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Carbon steel pipes for ordinary piping

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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 Iron and Steel Federation (JISF) 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 3452**:2016 is replaced with this Standard.

However, **JIS G 3452**:2016 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 June 19, 2020.

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.

Carbon steel pipes for ordinary piping

1 Scope

This Japanese Industrial Standard specifies the requirements for carbon steel pipes (hereafter referred to as pipes) used for the conveyance of steam, water (except public water supply service), oil, gas, air, etc. at comparatively low working pressures. This Standard is applicable to pipes with an outside diameter of 10.5 mm to 508.0 mm.

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 0203 *Taper pipe threads*

JIS B 0253 *Gauges for taper pipe threads*

JIS B 2301 *Screwed type malleable cast iron pipe fittings*

JIS B 2302 *Screwed type steel pipe fittings*

JIS G 0320 *Standard test method for heat analysis of steel products*

JIS G 0404 *Steel and steel products—General technical delivery requirements*

JIS G 0415 *Steel and steel products—Inspection documents*

JIS G 0582 *Automated ultrasonic examination of steel pipes and tubes*

JIS G 0583 *Automated eddy current examination of steel pipes and tubes*

JIS H 0401 *Test methods for hot dip galvanized coatings*

JIS H 2107 *Zinc ingots*

JIS H 8641 *Hot dip galvanized coatings*

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

3 Symbol of grade

This Standard covers the following one grade of pipe, which is designated by the symbol as shown in Table 1.

Table 1 Symbol of grade, symbols of manufacturing process and classification of zinc-coating

Symbol of grade	Symbol of manufacturing process			Classification of zinc-coating
	Pipe manufacturing process	Finishing method	Marking	
SGP	Electric resistance welded: E Butt welded: B	Hot-finished: H Cold-finished: C As electric resistance welded: G	As given in **13 b**).	Black pipes: pipes not given zinc-coating White pipes: pipes given zinc-coating
For identification of white pipe in the drawing, document, etc., where it is necessary, the symbol "—ZN" shall be attached after the symbol of grade. This does not apply to the marking on the product.				

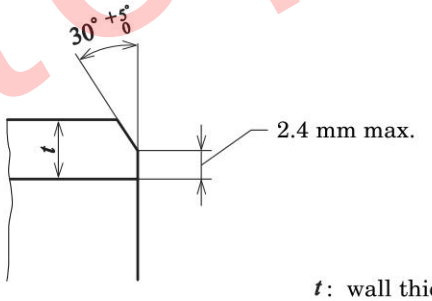
4 Manufacturing process

The manufacturing process shall be as follows.

a) The pipes shall be manufactured by a suitable combination of pipe manufacturing process and finishing method selected from Table 1. The symbol of manufacturing process shall be as specified in Table 1.

b) The pipes shall normally be delivered as manufactured. Cold-finished pipes shall be annealed after manufacturing.

c) The pipes of nominal diameter 300A or under in Table 4 shall be furnished with threaded or plain ends, and those of nominal diameter 350A or over, with plain ends. If the purchaser has requested bevelled ends, the shape of the bevelled ends shall be as agreed between the purchaser and the manufacturer. In the absence of a specific request of the shape by the purchaser, the bevelled ends as shown in Figure 1 shall be applied.



t: wall thickness

Figure 1 Shape of bevelled end

d) If the pipe is electric resistance welded, the weld bead on the external and internal surfaces of the pipe shall be removed so as to obtain a weld joint smooth along the contour of the pipe. If impracticable, the removal of the weld bead on the internal surface need not be performed.

e) Threaded pipes shall be manufactured by giving the pipe ends the taper threads as specified in **JIS B 0203**, and fitting one of the threaded ends with a screwed type fitting (hereafter referred to as the socket) conforming to **JIS B 2301** or **JIS B 2302**. The pipe end without a socket shall be protected with a thread protection ring or

other suitable means. Threaded pipes may be supplied without sockets if so specified by the purchaser. Inspection of taper threads shall be in accordance with **JIS B 0253**.

f) The pipes shall be either given zinc-coating or supplied without zinc-coating as shown in Table 1. Zinc-coating shall be performed on pipes and sockets before threading. In this case, the black pipes and sockets having passed the inspection shall be thoroughly cleaned by sand blasting, pickling, etc. before being zinc-coated by hot dip galvanizing.

g) For zinc-coating, the distilled zinc ingot Class 1 specified in **JIS H 2107** or zinc with at least equivalent quality to this shall be used.

h) Other general requirements for zinc coating are specified in **JIS H 8641**.

