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Ductile iron fittings

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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 Ductile Iron Pipe Association (JDPA) 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 G 5527:1998** is replaced with this Standard.

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Ductile iron fittings

Introduction

This Japanese Industrial Standard has been prepared based on the sixth edition of **ISO 2531** published in 2009 with some modifications of the technical contents.

The portions with continuous sidelines or dotted underlines are the matters in which the contents of the corresponding International Standard have been modified. A list of modifications with the explanations is given in Annex JD.

1 Scope

This Standard specifies the ductile iron fittings (hereafter referred to as “fittings”) and accessories used to convey water and the like, under pressure or non-pressure, through piping buried underground or laid on the ground.

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

ISO 2531:2009 *Ductile iron pipes, fittings, accessories and their joints for water applications* (MOD)

The 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 21-1**.

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 0202 *Parallel pipe threads*

JIS B 0205-1 *ISO general purpose metric screw threads—Part 1: Basic profile*

JIS B 0205-3 *ISO general purpose metric screw threads—Part 3: Selected sizes for screws, bolts and nuts*

JIS B 0205-4 *ISO general purpose metric screw threads—Part 4: Basic dimensions*

JIS B 1180 *Hexagon head bolts and hexagon head screws*

JIS B 1181 *Hexagon nuts and hexagon thin nuts*

JIS B 7507 *Vernier, dial and digital callipers*

JIS G 3101 *Rolled steels for general structure*

JIS G 3505 *Low carbon steel wire rods*

JIS G 3506 *High carbon steel wire rods*

JIS G 3507-1 *Carbon steels for cold heading—Part 1: Wire rods*

JIS G 4303 *Stainless steel bars*

JIS G 4304	<i>Hot-rolled stainless steel plate, sheet and strip</i>
JIS G 4305	<i>Cold-rolled stainless steel plate, sheet and strip</i>
JIS G 4308	<i>Stainless steel wire rods</i>
JIS G 4309	<i>Stainless steel wires</i>
JIS G 4315	<i>Stainless steel wires for cold heading and cold forging</i>
JIS G 5121	<i>Corrosion-resistant cast steels for general applications</i>
JIS G 5502	<i>Spheroidal graphite iron castings</i>
JIS G 5526	<i>Ductile iron pipes</i>
JIS G 5528	<i>Epoxy-powder coating for interior of ductile iron pipes and fittings</i>
JIS H 0401	<i>Test methods for hot dip galvanized coatings</i>
JIS H 8641	<i>Hot dip galvanized coatings</i>
JIS K 6250	<i>Rubber—General procedures for preparing and conditioning test pieces for physical test methods</i>
JIS K 6251	<i>Rubber, vulcanized or thermoplastics—Determination of tensile stress-strain properties</i>
JIS K 6253-3	<i>Rubber, vulcanized or thermoplastic—Determination of hardness—Part 3: Durometer method</i>
JIS K 6257	<i>Rubber, vulcanized or thermoplastic—Determination of heat ageing properties</i>
JIS K 6258	<i>Rubber, vulcanized or thermoplastic—Determination of the effect of liquids</i>
JIS K 6259	<i>Rubber, vulcanized or thermoplastics—Determination of ozone resistance</i>
JIS K 6262	<i>Rubber, vulcanized or thermoplastic—Determination of compression set at ambient, elevated or low temperatures</i>
JIS K 6771	<i>Flexible vinyl tube</i>
JIS K 6920-1	<i>Plastics—Polyamide (PA) moulding and extrusion materials—Part 1: Designation</i>
JIS K 6920-2	<i>Plastics—Polyamide (PA) moulding and extrusion materials—Part 2: Preparation of test specimens and determination of properties</i>
JIS Z 2241	<i>Metallic materials—Tensile testing—Method of test at room temperature</i>
JIS Z 2243	<i>Brinell hardness test—Test method</i>

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in JIS G 5526, and the following apply.

3.1 fitting

pipe-shaped casting other than the pipe manufactured by centrifugal casting specified in JIS G 5526, which changes the displacement, direction and diameter of pipeline

3.2 nominal pressure

designation of the pressure value expressed by the numerical value

3.3 standardized length

effective length of fitting having the dimensions I , L , L_1 and L_2 shown in Annex JB; however, the dimension L of collar or stopper is excluded

3.4 maximum batch

maximum mass of the crude product that constitutes a test lot in the test of tensile strength and elongation

3.5 collar

name of fitting used for jointing one spigot and another spigot, of which the shape is shown in Annex JB

3.6 cap

name of fitting used for water stop of the spigot for pipeline end, of which the shape is shown in Annex JB

4 Grade of wall thickness of fittings and symbol thereof

The fittings shall be one grade, and the symbol thereof shall be DF.

5 Classification of joint, joint system and symbol thereof, and range of nominal size

The classification of joint, joint system and symbol thereof, and range of nominal size of fittings shall be as given in table 1.

The accessories used to joint fittings shall be according to Annex JA.

Table 1 Classification of joint, joint system and symbol thereof, and nominal size range

Classification of joint	Joint system	Symbol of joint system	Nominal size range
Extensible restrained joint	Type S	S	1 100 to 2 600
	Type US	US	800 to 2 600
	Type PN	PN	300 to 1 100
	Type PII	PII	300 to 1 100
Restrained joint	Type NS	NS	75 to 1 000
	Type UF	UF	800 to 2 600
Flexible joint	Type K	K	75 to 2 600
	Type T	T	75 to 250
	Type U	U	800 to 2 600
Flange joint	Flange type	—	75 to 2 600

6 Manufacturing method

Fittings shall be cast through the processes of melting raw materials suitable for ductile iron, carrying out an appropriate treatment for spheroidizing graphite in an as-cast state and pouring this into a mould. For the casting of fittings, chaplets for holding the cores shall not be used. In an unavoidable case, they may be used upon the agreement between the purchaser and the manufacturer.

The heat treatment such as annealing shall be carried out on fittings, if required. Slight hollows generated on the internal and external surfaces of fitting at the time of manufacture may be filled by welding or with resin filler.

7 Mechanical properties

7.1 Tensile strength and elongation

The tensile strength and elongation of fittings shall be tested according to either of the following, which shall be as given in table 2.

- a) In the case of the batch test, they shall be checked by the tensile test. In this case, the tensile strength and elongation of the sample shall be tested according to 12.1.2 by using the sample of 12.1.1.
- b) In the case of the process control test, they shall be checked by the non-destructive test and the like. However, the test shall be carried out after the correlation between the test results of tensile strength and elongation in table 2 and the non-destructive test results has been demonstrated. The test piece to be used in the demonstration shall be the reference standard having known and verifiable properties.

Table 2 Tensile strength and elongation

Symbol of material	Tensile strength N/mm ²	Elongation %
FCD (420-10)	420 min.	10 min.
NOTE : 1 N/mm ² = 1 MPa		

7.2 Hardness

The hardness of fittings shall be such that they can be machined.

In case of doubt, the hardness shall be measured according to 12.2. In this case, the Brinell hardness shall not exceed 230 HBW.

8 Water pressure tightness

The water pressure tightness of fittings shall be tested according to 12.3 and there shall be no water leakage.

9 Shapes, dimensions and tolerances

The shapes and dimensions of fittings shall be tested according to 12.4, and shall be according to Annex JB and the following tolerances.

- a) For the tolerances on the wall thickness of fitting (T and t), the upper tolerance shall not be specified but the lower tolerance shall be -2.0 mm when the wall thickness of fitting is 10 mm or under, -2.5 mm when the wall thickness of fitting is 11 mm to 16 mm, and -15% of wall thickness of fitting when the wall thickness of fitting is 17 mm or over.

The significant figure of lower tolerance shall be expressed down to one decimal place, and the figures under the second decimal place shall be truncated.

- b) For the tolerances on the standardized length (I , L , L_1 and L_2), the upper tolerance shall be $+30$ mm and the lower tolerance shall be -15 mm. However, the tolerances on the standardized length of a double flange fitting and on that from an end face of flange to the centreline of flange shall be ± 5 mm.
- c) The tolerances on respective dimensions of socket part, spigot part and flange part shall be as given in table 3 to table 12.

Table 3 Tolerances on respective dimensions of Type NS of 75 to 250 in nominal size

Unit: mm

Nominal size	D_2	D_3	D_5	D_{10}	D_{12}	P	V
75 to 150	± 1.5	± 1.0	$+5.0$	$+1.5$	± 1.5	± 4.0	$+ \text{not specified}$
200, 250		± 1.3	-1.5	$- \text{not specified}$			-0.5

NOTE : Symbols of respective dimensions shall be as given in table JB.1.

Table 4 Tolerances on respective dimensions of socket part of collar and cap of Type NS of 75 to 250 in nominal size, and Type NS of 300 to 450 in nominal size

Unit: mm

Nominal size	D_2	D'_4	D'_5	D_6	D_{10}	P	K	V
75 to 150	—	± 1.5	$+ \text{not specified}$ -2.0	$+1.5$ -1.0	—	—	$+6.0$ -2.5	—
200, 250				$+1.8$				
300	$+1.5$			-1.3	$+1.5$	± 4.0	$+7.0$	$+ \text{not specified}$
350 to 450	-2.0			$+2.3$ -1.6	$- \text{not specified}$		-3.0	-0.5

NOTE : Symbols of respective dimensions shall be as given in table JB.2 and table JB.3.

Table 5 Tolerances on respective dimensions of Type NS of 500 to 1 000 in nominal size

Unit: mm

Nominal size	D_2	D_3	D_4	D_5	E	P	V
500, 600	± 2.0	$+1.5$ -1.0	± 1.5	$+ \text{not specified}$ -2.0	$+1.5$ -1.0	± 4.0	$+1.5$ -1.0
700 to 900	$+2.0$ -3.0	$+2.5$ -1.0				± 5.0	
1 000		$+3.0$ -1.0		$+ \text{not specified}$ -3.0			

NOTE : Symbols of respective dimensions shall be as given in table JB.4.

Table 6 Tolerances on respective dimensions of Type S

Unit: mm

Nominal size	D_3	D_4	D_5
1 100 to 1 500	$+2.0$	± 1.5	$+ \text{not specified}$
1 600 to 2 600	-1.0	± 2.0	-3.0

NOTE : Symbols of respective dimensions shall be as given in table JB.5.

Table 7 Tolerances on respective dimensions of Type US

Unit: mm

Nominal size	D_3	D_5
800, 900	$+1.5$ -1.0	$+ \text{not specified}$ -2.0
1 000 to 2 600	$+2.0$ -1.0	$+ \text{not specified}$ -3.0

NOTE : Symbols of respective dimensions shall be as given in table JB.6.

Table 8 Tolerances on respective dimensions of Type PN and Type PII

Unit: mm

Nominal size	D_3	D'_5	P
300	± 1.3	$+ \text{not specified}$	± 4.0
350 to 600	± 1.8	-2.0	
700 to 900	$+2.0$ -0.5		± 5.0
1 000, 1 100	$+2.5$ -0.5	$+ \text{not specified}$ -3.0	

NOTE : Symbols of respective dimensions shall be as given in table JB.7 and table JB.8.

