

# JIS

**JAPANESE INDUSTRIAL STANDARD**

**Carbon Steel Pipes for  
High Temperature Service**

 **JIS G 3456**—1988

**Translated and Published**

**by**

**Japanese Standards Association**

1. Scope

This Japanese Industrial Standard specifies the carbon steel pipes, hereinafter referred to as the "pipes", mainly used for piping at a temperature over 350°C.

Remarks 1. When previously agreed upon by the manufacturer, the purchaser may designate one or all of the supplementary quality requirements Z 2, Z 3 and Z 4 specified in Appendix, in addition to the items specified in this text.

Appendix Z 2: Elevated Temperature Yield Point or Proof Stress

Appendix Z 3: Ultrasonic Examination

Appendix Z 4: Eddy Current Examination

2. The units and numerical values given in { } in this Standard are based on the International System of Units (SI) and are appended for informative reference.

Further, the traditional units accompanied by numerical values in this Standard shall be converted to the SI units and numerical values on Jan. 1, 1991.

2. Grade and Symbol

The pipe shall be classified into three grades and their letter symbols shall be as given in Table 1-1 or Table 1-2.

Table 1-1. Letter Symbol of Grade

(Applicable till the end of 1990)

Letter symbol of grade
STPT 38
STPT 42
STPT 49

Table 1-2. Letter Symbol of Grade  
(Applicable on and after Jan. 1, 1991)

Letter symbol of grade	(For reference) Traditional units
STPT 370	STPT 38
STPT 410	STPT 42
STPT 480	STPT 49

3. Chemical Composition

The pipe shall be tested in accordance with 9.1 and the resulting ladle analysis values shall conform to Table 2-1 or Table 2-2.

Table 2-1. Chemical Composition  
(Applicable till the end of 1990)

Unit: %

Letter symbol of grade	C	Si	Mn	P	S
STPT 38	0.25 max.	0.10 to 0.35	0.30 to 0.90	0.035 max.	0.035 max.
STPT 42	0.30 max.	0.10 to 0.35	0.30 to 1.00	0.035 max.	0.035 max.
STPT 49	0.33 max.	0.10 to 0.35	0.30 to 1.00	0.035 max.	0.035 max.

Remark: When the product analysis is required by the purchaser, the tolerances for the above-mentioned values shall conform to Table 2 and Table 1 specified in JIS G 0321 for seamless steel pipes and electric resistance welded steel pipes, respectively.

Table 2-2. Chemical Composition  
(Applicable on and after Jan. 1, 1991)

Unit: %

Letter symbol of grade	C	Si	Mn	P	S
STPT 370	0.25 max.	0.10 to 0.35	0.30 to 0.90	0.035 max.	0.035 max.
STPT 410	0.30 max.	0.10 to 0.35	0.30 to 1.00	0.035 max.	0.035 max.
STPT 480	0.33 max.	0.10 to 0.35	0.30 to 1.00	0.035 max.	0.035 max.

Remark: When the product analysis is required by the purchaser, the tolerances for the above-mentioned values shall conform to Table 2 and Table 1 specified in JIS G 0321 for seamless steel pipes and electric resistance welded steel pipes, respectively.

4. Mechanical Properties

4.1 Tensile Strength, Yield Point or Proof Stress and Elongation The pipe shall be tested in accordance with 9.2 and the resulting tensile strength, yield point or proof stress and elongation of the pipe shall comply with Table 3-1 or Table 3-2.

Table 3-1. Mechanical Properties

(Applicable till the end of 1990)

Letter symbol of grade	Tensile strength kgf/mm <sup>2</sup> {N/mm <sup>2</sup> }	Yield point or proof stress kgf/mm <sup>2</sup> {N/mm <sup>2</sup> }	Elongation %			
			No. 11 or No. 12 test piece	No. 5 test piece	No. 4 test piece	
			Longitudinal	Transverse	Longitudinal	Transverse
STPT 38	38 {373} min.	22 {216} min.	30 min.	25 min.	28 min.	23 min.
STPT 42	42 {412} min.	25 {245} min.	25 min.	20 min.	24 min.	19 min.
STPT 49	49 {481} min.	28 {275} min.	25 min.	20 min.	22 min.	17 min.

