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Carbon steel pipes for high temperature
service

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Foreword

This Japanese Industrial Standard has been revised by the Minister of Economy, Trade and Industry based on the provision of Article 14, paragraph (1) of the Industrial Standardization Act applied mutatis mutandis pursuant to the provision of Article 16 of the said Act in response to a proposal for revision of Japanese Industrial Standard with a draft being attached, submitted by The Japan Iron and Steel Federation (JISF), an accredited standards development organization. This edition replaces the previous edition (**JIS G 3456** : 2019), which has been technically revised.

However, **JIS G 3456** : 2019 may be applied in the **JIS** mark certification based on the relevant provisions of Article 30, paragraph (1), etc. of the Industrial Standardization Act until 21 April 2025.

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Carbon steel pipes for high temperature service

Introduction

This Japanese Industrial Standard has been prepared based on **ISO 9329-2** : 1997, Edition 1, and **ISO 9330-2** : 1997, Edition 1, with some modifications of the technical contents.

Annex JA is unique to **JIS** and not given in the corresponding International Standards. The vertical lines on both sides and dotted underlines indicate changes from the corresponding International Standards. A list of modifications with the explanations is given in Annex JB.

1 Scope

This Standard specifies requirements for the carbon steel pipes (hereafter referred to as pipes) used mainly for service at temperatures over 350 °C.

NOTE 1 The dimensional range covered by this Standard is generally outside diameter 10.5 mm (nominal diameter 6A or 1/8B) to 660.4 mm (nominal diameter 650A or 26B).

NOTE 2 The International Standards corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 9329-2 : 1997 *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 2: Unalloyed and alloyed steels with specified elevated temperature properties*

ISO 9330-2 : 1997 *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 2: Electric resistance and induction welded unalloyed and alloyed steel tubes with specified elevated temperature properties* (overall evaluation: MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standards and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

Part or all of the provisions of the following standards, 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 G 0201 *Glossary of terms used in iron and steel (Heat treatment)*

JIS G 0202 *Glossary of terms used in iron and steel (Testing)*

JIS G 0203 *Glossary of terms used in iron and steel (Products and quality)*

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

JIS G 0321 *Product analysis and its tolerance for wrought steel*

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

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

JIS G 0567 *Method of elevated temperature tensile test for steels and heat-resisting alloys*

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

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

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

JIS Z 8401 *Rounding of numbers*

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in **JIS G 0201**, **JIS G 0202** and **JIS G 0203** apply.

4 Symbol of grade

Pipes are classified into 3 grades. The symbols of grades and manufacturing methods shall be as given in Table 1.

Table 1 Symbols of grades and manufacturing methods

Grade	Manufacturing method		
	Pipe manufacturing method	Finishing method	Marking
STPT370 STPT410	Seamless: S	Hot finished: H Cold finished: C	In accordance with 14 b) .
	Electric resistance welded: E	Hot finished: H Cold finished: C As electric resistance welded: G	
STPT480	Seamless: S	Hot finished: H Cold finished: C	

5 Manufacturing method

The manufacturing method shall be as follows.

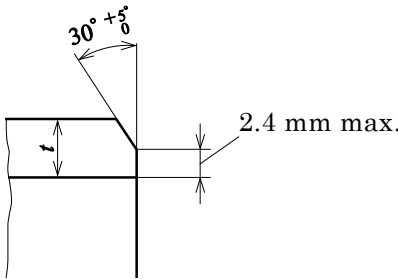
- The pipes shall be manufactured from killed steel by a combination of pipe manufacturing method and finishing method selected from Table 1. For pipes of grade STPT480, only seamless processing is applicable. The symbols of manufacturing processes are given in Table 1.
- The pipes shall be heat treated in accordance with Table 2. Other heat treatment than given in Table 2 may be performed upon agreement between the purchaser

and the manufacturer.

Table 2 Heat treatment

Symbol of grade	Hot-finished seamless steel pipe	Cold-finished seamless steel pipe	Hot-finished electric resistance welded steel pipe	Cold-finished electric resistance welded and as electric resistance welded steel pipe
STPT370 STPT410	As manufactured; or if necessary, low temperature annealed or normalized	Low temperature annealed or normalized	As manufactured; or if necessary, low temperature annealed or normalized	Low temperature annealed or normalized
STPT480			—	—

- c) Pipes shall be furnished with plain ends, unless otherwise specified. If the purchaser has requested bevel ends, the shape of the bevel ends shall be as agreed between the purchaser and the manufacturer. For pipes 22 mm or under in wall thickness, in the absence of a specific request of the shape by the purchaser, the bevel ends shall be as shown in Figure 1.



Key
t : wall thickness 22 mm max.