5 Chemical composition

When subjected to the heat analysis specified in **11.1**, the steel shall show the composition given in Table 2. Other alloy elements than given in this table may be added as required.

Table 2 Chemical composition

Unit: %

Symbol of grade	P	S
SGP	0.040 max.	0.040 max.

6 Mechanical properties

6.1 Tensile strength and elongation

When tested in accordance with **11.2.3**, the pipe shall satisfy the tensile strength and elongation requirements given in Table 3.

Table 3 Tensile strength and elongation

Symbol of grade	Tensile strength N/mm^2	Elongation [a] %						
		Test piece	Test direction	Wall thickness				
				Over 3 mm up to and incl. 4 mm	Over 4 mm up to and incl. 5 mm	Over 5 mm up to and incl. 6 mm	Over 6 mm up to and incl. 7 mm	Over 7 mm to and excl. 8 mm
SGP	290 min.	No. 11	Parallel to pipe axis	30 min.	30 min.	30 min.	30 min.	30 min.
		No. 12	Parallel to pipe axis	24 min.	26 min.	27 min.	28 min.	30 min.
		No. 5	Perpendicular to pipe axis	19 min.	20 min.	22 min.	24 min.	25 min.

NOTE 1 N/mm^2 = 1 MPa

Notes [a] For pipes of nominal diameter 32A or under, the elongation values in this table do not apply, though their elongation test results shall be recorded. In this case, elongation requirement agreed between the purchaser and the manufacturer may be applied.

6.2 Flattening property

The test piece shall be free from cracks when flattened between two platens according to **11.2.4** until the distance *H* between the platens reaches the value equal to two-thirds of the pipe outside diameter.

For pipes of nominal diameter 50A or under shown in Table 4, the purchaser may request a bend test instead of a flattening test.

6.3 Bendability

The bendability requirement applies where the purchaser specifies a bend test instead of a flattening test for pipes of a nominal diameter 50A or under shown in Table 4. The test piece shall not generate any cracks when bent to of 90° with an inside radius six times the pipe outside diameter in accordance with **11.2.5**. The bending angle is measured from the straight position before bending.

7 Uniformity of zinc-coating

When dipped in the cupric sulfate solution for a duration of 1 min five times in accordance with **11.3**, the white pipe shall not reach the end point.

NOTE The end point is recognized when the coating layer is lost and the brilliant adherent metallic copper deposited on the pipe base surface is observed (see **6.7** of **JIS H 0401**).

8 Hydraulic test characteristics or nondestructive test characteristics

When subjected to either the hydraulic test or nondestructive test according to **11.4**, the pipe shall satisfy the relevant requirements in the following. If not specified by the purchaser, which of the tests to perform shall be left to the discretion of the manufacturer.

a) **Hydraulic test characteristics** The pipe shall withstand the minimum hydraulic test pressure of 2.5 MPa without leakage.

b) **Nondestructive test characteristics** When subjected to either the ultrasonic or eddy current examination, the pipe shall satisfy the nondestructive test characteristics in the following. In place of these examinations, other nondestructive test specified in **JIS** may be performed upon agreement between the purchaser and the manufacturer, in which case the judgement criteria shall be at least equal to that applied in the ultrasonic examination or eddy current examination.

NOTE Other nondestructive test method is, for example, the automated flux leakage examination specified in **JIS G 0586**.

1) In the ultrasonic examination, the signals from a reference sample containing Category UE reference standard specified in **JIS G 0582** shall be used as an alarm level; any signal from the pipe equal to or greater than the alarm level shall be a cause for rejection. An alarm level lower in severity than the signals from the said reference standard may be used at the discretion of the manufacturer.

2) In the eddy current examination, the signals from a reference sample containing Category EZ reference standard specified in **JIS G 0583** shall be used as an alarm level; any signal from the pipe equal to or greater than the alarm level shall be a

cause for rejection. An alarm level lower in severity than the signals from the said reference standard may be used at the discretion of the manufacturer.

9 Dimensions, dimensional tolerances and unit mass

The dimensions, dimensional tolerances and unit mass of pipes shall be as follows.

a) The dimensions, dimensional tolerances and unit mass of black pipes shall be as given in Table 4.

Table 4 Dimensions, dimensional tolerances and unit mass

Nominal diameter [a]		Outside diameter	Tolerance on outside diameter [b] mm		Wall thickness	Tolerance on wall thickness	Unit mass, not including socket
A	B	mm	Pipes given taper threads	Other pipes	mm		kg/m
6	1/8	10.5	±0.5	±0.5	2.0	+Not specified	0.419
8	1/4	13.8	±0.5	±0.5	2.3	−12.5 %	0.652
10	3/8	17.3	±0.5	±0.5	2.3		0.851
15	1/2	21.7	±0.5	±0.5	2.8		1.31
20	3/4	27.2	±0.5	±0.5	2.8		1.68
25	1	34.0	±0.5	±0.5	3.2		2.43
32	1 1/4	42.7	±0.5	±0.5	3.5		3.38
40	1 1/2	48.6	±0.5	±0.5	3.5		3.89
50	2	60.5	±0.5	±0.6	3.8		5.31
65	2 1/2	76.3	±0.7	±0.8	4.2		7.47
80	3	89.1	±0.8	±0.9	4.2		8.79
90	3 1/2	101.6	±0.8	±1.0	4.2		10.1
100	4	114.3	±0.8	±1.1	4.5		12.2
125	5	139.8	±0.8	±1.4	4.5		15.0
150	6	165.2	±0.8	±1.6	5.0		19.8
175	7	190.7	±0.9	±1.6	5.3		24.2
200	8	216.3	±1.0	±1.7	5.8		30.1
225	9	241.8	±1.2	±1.9	6.2		36.0
250	10	267.4	±1.3	±2.1	6.6		42.4
300	12	318.5	±1.5	±2.5	6.9		53.0
350	14	355.6	—	±2.8 [c]	7.9		67.7
400	16	406.4	—	±3.3 [c]	7.9		77.6
450	18	457.2	—	±3.7 [c]	7.9		87.5
500	20	508.0	—	±4.1 [c]	7.9		97.4

NOTE The unit mass values in the table are calculated using the formula below assuming 1 cm^3 of steel to be 7.85 g in mass, and are rounded off to three significant figures in accordance with Rule A of **JIS Z 8401**.

$$W = 0.024\,66\,t\,(D - t)$$

where, W: unit mass of pipe (kg/m)
t: wall thickness of pipe (mm)
D: outside diameter of pipe (mm)
0.024 66: conversion factor for obtaining W

Notes [a] The nominal diameter shall be according to either of the designation A or B, and expressed by attaching the letter A or B, whichever designation is applied, after the numeral of the diameter.

In this Standard, all references to pipe nominal diameter use the designation A for the sake of convenience.

[b] For local repaired parts, tolerances in this table do not apply.

[c] For pipes of nominal diameter 350A or over, outside diameter measurement may be replaced by circumferential length measurement, in which case the tolerance applied shall be ±0.5 %. The measured circumferential length (l) shall be converted to the outside diameter (D) using the following formula.

$$D = l/\pi$$

where, D: outside diameter (mm)
l: circumferential length (mm)
π: 3.141 6

b) The length of the pipe shall be any specified length equal to or greater than 3 600 mm. The minus tolerance on pipe length shall be zero, and plus tolerance is not specified.