- Remarks 1. When the tensile test for pipes under 8 mm in wall thickness is carried out with No. 12 or No. 5 test piece, the minimum value of elongation shall be obtained by subtracting 1.5 % from the values of elongation given in Table 3-1 for each 1 mm decrease in wall thickness, and rounding off the value to an integer in compliance with JIS Z 8401. Examples of calculation are given in Reference Table 1.
2. The value of elongation given in Table 3-1 shall not be applied to the pipe whose outside diameter is under 40 mm. However, the value of elongation shall be recorded.
3. When a tensile test piece is taken from the electric resistance welded steel pipe, No. 12 or No. 5 test piece shall be taken from the portion which does not involve welded seam.

Reference Table 1. Calculated Examples of Elongation Applied to No. 12 (Longitudinal) and No. 5 (Transverse) Test Pieces for Pipes under 8 mm in Wall Thickness

(Applicable till the end of 1990)

Letter symbol of grade	Shape of test piece	Elongation for each division of wall thickness %						
		Over 7 mm, up to 8 mm	Over 6 mm, up to and incl. 7 mm	Over 5 mm, up to and incl. 6 mm	Over 4 mm, up to and incl. 5 mm	Over 3 mm, up to and incl. 4 mm	Over 2 mm, up to and incl. 3 mm	Over 1 mm, up to and incl. 2 mm
STPT 38	No. 12 test piece	30	28	27	26	24	22	21
	No. 5 test piece	25	24	22	20	19	18	16
STPT 42 STPT 49	No. 12 test piece	25	24	22	20	19	18	16
	No. 5 test piece	20	18	17	16	14	12	11

Table 3-2. Mechanical Properties  
(Applicable on and after Jan. 1, 1991)

Letter symbol of grade	Tensile strength N/mm <sup>2</sup>	Yield point or proof stress N/mm <sup>2</sup>	Elongation %			
			No. 11 or No. 12 test piece	No. 5 test piece	No. 4 test piece	
					Longitudinal	Transverse
STPT 370	370 min.	215 min.	30 min.	25 min.	28 min.	23 min.
STPT 410	410 min.	245 min.	25 min.	20 min.	24 min.	19 min.
STPT 480	480 min.	275 min.	25 min.	20 min.	22 min.	17 min.

- Remarks 1. When the tensile test for pipes under 8 mm in wall thickness is carried out with No. 12 or No. 5 test piece, the minimum value of elongation shall be obtained by subtracting 1.5 % from the values of elongation given in Table 3-2 for each 1 mm decrease in wall thickness, and rounding off the value to an integer in compliance with JIS Z 8401. Examples of calculation are given in Reference Table 2.
2. The value of elongation given in Table 3-2 shall not be applied to the pipe whose outside diameter is under 40 mm. However, the value of elongation shall be recorded.
3. When a tensile test piece is taken from the electric resistance welded steel pipe, No. 12 or No. 5 test piece shall be taken from the portion which does not involve welded seam.

Reference Table 2. Calculated Examples of Elongation Applied to No. 12 (Longitudinal) and No. 5 (Transverse) Test Pieces for Pipes under 8 mm in Wall Thickness

(Applicable on and after Jan. 1, 1991)

Letter symbol of grade	Shape of test piece	Elongation for each division of wall thickness %						
		Over 7 mm, up to 8 mm	Over 6 mm, up to and incl. 7 mm	Over 5 mm, up to and incl. 6 mm	Over 4 mm, up to and incl. 5 mm	Over 3 mm, up to and incl. 4 mm	Over 2 mm, up to and incl. 3 mm	Over 1 mm, up to and incl. 2 mm
STPT 370	No. 12 test piece	30	28	27	26	24	22	21
	No. 5 test piece	25	24	22	20	19	18	16
STPT 410 STPT 480	No. 12 test piece	25	24	22	20	19	18	16
	No. 5 test piece	20	18	17	16	14	12	11

4.2 Flattening Resistance The pipe shall be tested in accordance with 9.3 and the pipe shall be free from flaws or cracks on its wall surface.