Table 9 Tolerances on respective dimensions of Type UF and Type U

Unit: mm

Nominal size	D_2	D_3	D_5	P	V
					Type UF
800, 900	+ 2.0 − 4.0	+ 1.5 − 1.0	+ not specified − 2.0	± 5.0	+ 1.0 − 0.5
1 000 to 1 500		+ 2.0	+ not specified		
1 600 to 2 600		− 1.0	− 3.0		+ 1.5 − 0.5
NOTE : Symbols of respective dimensions shall be as given in table JB.9 and table JB.12.					

Table 10 Tolerances on respective dimensions of Type K

Unit: mm

Nominal size	D_2	D_3	D_4	D_5	P	K
75 to 250	± 1.5	+ 2.0 – 1.0	± 1.5	+ not specified – 2.0	± 4.0	+ 6.0 – 2.5
300 to 600	+ 2.0 – 3.0					+ 7.0 – 3.0
700 to 900		+ 3.0 – 1.5				± 5.0
1 000 to 1 500	+ 2.0 – 4.0	+ 4.0 – 1.0		+ not specified – 3.0	+ 9.0 – 3.5	
1 600 to 2 600	+ 4.0 – 5.0	+ 4.0 0	± 2.0			
NOTE : Symbols of respective dimensions shall be as given in table JB.10.						

Table 11 Tolerances on respective dimensions of Type T

Unit: mm

Nominal size	D_2	D_3	D_5	P
75 to 150	± 1.5	± 1.0	+ 3.0	± 4.0
200, 250		± 1.3	- 1.5	
NOTE : Symbols of respective dimensions shall be as given in table JB.11.				

Table 12 Tolerances on respective dimensions of flange type

Unit: mm

Nominal size	G_1	e	s	D_3	D_4	D_5	E	K
75 to 250	+ 1.5 0	+ 1.0 0	+ 0.2 − 0.5	+ 3.0 − 2.0	± 1.5	+ not specified − 2.0	+ 1.5 0	+ 4.0 0
300 to 450								+ 5.0 0
500, 600	± 1.5	+ 1.0 − 0.5						+ 6.0 0
700 to 900			+ 3.5 − 2.0	+ 7.0 0				
1 000 to 1 500		+ 0.5 − 1.0	+ 0.2 − 0.8	+ 4.0 − 2.0	± 2.0	+ not specified − 3.0		+ 8.0 0
1 600 to 2 600	± 2.0		+ 0.5 − 0.8					+ 9.0 0

NOTE : Symbols of respective dimensions shall be as given in table JB.13 to table JB.16.

10 Appearance

The appearance of fittings shall be tested according to 12.5, and the internal and external surfaces shall be free from fin, blowholes and the like that are detrimental to practical use.

11 Coating

The coating on fittings shall be as follows.

- The coating material shall not contain components that are harmful to practical use, be insoluble in water after drying and show no irregularities by heat and cold.
- When the internal surface of fitting is coated by epoxy-powder, it shall be according to JIS G 5528. However, upon the agreement between the purchaser and the manufacturer, other coating may be employed.
- The external surface of fitting, unless otherwise specified, shall be coated with epoxy, acrylic synthetic resin paint and the like. However, upon the agreement between the purchaser and the manufacturer, other coating may be employed. Zinc primer may be applied as an undercoating for the outer surface of fitting.
- When fittings are used for water supply facilities, it shall be checked that the coating does not have a detrimental effect on the water quality.

12 Tests

12.1 Tensile test

12.1.1 Sample

The sample for the tensile test shall be as follows.

- a) The sample shall be prepared, at the manufacturer's option, either by casting separately or by casting integrated with fitting. In the case of the separately cast sample, three pieces including preliminaries shall be cast using the melt same as that used for the fitting. In the case of the sample integrated with fitting, three pieces shall be cast by being attached to the crude product of the same batch.

If the fitting is subjected to heat treatment, the sample shall be heat treated simultaneously.

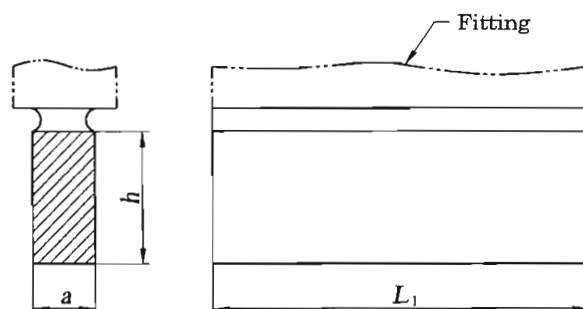
- b) The shapes and dimensions of the samples, for the separately cast sample, shall be according to 12.2 of JIS G 5502. The sample shall be No. A of Type Y for that of under 12 mm in wall thickness and that of No. B of Type Y for 12 mm or over in wall thickness. The knock-off type (Type Ka or Type Kb) may be used.

For the sample integrated with fitting, shapes and dimensions shall be as given in table 13. For the wall thickness of fitting having different nominal sizes for one product, a larger nominal size shall be applied.

Table 13 Shape and dimensions of sample integrated with fitting

Unit: mm

Wall thickness of fitting	Thickness	Height	Length
	a	h	L_1
Under 12	12.5	45 min.	100 min.
12 or over to and excl. 25	16.0		
25 or over	20.0		



12.1.2 Test method

For the tensile test, one test piece of table 14, which is conforming to No. 14A test piece of JIS Z 2241, shall be prepared from the centre of thickness of the sample obtained in 12.1.1. This shall be tested according to JIS Z 2241 to determine the tensile strength and elongation. The dimensions of test piece shall be according to either of Method A or Method B given in table 14 at the manufacturer's discretion, and shall be as follows.

- a) For Method A, a test piece shall be processed within the tolerance range of diameter in table 14, and the diameter shall be measured with an accuracy of ± 0.01 mm before the test. This value shall be used to calculate the cross-sectional area and the tensile strength.

- b) For Method B, a test piece shall be processed within the tolerance range of diameter in table 14, and the nominal area shall be used to calculate the tensile strength.

Table 14 Dimensions of test piece

Type of sample		Thickness of sample mm	Method A		Method B		
			Diameter mm	Tolerance on diameter %	Nominal area mm ²	Diameter mm	Tolerance on diameter mm
Sample cast separately ^{a)}	Fitting of under 12 mm in wall thickness	12.5	6.0	± 10	30.0	6.18	± 0.03
Sample cast separately ^{a)}	Fitting of 12 mm or over in wall thickness	25.0	12.0 or 14.0		—	—	—
Sample integrated with fitting		—	5.0		20.0	5.05	± 0.02
Note ^{a)} For the wall thickness of fitting when different nominal sizes are available in one product, a larger nominal size shall be applied.							

12.2 Hardness test

For the hardness test, one piece of a suitable size shall be prepared from a part of the test piece obtained 12.1.2 and the test shall be carried out according to JIS Z 2243.

12.3 Water pressure tightness test

WARNING Since a fitting may explode when carrying out this test, exercise the greatest possible caution.

A water pressure tightness test shall be carried out on fittings before being coated, as a rule. Water pressure shall be applied to a fitting up to the water pressure for test of table 15 and kept for 10 s or over, and the leakage shall be examined. In this case, the time of water pressure tightness test including this holding time shall be 15 s or over.

For the water pressure when different nominal sizes are available in one product, a larger nominal size shall be applied.

Table 15 Water pressure for test

Unit: MPa

Nominal size	Water pressure
75 to 300	3.0
350 to 600	2.5
700 to 1 000	2.0
1 100 to 2 600	1.5

12.4 Measurement of shapes and dimensions

The measurement of shapes for fitting shall be carried out visually or using a gauge. The measurement of dimensions shall be carried out using vernier callipers specified in **JIS B 7507** or a measuring instrument of at least equal thereto in accuracy, or the limit gauge and the like.

12.5 Appearance test

The appearance test for fitting shall be carried out visually.

13 Inspections

13.1 General

The inspections on fitting shall be according to **13.2** to **13.7**.

A part of inspections may be omitted upon the agreement between the purchaser and the manufacturer.

13.2 Tensile strength and elongation

The tensile strength and elongation shall conform to **7.1**. In this case, the inspection shall be carried out by sampling up to the maximum batch size in table 16 with respect to the mass of crude products manufactured by continuous casting.

When the mass of one crude product exceeds 4 000 kg in the batch test, the crude product shall be taken as one batch.

Table 16 Maximum batch size

Unit: kg

Nominal size	Maximum batch size	
	Batch test	Process control test
75 to 2 600	4 000	48 000

13.3 Hardness

The hardness shall conform to **7.2**.

13.4 Water pressure tightness

The water pressure tightness shall be inspected on each fitting and it shall conform to clause 8. However, it is not applicable to those having a bell mouth.

13.5 Shapes and dimensions

The shapes shall be inspected on each fitting and the dimensions shall be inspected at a frequency based on the quality management system of the manufacturer, and they shall conform to clause 9.

If the value obtained from the circumferential dimension falls within the tolerance range in table 3 to table 11, the dimension D_2 of the external diameter of the spigot part may be smaller by 0.5 mm than the tolerances in table 3 to table 11 for the nominal sizes 75 to 600, and may be larger by 1.0 mm or smaller by 1.0 mm than the tolerances in

table 3 to table 11 for the nominal sizes 700 to 2 600. In this case, π to be used when the value is obtained from the circumferential dimension shall be more accurate than 3.141 59, and the obtained value shall be rounded to one decimal place.

13.6 Appearance

The appearance shall be inspected on each fitting and it shall conform to clause 10.

13.7 Marking

The marking shall be inspected on each fitting visually and it shall conform to clause 14.

13.8 Reinspection

For the fitting having failed in the tensile test, the acceptance may be determined according to either of the following.

- a) The preliminary test piece shall be retested according to 12.1, and accepted when it conforms to 7.1.
- b) If it is judged that the test result has been influenced by flaws or blowholes of test piece, the test result shall be invalidated. When the test is carried out according to 12.1 using the preliminary test piece and the result conforms to 7.1, it shall be accepted.

14 Marking

The following items shall be marked on fittings which conform to all the requirements in this Standard legibly by means of casting-out, stamping, etc.

- a) Symbol of grade
- b) Year of manufacture (last two digits thereof)
- c) Manufacturer's name or its identifying brand
- d) Nominal size
- e) Angle (for bent tube)
- f) Nominal pressure (for flange type other than 7.5K)
- g) Symbol of joint system for socket

Annex JA (normative)

Accessories for ductile iron pipes and fittings

JA.1 Types

The types of accessory according to the joint system shall be as given in table JA.1.

Table JA.1 Types of accessory

Joint system	Name of accessory			
	Category I	Category II	Category III	Category IV
Type NS	Gland, lock ring, liner, bent preventing ring, spigot ring for cut fitting	T-bolt and nut, set bolt	Rubber gasket, rubber for centring lock ring, rubber for centring liner	Backup ring, bolt for centring liner
Type S	Gland, split ring, lock ring, spigot ring for cut fitting	Bolt and nut, connecting plate	Rubber gasket, backup ring	—
Type US	Gland, split ring, lock ring, spigot ring for cut fitting	Bolt, stay bar, set bolt	Rubber gasket, rubber for squeezing lock ring	Tube
Type PN, Type PII	Gland, lock ring	Bolt, set bolt	Rubber gasket	—
Type UF	Gland, lock ring	Bolt, stay bar, set bolt	Rubber gasket	—
Type K	Gland	T-bolt and nut	Rubber gasket	—
Type T	—	—	Rubber gasket	—
Type U	Gland, split ring, centre ring	Bolt, stay bar	Rubber gasket	—
Flange type	—	Hexagon head bolt and nut	Gasket	—

JA.2 Accessories category I

JA.2.1 Material

The material shall be that in **JIS G 5526** or FCD (420-10) in clause 7 of this Standard. For the material of the lock ring and the spigot ring for cut fitting of Type NS of 75 to 450 in nominal size, the material shall be FCD (600-3) in **JIS G 5502**.

JA.2.2 Manufacturing method

The manufacturing method shall be according to clause 6 of **JIS G 5526** or clause 6 of this Standard. For the material of FCD (420-10) of the gland, etc. of Type US, Type UF and Type U, cold-bending may be applied after continuous casting. Furthermore, light hollows, etc. generated at the time of manufacture may be filled by weld or with resin filler.

JA.2.3 Tensile strength and elongation

The tensile strength and elongation shall be checked using a sample. In this case, the tensile strength and elongation of sample, when the test is carried out according to **JA.2.7.1**, shall be according to table JA.2.

Table JA.2 Tensile strength and elongation

Material	Tensile strength N/mm ²	Elongation %
JIS G 5526 or FCD (420-10) in clause 7	420 min.	10 min.
FCD (600-3) in JIS G 5502	600 min.	3 min.

JA.2.4 Shapes and dimensions

The shapes and dimensions shall be tested according to **JA.2.7.2**, and shall be according to Annex JC.

The screw threads shall be according to **JIS B 0205-1**, **JIS B 0205-3** and **JIS B 0205-4**.

JA.2.5 Appearance

The appearance shall be tested according to **JA.2.7.3**, and there shall be no fin, blowholes and the like that are detrimental to practical use.

JA.2.6 Coating

The coating shall be as follows.

- When synthetic-resin coating is applied, it shall be according to clause 11.
- When epoxy resin powder coating is applied, it shall be applied with a guide application quantity of 120 g/m² according to clause 11. For the liner of Type NS, epoxy resin powder coating shall be applied to the internal and external surfaces according to **JIS G 5528**.
- When pipes and fittings are used for water supply facilities, it shall be checked that the coating of accessories in contact with drinking water does not have detrimental effects on the water quality.

JA.2.7 Tests

JA.2.7.1 Tensile test

The tensile test shall be as follows.

- For the centrifugal casting and continuous casting, the tensile test shall be according to 12.1 of **JIS G 5526**.
- For other castings, it shall be according to 12.1 of this Standard.

JA.2.7.2 Measurement of shapes and dimensions

The measurement of shapes shall be carried out visually or using a gauge. The measurement of dimensions shall be carried out using vernier callipers specified in **JIS B 7507** or a measuring instrument of at least equal thereto in accuracy, or the limit gauge and the like.

JA.2.7.3 Appearance test

The appearance test shall be carried out visually.

JA.2.8 Inspections

The inspections shall be as follows.

A part of inspections may be omitted upon the agreement between the purchaser and the manufacturer.

- a) The tensile strength and elongation shall conform to **JA.2.3**.
- b) The shapes shall be inspected on each accessory and the dimensions shall be inspected at a frequency based on the quality management system of the manufacturer, and they shall conform to **JA.2.4**.
- c) The appearance shall be inspected on each accessory and it shall conform to **JA.2.5**.
- d) The marking shall be inspected on each accessory visually and it shall conform to **JA.2.9**.

JA.2.9 Marking

The following items shall be marked on accessories category I which conforms to all the requirements in this **JA.2** legibly by means of casting-out, stamping, etc.

- a) Symbol of material (D of ductile iron)
- b) Year of manufacture (last two digits thereof)
- c) Manufacturer's name or its identifying brand
- d) Nominal size

JA.3 Accessories category II

JA.3.1 Materials

The materials shall be as given in table JA.3.

Table JA.3 Materials

Material	Joint system	Accessory
SUS304, SUS304J3 and SUSXM7 in JIS G 4303 , JIS G 4308 or JIS G 4309	Type NS	T-bolt and nut
	Type S	Bolt and nut
	Type PN, Type PII	Bolt
	Type NS, Type US, Type PN, Type PII	Set bolt
	Flange type	Hexagon head bolt and nut
SUS403 of JIS G 4303 or SCS2 of JIS G 5121	Type S	Connecting plate
FCD (420-10) in clause 7	Type US, Type UF and Type U	Bolt, stay bar
	Type K	T-bolt and nut
SS400 in JIS G 3101 , SWRM material in JIS G 3505 , SWRH material in JIS G 3506 or SWRCH material in JIS G 3507-1	Flange type	Hexagon head bolt and nut

JA.3.2 Mechanical properties of products

The mechanical properties of products shall be tested according to **JA.3.6.2** with respect to T-bolt and nut of Type NS, T-bolt and nut of Type K and bolt and nut of Type S, and hexagon head bolt and nut of flange type, and the permanent set shall be 0.2 % or under.

JA.3.3 Shapes and dimensions

The shapes and dimensions shall be tested according to **JA.3.6.3**, and shall be according to Annex JC.

The screw threads shall be according to **JIS B 0205-1**, **JIS B 0205-3** and **JIS B 0205-4**.

JA.3.4 Appearance

The appearance shall be tested according to **JA.3.6.4**, and shall be as follows.

- a) The appearance prior to coating shall be free from defects that are detrimental to practical use.

In this case, repairing shall not be applied to flaws and blowholes.

- b) The finished surface after coating shall be free from bubble, blister, peeling, tear-dropping, holiday, adhesion of foreign matters, inordinate viscosity and the like that are detrimental to practical use, and the surface shall be smooth.

JA.3.5 Coating, burn-on preventing treatment, hot-dip galvanizing and oxide film treatment

The coating, burn-on preventing treatment, hot-dip galvanizing and oxide film treatment shall be as follows.

- a) The coating of accessories of which the material quality is FCD (420-10) shall be according to clause 11.
- b) For the thread parts of T-bolt and nut of Type NS, bolt and nut of Type S, and hexagon head bolt and nut of flange type of which the material quality is SUS304, SUS304J3 and SUS304XM7 of **JIS G 4303**, **JIS G 4308** and **JIS G 4309**, the burn-on preventing treatment shall be applied, then the test shall be carried out according to **JA.3.6.5**. The difference between the maximum and the minimum of moved distance of nut among five times shall be 5 mm or under.
- c) The hexagon head bolt and nut of flange type of which the material quality is SS400 of **JIS G 3101**, SWRM of **JIS G 3505**, SWRH of **JIS G 3506** and SWRCH of **JIS G 3507-1** shall be subjected to hot-dip galvanizing, then the test shall be carried out according to **JA.3.6.6**. The coating mass of hot-dip galvanizing thereof shall conform to the requirement of HDZ35 in **JIS H 8641**. However, the coating mass of hot-dip galvanizing of nut shall be about 200 g/mm².
- d) The epoxy resin powder coating shall be applied to the connecting plate except the thread part according to **JIS G 5528**, then the test shall be carried out according to **JA.3.6.7**. The film thickness thereof shall be 0.1 mm to 0.6 mm.
- e) For the T-bolt and nut of which the material quality is FCD (420-10), the oxide film with sufficient adhesion to the threaded surface shall be made generated, then the test shall be carried out according to **JA.3.6.8**. The oxide film shall be generated.
- f) When pipes and fittings are used for water supply facilities, it shall be checked that the coating of accessories in contact with drinking water does not have detrimental effects on the water quality.

JA.3.6 Tests

JA.3.6.1 Material test

The material test shall be according to **JISs** given in table JA.3.

JA.3.6.2 Product test

The product test of the bolt and nut shall be carried out by gripping the engaged bolt and nut by a suitable method and pulling them up to the load in table JA.4 by a load tester.

Table JA.4 Test load

Unit: kN

Designation of bolt	Load		
	SS400 SWRM material SWRH material SWRCH material	FCD (420-10)	SUS304 SUS304J3 SUSXM7
M16	37	38	31
M20	55	60	48
M22	69	—	60
M24	80	86	69
M30	127	138	111
M36	185	—	161
M39	222	—	194
M42	234	—	222
M45	273	—	259
M48	307	—	292
M52	368	—	349
M56	424	—	403

JA.3.6.3 Measurement of shapes and dimensions

The measurement of shapes shall be carried out visually or using a gauge. The measurement of dimensions shall be carried out using vernier callipers specified in **JIS B 7507** or a measuring instrument at least equal thereto in accuracy, or the limit gauge and the like.

JA.3.6.4 Appearance test

The appearance test shall be carried out visually.

JA.3.6.5 Burn-on preventing treatment test

For the burn-on preventing treatment test, the same burn-on preventing treatment as that of the product shall be applied to the bolt and nut of M20 of the same material quality as the product, and five cycles shall be repeated taking the conditions in **a)** to **d)** as one cycle. In this case, the cushion material of which the moved distance of the nut until the predetermined torque is reached from the time when the torque begins to be applied becomes 10 mm to 20 mm shall be used (see figure JA.1).

- The nut shall be tightened by hand until it touches the cushion material.
- The nut shall be tightened up to the torque of 190 N·m.
- The moved distance of the nut until the predetermined torque is reached from the time when the torque begins to be applied shall be measured.
- The nut shall be loosened until it separates from the cushion material.

Unit: mm

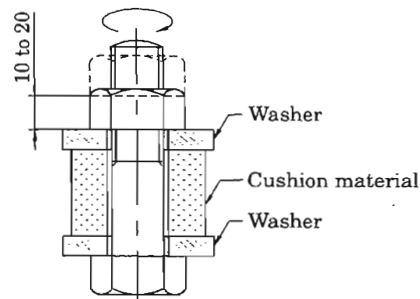


Figure JA.1 Example of test jig for burn-on preventing treatment test

JA.3.6.6 Coating mass test

The coating mass test of hot-dip galvanizing shall be carried out according to **JIS H 0401**.

JA.3.6.7 Measurement of film thickness

The measurement of the film thickness of a connecting plate shall be carried out by a suitable measuring instrument such as an electromagnetic film thickness tester.

JA.3.6.8 Oxide film test

The oxide film test shall be carried out using the bolt of which the central part is cut on the axis line, and the existence of film shall be examined with a microscope or a magnifying glass.

JA.3.7 Inspections

The inspections shall be as follows.

A part of inspections may be omitted upon the agreement between the purchaser and the manufacturer. When the results of the inspection in **b)** and **e)** to **h)** fail to conform to the requirements, reinspection may be carried out by further taking the double test pieces from the group or by using the double reserved test pieces.

- a) The materials, when the test is carried out, shall conform to **JA.3.1**.
- b) The mechanical properties of products, when the test is carried out by sampling two pieces arbitrarily from each group taking 1 000 pieces of products or the fraction thereof as one group, shall conform to **JA.3.2**.
- c) The shapes shall be inspected on each accessory and the dimensions shall be inspected at a frequency based on the quality management system of the manufacturer, and they shall conform to **JA.3.3**.
- d) The appearance shall be inspected on each accessory and it shall conform to **JA.3.4**.
- e) The burn-on preventing treatment, when the test is carried out by using two pieces of bolts and nuts manufactured under the same condition as the product taking 10 000 pieces of products or the fraction thereof as one group for each of the same burn-on preventing treatment, shall conform to **JA.3.5 b)**.

- f) The hot-dip galvanizing, when the test is carried out by sampling two pieces arbitrarily from each group taking 2 000 pieces of products or the fraction thereof as one group, shall conform to **JA.3.5 c**).
- g) The film thickness of epoxy resin powder coating of a connecting plate, when the test is carried out by sampling two pieces arbitrarily from each group taking 500 pieces of products or the fraction thereof as one group, shall conform to **JA.3.5 d**).
- h) The oxide film treatment, when the test is carried out by sampling two pieces arbitrarily from each group taking 2 000 pieces of products or the fraction thereof as one group, shall conform to **JA.3.5 e**).
- i) The marking shall be inspected on each accessory visually and it shall conform to **JA.3.8**.

JA.3.8 Marking

JA.3.8.1 Bolt

For T-bolt of Type NS, T-bolt of Type K and bolt of Type S which conform to all the requirements in this **JA.3**, the following items shall be marked on an appropriate position by means of embossing, stamping, etc.

For other bolts, set bolts and stay bars, the following matters shall be marked on a package.

- a) Manufacturer's name or its identifying brand
- b) Symbol of surface treatment (S for oxide-film treated bolt).

JA.3.8.2 Connecting plate

For the connecting plate which conforms to all the requirements in this **JA.3**, the following items shall be indelibly marked on an appropriate position.

- a) Nominal size
- b) Manufacturer's name or its identifying brand
- c) Piece number (e.g., I, II or III)

JA.4 Accessories category III

JA.4.1 Materials

For the materials of accessories category III, styrene butadiene rubber (SBR), ethylene propylene rubber (EPDM) or acrylonitrile butadiene rubber (NBR) of good quality shall be used. In this case, SBR is normally used, EPDM is used when ozone resistance is needed, and NBR is used when there is an influence of oils, chemicals, heat, etc. in sewerage, etc.

JA.4.2 Physical properties

The physical properties shall be tested according to **JA.4.6.1** to **JA.4.6.4**, and shall be as given in table JA.5 and table JA.6.

Table JA.5 Physical properties of SBR, EPDM and NBR

Joint system	Name		Symbol of classification	Durometer hardness H _A (Type A)	Tensile test				Accelerated aging test			Rate of compression set %	Mass change rate by immersion test % (within)	Ozone deterioration test		
					Elongation under load of 7.0 MPa % (max.)	Tensile strength MPa (min.)			Elongation % (min.)	Change rate of tensile strength % (within)	Change rate of elongation % (within)				Change in durometer hardness H _A (within)	
						SBR	EPDM	NBR								
Type NS	Rubber gasket ^{a)}	Bulb part	Nominal size 75 to 450	50 ± 5	—	18	14	16	450	—	—	+5 0	20	+7 0	No abnormalities	
				Heel part	80 ± 5	—	12	12	12	280	—	—	+5 0	—	+15 0	—
			Nominal size 300 to 450	90 ± 5	—	12	12	12	280	—	—	+5 0	—	+15 0	—	
	Rubber gasket ^{b)}	Round part	Nominal size 75 to 450	55 ± 5	350	18	14	16	400	—20	+10 —30	+7 0	7	—	—	
			Nominal size 500 to 1 000	50 ± 5	400	18	14	16	400	—20	+10 —30	+7 0	7	—	—	
		Angular part	Nominal size 75 to 1 000	70 ± 5	200	18	14	16	300	—20	+10 —20	+7 0	20	—	—	
Type S Type US Type UF Type K Type U	Rubber for centring lock ring ^{c)}	Projecting part	Projecting part	50 ± 5	400	18	14	16	450	—	—	+5 0	—	—	—	
				Ring part	80 ± 5	150	12	12	12	280	—	—	+5 0	—	—	—
		Rubber for centring lock ring ^{d)}	80 ± 5	150	12	12	12	280	—	—	+5 0	—	—	—	—	
	Rubber for centring liner			50 ± 5	400	18	14	16	450	—	—	+5 0	—	—	—	
		Rubber gasket	Round part	IA•55	55 ± 5	350	18	14	16	400	—20	+10 —30	+7 0	7	—	—
			Angular part	I•70	70 ± 5	200	18	14	16	300	—20	+10 —20	+7 0	20	—	—
Type US	Rubber for squeezing lock ring		III•60	60 ± 5	300	12	—	—	300	—	—	+7 0	—	—	—	

Table JA.5 (concluded)

Joint system	Name	Symbol of classification	Durometer hardness H_A (Type A)	Tensile test			Accelerated aging test			Rate of compression set	Mass change rate by immersion test	Ozone deterioration test		
				Elongation under load of 7.0 MPa % (max.)	Tensile strength MPa (min.)		Elongation % (min.)	Change of rate of tensile strength % (within)	Change of rate of elongation % (within)				Change in durometer hardness H_A (within)	
Type PN Type PII	Rubber gasket	Bulb part	50 ± 5	—	18	14	16	450	—40	+10 —40	+5 0	20	+7 0	No abnormalities
		Heel part	80 ± 5	—	12	12	12	280	—	—	+5 0	—	+15 0	—
Type T	Rubber gasket	Bulb part	50 ± 5	—	18	14	16	450	—40	+10 —40	+5 0	20	+7 0	No abnormalities
		Heel part	80 ± 5	—	12	12	12	280	—	—	+5 0	—	+15 0	—
		Nominal size 700 to 2 000	65 ± 5	—	18	14	16	450	—40	+10 —40	+5 0	20	+7 0	No abnormalities
Flange type	Gasket	Type RF	60 ± 5	300	12	12	12	300	—25	—	—	—	—	—
		Type GF	55 ± 5	350	18	14	16	400	—20	+10 —30	+7 0	20	—	—
The mass change rate by the immersion test of NBR shall be $+^{10}_0$ %, and the rate of compression set shall not be specified.														
Notes a) Nominal sizes 75 to 450 and nominal sizes 75 to 250 are applicable to pipes and fittings, respectively.														
b) Nominal sizes 75 to 250, nominal sizes 75 to 250, nominal sizes 300 to 450 and nominal sizes 500 to 1 000 are applicable to collar, cap, fittings, and pipes and fittings, respectively.														
c) Nominal sizes 75 to 450 and nominal sizes 75 to 250 are applicable to pipes and fittings, respectively.														
d) Nominal sizes 300 to 450 is applicable to fittings.														

Table JA.6 Physical properties of Type S backup ring

Durometer hardness	Tensile test		Accelerated aging test			Rate of compression set
	Tensile strength	Elongation	Durometer hardness	Change rate of tensile strength	Change rate of elongation	
H _A	MPa	%	H _A	%	%	%
90 ± 5	14 min.	150 min.	+ 10 0	Within – 15	+ 10 – 40	45 max.

JA.4.3 Shapes and dimensions

The shapes and dimensions shall be tested according to **JA.4.6.5**, and shall be according to Annex JC.

JA.4.4 Appearance

For the appearance, when the test is carried out according to **JA.4.6.6**, the surface shall be smooth and there shall be no defects such as flaws that are detrimental to practical use, cracks, bubbles and inclusion of foreign matters.

JA.4.5 Processing

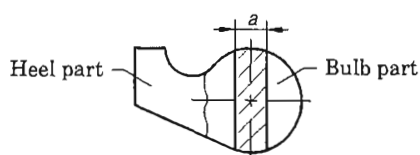
The processing shall be as follows.

- Rubber shall be manufactured by vulcanization.
- The angular part and round part of rubber gasket, the heel part and bulb part of rubber gasket and the projecting part and ring part of rubber for centring lock ring shall be well adhered at the time of vulcanization so that they are uniformly integrated.
- For the rubber gasket, as given in table JA.7, the part that affects watertightness (*a* and *b*) when pipes and fittings are jointed shall be free from the parting line of die.

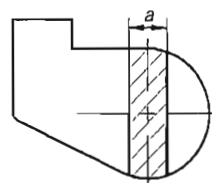
In addition, *a* and *b* indicate the minimum dimensions.

- When pipes and fittings are used for water supply facilities, it shall be checked that the coating does not have a detrimental effect on the water quality.

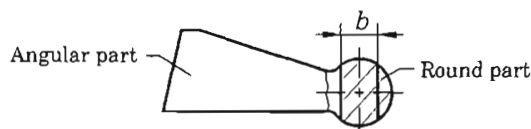
Table JA.7 Part giving effects on watertightness when jointing pipe and fitting



Type NS^{a)}, Type PN, Type PII and Type T (nominal sizes 75 to 600)



Type T (nominal sizes 700 to 2 600)



Type NS^{b)}, Type S, Type US, Type UF, Type K and Type U

Unit: mm

Nominal size	Dimension <i>a</i>			Dimension <i>b</i>
	Type NS	Type PN, Type PII	Type T	
75	6.4	—	3.2	1.5
100, 150			4.8	
200, 250			6.4	
300	8.0	6.4	8.0	2.5
350 to 450		8.0		
500 to 600		—		
700 to 900				
1 000 to 1 500				
1 600 to 2 000				
2 100 to 2 600	—	—	—	4.0

Notes ^{a)} Nominal sizes 75 to 450 are applicable to pipes and nominal sizes 75 to 250 are to fittings, respectively.

^{b)} Nominal sizes 75 to 250 are applicable to collar and cap, nominal sizes 300 to 450 are applicable to fittings, and nominal sizes 500 to 1 000 are applicable to pipes and fittings, respectively.

JA.4.6 Tests

JA.4.6.1 Physical property test

The physical property test shall be as follows.

- General conditions of tests shall be according to **JIS K 6250**.
- The sampling method shall be according to clause 8 of **JIS K 6250**.
- The hardness test shall be according to **JIS K 6253-3**.
- The tensile test shall be according to **JIS K 6251**.

- e) The aging test shall be according to Method A AA-2 of accelerated aging test of **JIS K 6257**. In this case, the test temperature shall be $70\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$, and the test time shall be $96\text{ }_{-2}^{0}\text{ h}$.

JA.4.6.2 Compression set test

The compression set test shall be carried out according to **JIS K 6262**. In this case, the test temperature shall be $70\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$, the test time shall be $24\text{ }_{-2}^{0}\text{ h}$ and the shape and dimensions of test piece shall be those of a large-sized test piece in 6.2.1 of **JIS K 6262**. When a predetermined test piece cannot be sampled from a product, the cross section of a test piece shall be the product shape as it is, and the thickness shall be $12.5\text{ mm} \pm 0.5\text{ mm}$. When a product is small, the thickness may be $10.20\text{ }_{0}^{+0.15}\text{ mm}$ or $7.20\text{ }_{0}^{+0.15}\text{ mm}$. In this case, the thickness of a spacer shall be $7.65\text{ }_{-0.02}^{+0.01}\text{ mm}$ when the thickness of test piece is 10.20 mm , and $5.40\text{ }_{-0.02}^{+0.01}\text{ mm}$ when it is 7.20 mm .