10 Appearance

The pipe appearance shall be as follows.

a) The pipe shall be straight for practical purposes, with both ends being at right angles to the pipe axis.

b) Both internal and external surfaces of the pipe shall be finished smoothly and free from defects detrimental to use.

c) Black pipes may be repaired by grinding, machining or other method, provided the wall thickness after repair remains within the specified tolerance.

d) The repaired surface shall be smooth along the contour of the pipe.

e) Either or both surfaces of the pipe may be given coating (e.g. zinc rich coating, epoxy coating, primer coating, etc.) upon agreement between the purchaser and the manufacturer.

11 Tests

11.1 Chemical analysis

11.1.1 General requirements and sampling method

General requirements for chemical analysis and sampling method for heat analysis shall be in accordance with Clause **8** of **JIS G 0404**.

11.1.2 Analytical method

The heat analysis method shall be in accordance with **JIS G 0320**.

11.2 Mechanical tests

11.2.1 General

General requirements for mechanical tests shall be in accordance with Clauses **7** and **9** of **JIS G 0404**. Among the sampling methods given in **7.6** of the said standard, however, only Class A sampling method shall apply.

11.2.2 Sampling method and number of test pieces

From each of the samples taken according to Table 5, take one tensile test piece, and one flattening or bend test piece. In the case of white pipes, the sample shall be generally taken from the pipes before zinc-coating.

Table 5 Sampling method

Nominal diameter	Sampling method
50A or under	Take one sample from each unit of 2 000 or its fraction of pipes of the same dimensions [a] and from the same heat treatment batch [b] [c].
65A or over up to and incl. 125A	Take one sample from each unit of 1 000 or its fraction of pipes of the same dimensions [a] and from the same heat treatment batch [b] [c].
150A or over up to and incl. 300A	Take one sample from each unit of 500 or its fraction of pipes of the same dimensions [a] and from the same heat treatment batch [b] [c].
350A or over	Take one sample from each unit of 300 or its fraction of pipes of the same dimensions [a] and from the same heat treatment batch [b] [c].

Notes [a] Pipes of the same dimensions means pipes of the same outside diameter and wall thickness.

[b] Applicable to heat-treated pipes. Pipes from the same heat treatment batch means a group of pipes from continuous furnace operation under consistent heat treatment conditions; pipes after any stop of furnace operation are not considered as belonging to the same heat treatment batch.

[c] Where the pipes under test of the same dimensions are all from the same heat, "same heat treatment batch" may be replaced with "same heat treatment conditions".

11.2.3 Tensile test

The test piece and test method shall be as follows.

a) **Test piece** Test piece used shall be of No. 11, No. 12 (No. 12A, No. 12B or No. 12C), or No. 5 specified in **JIS Z 2241**. Test pieces No. 11 and No. 12 shall be taken in parallel to the pipe axis, and Test piece No. 5, in perpendicular to the pipe axis. Test piece No. 12 or No. 5 shall not contain the seam.

b) **Test method** The test method shall be in accordance with **JIS Z 2241**.

11.2.4 Flattening test

The test piece and test method shall be as follows.

a) **Test piece** The length of the test piece shall be 50 mm or greater.

b) **Test method** At room temperature (5 °C to 35 °C), flatten the test piece between two platens until the distance H between the platens reaches the value specified in **6.2**, and then examine for cracks. In this test, place the test piece as shown in Figure 2 such that the line across the pipe section passing through the weld is perpendicular to the direction of compression.