In this case, the distance between the flattening plates shall be calculated from the following formula.

$$H = \frac{(1+e)t}{e + \frac{t}{D}}$$

where (Applicable till the end of 1990)

- $H$  : distance between flattening plates (mm)
- $t$  : wall thickness of pipe (mm)
- $D$  : outside diameter of pipe (mm)
- $e$  : constant which varies depending on the grade of pipe,  
0.08 for STPT 38,  
0.07 for STPT 42 and STPT 49

where (Applicable on and after Jan. 1, 1991)

- $H$  : distance between flattening plates (mm)
- $t$  : wall thickness of pipe (mm)
- $D$  : outside diameter of pipe (mm)
- $e$  : constant which varies depending on the grade of pipe,  
0.08 for STPT 370  
0.07 for STPT 410 and STPT 480

4.3 Bending Resistance For the pipe whose outside diameter is 50 mm or under, the purchaser may specify the bending test in lieu of the flattening test. The pipe shall be tested in accordance with 9.4 and its wall surfaces shall be free from the occurrence of flaws or cracks. In this test the pipe is bent through 90° around an inside radius that is 6 times its outside diameter.

However, the purchaser may specify the bend test of which the bent angle is 180° and bending inside radius is 4 times the outside diameter.

#### 5. Hydrostatic Characteristic or Nondestructive Characteristic

The pipe shall be tested in accordance with 9.5 and the resulting hydrostatic characteristic or nondestructive characteristic shall conform to either of the following two. The preference shall be in accordance with the designation made by the purchaser or left to the discretion of the manufacturer.

5.1-1 Hydrostatic Characteristic (Applicable till the end of 1990) When the hydrostatic pressure specified by the purchaser or, unless otherwise specified, the values given in Attached Table 1-1 is applied, the pipe shall withstand it without leakage. In this case, the purchaser may specify values of pressure lower or higher than those given in Attached Table 1-1.

When a hydrostatic pressure test is made in compliance with the designation of the purchaser and the test pressure exceeds either 200 kgf/cm<sup>2</sup> {196 bar} or the value  $P$  calculated from the following formula, the test pressure shall be agreed upon by the purchaser and the manufacturer. The designated hydrostatic test pressure shall be graduated in 5 kgf/cm<sup>2</sup> {4.9 bar}.

The value  $P$  in the following formula shall be obtained by computing to the unit digit and rounding off to the nearest 5 kgf/cm<sup>2</sup> {4.9 bar}.

$$P = \frac{200 st}{D}$$

- where
- $P$  : test pressure [kgf/cm<sup>2</sup> {10<sup>-1</sup> bar}{<sup>1</sup>}]
  - $t$  : wall thickness of pipe (mm)
  - $D$  : outside diameter of pipe (mm)
  - $s$  : 60 % of the minimum value of yield point or proof stress specified in Table 3-1 (kgf/mm<sup>2</sup> {N/mm<sup>2</sup>})

Note (<sup>1</sup>) 1 bar = 10<sup>5</sup> Pa

5.1-2 Hydrostatic Characteristic (Applicable on and after Jan. 1, 1991) When the hydrostatic pressure specified by the purchaser or, unless otherwise specified, the values given in Attached Table 1-2 is applied, the pipe shall withstand it without leakage. In this case, the purchaser may specify values of pressure lower or higher than those given in Attached 1-2.

When a hydrostatic pressure test is made in compliance with the designation of the purchaser and the test pressure exceeds either 20 MPa or the value  $P$  calculated from the following formula, the test pressure shall be agreed upon by the purchaser and the manufacturer. The designated hydrostatic test pressure shall be graduated in 0.5 MPa for under 10 MPa, and in 1 MPa for 10 MPa or over.

