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**Double wall polyethylene pipes for
water supply**

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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 6762:2014** is replaced with this Standard.

However, **JIS K 6762:2014** 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 May 19, 2020.

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Attention is drawn to the possibility that some parts of this Standard may conflict with patent rights, applications for a patent after opening to the public or utility model rights. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying any of such patent rights, applications for a patent after opening to the public or utility model rights.

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Double wall polyethylene pipes for water supply

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 by adopting only the matters related to double wall polyethylene pipes for water supply, with some modifications of the technical contents. The amendments to the said International Standards have been incorporated into this Standard.

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 JF.

1 Scope

This Standard specifies the double wall polyethylene pipes to be used for water supply, which have a maximum operating pressure up to and including 0.75 MPa (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*, Amendment 1:2015

ISO 4427-2:2007 *Plastics piping systems—Polyethylene (PE) pipes and fittings for water supply—Part 2: Pipes*, 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 0050 *General rules for chemical analysis*

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*

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*

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

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

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*

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*

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 1183-1 *Plastics—Methods for determining the density of non-cellular plastics—Part 1: Immersion method, liquid pycnometer method and titration method*, ISO 1183-2 *Plastics—Methods for determining the density of non-cellular plastics—Part 2: Density gradient column method* and ISO 1183-3 *Plastics—Methods for determining the density of non-cellular plastics—Part 3: Gas pycnometer method*

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

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

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*

JIS K 7251 *Plastics—Determination of water content*

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

- JIS K 8005 *Reference materials for volumetric analysis*
- JIS K 8625 *Sodium carbonate (Reagent)*
- JIS K 8637 *Sodium thiosulfate pentahydrate (Reagent)*
- JIS K 8659 *Starch, soluble (Reagent)*
- JIS K 8913 *Potassium iodide (Reagent)*
- 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*
- 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 12162 *Thermoplastics materials for pipes and fittings for pressure applications—Classification, designation and 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

3.1.1

lower confidence limit of the predicted hydrostatic strength

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

NOTE Unit: MPa

3.1.2

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 Unit: MPa

3.2 Terms and definitions related to dimensions

3.2.1

nominal outside diameter

designation based on the outside diameter

3.2.2

nominal size

designation based on the inside diameter

3.2.3

outside diameter

basic dimension of outside diameter

3.2.4

out-of-roundness

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

3.2.5

wall thickness

basic dimension of wall thickness

3.2.6

minimum wall thickness

minimum value of wall thickness

3.2.7

mean outside diameter

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

3.2.8

standard dimension ratio, SDR

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

3.3 Terms and definitions related to operating conditions

3.3.1

maximum operating pressure, MOP

highest water pressure under normal operating conditions

3.4 Terms and definitions related to materials

3.4.1

compound

uniformly kneaded or mixed resins as raw material, pigments necessary for manufacture and use of pipes which comply with the requirements specified in this Standard, and additives including antioxidants and stabilizers

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

3.4.2

coloured compound

uniformly kneaded resins as raw material, pigments and additives

3.4.3

master batch compound

mixture of the coloured material prepared by kneading raw material resins with pigments in high concentration and additives, and of the uncoloured material prepared by kneading raw material resins with additives

3.5 Terms and definitions related to pipes

3.5.1

double wall pipe

pipe of which the outside layer is composed of black polyethylene layer compounded with carbon black (hereafter referred to as outer layers), and of which the inside layer is composed of opaque white polyethylene layer compounded without carbon black (hereafter referred to as inner layers)

3.6 Terms and definitions related to inspections

3.6.1

type inspection

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

3.6.2

delivery inspection

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 having passed the type inspection

4 Classification of pipes

The classification of pipes and the symbols shall be as given in Table 1.

Table 1 Classification of pipes

Class	Symbol of class	Applicable material	SDR	Dimensional system based on outside diameter of pipe (reference)
Class 1 double wall pipe	①W	PE50	—	Dimensional system based on nominal size
Class 2 double wall pipe	②W	PE80	—	Dimensional system based on nominal size
Class 3 double wall pipe	③W	PE80, PE100	11	Dimensional system based on nominal outside diameter
The minus sign “—” in this table indicates that no requirement is specified.				

5 Compounds

5.1 Classification of materials

Raw material resins, compounds or uncoloured materials shall be classified according to MRS. The classification shall be as given in Table 2.

Table 2 Classification of applicable materials (source: ISO 12162)

Unit: MPa

Class	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

NOTE The classification shall be determined with MRS which is obtained from the classification table in **ISO 12162**, using the lower confidence limit of the predicted hydrostatic strength obtained in accordance with **ISO 1167-1**, **ISO 1167-2** and **ISO 9080** [1].

5.2 Reprocessable/recyclable compounds

The pipe manufacturer may reuse the clean and reprocessable/recyclable compounds generated from the manufacture of pipes conforming to this Standard and generated in quality evaluation tests of the pipes, in the manufacture of products using the same type of compound, except those used for the tests of melt mass-flow rate (MFR), thermal stability, environmental stress cracking, slow crack growth, thermal longitudinal reversion, hydrostatic strength and fusion compatibility among various quality evaluation tests.

5.3 Performance of compound

Compounds for the manufacture of pipes shall deliver performance as given in Table 3.

The performance of compound shall be confirmed by the pipe manufacturer with the certificate provided by the compound manufacturer. When the compound manufacturer has difficulty in providing the certificate, other bodies than the compound manufacturer may test the performance of compounds.

Table 3 Performance of compounds

Characteristics		Required performance	Applicable clause	
Density ^{a)}		PE50: 0.915 g/cm ³ or more PE80: 0.930 g/cm ³ or more PE100: 0.942 g/cm ³ or more	7.3	
Melt mass-flow rate (MFR) ^{a)}		Nominated value ^{b)} : 0.2 g/10 min to 1.4 g/10 min Maximum deviation of MFR value: ± 25 % of the nominated value	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	
Environmental stress cracking ^{a)}		Free from cracks within 240 h	7.9	
Volatile component ^{e)}		350 mg/kg or under	7.10	
Water content ^{f)}		300 mg/kg or under	7.11	
Resistance to weathering ^{d), g)}	Tensile fracture elongation	350 % or more	7.12	7.13
	Hydrostatic strength ^{h)}	No leakage or breakage		7.14
Slow crack growth ^{e)}		No leakage or breakage	7.15	
Notes ^{a)} <u>When pipes are manufactured using the master batch compound, the uncoloured material shall be tested.</u> ^{b)} Nominated value given by the compound manufacturer. ^{c)} <u>Applicable to black coloured compound.</u> ^{d)} <u>Applicable to blue coloured compound.</u> ^{e)} <u>To be tested on PE100 pipes.</u> ^{f)} Applicable only when the volatile component performance is not satisfied. ^{g)} After exposure as specified in 7.12 , the test shall be carried out in accordance with 7.13 and 7.14 . ^{h)} To be tested when outdoor exposure test is carried out.				

6 Quality of pipes

6.1 General characteristics

The general characteristics of pipes shall be as follows.

- The internal and external surfaces of pipes shall be smooth and free from flaws, fissures, twists and other visible defects which are detrimental to use.
- The construction of pipes shall be as shown in Figure 1.
- The colour of outer layer of pipes shall be black. The inner layer shall have an opaque white colour which is the original colour of polyethylene (see Figure 1). Raw material resins used for inner and outer layers shall be of the same MRS.

Where applicable, blue identification stripes shall be provided on the external surface of pipes by using co-extruded layers, using ink printing, attaching tapes, etc. When blue identification stripes are provided by using co-extruded layers, the identification stripes shall have an area of 10 % or under of the external surface area of pipes and a depth of at most half the thickness of outer layer.

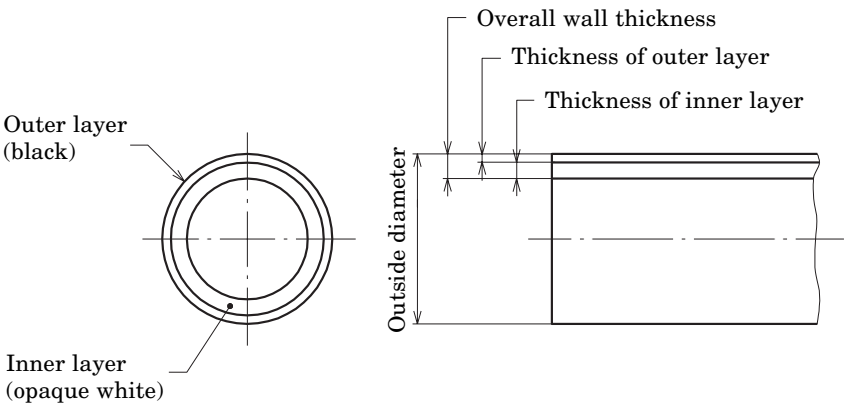


Figure 1 Construction and colour of pipes

6.2 Performance of pipes

The performance of pipes shall be as given in Table 4.

