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Ductile iron pipes

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan 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 5526:1998** is replaced with this Standard.

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Ductile iron pipes

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 JB.

1 Scope

This Standard specifies the ductile iron pipes (hereafter referred to as “pipes”) 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 A 5314 *Mortar lining for ductile iron pipes*

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 7507 *Vernier, dial and digital callipers*

JIS G 5527 *Ductile iron fittings*

JIS G 5528 *Epoxy-powder coating for interior of ductile iron pipes and fittings*

JIS Z 2241 *Metallic materials—Tensile testing—Method of test at room temperature*

JIS Z 2243 *Brinell hardness test—Test method*

3 Terms and definitions

For the purpose of this Standard, the following terms and definitions apply.

3.1 ductile iron

a type of cast iron used for pipes, fittings and accessories in which graphite is practically present in spheroidal form

3.2 pipe

pipe-shaped casting manufactured by the centrifugal casting, which has a socket and a spigot at both ends

3.3 accessory

component used to joint a pipe or a fitting

3.4 spigot

male end of pipe to joint a pipe or fitting

3.5 socket

female end of pipe for a spigot to joint a pipe or fitting

3.6 nominal size

designation of size shown by integer

3.7 extensible restrained joint

joint with a separation preventing mechanism, which is extensible and flexible

3.8 restrained joint

joint with a separation preventing mechanism, which is not extensible nor flexible

3.9 flexible joint

joint without a separation preventing mechanism, which is extensible and flexible

3.10 standardized length

length of pipe excluding the depth of spigot insertion for jointing a pipe (see dimension L in Annex JA)

3.11 batch test

test carried out for determination of tensile strength and elongation using a test piece processed from a sample taken from each constant numerical quantity of products

3.12 process control test

test for grasping the material strength from the test result obtained by carrying out the non-destructive test (metallographic test etc.) that is in correlation with the tensile strength and elongation continuously in the manufacturing process for the determination of tensile strength and elongation

4 Grade of wall thickness of pipe and symbol thereof

The grades of wall thickness of pipe and symbols thereof shall be as given in table 1.

Table 1 Grades of wall thickness of pipe and symbols thereof

Grade of wall thickness of pipe	Symbol of wall thickness of pipe
Grade 1 pipe	D1
Grade 2 pipe	D2
Grade 3 pipe	D3
Grade 4 pipe	D4
Grade S pipe	DS
Grade PF pipe	DPF

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

The classification of joint, joint system and symbol thereof, and nominal size range of pipes shall be as given in table 2.

The accessories used to joint a pipe shall be according to Annex JA of **JIS G 5527**.

Table 2 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 NS	NS	75 to 1 000
	Type S	S	1 100 to 2 600
	Type US	US	800 to 2 600
	Type PN	PN	300 to 1 500
	Type PII	PII	300 to 1 350
Restrained joint	Type UF	UF	800 to 2 600
Flexible joint	Type K	K	75 to 2 600
	Type T	T	75 to 2 000
	Type U	U	800 to 2 600

6 Manufacturing method

Pipes shall be centrifugally casted 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.

Heat treatment such as annealing shall be carried out on pipes, if required. Slight hollows generated on the internal and external surfaces of pipe at the time of manufacture may be filled by weld or with resin filler.

7 Mechanical properties

7.1 Tensile strength and elongation

The tensile strength and elongation of pipes shall be tested according to either of the following, which shall be as given in table 3.

- 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 3 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 3 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 pipes shall be such that they can be cut, tapped, drilled and 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 pipes shall be tested according to 12.3 and there shall be no water leakage.

9 Shapes, dimensions and tolerances

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

- a) For the tolerances of wall thickness of pipe (T), the upper tolerance shall not be specified but the lower tolerance shall be -10 %. When the pipe wall thickness is 10 mm or under, however, the lower tolerance shall be -1.0 mm.
The significant figure of lower tolerance shall be rounded off to one decimal, and the figures under the second decimal place shall be truncated.
- b) For the tolerances on the standardized length (L), the upper tolerance shall be +70 mm but the lower tolerance shall be -30 mm. For the pipes from which a sample has been cut off, however, the length may be up to about 100 mm shorter than the specified length.
- c) The tolerances on respective dimensions of socket part and spigot part shall be as given in table 4 to table 10.

Table 4 Tolerances on respective dimensions of Type NS

Unit: mm

Nominal size	D_2	D_3	D_4	D_5	D_{10}	E	P	K	V
75 to 150	± 1.5	± 1.0	—	+ 5.0	+ 1.5 — not specified	—	± 4.0	—	+ not specified — 0.5
200, 250		± 1.3		— 1.5					
300	+ 1.5	+ 4.0							
350 to 450	-2.0			+ 1.8 — 1.6					
500, 600	± 2.0	+ 1.5 — 1.0	± 1.5	+ not specified — 2.0	—	+ 1.5 — 1.0	± 5.0	+ 4.0 — 3.0	+ 1.5 — 1.0
700 to 900	+ 2.0 — 3.0	+ 2.5 — 1.0						+ 5.0 — 3.5	
1 000		+ 3.0 — 1.0		+ not specified — 3.0				+ 6.0 — 3.5	
NOTE : Symbols of respective dimensions shall be as given in table JA.1 and table JA.2.									

Table 5 Tolerances on respective dimensions of Type S

Unit: mm

Nominal size	D_2	D_3	D_4	D_5	P	V'
1 000 to 1 500	+ 2.0	+ 2.0	± 1.5	+ not specified	± 5.0	+ 1.5
1 600 to 2 600	— 4.0	— 1.0	± 2.0	— 3.0		— 1.0
NOTE : Symbols of respective dimensions shall be as given in table JA.3.						

Table 6 Tolerances on respective dimensions of Type US

Unit: mm

Nominal size	D_2	D_3	D_5	P	V'
800, 900	+ 2.0 − 4.0	+ 1.5 − 1.0	+ not specified − 2.0	± 3.0	+ 1.5 − 1.0
1 000 to 2 600		+ 2.0 − 1.0	+ not specified − 3.0		
NOTE : Symbols of respective dimensions shall be as given in table JA.4.					

Table 7 Tolerances on respective dimensions of Type PN and Type PII

Unit: mm

Nominal size	D'_2	D_3	D_5		P	V
			Type PN	Type PII		
300	+ 1.5 − 2.0	± 1.3	+ 4.0 0	+ 3.0 − 2.0	± 4.0	± 0.5
350 to 600		± 1.8	+ 6.0 0			
700 to 900	+ 1.5 − 3.0	+ 2.0 − 0.5	+ 8.0 0		± 5.0	+ 1.0 0
1 000, 1 100		+ 2.5				
1 200 to 1 500		− 0.5	+ 10.0 0			
NOTE : Symbols of respective dimensions shall be as given in table JA.5 and table JA.6.						

Table 8 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 JA.7 and table JA.10.					

Table 9 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	$+ \text{ not specified}$ $- 2.0$	± 4.0	$+ 3.0$ $- 2.5$
300 to 600	$+ 2.0$ $- 3.0$	$+ 3.0$ $- 1.5$				± 5.0
700 to 900						
1 000 to 1 500	$+ 2.0$ $- 4.0$	$+ 4.0$ $- 1.0$		$+ \text{ not specified}$ $- 3.0$	± 5.0	$+ 6.0$ $- 3.5$
1 600 to 2 600	$+ 4.0$ $- 5.0$	$+ 4.0$ 0	± 2.0			$+ 7.0$ $- 3.5$
NOTE : Symbols of respective dimensions shall be as given in table JA.8.						

Table 10 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	
300	+ 1.5 – 2.0		+ not specified – 1.5	
350 to 600			+ 1.8 – 1.6	
700 to 900	+ 1.5 – 3.0	+ 3.0 – 1.0	+ not specified – 3.0	± 5.0
1 000 to 1 200		+ 3.5 – 1.0	+ not specified – 4.0	
1 350 to 1 600		+ 4.5 – 1.0		
1 650 to 2 000		+ 2.0 – 4.0	+ 2.5 – 0.5	
NOTE: Symbols of respective dimensions shall be as given in table JA.9.				