The value  $P$  in the following formula shall be obtained likewise by rounding off to the nearest 0.5 MPa or 1 MPa.

$$P = \frac{2 st}{D}$$

- where
- $P$  : test pressure (MPa)
  - $t$  : wall thickness of pipe (mm)
  - $D$  : outside diameter of pipe (mm)
  - $s$  : 60 % of the minimum value of yield point or proof stress specified in Table 3-2 (N/mm<sup>2</sup>)

5.2 Nondestructive Characteristic Either an ultrasonic examination or an eddy current examination shall be made on the pipe, and there shall be no signal greater than those produced by the artificial defects of the reference test block which is the division UD of the working sensitivity specified in JIS G 0582 or the division EY of the working sensitivity specified in JIS G 0583, respectively.

6. Dimensions, Mass and Dimensional Tolerances

6.1 Dimensions and Mass The outside diameter, wall thickness and mass of the pipe shall be as specified in Attached Table 2.

6.2 Dimensional Tolerances The tolerances on outside diameter, wall thickness and deviation in wall thickness of the pipe shall be as specified Table 4.

In the case where the pipe length is specified by the purchaser, the tolerances on the pipe length shall be on the plus side.

Table 4. Tolerances on Outside Diameter, Wall Thickness and Deviation in Wall Thickness

Division	Tolerances on outside diameter	Tolerances on wall thickness	Tolerance on deviation in wall thickness
Hot finished seamless steel pipe	Up to 50 mm: ± 0.5 mm	Up to 4 mm: ± 0.5 mm 4 mm and over: ± 12.5 %	Up to and incl. 20 % of wall thickness
	50 mm and over, up to 160 mm: ± 1 %		
	160 mm and over, up to 200 mm: ± 1.6 mm		
	200 mm and over: ± 0.8 % However, for pipes 350 mm and over in diameter, the length of circumference may substitute as a basis for the tolerances. In this case, the tolerances shall be ± 0.5 %.		
Cold finished seamless steel pipe and electric resistance welded steel pipe	Up to 40 mm: ± 0.3 mm	Up to 2 mm: ± 0.2 mm 2 mm and over: ± 10 %	-
	40 mm and over: ± 0.8 % However, for pipes 350 mm and over in diameter, the length of circumference may substitute as a basis for tolerances. In this case, the tolerances shall be ± 0.5 %.		

Remarks 1. The deviation in wall thickness means the ratio of the difference between the maximum and the minimum of the measured thickness of a wall in the same section to the specified wall thickness. This shall not be applied to pipes under 5.6 mm in wall thickness.

2. When the length of circumference is used as a basis for the tolerances, either the measured value of the length of circumference itself or the outside diameter derived from the measured value may be used as the criteria. In both cases, the same value ± 0.5 % shall be applied as the tolerances. The outside diameter ( $D$ ) and the length of circumference ( $l$ ) shall be calculated reversibly from the following formula.

$$l = \pi \cdot D$$

where  $\pi = 3.1416$

3. In the case where compliance with the tolerances on wall thickness in the above table is clearly confirmed in such a local portion as under repairs, the tolerances on the outside diameter in the above table shall not be applied.

7. Appearance

The appearance shall be as follows.

- (1) The pipe shall be practically straight, and its both ends shall be at right angles to the axes.
- (2) The inside and outside surfaces of the pipe shall be well-finished, and free from defects detrimental to practical use.

8. Method of Manufacture

The method of manufacture shall be as follows.

- (1)-1 (Applicable till the end of 1990) The pipe shall be manufactured from coarse-grained killed steel by the seamless or electric resistance welding process. However, the pipe of grade STPT 49 shall be manufactured by the seamless process.
- (1)-2 (Applicable on and after Jan. 1, 1991) The pipe shall be manufactured from coarse-grained killed steel by the seamless or electric resistance welding process. However, the pipe of grade STPT 480 shall be manufactured by the seamless process.
- (2) The pipe shall be subjected to the heat treatment specified in Table 5-1 or Table 5-2. The heat treatment other than specified in Table 5-1 or Table 5-2 shall be agreed upon by the purchaser and the manufacturer.

Table 5-1. Heat Treatment

(Applicable till the end of 1990)

Letter symbol of grade	Hot finished seamless steel pipe	Cold finished seamless steel pipe	Hot finished electric resistance welded steel pipe	Electric resistance welded steel pipe other than hot finished
STPT 38 STPT 42	As manufactured. However, low temperature annealing or normalizing may be applied, as necessary.	Low temperature annealed or normalized.	As manufactured. However, low temperature annealing or normalizing may be applied, as necessary.	Low temperature annealed or normalized.
STPT 49			—	—

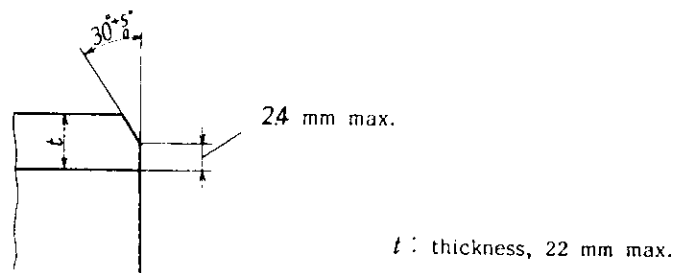
Table 5-2. Heat Treatment  
(Applicable on and after Jan. 1, 1991)

Letter symbol of grade	Hot finished seamless steel pipe	Cold finished seamless steel pipe	Hot finished electric resistance welded steel pipe	Electric resistance welded steel pipe other than hot finished
STPT 370 STPT 410	As manufactured. However, low temperature annealing or normalizing may be applied, as necessary.	Low temperature annealed or normalized.	As manufactured. However, low temperature annealing or normalizing may be applied, as necessary.	Low temperature annealed or normalized.
STPT 480			—	—

(3) When required by the purchaser, the pipe may be furnished with the bevel end <sup>(2)</sup>.

Note <sup>(2)</sup> Unless otherwise specified, the shape of the bevel end shall be as shown in Fig. 1.

Fig. 1. Shape of Bevel End



## 9. Test

### 9.1 Chemical Analysis

9.1.1 Chemical Analysis General matters about chemical analysis and method of sampling specimens for analysis shall be in accordance with 3. in JIS G 0303.

9.1.2 Analytical Method The analytical method shall be in accordance with one of the following Standards.

JIS G 1211	JIS G 1212
JIS G 1213	JIS G 1214
JIS G 1215	JIS G 1253
JIS G 1256	JIS G 1257

## 9.2 Tensile Test

9.2.1 Test Piece The test specimen shall be No. 11, No. 12 A, No. 12 B, No. 12 C, No. 4 or No. 5 test piece specified in JIS Z 2201 and shall be cut off from the end of the pipe. In this case, the gauge length for No. 4 test piece shall be 50 mm.

9.2.2 Test Method The test method shall be in accordance with JIS Z 2241.

## 9.3 Flattening Test

9.3.1 Test Piece A test piece 50 mm or over in length shall be cut off from the end of a pipe. For the pipe whose wall thickness is 15 % or over of the outside diameter, a C-shape test piece made by removing part of the circumference of a whole test piece may be used.

9.3.2 Test Method The test piece shall be placed between two flat plates at ordinary temperature and flattened by compression until the distance between the plates comes to the specified value, and checked for the occurrence of flaws or cracks on its wall surface. An electric resistance welded steel pipe shall be placed with the welded portion at right angles to the direction of compression as shown in Fig. 2, and a C-shape test piece shall be placed as shown in Fig. 3.

Fig. 2. Flattening Test  
(for Whole Test Piece)

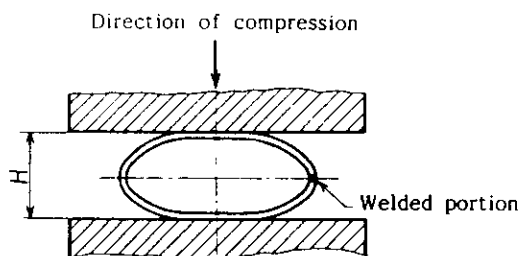
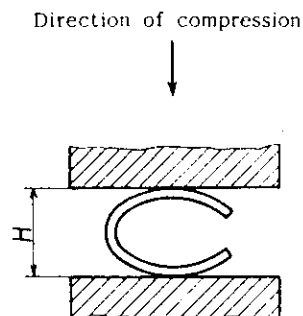


Fig. 3. Flattening Test  
(for C-Shape Test Piece)



## 9.4 Bending Test

9.4.1 Test Piece An appropriate length shall be cut off from the end of a pipe to be made into a test piece.

9.4.2 Test Method The test piece shall be bent through the angle around a cylinder with an inside radius specified in 4.3 at ordinary temperature, and checked for the occurrence of flaws or cracks on its wall surface. In the case of an electric resistance welded steel pipe, the welded portion shall be placed in the outermost part of the bent portion.

9.5 Hydrostatic Test or Nondestructive Examination Either the hydrostatic test or the nondestructive examination shall be made in accordance with (1) or (2), respectively.

- (1) When the pipe is subjected to hydrostatic pressure and kept under the specified pressure, it shall withstand the pressure without leakage.
- (2) The test method of nondestructive examination shall be in accordance with either JIS G 0582 or JIS G 0583.

## 10. Inspection

10.1 Inspection The inspection shall be as follows.

- (1) General matters of inspection shall be as specified in JIS G 0303.
- (2) The chemical composition, mechanical properties, hydrostatic or nondestructive characteristic, dimensions and appearance shall conform to 3., 4., 5., 6. and 7. However, the nondestructive examination may be replaced by appropriate nondestructive examination other than those specified in 9.5 (2) when agreed upon by the purchaser and the manufacturer.

Further, when the supplementary quality requirements given in Appendix are specified by agreement by the purchaser and the manufacturer, the results of inspection shall conform to the relevant requirements specified in Z 2, Z 3 or Z 4.

- (3) Either the hydrostatic test or the nondestructive examination shall be performed for each pipe.
- (4) The number of specimens for the product analysis shall be agreed upon by the purchaser and the manufacturer.
- (5) The method of sampling test specimens and the number of test pieces for tensile test and flattening test or bending test shall be as follows. From the pipe as manufactured, take one pipe as the specimen from each 50 pipes or its fraction of the same dimensions <sup>(3)</sup>, for the pipe to be heat-treated, take one pipe as the specimen from each 50 pipes or its fraction of the same dimensions <sup>(3)</sup> and of the concurrent heat treatment, and in any case from the test specimen take one tensile test piece. Further, from the pipe 50 mm or under in outside diameter, take one test piece for flattening test or bending test, and from the pipe over 50 mm in outside diameter, take one flattening test piece.

Note <sup>(3)</sup> The "same dimensions" here means the same wall thickness concurrent with the same outside diameter.

10.2 Reinspection The pipe may be retested in accordance with 4.4 in JIS G 0303 for final acceptance.

## 11. Marking

Each pipe having passed the inspection shall be marked with the following items. However, in the case of smaller pipes or on a request from the purchaser, pipes may be bundled together and marked for each bundle by suitable means. In either case, the order of arranging the items is not specified.

When approved by the purchaser, part of the items may be omitted.

- (1) Letter symbol of grade
- (2) Letter symbol indicating the manufacturing process <sup>(4)</sup>
- (3) Dimensions <sup>(5)</sup>
- (4) Manufacturer's name or its abbreviation
- (5) Letter symbol indicating the supplementary quality requirement, Z

Notes <sup>(4)</sup> The letter symbol indicating the manufacturing process shall be as follows, provided that the dash may be replaced by a blank.

Hot finished seamless steel pipe: -S-H

Cold finished seamless steel pipe: -S-C

Electric resistance welded steel pipe neither hot finished nor cold finished: -E-G

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

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

<sup>(5)</sup> The dimensions shall be expressed as follows:

Nominal diameter x nominal wall thickness or  
outside diameter x wall thickness

Example: 50 A x Sch 40

## 12. Report

The manufacturer shall, as a rule, submit to the purchaser the report on the test results, method of manufacture, ordered dimensions, quantity and work lot number traceable to the manufacturing conditions, etc.

Attached Table 1-1. Hydrostatic Test Pressure

(Applicable till the end of 1990)

Unit: kgf/cm<sup>2</sup> {bar}

Schedule number Sch	10	20	30	40	60	80	100	120	140	160
Hydrostatic test pressure	20 {20}	35 {34}	50 {49}	60 {59}	90 {88}	120 {118}	150 {147}	180 {177}	200 {196}	200 {196}

Remark: For the pipe whose dimension is not given in Attached Table 2, the hydrostatic test pressure shall be as specified in the following table depending on the division of the ratio ( $t/D$ ) of the wall thickness to the outside diameter of the pipe.

Unit: kgf/cm<sup>2</sup> {bar}

$t/D$ (%)	Over 0.80, up to and incl. 1.60	Over 1.60, up to and incl. 2.40	Over 2.40, up to and incl. 3.20	Over 3.20, up to and incl. 4.00	Over 4.00, up to and incl. 4.80	Over 4.80, up to and incl. 5.60	Over 5.60, up to and incl. 6.30	Over 6.30, up to and incl. 7.10	Over 7.10, up to and incl. 7.90	Over 7.90
Hydrostatic test pressure	20 {20}	40 {39}	60 {59}	80 {78}	100 {98}	120 {118}	140 {137}	160 {157}	180 {177}	200 {196}

Attached Table 1-2. Hydrostatic Test Pressure

(Applicable on and after Jan. 1, 1991)

Unit: MPa

Schedule number Sch	10	20	30	40	60	80	100	120	140	160
Hydrostatic test pressure	2.0	3.5	5.0	6.0	9.0	12	15	18	20	20

Remark: For the pipe whose dimension is not given in Attached Table 2, the hydrostatic test pressure shall be as specified in the following table depending on the division of the ratio ( $t/D$ ) of the wall thickness to the outside diameter of the pipe.

Unit: MPa

$t/D$ (%)	Over 0.80, up to and incl. 1.60	Over 1.60, up to and incl. 2.40	Over 2.40, up to and incl. 3.20	Over 3.20, up to and incl. 4.00	Over 4.00, up to and incl. 4.80	Over 4.80, up to and incl. 5.60	Over 5.60, up to and incl. 6.30	Over 6.30, up to and incl. 7.10	Over 7.10, up to and incl. 7.90	Over 7.90
Hydrostatic test pressure	2.0	4.0	6.0	8.0	10	12	14	16	18	20

Attached Table 2. Dimensions and Mass of Carbon Steel Pipes for High Temperature Service

Nominal dia.		Nominal wall thickness												Schedule 160									
		Out-side dia. mm		Schedule 10		Schedule 20		Schedule 30		Schedule 40		Schedule 60			Schedule 80		Schedule 100		Schedule 120		Schedule 140		
A	B	Wall thick. mm	Unit mass kg/m	Wall thick. mm	Unit mass kg/m	Wall thick. mm	Unit mass kg/m	Wall thick. mm	Unit mass kg/m	Wall thick. mm	Unit mass kg/m	Wall thick. mm	Unit mass kg/m	Wall thick. mm	Unit mass kg/m	Wall thick. mm	Unit mass kg/m	Wall thick. mm	Unit mass kg/m	Wall thick. mm	Unit mass kg/m	Wall thick. mm	Unit mass kg/m
6	10.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
8	13.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10	17.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15	21.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20	27.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25	34.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
32	42.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
40	48.6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
50	60.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
65	76.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
80	89.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
90	101.6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
100	114.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
125	139.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
150	165.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
200	216.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
250	267.4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
300	318.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
350	355.6	6.4	55.1	7.9	67.7	9.5	81.1	11.1	94.3	12.7	123	15.1	127	17.4	129	19.0	158	21.4	157	23.8	195	27.8	225
400	406.4	6.4	63.1	7.9	77.6	9.5	93.0	11.1	122	14.3	156	16.7	160	16.7	160	21.4	203	26.2	246	29.4	310	30.9	286
450	457.2	6.4	71.1	7.9	87.5	11.1	122	15.1	184	15.1	184	20.6	248	20.6	248	26.2	311	32.5	381	34.9	451	38.1	441
500	508.0	6.4	79.2	9.5	117	12.7	155	15.9	213	17.5	256	22.2	294	22.2	294	28.6	374	34.9	451	41.3	527	44.4	508
550	558.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
600	609.6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
650	660.4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Remarks 1. The designation of the pipe shall be based on the nominal diameter and the nominal wall thickness (schedule number; Sch). However, for the nominal diameter, either A or B shall be used, and the letter A or B shall be suffixed to the figures of nominal diameter for identification.  
 2. Calculate the value of mass from the following formula assuming 1 cm<sup>3</sup> of steel to be 7.85 g and round off the value to 3 significant figures in accordance with JIS Z 8401. However, the value over 1000 kg/m shall be rounded off to an integer of kg/m.

where  $W$  : unit mass of pipe (kg/m)  
 $t$  : wall thickness of pipe (mm)  
 $D$  : outside diameter of pipe (mm)

3. When dimensions other than those given in the above table are necessary, agreement shall be made by the purchaser and the manufacturer.

Appendix. Supplementary Quality Requirements

The supplementary quality requirements shall apply only when requested by the purchaser, and shall be executed by the manufacturer on the designated items.

Z 2 Elevated Temperature Yield Point or Proof Stress The elevated temperature yield point or proof stress is the following.

- (1) The value of elevated temperature yield point or proof stress and the testing temperature of the pipe shall be agreed upon by the purchaser and the manufacturer.
- (2) The test piece and the test method shall be as specified JIS G 0567.

However, when it is practically difficult to take the test piece specified in JIS G 0567, the shape of the test piece shall be agreed upon by the purchaser and the manufacturer.

- (3) The method of sampling the test specimens and the number of test pieces shall be as follows. Take one test specimen for each lot of the same heat charge, and then from one test specimen take one test piece for each lot of the same testing temperature.

Z 3 Ultrasonic Examination The ultrasonic examination is the following.

- (1) The criteria of the working sensitivity in the ultrasonic examination shall be the division UB or UC specified in JIS G 0582, and there shall be no signal greater than those produced by the artificial defects of the reference test block.
- (2) The test method of the ultrasonic examination shall be as specified in JIS G 0582.
- (3) The ultrasonic examination shall be performed for each pipe and the results shall conform to the requirements specified in (1).

Z 4 Eddy Current Examination The eddy current examination is the following.

- (1) The criteria of the working sensitivity in the eddy current examination shall be the division EV, EW, or EX specified in JIS G 0583, and there shall be no signal greater than those produced by the artificial defects of the reference test block.
- (2) The test method of the eddy current examination shall be as specified in JIS G 0583.
- (3) The eddy current examination shall be performed for each pipe and the results shall conform to the requirements specified in (1).

Applicable Standards:

- JIS G 0303-General Rules for Inspection of Steel
- JIS G 0321-Product Analysis and its Tolerance for Wrought Steel
- JIS G 0567-Method of High Temperature Tensile Test for Steels and Heat-Resisting Alloys
- JIS G 0582-Ultrasonic Examination of Steel Pipes and Tubes
- JIS G 0583-Eddy Current Examination of Steel Pipes and Tubes
- JIS G 1211-Methods for Determination of Carbon in Iron and Steel
- JIS G 1212-Methods for Determination of Silicon in Iron and Steel
- JIS G 1213-Methods for Determination of Manganese in Iron and Steel
- JIS G 1214-Methods for Determination of Phosphorus in Iron and Steel
- JIS G 1215-Methods for Determination of Sulfur in Iron and Steel
- JIS G 1253-Method for Photoelectric Emission Spectrochemical Analysis of Iron and Steel
- JIS G 1256-Method for X-Ray Fluorescence Spectrometric Analysis of Iron and Steel
- JIS G 1257-Atomic Absorption Spectrochemical Analysis of Iron and Steel
- JIS Z 2201-Test Pieces for Tensile Test for Metallic Materials
- JIS Z 2241-Method of Tensile Test for Metallic Materials
- JIS Z 8401-Rules for Rounding off of Numerical Values

In the event of any doubt arising,  
the original Standard in Japanese is to be final authority.

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