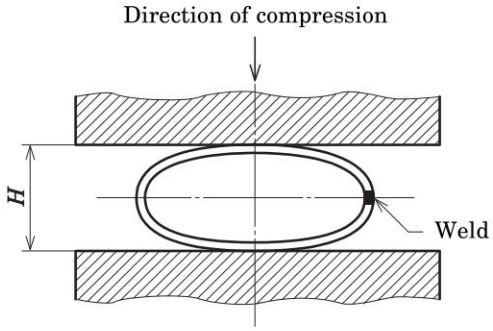


Figure 2 Flattening test

11.2.5 Bend test

The test piece and test method shall be as follows.

a) **Test piece** Cut an adequate length from a sample pipe.

b) **Test method** At room temperature (5 °C to 35 °C), bend the test piece around a mandrel to not less than the angle specified in **6.3** with an inside radius not more than the value specified in **6.3**, and examine for cracks. In this test, the weld shall be positioned at about 90° from the outermost part of the bend.

11.3 Zinc-coating test

The zinc-coating test shall be as follows.

a) **Sampling method and number of test pieces** Take one sample from each unit of 500 or its fraction of pipes of the same dimensions, and take one test piece from both ends of the sample pipe. Pipes of the same dimensions means pipes of the same outside diameter and wall thickness.

b) **Test piece** The test piece shall be a pipe end cut to a length of about 60 mm. If too large in diameter, the test piece may be cut into sections of suitable size for testing.

c) **Test method** Dip the test piece in cupric sulfate solution for a duration of 1 min five times according to the test method specified in Clause **6** of **JIS H 0401**, and examine if the test piece reaches the end point.

11.4 Hydraulic test or nondestructive test

Either the hydraulic test or the nondestructive test shall be carried out according to the following. In the case of white pipes, the test shall be conducted before zinc-coating.

a) **Frequency of test** Either the hydraulic test or the nondestructive test shall be performed on each pipe.

b) **Test method** The test method shall be as follows.

1) **Hydraulic test** Hold the pipe under at least the minimum hydraulic test pressure specified in **8 a**) for at least 5 s to see if it has endured the pressure without leakage.

2) **Nondestructive test**, as follows.

2.1) The ultrasonic examination specified in **JIS G 0582** shall apply. Test level may be severer than Category UE.

2.2) The eddy current examination specified in **JIS G 0583** shall apply. Test level may be severer than Category EZ.

12 Inspection and reinspection

12.1 Inspection

The inspection shall be as follows.

a) General requirements shall be as specified in **JIS G 0404**.

b) Chemical composition shall conform to the requirements in Clause **5**.

c) Mechanical properties shall conform to the requirements in Clause **6**.

d) Uniformity of zinc-coating shall conform to the requirements in Clause **7**.

e) Hydraulic test characteristics or nondestructive test characteristics shall conform to the requirements in Clause **8**.

f) Dimensions shall conform to the requirements in Clause **9**.

g) Appearance shall conform to the requirements in Clause **10**.

12.2 Reinspection

Pipes having failed the mechanical tests or zinc-coating test may be subjected to the retest in accordance with **9.8** of **JIS G 0404** for further acceptance judgement.

13 Marking

Each of the pipes having passed the inspection shall be marked with the following information. Where this is difficult for small diameter pipes, or if requested by the purchaser, the marking may be given on each bundle of pipes by a suitable means. The following items of information may be indicated in any order, and those which are deemed inessential for identification of the product may be omitted upon agreement between the purchaser and the manufacturer.

a) Symbol of grade

b) Symbol of manufacturing process

The symbol of manufacturing process shall be as follows. The dash(es) may be replaced with blanks.

As electric resistance welded steel pipe: —E—G

Hot-finished electric resistance welded steel pipe: —E—H

Cold-finished electric resistance welded steel pipe: —E—C

Butt-welded steel pipe: —B

c) Dimensions, expressed by nominal diameter

d) Manufacturer's name or identifying brand

14 Report

When requested by the purchaser, the manufacturer shall submit an inspection document to the purchaser. Reporting of test results shall be in accordance with Clause **13** of **JIS G 0404**. Unless otherwise specified in the order, the inspection document shall be in accordance with **5.1** of **JIS G 0415**.

Where any alloy elements not given in Table 2 have been intentionally added, the content of these elements shall also be reported in the document.

Bibliography

JIS Z 8401 *Guide to the rounding of numbers*

Blank

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