



JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS K 6761 : 2017

(JPIF/JPPE/JSA)

**Polyethylene pipes for general
purposes**

ICS 23.040.20;23.040.45;91.140.60;93.025

Reference number : JIS K 6761 : 2017 (E)

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Date of Establishment: 1956-10-27

Date of Revision: 2017-11-20

Date of Public Notice in Official Gazette: 2017-11-20

Investigated by: Japanese Industrial Standards Committee
Standards Board for ISO area
Technical Committee on Chemical Products and
Analytical Methods

JIS K 6761:2017, First English edition published in 2018-03

Translated and published by: Japanese Standards Association
Mita MT Building, 3-13-12, Mita, Minato-ku, Tokyo, 108-0073 JAPAN

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Foreword

This Japanese Industrial Standard has been 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 the Japan Plastics Industry Federation (JPIF)/Japan Polyethylene Pipe System Association (JPPE)/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 6761:2014** is replaced with this Standard.

However, **JIS K 6761:2014** may be applied in the **JIS** mark certification based on the relevant provisions of Article 19 Clause 1, etc. of the Industrial Standardization Law until November 19, 2018.

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Polyethylene pipes for general purposes

Introduction

This Japanese Industrial Standard has been prepared based on **ISO 4427-1:2007**, Edition 1, and Amendment 1:2015, and **ISO 4427-2:2007**, Edition 1, and Amendment 1:2014 with some modifications of the technical contents.

The vertical lines on both sides and dotted underlines indicate changes from the corresponding International Standards. A list of modifications with the explanations is given in Annex JE.

1 Scope

This Standard specifies the polyethylene pipes for general purposes to be used mainly for the conveyance of water not containing chlorine (hereafter referred to as pipes).

NOTE : The International Standards corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 4427-1:2007 *Plastics piping systems—Polyethylene (PE) pipes and fittings for water supply—Part 1: General* and Amendment 1:2015

ISO 4427-2:2007 *Plastics piping systems—Polyethylene (PE) pipes and fittings for water supply—Part 2: Pipes* and Amendment 1:2014 (overall evaluation: MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standards and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

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

JIS B 7502 *Micrometers*

JIS B 7503 *Mechanical dial gauges*

JIS B 7507 *Vernier, dial and digital callipers*

JIS B 7512 *Steel tape measures*

JIS K 6812 *Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds*

NOTE : Corresponding International Standard: ISO 18553 *Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds* (IDT)

JIS K 6813 *Polyolefin pipes and fittings—Determination of carbon black content by calcination and pyrolysis—Test method and basic specification*

NOTE : Corresponding International Standard: ISO 6964 *Polyolefin pipes and fittings—Determination of carbon black content by calcination and pyrolysis—Test method and basic specification* (MOD)

JIS K 6814 *Thermoplastics pipes—Thermal reversion test method*

NOTE : Corresponding International Standard: ISO 2505 *Thermoplastics pipes—Longitudinal reversion—Test method and parameters* (MOD)

JIS K 6815-1 *Thermoplastics pipes—Determination of tensile properties—Part 1: General test method*

NOTE : Corresponding International Standard: ISO 6259-1 *Thermoplastics pipes—Determination of tensile properties—Part 1: General test method* (IDT)

JIS K 6815-3 *Thermoplastics pipes—Determination of tensile properties—Part 3: Polyolefin pipes*

NOTE : Corresponding International Standard: ISO 6259-3 *Thermoplastics pipes—Determination of tensile properties—Part 3: Polyolefin pipes* (IDT)

JIS K 6900 *Plastics—Vocabulary*

JIS K 7112 *Plastics—Methods of determining the density and relative density of non-cellular plastics*

NOTE : Corresponding International Standard: ISO 1183 *Plastics—Methods of determining the density and relative density of non-cellular plastics* (MOD)

JIS K 7151 *Plastics—Compression moulding test specimens of thermoplastic materials*

NOTE : Corresponding International Standard: ISO 293 *Plastics—Compression moulding test specimens of thermoplastic materials* (IDT)

JIS K 7161-2 *Plastics—Determination of tensile properties—Part 2: Test conditions for moulding and extrusion plastics*

JIS K 7210-1 *Plastics—Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics—Part 1: Standard method*

NOTE : Corresponding International Standard: ISO 1133-1 *Plastics—Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics—Part 1: Standard method* (IDT)

JIS K 7251 *Plastics—Determination of water content*

NOTE : Corresponding International Standard: ISO 15512 *Plastics—Determination of water content* (IDT)

JIS Z 8401 *Guide to the rounding of numbers*

ISO 1167-1 *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids—Determination of the resistance to internal pressure—Part 1: General method*

- ISO 1167-2 *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids—Determination of the resistance to internal pressure—Part 2: Preparation of pipe test pieces*
- ISO 9080 *Plastics piping and ducting systems—Determination of the long-term hydrostatic strength of thermoplastics materials in pipe form by extrapolation*
- ISO 12162 *Thermoplastics materials for pipes and fittings for pressure applications—Classification and designation—Overall service (design) coefficient*
- ISO 16871 *Plastics piping and ducting systems—Plastics pipes and fittings—Method for exposure to direct (natural) weathering*

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in **JIS K 6900**, and the following apply.

3.1 Terms and definitions related to material performance

a) **lower confidence limit of the predicted hydrostatic strength**

predicted value of 97.5 % lower confidence limit of long-term hydrostatic strength in water at 20 °C after 50 years

NOTE : The unit is MPa.

b) **minimum required strength (MRS)**

value based on the lower confidence limit of the predicted hydrostatic strength, which corresponds to the lower confidence limit of predicted hydrostatic strength in the classification table specified in **ISO 12162**

NOTE : The unit is MPa.

3.2 Terms and definitions related to dimensions

a) **nominal outside diameter**

designation assigned to outside diameter

b) **nominal diameter**

designation assigned to inside diameter

c) **basic outside diameter**

basic dimension of outside diameter

d) **out-of-roundness**

difference between the maximum outside diameter and the minimum outside diameter measured in the same cross-section of pipe

e) **basic wall thickness**

basic dimension of wall thickness

f) **minimum wall thickness**

minimum value of wall thickness

g) **mean outside diameter**

mean of values of outside diameter measured in two orthogonal directions at any cross-section

h) **standard dimension ratio (SDR)**

value obtained by dividing the basic outside diameter of pipe by the minimum wall thickness

3.3 Terms and definitions related to materials

a) **compound**

uniformly kneaded or mixed raw resin material, pigments and additives (including antioxidants, stabilizers, etc.) which are necessary for manufacturing and application of pipes conforming to this Standard

Compounds are classified into the coloured compounds and the master batch compounds.

b) **coloured compound**

uniform mixture of raw resin material, pigments and additives

c) **master batch compound**

mixture of the coloured material in which raw resin material, pigments in high concentration and additives are kneaded, and the uncoloured material in which raw resin material and additives are kneaded

3.4 Terms and definitions related to inspections

a) **type tests**

inspection to confirm if the compounds and pipes satisfy all the requirements specified in this Standard

b) **batch release tests**

inspection to confirm if the necessary requirements are satisfied at the delivery of compounds and pipes which are manufactured in the same facility as those accepted in the type tests

4 Classification

Table 1 shows the classification of pipes.

Table 1 Classification of pipes

Classification	Symbol	Material	Dimensional system based on outside diameter of pipe (informative)
Class 1 pipe	①	PE50	Dimensional system based on nominal diameter
Class 2 pipe	②	PE80	Dimensional system based on nominal diameter
Class 3 pipe	③	PE80, PE100	Dimensional system based on nominal outside diameter

5 Compounds

5.1 Classification of raw resin materials and compounds

Raw resin materials and compounds shall be classified according to the minimum required strength (hereafter referred to as MRS). The classification shall be as given in Table 2. The classification shall be determined by the manufacturer of raw resin materials or compounds with MRS which is obtained from the classification table of **ISO 12162**, using the lower confidence limit of the predicted hydrostatic strength in accordance with **ISO 1167-1**, **ISO 1167-2** and **ISO 9080**.

Table 2 Classification of compounds

Unit: MPa

Classification	Lower confidence limit of the predicted hydrostatic strength	MRS
PE50	5.0 or over to and excl. 6.3	5.0
PE80	8.0 or over to and excl. 10.0	8.0
PE100	10.0 or over to and excl. 11.2	10.0

5.2 Reprocessable/recyclable compounds

The pipe manufacturer may use the clean and reprocessable/recyclable compounds generated from the manufacture of pipes conforming to this Standard and the quality evaluation test thereof in the manufacture of products using the same type of compound, except those used for the tests of melt mass-flow rate, thermal stability, environmental stress cracking, slow crack growth, thermal longitudinal reversion, internal pressure creep, resistance to weathering, and fusion compatibility.

5.3 Performance

The performance of compounds to be used in the manufacture of pipes shall conform to Table 3 when tested in accordance with clause 7. The certificate for the performance of compound shall be provided by the compound manufacturer, which shall be confirmed by the pipe manufacturer.

Table 3 Performance of compound

Characteristics		Required performance	Applicable clause	
Density ^{a)}		0.915 g/cm ³ or more for PE50 0.930 g/cm ³ or more for PE80 0.942 g/cm ³ or more for PE100	7.3	
Melt mass-flow rate (MFR) ^{a), b)}		0.2 g/10 min to 1.4 g/10 min	7.4	
Thermal stability ^{a)}		20 min or more	7.5	
Carbon dispersion ^{c)}		Grade 3 or under	7.6	
Pigment dispersion ^{d)}		Grade 3 or under	7.7	
Carbon concentration ^{c)}		2.0 % to 2.5 % in mass fraction	7.8	
Volatile component ^{e)}		350 mg/kg or under	7.9	
Water content ^{f)}		300 mg/kg or under	7.10	
Environmental stress cracking test ^{a)}		Free from cracking within 240 h	7.11	
Resistance to weathering ^{d), e)}	Tensile fracture elongation	350 % or more	7.16	7.13
	Internal pressure creep ^{g)}	No leakage or breakage.		7.15
Slow crack growth ^{e)}		No leakage or breakage.	7.17	
Notes ^{a)} When pipes are manufactured using the master batch compound, the uncoloured material shall be tested.				
^{b)} The values shall be designated by the compound manufacturer, and shall be in the range of ± 25 %.				
^{c)} Applicable to black for the coloured compound.				
^{d)} Applicable to coloured compound other than black.				
^{e)} For PE100 pipes.				
^{f)} Applicable only when the volatile component performance is not satisfied.				
^{g)} Applicable when outdoor exposure test is carried out.				

6 Pipes

6.1 Appearance and shape

The appearance and shape of pipes shall conform to the following matters when tested in accordance with **7.1**.

- The appearance of pipes shall be smooth on outside and inside surfaces, and free from flaws, fissures, twists and other defects which are detrimental to use. The colour of pipe shall be black; however, colour other than black may be used upon the agreement between the parties concerned with delivery.
- The shape of cross-section of pipes shall be practically circle when visually checked.

6.2 Performance

The performance of pipes shall conform to Table 4 when tested in accordance with clause **7**.