Table 4 Performance of pipes

Characteristics		Required performance	Applicable clause	
Rate of change in melt mass-flow rate (MFR) ^{a)}		± 25 %	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	
Resistance to weathering ^{d)}	Tensile fracture elongation	350 % or more	7.12	7.13
	Hydrostatic strength ^{e)}	No leakage or breakage		7.14
Tensile fracture elongation		350 % or more	7.13	
Hydrostatic strength		No leakage or breakage	7.14	
Tensile strength ^{f)}	Class 1 double wall pipe	9.8 MPa or more	7.16	
	Class 2 double wall pipe	19.6 MPa or more		
Thermal longitudinal reversion		Rate of change in length ± 3 %	7.17	
Pressure resistance		No leakage or breakage	7.18	
Effect to water quality	Turbidity	0.5 degrees max.	7.19	
	Chromaticity	1 degree max.		
	Total organic carbon (TOC)	1 mg/L max.		
	Loss of residual chlorine	0.7 mg/L max.		
	Odour	No abnormal odour		
	Taste	No abnormal taste		
Chlorine water resistance		No occurrence of blisters	7.20	
Fusion compatibility ^{g)}		No leakage or breakage	7.21	

Notes ^{a)} Rate of change of the value measured on pipes by the pipe manufacturer with respect to the measured value of compounds. The rate of change is calculated according to the following formula.

$$R = \left(\frac{F_1 - F_0}{F_0} \right) \times 100$$

where, R : rate of change by processing (%)

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 outer layer of the pipe manufactured by using the master batch compound.
- ^{c)} Applicable to blue identification stripes, provided by using co-extruded layers, on pipes manufactured using the master batch compound.
- ^{d)} Applicable to pipes with blue identification stripes provided by using co-extruded layers. After exposure as specified in **7.12**, the test shall be carried out in accordance with **7.13** and **7.14**.
- ^{e)} To be tested when outdoor exposure test is carried out.
- ^{f)} Not applicable to Class 3 double wall pipe.
- ^{g)} The fusion compatibility test shall be carried out upon agreement between the interested parties, if required.

6.3 Dimensions and tolerances

Dimensions of pipes shall be as given in Table 5 to Table 7 according to the class of pipes.

Table 5 Dimensions and tolerances (Class 1 double wall pipe)

Nominal size	Outside diameter			Overall wall thickness			Outer layer wall thickness		Reference value					
	mm			mm			mm		Inside diameter ^{c)} mm	Inner layer wall thickness ^{d)} mm	Mass per metre ^{e)} kg	Length ^{f)} m	Diameter of coiled pipe cm	
	Outside diameter	Tolerance ^{a)}	Out-of-roundness (max.) ^{b)}	Wall thickness	Tolerance	Minimum wall thickness	Outer layer wall thickness	Tolerance					Inside diameter	Equivalent outside diameter
13	21.5	± 0.15	1.3	3.5	± 0.30	3.2	1.5	± 0.3	14.5	1.7	0.184	120	40 min.	Approx. 80 min.
20	27.0		1.7	4.0		3.7			19.0	2.2	0.269		50 min.	Approx. 90 min.
25	34.0	± 0.20	2.1	5.0	± 0.35	4.65			24.0	3.15	0.423	90	70 min.	Approx. 110 min.
30	42.0		2.6	5.6		5.2	2.0	± 0.4	30.8	3.2	0.595		80 min.	Approx. 120 min.
40	48.0	± 0.25	2.9	6.5	± 0.45	6.05			35.0	4.05	0.788	60	90 min.	Approx. 130 min.
50	60.0	± 0.30	3.6	8.0	± 0.55	7.45			44.0	5.45	1.216	40	110 min.	Approx. 150 min.

- Notes
- ^{a)} The tolerance on outside diameter means the difference between the mean outside diameter and the outside diameter.
 - ^{b)} The requirements for out-of-roundness are applicable to straight pipes only. The values may be used as reference for coiled pipes.
 - ^{c)} The inside diameter given as reference is the value calculated from the outside diameter and the wall thickness.
 - ^{d)} The inner layer wall thickness given as reference is the value calculated from the difference between minimum wall thickness and outer layer wall thickness.
 - ^{e)} The mass per metre given as reference is calculated based on the outside diameter and the inside diameter on the assumption that the density of compound to be used for pipe is 0.930 g/cm³.
 - ^{f)} The length indicated above is commonly used dimensions.