For the compression set test of the round part of Type NS (nominal sizes 75 to 250 for collar, nominal sizes 75 to 250 for cap, nominal sizes 300 to 450 for fitting and nominal sizes 500 to 1 000 for pipe and fitting), Type S, Type US, Type UF, Type K and Type U, three pieces of $25\text{ mm} \pm 2\text{ mm}$ in length cut in the circumferential direction of the round part of the sample shall be prepared, and the compression set shall be measured after the predetermined lapse of time by compressing them by 70 % in the diameter direction of the cross section of the test piece with the spacer inserted. In this case, the spacer made of steel shall be used, and the thickness shall be $30\text{ }\% \text{ }_{-0.02}^{+0.01}\text{ mm}$ of the diameter of the cross section of a test piece, which may be finely adjusted by metal foil, etc. The test temperature shall be $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and the test time shall be $168\text{ h} \pm 2\text{ h}$.

For the compression set test of the bulb part of rubber gasket of Type NS (nominal sizes 75 to 450 for pipe and nominal sizes 75 to 250 for fitting), Type PN, Type PII and Type T, a test piece of $25\text{ mm} \pm 2\text{ mm}$ in length cut in the circumferential direction of the rubber gasket shall be prepared, and the test shall be carried out with the spacer that can be compressed by 25 % $\text{ }_{-0.02}^{+0.01}\text{ mm}$ of the thickness of the test piece inserted as shown in figure JA.2. The spacer made of steel shall be used, and its thickness may be finely adjusted by metal foil, etc. In this case, the test temperature shall be $70\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$ and the test time shall be $24\text{ }_{-2}^{0}\text{ h}$.

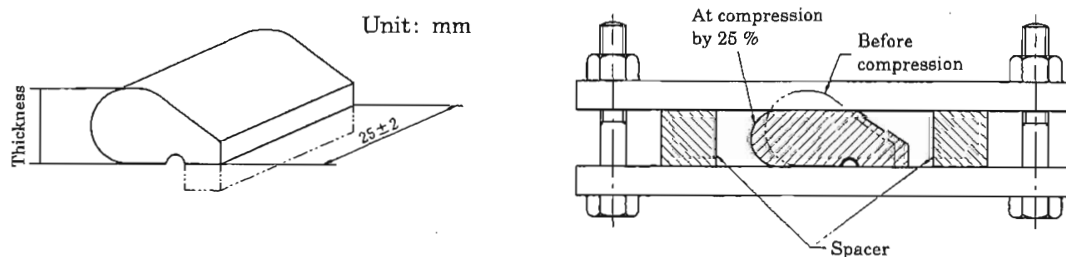


Figure JA.2 Example of test piece and test apparatus for compression set test

JA.4.6.3 Immersion test

The immersion test shall be carried out with respect to mass change in clause 5 of **JIS K 6258**.

For the immersion test, three test pieces in table JA.8 shall be prepared from the bulb part and heel part of Type NS (nominal sizes 75 to 450 for pipe and nominal sizes 75 to 250 for fitting), Type PN, Type PII and Type T rubber gaskets, respectively, and the mass change shall be measured. In this case, the liquid for immersion shall be water, the test temperature shall be $100\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$ and the test time shall be $168\text{ h} \pm 2\text{ h}$.

Table JA.8 Dimensions of test piece for immersion test

Unit: mm

Nominal size	Bulb part						Heel part					
	Type NS			Type PII			Type T			Type NS		
	Length	Width	Thick- ness	Length	Width	Thick- ness	Length	Width	Thick- ness	Length	Width	Thick- ness
75	25 ±0.5	17.4 ±0.5	2 ±0.15	—	—	—	25 ±0.5	—	—	25 ±0.5	6.4 ±0.5	2 ±0.15
100	—	19.9 ±0.5	—	—	—	—	—	—	—	—	7.9 ±0.5	—
150	—	21.9 ±0.5	—	—	—	—	—	—	—	—	—	—
200, 250	50 ±0.5	23.9 ±0.5	—	50 ±0.5	12.8 ±0.5	2 ±0.15	—	—	—	—	10.4 ±0.5	—
300	—	27.9 ±0.5	—	—	15.2 ±0.5	—	—	—	—	—	—	—
350	—	30.9 ±0.5	—	—	—	—	—	—	—	—	—	—
400, 450	—	34.9 ±0.5	—	—	—	—	—	—	—	—	—	—
500, 600	—	—	—	—	—	—	—	—	—	—	—	—
700 to 1 500	—	—	—	—	—	—	—	—	—	—	—	—
1 600 to 2 000	—	—	—	—	—	—	—	—	—	—	—	—

JA.4.6.4 Ozone deterioration test

The ozone deterioration test shall be according to clause 5 of **JIS K 6259**. In this case, the ozone concentration shall be $50 \text{ ppm} \pm 5 \text{ ppm}$, the test temperature shall be $40 \text{ }^{\circ}\text{C} \pm 2 \text{ }^{\circ}\text{C}$, the test time shall be 24 consecutive hours and the tensile strain of test piece shall be $20 \% \pm 2 \%$.

JA.4.6.5 Measurement of shapes and dimensions

The measurement of shapes for fitting shall be carried out visually or using a gauge. The measurement of dimensions shall be carried out using vernier callipers specified in **JIS B 7507** or a measuring instrument of at least equal thereto in accuracy, or the limit gauge and the like.

JA.4.6.6 Appearance test

The appearance test for fitting shall be carried out visually.

JA.4.7 Inspections

The inspections shall be as follows.

A part of inspections may be omitted upon the agreement between the purchaser and the manufacturer.

- a) For the physical properties, one product shall be arbitrarily taken from a group of products of the same nominal size, test pieces of the necessary number shall be prepared and the test is carried out, and it shall conform to **JA.4.2**. In this case, the number of test pieces in one group shall be as given in table JA.9.

When the results of the inspection fail to conform to the requirements, reinspection may be carried out by further taking the double samples from the group, and preparing the predetermined number of test pieces.

Table JA.9 Number of test pieces in one group

Nominal size	Number of test pieces in one group
75 to 300	1 000
350 to 600	500
700 to 1 500	200
1 600 to 2 600	100

- b) The shapes shall be inspected on each accessory and the dimensions shall be inspected at a frequency based on the quality management system of the manufacturer, and they shall conform to **JA.4.3**.
- c) The appearance shall be inspected on each accessory and it shall conform to **JA.4.4**.
- d) The marking shall be inspected on each accessory visually and it shall conform to **JA.4.8**.

JA.4.8 Marking

The following items shall be marked on the rubber gasket, backup ring and gasket which are conforming to all the requirements in this **JA.4** by means of embossing or indelible method, etc. in an appropriate position not interfering with use.

- a) Year of manufacture (last two digits thereof)
- b) Manufacturer's name or its identifying brand
- c) Nominal size
- d) Symbol of joint system (flange type is excluded)

The marking symbol of joint system of rubber gasket shall be as given in table JA.10.

Table JA.10 Joint system and marking symbol

Joint system	Marking symbol
Type NS	NS
Type S, Type US, Type U	U/S/US; however, U/US for nominal sizes 800 to 1 000, U/UF/S/US for nominal size 2 600
Type PN, Type PII	PN/PII
Type UF	UF; however, U/UF/S/US for nominal size 2 600
Type K	K
Type T	T

- e) Symbol of material (e.g., SBR, EPDM or NBR)

JA.5 Accessories category IV

JA.5.1 Materials

The materials shall be as follows.

- a) The raw material of Type NS backup ring and bolt for centring liner shall be polyamide resin (PA6) specified in **JIS K 6920-1**.
- b) For Type US tube, the material shall be according to clause 5 of **JIS K 6771**.

JA.5.2 Physical properties

The physical properties shall be as follows.

- a) The physical properties of Type NS backup ring and bolt for centring liner, when the test is carried out according to **JA.5.7.1 a)**, shall be as given in table JA.11.

Table JA.11 Physical properties

Test item	Physical property
Tensile yield stress MPa	50 min.
Tensile nominal strain at break %	51 min.

- b) The physical properties of Type US tube, when the test is carried out according to **JA.5.7.1 b)**, shall be according to clause **2** of **JIS K 6771**.

JA.5.3 Airtightness of connection part

For the airtightness of the connection part of Type US tube, when the test is carried out according to **JA.5.7.2**, there shall be no defects such as leakage from the connection part.

JA.5.4 Shapes and dimensions

The shapes and dimensions, when the test is carried out according to **JA.5.7.3**, shall be according to in Annex JC. Furthermore, the basic profile of a thread of the bolt for centring liner, the nominal diameter and pitch, and the basic dimensions shall be according to **JIS B 0205-1**, **JIS B 0205-3** and **JIS B 0205-4**, respectively.

JA.5.5 Appearance

The appearance shall be tested according to **JA.5.7.4**, and as follows.

- a) For the appearance of the Type NS backup ring and the bolt for centring liner, the surface shall be smooth and free from flaws, cracks and the like that are detrimental to practical use.
- b) For the appearance of Type US tube, the internal and external surfaces thereof shall be free from flaws and irregularity, and shall not contain inclusion of foreign matters.

JA.5.6 Processing

The processing shall be as follows.

- a) The Type NS backup ring and bolt for centring liner shall be processed by injection moulding. However, Type NS backup ring of 500 to 1 000 in nominal size may be processed by extrusion moulding.
- b) Type US tube shall be according to clause **5** of **JIS K 6771**.

When a tube is connected, the connection part shall be stuck fast by adhesion, fusion, etc.

- c) When pipes and fittings are used for water supply facilities, it shall be checked that the coating does not have a detrimental effect on the water quality.

JA.5.7 Tests

JA.5.7.1 Physical properties test

The physical properties test shall be as follows.

- a) The physical properties test of Type NS backup ring and bolt for centring liner shall be according to clause **5** of **JIS K 6920-2**. However, five test pieces of multi-purpose test piece Type A shall be prepared by injection moulding, and the tensile yield stress and the tensile nominal strain at break shall be measured.

- b) The tensile test, hydrostatic test, aging test, low temperature resistant test and immersion test of Type US tube shall be carried out according to clause 6 of **JIS K 6771**. The test pressure of the hydrostatic test shall be 0.3 MPa.

JA.5.7.2 Airtightness of connection part

For the airtightness test of the connection part of Type US tube, compressed air shall be filled in the tube, air pressure shall be applied in water until the test air pressure becomes 0.3 MPa, this state shall be maintained for 30 s, then leakage shall be examined.

JA.5.7.3 Measurement of shapes and dimensions

The measurement of shapes shall be carried out visually or using a gauge. The measurement of dimensions shall be carried out using vernier callipers specified in **JIS B 7507** or a measuring instrument of at least equal thereto in accuracy, or the limit gauge and the like.

JA.5.7.4 Appearance test

The appearance test shall be carried out visually.

JA.5.8 Inspections

The inspections shall be as follows.

A part of inspections may be omitted upon the agreement between the purchaser and the manufacturer.

- a) The physical properties shall be as follows.

When the results of inspection of physical properties fail to conform to the requirements, reinspection may be carried out by using the double test pieces.