Table 4 Performance of pipes

Characteristics		Required performance	Applicable clause	
Melt mass-flow rate (MFR) ^{a)}		± 25 % in change rate due to manufacture	7.4	
Thermal stability		20 min or more	7.5	
Carbon dispersion ^{b)}		Grade 3 or under	7.6	
Pigment dispersion ^{c)}		Grade 3 or under	7.7	
Carbon concentration ^{b)}		2.0 % to 2.5 % in mass fraction	7.8	
Tensile yield strength ^{d)}	Class 1 pipe	9.8 MPa or more	7.12	
	Class 2 pipe	19.6 MPa or more		
Tensile fracture elongation		350 % or more	7.13	
Thermal longitudinal reversion		± 3 % in change rate of length	7.14	
Internal pressure creep		No leakage or breakage.	7.15	
Resistance to weathering ^{e)}	Tensile fracture elongation	350 % or more	7.16	7.13
	Internal pressure creep	No leakage or breakage.		7.15
Fusion compatibility ^{f)}		No leakage or breakage.	7.18	
Notes ^{a)} The change rate of the value of pipe measured by the pipe manufacturer to the value measured on the compound, which is calculated according to the following formula. $R = \left(\frac{F_1 - F_0}{F_0} \right) \times 100$ where, R : change rate due to manufacture (%) F_0 : measured value of MFR of compound (g/10 min) F_1 : measured value of MFR of pipe (g/10 min) ^{b)} Applicable to the black pipes manufactured by using the master batch compound. ^{c)} Applicable to the pipes other than black manufactured by using the master batch compound. ^{d)} Not applicable to Class 3 pipe. ^{e)} Applicable to the pipes other than black. After the exposure of 7.16, the test shall be carried out in accordance with 7.13 and 7.15. ^{f)} The fusion compatibility test shall be carried out upon the agreement between the parties concerned with delivery, if required.				

6.3 Dimensions and tolerances

The dimensions of pipes shall be divided into Class 1 pipe dimensions, Class 2 pipe dimensions and Class 3 pipe dimensions. The dimensions and tolerances thereof shall be as given in Table 5, Table 6, Table 7 and Table 8.

Table 5 Dimensions and tolerances (Class 1 pipe)

Unit: mm

Nominal diameter	Outside diameter			Thickness		(Informative)				
	Basic outside diameter	Tolerance ^{a)}	Out-of-roundness ^{b)} (max.)	Basic wall thickness	Tolerance	Length ^{c)} (m)	Inside diameter ^{d)}	Mass per metre ^{e)} (kg)	Inside diameter of coiled-pipe ^{f)} (cm)	Shape
10	17.0	± 0.15	1.1	2.0	+0.4 0	120	12.6	0.095	30 min.	Coiled-pipe
13	21.5		1.3	2.7	+0.5 0		15.6	0.160	40 min.	
20	27.0		1.7	3.0			20.5	0.226	50 min.	
25	34.0	± 0.20	2.1	3.0	+0.6 0	90	27.5	0.292	70 min.	
30	42.0		2.6	3.5			34.4	0.424	80 min.	
40	48.0	± 0.25	2.9	3.5			40.4	0.491	90 min.	
50	60.0	± 0.30	3.6	4.0	+0.8 0	60	51.4	0.700	110 min.	
65	76.0	± 0.35	4.6	5.0		5	65.2	1.11	—	Straight pipe
75	89.0	± 0.45	5.4	5.5			77.2	1.43		
100	114.0	± 0.55	6.9	6.0			101.1	2.03		
125	140.0	± 0.65	8.4	6.5			125.0	2.90		
150	165.0	± 0.75	9.9	7.0			149.0	3.67		

- Notes ^{a)} The tolerance on outside diameter means the difference between the mean outside diameter and the basic outside diameter.
- ^{b)} The out-of-roundness is obtained from the difference between the maximum outside diameter and the minimum outside diameter in the same cross-section, which is applicable only to straight pipes but informative for coiled-pipes.
- ^{c)} The informative length may be altered upon the agreement between the parties concerned with delivery.
- ^{d)} The informative inside diameter is the value calculated from the basic outside diameter and the thickness at centre.
- ^{e)} The informative mass per metre is calculated based on the inside diameter and the outside diameter on the assumption that the density of material to be used for pipe is 0.930 g/cm³.
- ^{f)} The informative inside diameter of coiled-pipe is the dimension so as not to break pipe, produce buckling and other defects by rolling up.