10 Appearance

The appearance of pipes shall be tested according to **12.5** and shall be as follows.

- a) The pipe shall be practically straight.

In case of doubt, the maximum deviation from the straight axis shall be measured. In this case, its maximum deviation shall be 0.125 % or under of the standardized length of pipe.

- b) The inner and outer surfaces of pipe shall be free from blowholes or other defects that are detrimental to practical use.

11 Coating and lining

The coating and lining of pipes shall be as follows.

- a) The coating material shall not contain harmful components for practical use, be insoluble in water after drying and show no irregularities by heat and cold.
- b) When the inner surface of pipe is coated by epoxy-powder, it shall be carried out according to **JIS G 5528**, and, if a mortar lining treatment is applied, it shall be carried out according to **JIS A 5314**. However, upon the agreement between the purchaser and the manufacturer, other coating or lining may be employed.
- c) The outer surface of pipe, 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 or lining may be employed. Zinc primer may be applied as an undercoating for the outer surface of pipe.
- d) When pipes are used for water supply facilities, it shall be checked that coating and lining do not have a detrimental effect on the water quality.

12 Tests

12.1 Tensile test

12.1.1 Sample

The sample for tensile test shall be a piece of pipe cut-off from the pipe at right angles or in parallel from the spigot end part of this pipe.

12.1.2 Test method

For the tensile test, one test piece of table 11, which is conforming to No. 14A test piece specified in **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. In case of doubt, the test piece taken in parallel to the axis of pipe shall be employed. The dimensions of test piece shall be according to those in Method A or Method B column given in table 11 at the manufacturer's option, and shall be as follows.

- For Method A, a test piece shall be processed within the range of tolerance of diameter in table 11, and the diameter shall be measured before the test with accuracy of ± 0.01 mm. This value shall be used to calculate the cross-sectional area and the tensile strength.
- For Method B, a test piece shall be processed within the range of tolerance of diameter in table 11, and the nominal area shall be used to calculate the tensile strength.

Table 11 Dimensions of test piece

Wall thickness of pipe mm	Method A		Method B		
	Diameter mm	Tolerance on diameter %	Nominal area mm ²	Diameter mm	Tolerance on diameter mm
6 or over to and excl. 8	3.5	± 10	10.0	3.57	± 0.02
8 or over to and excl. 12	5.0		20.0	5.05	± 0.02
12 or over	6.0		30.0	6.18	± 0.03

12.2 Hardness test

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

12.3 Water pressure tightness test

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

A water pressure tightness test shall be carried out on pipes before being coated, as a rule. Water pressure shall be applied to a pipe up to the water pressure for test of table 12 and kept for the holding time, and whether leakage occurs or not shall be examined. In this case, the time of water pressure tightness test including this holding time shall be 15 s or over.

Zinc primer for the outer surface of pipe may be applied before the test.

Table 12 Water pressure for test and holding time

Nominal size	Water pressure MPa	Holding time s
75 to 250	6.0	5 min.
300		10 min.
350 to 600	5.0	
700 to 1 000	4.0	
1 100 to 1 500	3.0	
1 600 to 2 600	2.5	

12.4 Measurement for shapes and dimensions

The measurement of shapes for pipe 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 on pipe shall be carried out visually. The maximum deviation shall be measured by rotating on two stages apart at least two thirds of the standardized length of pipe, or rolling on a roller.

13 Inspections

13.1 General

The inspections on pipe 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 taking a sample according to the range of batch and the maximum batch size of table 13 manufactured successively.

Table 13 Batch range and maximum batch size

Range of batch		Maximum batch size	
		Batch test	Process control test
Nominal size	75 to 300	200	1 200
	350 to 600	100	600
	700 to 1 000	50	300
	1 100 to 2 600	25	150