- 1) The physical properties of Type NS backup ring and bolt for centring liner, when the test is carried out using the test pieces manufactured under the same condition as those of Type NS backup ring for each lot of material, shall conform to **JA.5.2 a)**.
- 2) The physical properties of Type US tube, when the test is carried out by taking samples arbitrarily from each group taking 500 pieces of products or the fraction thereof as one group and preparing the predetermined number of test pieces from the samples, shall conform to **JA.5.2 b)**.
- b) The airtightness of the connection part of Type US tube, when the inspection is carried out on each, shall conform to **JA.5.3**.
- c) The shapes shall be inspected on each accessory and the dimensions shall be inspected at a frequency based on the quality management system of the manufacturer, and they shall conform to **JA.5.4**.
- d) The appearance shall be inspected on each accessory and it shall conform to **JA.5.5**.
- e) The marking shall be inspected on each accessory visually and it shall conform to **JA.5.9**.

JA.5.9 Marking

JA.5.9.1 Type NS backup ring

For Type NS backup ring which conforms to all the requirements in this **JA.5**, the following items shall be marked on an appropriate position not interfering with use by means of embossing, etc.

- a) Year of manufacture (last two digits thereof)
- b) Manufacturer's name or its identifying brand
- c) Nominal size

JA.5.9.2 Type US tube

For Type US tube which conforms to all the requirements in this **JA.5**, the following items shall be marked on both ends legibly by indelible method.

- a) Year of manufacture (last two digits thereof)
- b) Manufacturer's name or its identifying brand
- c) Nominal size and length (e.g., 800 × 6 500)

Annex JB (normative)

Shapes and dimensions of ductile iron fittings

JB.1 Scope

In this Annex, the shapes and dimensions of fittings are specified.

JB.2 Shapes and dimensions

The shapes and dimensions of fittings shall be according to table JB.1 to table JB.106.

The mass in tables indicates the value for reference.

Table JB.1 Type NS ductile iron fitting (1)

Table JB.2 Type NS ductile iron fitting (2)

Table JB.3 Type NS ductile iron fitting (3)

Table JB.4 Type NS ductile iron fitting (4)

Table JB.5 Type S ductile iron fitting

Table JB.6 Type US ductile iron fitting

Table JB.7 Type PN ductile iron fitting (for socket and spigot connecting piece)

Table JB.8 Type PII ductile iron fitting (for socket and spigot connecting piece)

Table JB.9 Type UF ductile iron fitting

Table JB.10 Type K ductile iron fitting

Table JB.11 Type T ductile iron fitting

Table JB.12 Type U ductile iron fitting

Table JB.13 Flange type ductile iron fitting (1) 7.5K

Table JB.14 Flange type ductile iron fitting (2) 10K

Table JB.15 Flange type ductile iron fitting (3) 16K

Table JB.16 Flange type ductile iron fitting (4) 20K

Table JB.17 Type NS socket and spigot cross with socket branches

Table JB.18 Type NS socket and spigot tee with socket branch

Table JB.19 Type NS reducer (socket and spigot reducer)

Table JB.20 Type NS reducer (spigot and socket reducer)

Table JB.21 Type NS double-socket 45° bend

Table JB.22 Type NS double-socket 22½° bend

Table JB.23 Type NS socket and spigot 90° bend

Table JB.24 Type NS socket and spigot 45° bend

Table JB.25 Type NS socket and spigot 22½° bend

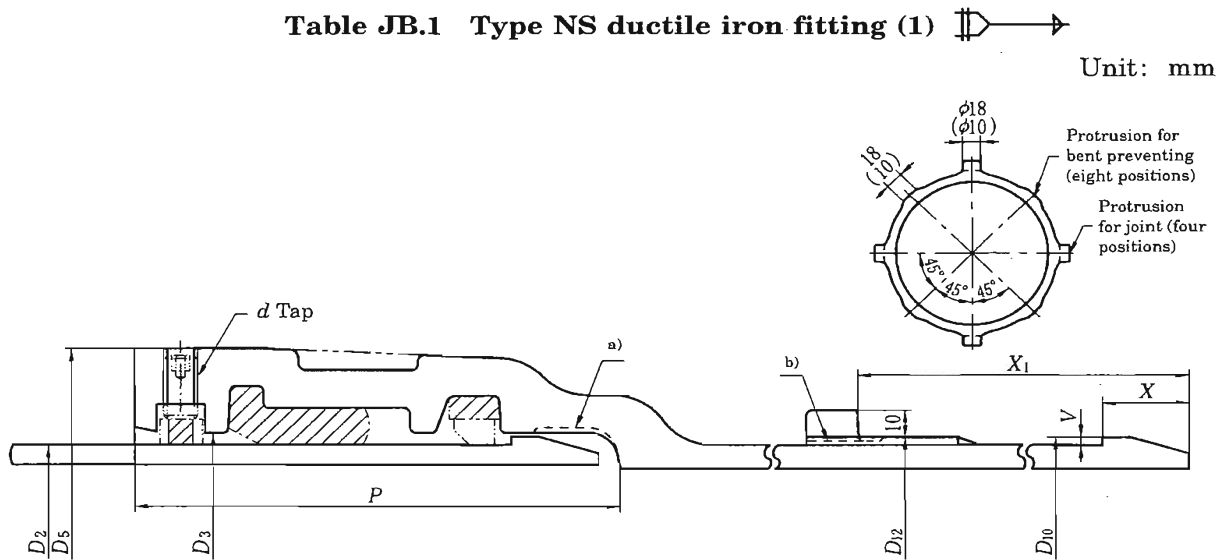
Table JB.26	Type NS socket and spigot $11\frac{1}{4}^{\circ}$ bend
Table JB.27	Type NS socket and spigot $5\frac{5}{8}^{\circ}$ bend
Table JB.28	Type NS sluice valve sub pipe A1
Table JB.29	Type NS sluice valve sub pipe A2
Table JB.30	Type NS socket and spigot tee with flange (for air valve/for hydrant)
Table JB.31	Type NS tee with flange for shallow embedding (for air valve/for hydrant)
Table JB.32	Type NS vortex type tee with flange (for hydrant)
Table JB.33	Type NS drainage tee
Table JB.34	Type NS collar
Table JB.35	Type NS connecting piece (connecting piece No. 1)
Table JB.36	Type NS connecting piece (connecting piece No. 2)
Table JB.37	Type NS cap
Table JB.38	Type NS stopper
Table JB.39	Type S collar
Table JB.40	Type US collar
Table JB.41	Type PN socket and spigot connecting piece (PN-NS)
Table JB.42	Type PN socket and spigot connecting piece (PN-S)
Table JB.43	Type PN socket and spigot connecting piece (PN-UF)
Table JB.44	Type PN socket and spigot connecting piece (PN-K)
Table JB.45	Type PII socket and spigot connecting piece (PII-NS)
Table JB.46	Type PII socket and spigot connecting piece (PII-S)
Table JB.47	Type PII socket and spigot connecting piece (PII-UF)
Table JB.48	Type PII socket and spigot connecting piece (PII-K)
Table JB.49	Type UF socket and spigot cross with socket branches
Table JB.50	Type UF socket and spigot tee with socket branch
Table JB.51	Type UF reducer (socket and spigot reducer/spigot and socket reducer)
Table JB.52	Type UF double-socket bend
Table JB.53	Type UF socket and spigot bend
Table JB.54	Type UF sluice valve sub pipe A1
Table JB.55	Type UF sluice valve sub pipe A2
Table JB.56	Type UF socket and spigot tee with flange (for air valve/for hydrant/for manhole)
Table JB.57	Type UF drainage tee

Table JB.58	Type UF connecting piece (connecting piece No. 1/connecting piece No. 2)
Table JB.59	Type K socket and spigot cross with socket branches
Table JB.60	Type K socket and spigot tee with socket branch
Table JB.61	Type K reducer (socket and spigot reducer/spigot and socket reducer)
Table JB.62	Type K socket and spigot bend
Table JB.63	Type K sluice valve sub pipe A1
Table JB.64	Type K sluice valve sub pipe A2
Table JB.65	Type K socket and spigot tee with flange (for air valve/for hydrant/for manhole)
Table JB.66	Type K tee with flange for shallow embedding (for air valve/for hydrant)
Table JB.67	Type K vortex type tee with flange (for hydrant)
Table JB.68	Type K drainage tee
Table JB.69	Type K collar
Table JB.70	Type K connecting piece (connecting piece No. 1/connecting piece No. 2)
Table JB.71	Type K stopper
Table JB.72	Type T socket and spigot cross with socket branches
Table JB.73	Type T socket and spigot tee with socket branches
Table JB.74	Type T reducer (socket and spigot reducer/spigot and socket reducer)
Table JB.75	Type T socket and spigot bend
Table JB.76	Type T socket and spigot tee with flange (for air valve/for hydrant)
Table JB.77	Type T tee with flange for shallow embedding (for air valve/for hydrant)
Table JB.78	Type T vortex type tee with flange (for hydrant)
Table JB.79	Type T drainage tee
Table JB.80	Type T collar
Table JB.81	Type T connecting piece (connecting piece No. 1/connecting piece No. 2)
Table JB.82	Type T stopper
Table JB.83	Type U socket and spigot cross with socket branches
Table JB.84	Type U socket and spigot tee with socket branches
Table JB.85	Type U reducer (socket and spigot reducer/spigot and socket reducer)

Table JB.86	Type U socket and spigot bend
Table JB.87	Type U sluice valve sub pipe A1
Table JB.88	Type U sluice valve sub pipe A2
Table JB.89	Type U socket and spigot tee with flange (for air valve/for hydrant/for manhole)
Table JB.90	Type U drainage tee
Table JB.91	Type U collar
Table JB.92	Type U connecting piece (connecting piece No. 1/connecting piece No. 2)
Table JB.93	Double flanged pipe
Table JB.94	Flange and spigot pipe
Table JB.95	All flanged tee
Table JB.96	Flange and spigot tee with flange branch
Table JB.97	Double flanged reducer
Table JB.98	Double flanged 90° bend
Table JB.99	Double flanged 45° bend
Table JB.100	Double flanged type bypass bend for sluice valve sub pipe B1 (1) (7.5K/10K)
Table JB.101	Double flanged type bypass bend for sluice valve sub pipe B1 (2) (16K/20K)
Table JB.102	Double flanged connecting piece
Table JB.103	Blank flange (Model 1)
Table JB.104	Blank flange (Model 2)
Table JB.105	Connecting piece for manhole
Table JB.106	Flanged bellmouth

Table JB.1 Type NS ductile iron fitting (1)

Unit: mm



NOTE : The dimension in parentheses in this diagram indicates the case of 75 in nominal size.

Notes a) The shape of internal surface of socket may be that indicated with broken lines.

