic dimension	Tolerance	Basic dimension (m)	Tolerance (%)	Mass (kg/m)	Coil inside diameter (cm)
16	16.0	+0.3 0	1.8	+0.3 0	120	+2 0	0.071	50 min.
20	20.0		2.3	+0.4 0			0.130	
25	25.0		2.8	+0.5 0	100		0.196	80 min.
32	32.0		3.6	+0.6 0			0.322	
40	40.0	+0.4 0	4.5	+0.6 0			0.502	120 min.
50	50.0	+0.5 0	5.6	+0.7 0	60		0.778	

Remarks 1 The tolerance of average outside diameter means the difference between the basic dimension and the average value of measured values of outside diameter (average outside diameter) in two directions which are mutually at equal intervals at optional cross-section.

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

Information : The mass is calculated so that the dimensions of pipes are regarded as the basic dimension and the density of material to be used for pipes is regarded as 0.94 g/cm³.

8 Materials The materials of pipes shall be mainly composed of polyethylene, and be in accordance with annex 1. The quality after moulding shall be uniform, and shall not be attached by water, and shall not influence badly on the quality of water.

9 Test method

9.1 Appearance and shape The appearance and shape of the pipes shall be visually examined.

9.2 Dimensions The dimensions of the pipes shall be measured by micrometer calipers specified in JIS B 7502, vernier, dial and digital calipers specified in JIS B 7507, or an instrument with the accuracy at least equivalent thereto after the test pipe is conditioned at 23 °C ± 2 °C for at least 1 h.

9.3 Tensile test The tensile test of the pipes shall comply with annex 2 (normative). The pipes of class E shall be visually checked for the existence of the pipes defects in the non-crosslinked and crosslinked layers after the tensile test is completed.

9.4 Pressure resistance test The pressure resistance test of the pipes shall comply with **JIS S 3200-1**. The test hydrostatic pressure shall be 2.5 MPa, and its holding duration shall be 2 min.

9.5 Hot internal pressure creep test The hot internal pressure creep test of the pipes shall comply with annex 3 (normative).

9.6 Leaching test The leaching test of the pipes shall comply with annex 4 (normative). The length of the test pipes shall comply with table 6.

Table 6 Length of test pipe for leaching test

Unit: m

Nominal diameter or nominal outside diameter	Length
10	8
13 ND16	5
16 ND20	3
20 ND25	2
25 min. ND32 min.	1

Remarks 1 The letters of ND show the nominal outside diameter, and others show the nominal diameter.

2 The pipes of not less than 2 m in length may be cut at every 1 m, tested and mixed with sample solution.

9.7 Chlorine water test The chlorine water test method of pipes and the preparing method of the test water shall follow annex 5 (normative). Three tubular or strip-shaped test pieces of about 50 mm in length shall be cut from the test pipe, the cut section shall be finished smooth, the inner and outer surfaces and end faces of the test piece shall be sufficiently cleaned with water specified in annex 5 (normative), and dried on filter paper at ordinary temperature to make test pieces.

9.8 Gel content test The gel content test for pipes shall be in accordance with **JIS K 6796**.

9.9 Expression method for numerical value of test results The test results of 9.3, 9.8 and consumption of potassium permanganate, TOC and loss of residual chlorine in 9.6 shall be obtained to one place lower than the specified numerical value and rounded off according to **JIS Z 8401**.

10 Inspection The inspection of pipes shall be classified into the type inspection⁽⁴⁾ and delivery inspection⁽⁵⁾, tested in accordance with clause 9 and comply with clauses 5 to 7 and 11.

The sampling method of sample for inspection shall be in accordance with the agreement between the parties concerned with delivery.

Notes (4) The type inspection means the inspection to judge if the quality of pipes have been conformed to all performance given in the design.

(5) The delivery inspection means the inspection to judge if the pipes have been conformed to performance required at the delivery of pipes.

a) **Type inspection** The type inspection shall be carried out on the following items.

- 1) Appearance and shape inspection
- 2) Dimensions inspection
- 3) Materials inspection
- 4) Tensile inspection
- 5) Pressure resistance inspection
- 6) Hot internal pressure creep inspection
- 7) Leaching inspection
- 8) Chlorine water inspection
- 9) Gel content inspection
- 10) Marking inspection

b) **Delivery inspection** The delivery inspection shall be carried out on the following items.

- 1) Appearance and shape inspection
- 2) Dimensions inspection
- 3) Tensile inspection
- 4) Pressure resistance inspection
- 5) Hot internal pressure creep inspection⁽⁶⁾
- 6) Leaching inspection⁽⁷⁾
- 7) Gel content inspection
- 8) Marking inspection

Notes (6) The hot internal pressure creep inspection shall be carried out at 95 °C in test temperature and for 1 h ion test duration.

(7) The leaching inspection shall be periodically carried out.

11 Marking The following items shall be marked indelibly on the outside of pipes.

a) Symbol of ✕