Table 6 Dimensions and tolerances (Class 2 pipe)

Unit: mm

Nominal diameter	Outside diameter			Thickness		(Informative)				
	Basic outside diameter	Tolerance ^{a)}	Out-of-roundness ^{b)} (max.)	Basic wall thickness	Tolerance	Length ^{c)} (m)	Inside diameter ^{d)}	Mass per metre ^{e)} (kg)	Inside diameter of coiled-pipe ^{f)} (cm)	Shape
10	17.0	± 0.15	1.2	2.0	+0.4 0	120	12.6	0.096	30 min.	Coiled-pipe
13	21.5			2.4	+0.5 0		16.2	0.148	40 min.	
20	27.0			2.4			21.7	0.191	50 min.	
25	34.0	± 0.20	1.3	2.6		90	28.3	0.263	70 min.	
30	42.0			2.8	35.9		0.352	80 min.		
40	48.0			3.0	41.5		0.431	90 min.		
50	60.0	± 0.30	1.5	3.5	+0.6 0	60	52.4	0.632	110 min.	Straight pipe
65	76.0	± 0.35	1.6	4.0	+0.8 0	5	67.4	0.913	—	
75	89.0	± 0.45	1.8	5.0			78.2	1.34		
100	114.0	± 0.55	2.3	5.5			102.2	1.89		
125	140.0	± 0.65	2.8	6.5	+1.0 0		126.0	2.76		
150	165.0	± 0.75	3.3	7.0	+1.1 0		149.9	3.52		
200	216.0	± 1.00	4.4	8.0	+1.2 0		198.8	5.28		
250	267.0	± 1.25	9.4	9.0	+1.3 0		247.7	7.35		
300	318.0	± 1.45	11.2	10.0	+1.40 0			296.6	9.74	

Notes ^{a)} The tolerance on outside diameter means the difference between the mean outside diameter and the basic outside diameter.

^{b)} The out-of-roundness is obtained from the difference between the maximum outside diameter and the minimum outside diameter in the same cross-section, which is applicable only to straight pipes but informative for coiled-pipes.

^{c)} The informative length may be altered upon the agreement between the parties concerned with delivery.

^{d)} The informative inside diameter is the value calculated from the basic outside diameter and the thickness at centre.

^{e)} The informative mass per metre is calculated based on the inside diameter and the outside diameter on the assumption that the density of material to be used for pipe is 0.943 g/cm³.

^{f)} The informative inside diameter of coiled-pipe is the dimension so as not to break pipe, produce buckling and other defects by rolling up.

Table 7 Outside diameter, length and tolerance (Class 3 pipe)

Unit: mm

Nominal outside diameter	Outside diameter			(Informative)
	Basic outside diameter	Tolerance ^{a)}	Out-of roundness ^{b)} (max.)	Length ^{c)} (m)
25	25.0	+0.3 0	1.2	5
32	32.0	+0.3 0	1.3	
40	40.0	+0.4 0	1.4	
50	50.0	+0.4 0	1.4	
63	63.0	+0.4 0	1.5	
75	75.0	+0.5 0	1.6	
90	90.0	+0.6 0	1.8	
110	110.0	+0.7 0	2.2	
125	125.0	+0.8 0	2.5	
160	160.0	+1.0 0	2.8	
180	180.0	+1.1 0	3.2	
250	250.0	+1.5 0	5.0	
315	315.0	+1.9 0	11.1	
355	355.0	+2.2 0	12.5	
400	400.0	+2.4 0	14.0	
450	450.0	+2.7 0	15.6	
500	500.0	+3.0 0	17.5	
560	560.0	+3.4 0	19.6	
630	630.0	+3.8 0	22.1	
710	710.0	+6.4 0	—	
800	800.0	+7.2 0	—	

Notes ^{a)} The tolerance on outside diameter means the difference between the mean outside diameter and the basic outside diameter.

^{b)} The out-of-roundness is obtained from the difference between the maximum outside diameter and the minimum outside diameter in the same cross-section.

For the pipes whose nominal outside diameter is not less than 710 shall be as agreed between the parties concerned with delivery.

^{c)} The informative length may be altered upon the agreement between the parties concerned with delivery.