Table 6 Dimensions and tolerances (Class 2 double wall pipe)

Nominal size	Outside diameter			Overall wall thickness			Outer layer wall thickness		Reference value					
	mm			mm			mm		Inside diameter ^{c)} mm	Inner layer wall thickness ^{d)} mm	Mass per metre ^{e)} kg	Length ^{f)} m	Diameter of coiled pipe cm	
	Outside diameter	Tolerance ^{a)}	Out-of-roundness (max.) ^{b)}	Wall thickness	Tolerance	Minimum wall thickness	Outer layer wall thickness	Tolerance					Inside diameter	Equivalent outside diameter
13	21.5	± 0.15	1.2	2.5	± 0.20	2.3	1.0	± 0.2	16.5	1.3	0.141	120	40 min.	Approx. 80 min.
20	27.0		1.3	3.0	± 0.25	2.75			21.0	1.75	0.213		50 min.	Approx. 90 min.
25	34.0	± 0.20		3.5	± 0.30	3.2			27.0	2.2	0.316	90	70 min.	Approx. 110 min.
30	42.0		1.4	4.0		3.7	1.5	± 0.3	34.0	2.2	0.450		80 min.	Approx. 120 min.
40	48.0	± 0.25		4.5	± 0.35	4.15			39.0	2.65	0.580	60	90 min.	Approx. 130 min.
50	60.0	± 0.30	1.5	5.0		4.65			50.0	3.15	0.814	40	110 min.	Approx. 150 min.

- Notes
- ^{a)} The tolerance on outside diameter means the difference between the mean outside diameter and the outside diameter.
 - ^{b)} The requirements for out-of-roundness are applicable to straight pipes only. The values may be used as reference for coiled pipes.
 - ^{c)} The inside diameter given as reference is the value calculated from the outside diameter and the wall thickness.
 - ^{d)} The inner layer wall thickness given as reference is the value calculated from the difference between minimum wall thickness and outer layer wall thickness.
 - ^{e)} The mass per metre given as reference is calculated based on the outside diameter and the inside diameter on the assumption that the density of compound to be used for pipe is 0.943 g/cm³.
 - ^{f)} The length indicated above is commonly used dimensions.

Table 7 Dimensions and tolerances (Class 3 double wall pipe)

Nominal outside diameter	Outside diameter			Overall wall thickness		Outer layer wall thickness		Reference value					
	mm			mm		mm		Inside diameter ^{d)} mm	Inner layer wall thickness ^{e)} mm	Mass per metre ^{f)} kg	Length ^{g)} m	Diameter of coiled pipe cm	
	Outside diameter	Tolerance ^{a)}	Out-of-roundness (max.) ^{b)}	Wall thickness ^{c)}	Tolerance	Outer layer wall thickness	Tolerance					Inside diameter	Equivalent outside diameter
20	20.0	+0.3 0	1.2	2.0	+0.3 0	0.8	+0.4 0	15.7	1.0	0.116	120	40 min.	Approx. 80 min.
25	25.0			2.3				20.0	1.3	0.170		50 min.	Approx. 90 min.
32	32.0			3.0				25.6	2.0	0.278		70 min.	Approx. 110 min.
40	40.0	+0.4 0	1.4	3.7	+0.5 0	1.2	+0.6 0	32.1	2.2	0.429	90	80 min.	Approx. 120 min.
50	50.0	+0.4 0		4.6	+0.6 0			40.2	3.1	0.666		90 min.	Approx. 130 min.
63	63.0	+0.4 0		5.8	+0.7 0			50.7	4.3	1.054		110 min.	Approx. 150 min.
75	75.0	+0.5 0	1.6	6.8	+0.8 0	1.4	+0.7 0	60.6	5.05	1.472	5	—	—
90	90.0	+0.6 0	1.8	8.2	+1.0 0	1.6	+0.8 0	72.6	6.2	2.132		—	—
110	110.0	+0.7 0	2.2	10.0	+1.1 0			88.9	8.0	3.163		—	—
125	125.0	+0.8 0	2.5	11.4	+1.3 0			100.9	9.4	4.103		—	—
160	160.0	+1.0 0	2.8	14.6	+1.6 0	2.0	+1.0 0	129.2	12.1	6.713		—	—
180	180.0	+1.1 0	3.6	16.4	+1.8 0			145.4	13.9	8.485		—	—
250	250.0	+1.5 0	5.0	22.7	+2.4 0			202.2	20.2	16.29		—	—

- Notes
- a) The tolerance on outside diameter means the difference between the mean outside diameter and the outside diameter.
 - b) The requirements for out-of-roundness are applicable to straight pipes only. The values may be used as reference for coiled pipes.
 - c) The wall thickness is equivalent to minimum wall thickness.
 - d) The inside diameter given as reference is the value calculated from the outside diameter and the central value of wall thickness.
 - e) The inner layer wall thickness given as reference is the value calculated from the difference between wall thickness and central value of outer layer wall thickness.
 - f) The mass per metre given as reference is calculated based on the outside diameter and the inside diameter on the assumption that the density of compound to be used for pipe is 0.960 g/cm³.
 - g) The length indicated above is commonly used dimensions.