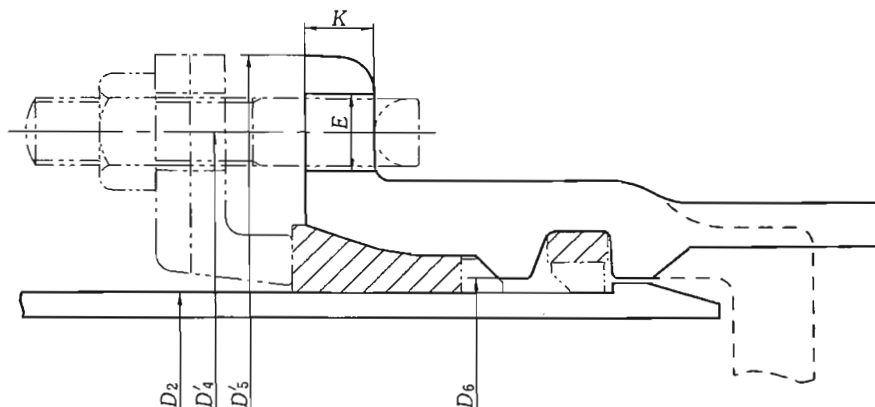
b) The shape of protrusion for bent preventing of spigot part may be that indicated with broken lines.

Nominal size	External diameter	Dimension of each part										Mass for reference (kg)		Nominal size
		D_3	D_5	D_{10}	D_{12}	P	V	X	X_1	Hole for tap		Protrusion on socket	Protrusion on spigot	
D	D_2									d	Number			D
75	93.0	100.8	153	98.0	98.0	154	2.5	30.4	150	M10	4	8.15	0.172	75
100	118.0	126.8	184	124.0	124.0	164	3.0	30.4	160	M12	6	11.0	0.398	100
150	169.0	177.8	240	175.0	175.0	170	3.0	30.4	166	M12	6	16.3	0.430	150
200	220.0	229.0	294	226.0	226.0	178	3.0	30.4	174	M16	8	21.3	0.462	200
250	271.6	280.6	346	277.6	277.6	178	3.0	30.4	174	M16	8	25.7	0.494	250

Table JB.2 Type NS ductile iron fitting (2) 

Unit: mm

Nominal size 75 to 250 for collar and cap

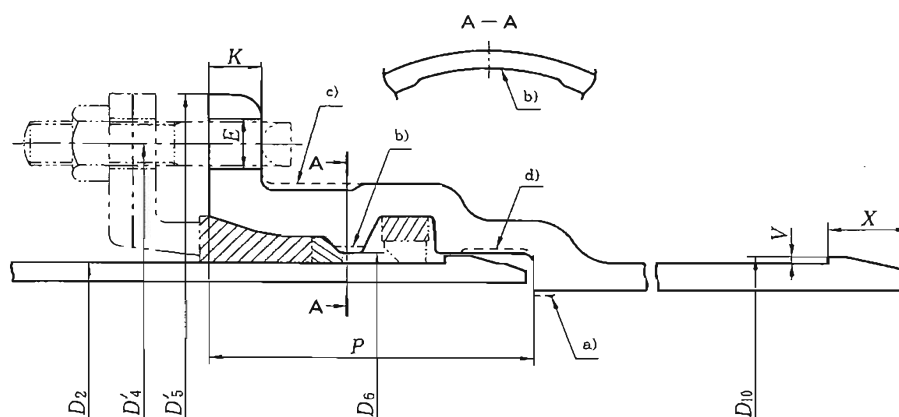


NOTE : The shape indicated with broken lines indicates the case of cap.

Nominal size	External diameter	Dimension of each part					Number of bolts	Nominal size
D	D_2	D'_4	D'_5	D_6	K	E		D
75	93.0	186	224	100.8	18	19	4	75
100	118.0	209	255	126.8	19	23	4	100
150	169.0	264	310	177.8	20	23	6	150
200	220.0	318	364	229.0	21	23	6	200
250	271.6	370	416	280.6	22	23	8	250

Table JB.3 Type NS ductile iron fitting (3) 

Unit: mm

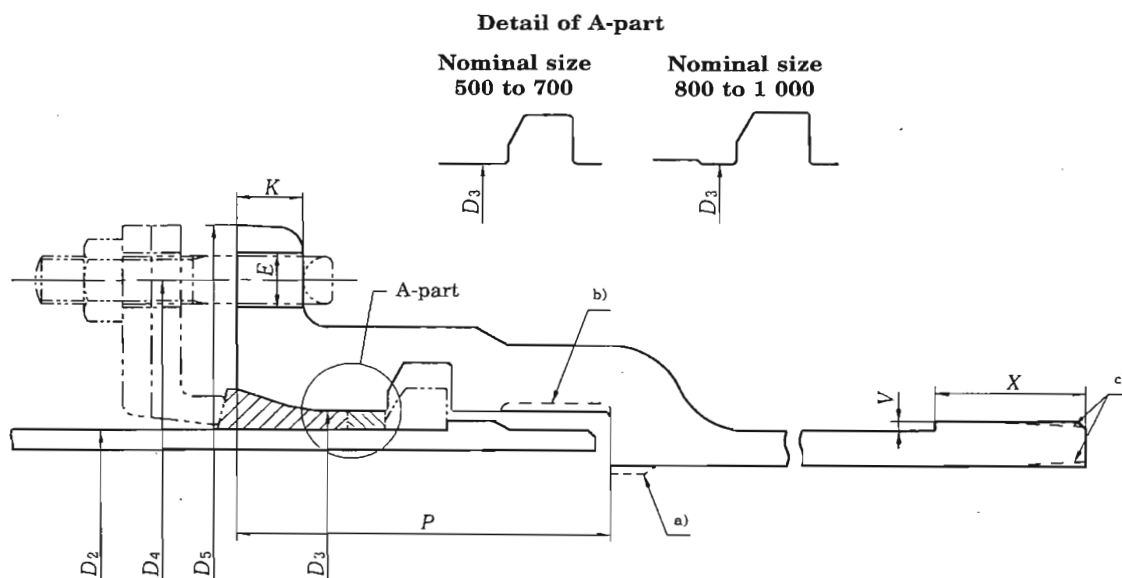


- Notes
- a) The shape of internal surface of fitting may be that indicated with broken lines. In this case, the height of the protrusion indicated with broken lines shall be up to about 5 mm.
 - b) The notch of the dimension part D_6 shall be one on the circumference.
 - c) The shape of external surface of socket may be that indicated with broken lines.
 - d) The shape of internal surface of socket may be that indicated with broken lines.

Nominal size	External diameter	Dimension of each part									Number of bolts	Mass for reference (kg)		Nominal size
		D'_4	D'_5	$D_6^{b)}$	D_{10}	P	K	E	V	X		Protrusion on socket	Protrusion on spigot	
300	322.8	431	477	331.8	328.8	141	23	23	3	35.4	8	33.5	0.167	300
350	374.0	482	528	383.6	380.0	141	24	23	3	35.4	10	38.5	0.193	350
400	425.6	536	582	435.2	431.6	143	25	23	3	35.4	12	46.2	0.219	400
450	476.8	587	633	486.4	482.8	143	26	23	3	35.4	12	51.7	0.245	450

Table JB.4 Type NS ductile iron fitting (4) 

Unit: mm

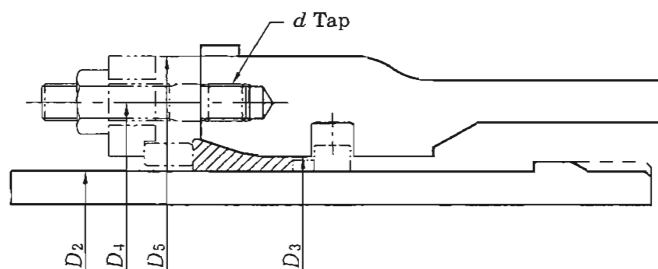


- Notes
- a) The shape of internal surface of fitting may be that indicated with broken lines. In this case, the height of the protrusion indicated with broken lines shall be up to about 5 mm.
 - b) The shape of internal surface of socket may be that indicated with broken lines.
 - c) The shape of spigot may be that indicated with broken lines. In this case, the thickness of pipe end part shall be that of wall thickness of fitting or more.

Nominal size	External diameter	Dimension of each part								Number of bolts	Mass for reference (kg)		Nominal size
		D_3	D_4	D_5	E	P	K	V	X		Protrusion on socket	Protrusion on spigot	
500	528.0	544.0	654	700	23	151	27	4	60	14	86.2	2.87	500
600	630.8	646.8	758	804	23	151	28	4	60	14	105	3.42	600
700	733.0	753.0	876	930	27	187	29	6	80	16	157	7.97	700
800	836.0	856.0	985	1 039	27	195	30	6	80	20	191	9.08	800
900	939.0	959.0	1 098	1 164	33	195	31	6	80	20	229	10.2	900
1 000	1 041.0	1 061.0	1 207	1 273	33	202	32	6	80	20	270	11.2	1 000

Table JB.5 Type S ductile iron fitting 

Unit: mm



NOTE : The spigot is that of a pipe.

Nominal size	External diameter	Dimension of each part					Nominal size
D	D_2	D_3	D_4	D_5	Hole for tap		D
					d	Number	
1 100	1 144	1 164	1 246	1 326	M30	24	1 100
1 200	1 246	1 266	1 348	1 432	M30	28	1 200
1 350	1 400	1 420	1 502	1 594	M30	28	1 350
1 500	1 554	1 574	1 656	1 764	M30	28	1 500
1 600	1 650	1 674	1 758	1 876	M30	30	1 600
1 650	1 701	1 725	1 809	1 931	M30	30	1 650
1 800	1 848	1 872	1 956	2 086	M30	34	1 800
2 000	2 061	2 085	2 169	2 307	M30	36	2 000
2 100	2 164	2 188	2 272	2 414	M30	38	2 100
2 200	2 280	2 304	2 388	2 534	M30	40	2 200
2 400	2 458	2 482	2 566	2 724	M30	44	2 400
2 600	2 684	2 712	2 802	2 988	M30	48	2 600

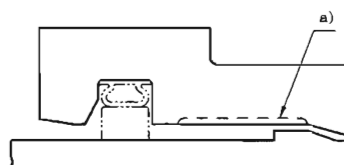
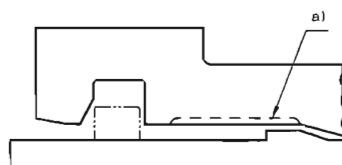
Table JB.6 Type US ductile iron fitting 

Unit: mm

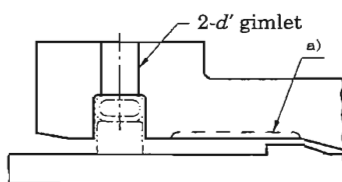
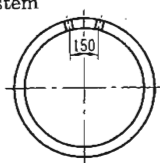
LS system

Nominal size 800 to 1 000

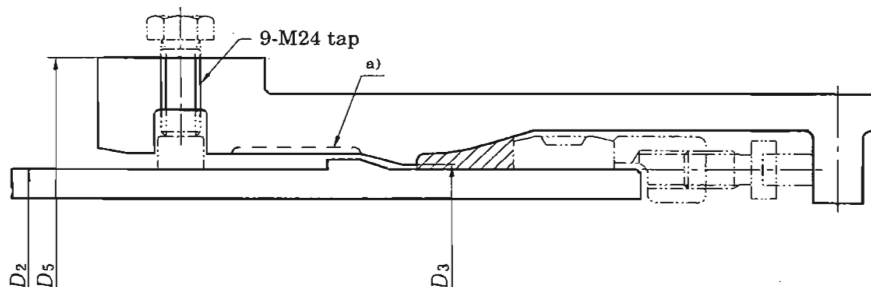
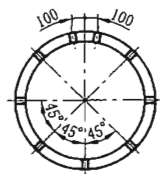
Nominal size 1 100 to 2 600



VT system



SB system



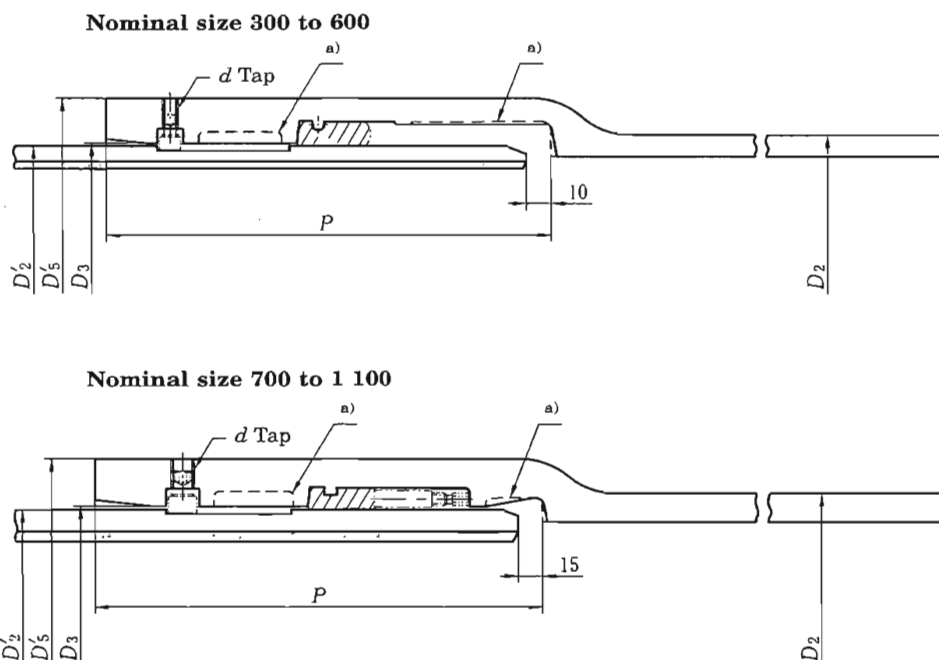
NOTE : The spigot is that of a pipe.

Note ^{a)} The shape of internal surface of socket may be that indicated with broken lines.

Nominal size	External diameter	Dimension of each part			Nominal size
D	D_2	D_3	D_5	d'	D
800	836	841	973	25	800
900	939	944	1 077	25	900
1 000	1 041	1 047	1 183	28	1 000
1 100	1 144	1 150	1 288	28	1 100
1 200	1 246	1 252	1 390	28	1 200
1 350	1 400	1 406	1 546	28	1 350
1 500	1 554	1 560	1 705	30	1 500
1 600	1 650	1 656	1 805	30	1 600
1 650	1 701	1 707	1 856	30	1 650
1 800	1 848	1 854	2 003	30	1 800
2 000	2 061	2 067	2 220	30	2 000
2 100	2 164	2 170	2 326	30	2 100
2 200	2 280	2 286	2 445	30	2 200
2 400	2 458	2 464	2 630	30	2 400
2 600	2 684	2 690	2 874	30	2 600

Table JB.7 Type PN ductile iron fitting (for socket and spigot connecting piece)

Unit: mm



Note ^{a)} The shape of internal surface of socket may be that indicated with broken lines.

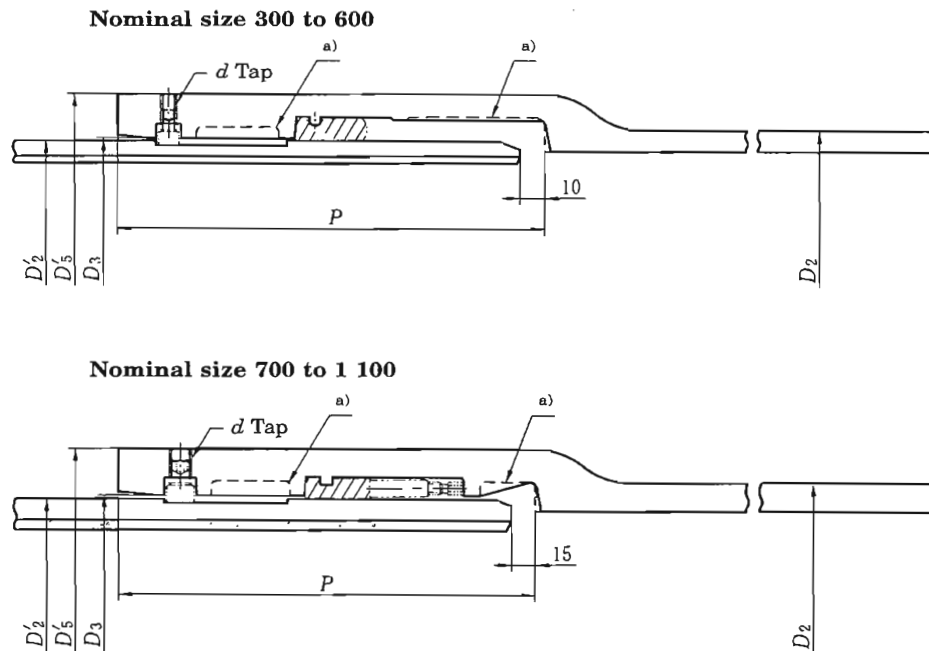
Nominal size	External diameter		Dimension of each part					Mass for reference (kg)	Nominal size
D	D'_2	D_2	D_3	D'_5	P	Hole for tap		Protrusion on socket	D
						$d^b)$	Number		
300	318.5	322.8	321.5	367.1	230	M14	4	33.9	300
350	355.6	374.0	359.2	415.6	245	M14	4	45.0	350
400	406.4	425.6	410.0	468.4	245	M14	4	53.8	400
500	508.0	528.0	511.6	572.0	245	M14	4	69.8	500
600	609.6	630.8	613.2	675.6	253	M14	4	90.0	600
700	711.2	733.0	715.2	773.2	253	M18	6	105	700
800	812.8	836.0	816.8	876.8	265	M18	6	130	800
900	914.4	939.0	918.4	980.4	275	M18	6	157	900
1 000	1 016.0	1 041.0	1 020.0	1 084.0	275	M18	8	181	1 000
1 100	1 117.6	1 144.0	1 121.6	1 187.6	288	M18	8	213	1 100

NOTE : D'_2 and D_2 indicate the external diameter of pipe and that of fitting, respectively.

Note ^{b)} The hole for tap shall be according to M14 × 1.5 or M18 × 2.0 of **JIS B 0205-1, JIS B 0205-3 and JIS B 0205-4.**

Table JB.8 Type PII ductile iron fitting (for socket and spigot connecting piece)

Unit: mm

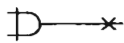


Note a) The shape of internal surface of socket may be that indicated with broken lines.

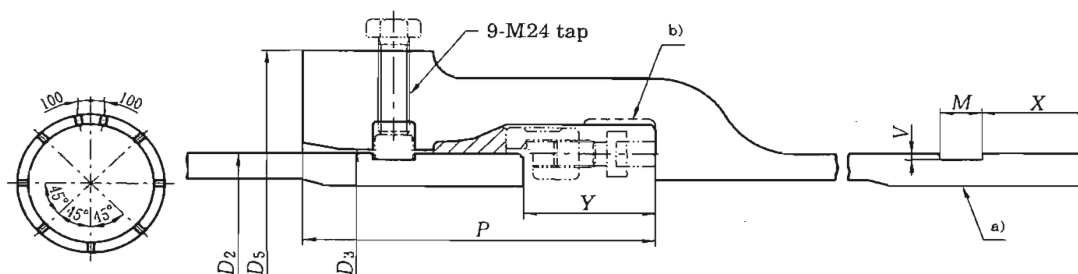
Nominal size <i>D</i>	External diameter		Dimension of each part					Mass for reference (kg)	Nominal size <i>D</i>
	<i>D'</i> ₂	<i>D</i> ₂	<i>D</i> ₃	<i>D'</i> ₅	<i>P</i>	Hole for tap		Protrusion on socket	
						<i>d</i> ^{b)}	Number		
300	318.5	322.8	321.5	367.1	220	M14	4	34.3	300
350	355.6	374.0	359.2	415.6	235	M14	4	45.3	350
400	406.4	425.6	410.0	468.4	235	M14	4	53.7	400
500	508.0	528.0	511.6	572.0	235	M14	4	69.1	500
600	609.6	630.8	613.2	675.6	240	M14	4	88.4	600
700	711.2	733.0	715.2	773.2	240	M14	6	104	700
800	812.8	836.0	816.8	876.8	250	M18	6	127	800
900	914.4	939.0	918.4	980.4	260	M18	6	155	900
1 000	1 016.0	1 041.0	1 020.0	1 084.0	260	M18	8	178	1 000
1 100	1 117.6	1 144.0	1 121.6	1 187.6	270	M18	8	209	1 100

NOTE : *D'*₂ and *D*₂ indicate the external diameter of pipe and that of fitting, respectively.

Note ^{b)} The hole for tap shall be according to M14 × 1.5 or M18 × 2.0 of JIS B 0205-1, JIS B 0205-3 and JIS B 0205-4.

Table JB.9 Type UF ductile iron fitting 

Unit: mm



- Notes a) The thickness of the grooved part of the spigot part shall satisfy the wall thickness of fitting and its tolerance.
b) The shape of internal surface of socket may be that indicated with broken lines.

Nominal size	External diameter	Dimension of each part							Mass for reference (kg)		Nominal size
		D_3	D_5	M	P	V	Y	X	Protru- sion on socket	Protru- sion on spigot	
800	836	841	983	27	265	4	100	84	310	10.3	800
900	939	944	1 090	27	265	4	100	84	359	11.6	900
1 000	1 041	1 047	1 201	32	270	5	100	84	425	16.1	1 000
1 100	1 144	1 150	1 312	32	270	5	100	84	500	17.8	1 100
1 200	1 246	1 252	1 418	32	270	5	100	84	557	19.4	1 200
1 350	1 400	1 406	1 580	32	280	5	100	94	695	23.4	1 350
1 500	1 554	1 560	1 750	37	285	6	100	94	850	31.0	1 500
1 600	1 650	1 656	1 858	37	295	6	110	94	974	33.0	1 600
1 650	1 701	1 707	1 913	37	295	6	110	94	1 026	34.0	1 650
1 800	1 848	1 854	2 068	37	295	6	110	94	1 174	37.0	1 800
2 000	2 061	2 067	2 289	42	300	7	110	94	1 422	48.2	2 000
2 100	2 164	2 170	2 396	42	305	7	110	97	1 549	52.3	2 100
2 200	2 280	2 286	2 516	42	310	7	110	101	1 709	56.9	2 200
2 400	2 458	2 464	2 706	42	320	7	110	108	2 033	65.2	2 400
2 600	2 684	2 690	2 966	42	395	7	130	159	2 912	102	2 600