Figure 1 Shape of bevel 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.

6 Chemical composition

In the heat analysis performed according to 12.1, the pipes shall conform to the composition given in Table 3. In the product analysis, if one is requested by the purchaser, the pipe shall conform to the composition given in Table 3 when subjected to

the analysis specified in 12.1. To the values in Table 3, the tolerances given in Table 3 of JIS G 0321 shall apply for seamless steel pipes, and those given in Table 2 of JIS G 0321 for electric resistance welded steel pipes.

Table 3 Chemical composition

Unit: %					
Symbol of grade	C	Si	Mn	P	S
STPT370	0.25 max.	0.10 to 0.35	0.30 to 0.90	0.035 max.	0.035 max.
STPT410	0.30 max.	0.10 to 0.35	0.30 to 1.00	0.035 max.	0.035 max.
STPT480	0.33 max.	0.10 to 0.35	0.30 to 1.00	0.035 max.	0.035 max.
Alloy elements not specified in this table may be added as necessary.					

7 Mechanical properties

7.1 Tensile strength, yield point or proof stress, and elongation

When tested in accordance with 12.2.1, 12.2.2 and 12.2.3, the pipes shall satisfy the requirements for tensile strength, yield point or proof stress, and elongation given in Table 4. For tensile test of pipes under 8 mm in wall thickness performed using a Test piece No. 12 or Test piece No. 5, the elongation requirement given in Table 5 shall apply.

Table 4 Tensile strength, yield point or proof stress, and elongation

Symbol of grade	Tensile strength	Yield point or proof stress ^{a)}	Elongation ^{b)}			
			%			
			Test piece No. 11 Test piece No. 12	Test piece No. 5	Test piece No. 4 ^{c)} :upper value Test piece No. 14 ^{c)} :lower value	
	N/mm ²	N/mm ²	Parallel to pipe axis	Perpendicular to pipe axis	Parallel to pipe axis	Perpendicular to pipe axis
STPT370	370 min.	215 min.	30 min.	25 min.	28 min. 24 min.	23 min. 20 min.
STPT410	410 min.	245 min.	25 min.	20 min.	24 min. 21 min.	19 min. 17 min.
STPT480	480 min.	275 min.	25 min.	20 min.	22 min. 19 min.	17 min. 15 min.

NOTE 1 N/mm² = 1 MPa

Note ^{a)} Unless otherwise specified, the yield point to be determined shall be the upper yield point, R_{eH} , or, wherever this is not pronounced, the 0.2 % proof stress, $R_{p0.2}$.

Note ^{b)} For pipes of outside diameter under 40 mm, 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.

Note ^{c)} The tensile direction shall be parallel to the pipe axis. Where feasible, however, test pieces may be taken perpendicularly to the pipe axis.

Table 5 Elongation of pipes with a wall thickness under 8 mm, tested using Test piece No. 12 (parallel to pipe axis) and Test piece No. 5 (perpendicular to pipe axis)

Unit: %

Symbol of grade	Test piece ^{a)}	Elongation						
		Wall thickness						
		Over 1 mm up to and incl. 2 mm	Over 2 mm up to and incl. 3 mm	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
STPT370	Test piece No. 12	21 min.	22 min.	24 min.	26 min.	27 min.	28 min.	30 min.
	Test piece No. 5	16 min.	18 min.	19 min.	20 min.	22 min.	24 min.	25 min.
STPT410 STPT480	Test piece No. 12	16 min.	18 min.	19 min.	20 min.	22 min.	24 min.	25 min.
	Test piece No. 5	11 min.	12 min.	14 min.	16 min.	17 min.	18 min.	20 min.
NOTE		The elongation values in this table are calculated by subtracting 1.5 from the elongation values given in Table 4 for each 1 mm decrease of wall thickness from 8 mm, and by rounding the calculated value to an integer according to Rule A of JIS Z 8401 .						
Note ^{a)}		The tensile direction shall be parallel to the pipe axis for Test piece No. 12, and perpendicular to the pipe axis for Test piece No. 5.						

7.2 Flattening property

The test piece shall be free from cracks when flattened between two platens according to 12.2.1, 12.2.2 and 12.2.4 until the distance H between the platens reaches the value calculated by Formula (1).

For pipes of outside diameter 60.5 mm or under, the purchaser may request a bend test in place of a flattening test.

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

where, H : distance between the platens (mm)
 t : wall thickness of pipe (mm)
 D : outside diameter of pipe (mm)
 e : constant given for each grade of pipe:

0.08 for STPT370;

0.07 for STPT410 and STPT480.

NOTE..... For the flattening test, see 12.2.4.

7.3 Bendability

The bendability requirement applies where the purchaser specifies a bend test in: