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Steel plate butt-welding pipe 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 Pipe Fittings Association (JPFA)/Japanese Standards Association (JSA) 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 B 2313** : 2009 is replaced with this Standard.

However, **JIS B 2313** : 2009 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 January 19, 2016.

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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.

Steel plate butt-welding pipe fittings

Introduction

This Japanese Industrial Standard has been prepared based on the second edition of **ISO 3419** published in 1981 and the first edition of **ISO 5251** published in 1981 by modifying some of their specification contents as well as adding contents not given therein.

The portions given sidelines or dotted underlines are the matters in which the contents of the original International Standards have been modified. A list of modifications with the explanations is given in Annex JE.

Matters contained in Annexes JA to JD are unique contents of **JIS** that are not given in the corresponding International Standards.

1 Scope

This Standard specifies the pipe fittings having longitudinal seams to be fitted by butt-welding, mainly to pressure service pipings¹⁾, high temperature service pipings²⁾, alloy steel pipings³⁾, stainless steel pipings⁴⁾ and low temperature service pipings⁵⁾ (hereafter referred to as “pipe fittings”).

The special quality requirements, a part of or all of which may be designated by the agreement between the purchaser and the manufacturer, are given in Annex JA and the requirements of special shape pipe fittings are specified in Annex JB. The shapes and dimensions of special bevel ends are shown in Annex JC and marking and report for pipe fittings with special necks are shown in Annex JD for reference.

NOTE 1 This Standard covers pipe fittings that are manufactured from welded tubes.

NOTE 2 Design conditions of pipe fittings should take into account the efficiency of fittings.

NOTE 3 The International Standards corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 3419 : 1981 *Non-alloy and alloy steel butt-welding fittings*

ISO 5251 : 1981 *Stainless steel butt-welding fittings* (Overall evaluation : MOD)

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

Notes ¹⁾ Pipings using the carbon steel pipes for pressure service specified in **JIS G 3454**.

²⁾ Pipings using the carbon steel pipes for high temperature service specified in **JIS G 3456**.

- 3) Pipings using alloy steel pipes specified in JIS G 3458.
- 4) Pipings using the stainless steel pipes specified in JIS G 3459 and JIS G 3468.
- 5) Pipings using the steel pipes for low temperature service specified in JIS G 3460.

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) listed below shall be applied.

JIS B 0151	<i>Iron and steel pipe fittings — Vocabulary</i>
JIS G 0415	<i>Steel and steel products — Inspection documents</i>
JIS G 0567	<i>Method of elevated temperature tensile test for steels and heat-resisting alloys</i>
JIS G 0801	<i>Ultrasonic testing of steel plates for pressure vessels</i>
JIS G 3103	<i>Carbon steel and molybdenum alloy steel plates for boilers and pressure vessels</i>
JIS G 3106	<i>Rolled steels for welded structure</i>
JIS G 3126	<i>Carbon steel plates for pressure vessels for low temperature service</i>
JIS G 3127	<i>Nickel steel plates for pressure vessels for low temperature services</i>
JIS G 3454	<i>Carbon steel tubes for pressure service</i>
JIS G 3456	<i>Carbon steel pipes for high temperature service</i>
JIS G 3458	<i>Alloy steel pipes</i>
JIS G 3459	<i>Stainless steel pipes</i>
JIS G 3460	<i>Steel tubes for low temperature service</i>
JIS G 3468	<i>Large diameter welded stainless steel pipes</i>
JIS G 4109	<i>Chromium-molybdenum alloy steel plates for boilers and pressure vessels</i>
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 4312	<i>Heat-resisting steel plate, sheet and strip</i>
JIS Z 2241	<i>Metallic materials — Tensile testing — Method of test at room temperature</i>
JIS Z 2242	<i>Method for Charpy pendulum impact test of metallic materials</i>
JIS Z 2320-1	<i>Non-destructive testing — Magnetic particle testing — Part 1 : General principles</i>

JIS Z 2343-1	<i>Non-destructive testing — Penetrant testing — Part 1 : General principles — Method for liquid penetrant testing and classification of the penetrant indication</i>
JIS Z 3040	<i>Method of qualification test for welding procedure</i>
JIS Z 3060	<i>Method for ultrasonic examination for welds of ferritic steel</i>
JIS Z 3104	<i>Methods of radiographic examination for welded joints in steel</i>
JIS Z 3106	<i>Methods of radiographic examination for welded joints in stainless steel</i>
JIS Z 3121	<i>Methods of tensile test for butt welded joints</i>
JIS Z 3122	<i>Methods of bend test for butt welded joint</i>
JIS Z 3801	<i>Standard qualification procedure for manual welding technique</i>
JIS Z 3821	<i>Standard qualification procedure for welding technique of stainless steel</i>
JIS Z 3841	<i>Standard qualification procedure for semi-automatic welding technique</i>

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in **JIS B 0151** apply.

4 Classification

The pipe fittings shall be classified as given in the following according to the shapes and materials.

a) Classification of pipe fittings by shape and their symbols shall be as given in table 1.

Table 1 Classification by shape and symbols

Classification by shape			Symbol ^{a)}
Large classification	Small classification		
45° elbow	Long		45E(L)
	Short		45E(S)
90° elbow	Long		90E(L)
	Short		90E(S)
180° elbow	Long		180E(L)
	Short		180E(S)
Reducer ^{b)}	Concentric	Shape 1	R(C)1
		Shape 2	R(C)2
	Eccentric	Shape 1	R(E)1
		Shape 2	R(E)2
Tee	Straight		T(S)
	Reducing		T(R)
Notes ^{a)} The parentheses in the symbol may be omitted. Example : 45E(L) may be 45EL.			
^{b)} In the symbols [R(C)1] for concentric reducers of Shape 1, and [R(E)1] for eccentric reducers of Shape 1, the numeral “1”, denoting Shape 1, may be omitted.			

- b) Symbols of grade according to materials and steel pipes to be connected shall be as given in table 2.

“Steel pipes to be connected” refers to the steel pipes of Japanese Industrial Standard which are generally connected with the pipe fittings in piping.

Table 2 Symbols of grades according to materials and steel pipes to be connected

Division	Symbol of grade according to material	Steel pipes to be connected	Remarks
Carbon steel	PG370W	STPG370 of JIS G 3454	For pressure service pipings
	PG410W	STPG410 of JIS G 3454	
	PT370W	STPT370 of JIS G 3456	For high temperature service pipings
	PT410W	STPT410 of JIS G 3456	
	PT480W	STPT480 of JIS G 3456	
	PL380W	STPL380 of JIS G 3460	For low temperature service pipings
Alloy steel	PA12W	STPA12 of JIS G 3458	For high temperature service pipings
	PA22W	STPA22 of JIS G 3458	
	PA23W	STPA23 of JIS G 3458	
	PA24W	STPA24 of JIS G 3458	
	PA25W	STPA25 of JIS G 3458	
	PA26W	STPA26 of JIS G 3458	
	PL450W	STPL450 of JIS G 3460	For low temperature service pipings
	PL690W	STPL690 of JIS G 3460	

Table 2 (concluded)

Division	Symbol of grade according to material	Steel pipes to be connected	Remarks
Stainless steel	SUS304W	SUS304TP of JIS G 3459	For corrosion resistance and high temperature service pipings. These may be used also for low temperature service pipings, except for SUS329J1W, SUS329J3LW, SUS329J4LW, SUS405W, SUS409LW, SUS430W, SUS430LXW, SUS430J1LW, SUS436LW and SUS444W.
		SUS304TPY of JIS G 3468	
	SUS304HW	SUS304HTP of JIS G 3459	
	SUS304LW	SUS304LTP of JIS G 3459	
		SUS304LTPY of JIS G 3468	
	SUS309SW	SUS309STP of JIS G 3459	
		SUS309STPY of JIS G 3468	
	SUS310SW	SUS310STP of JIS G 3459	
		SUS310STPY of JIS G 3468	
	SUS316W	SUS316TP of JIS G 3459	
		SUS316TPY of JIS G 3468	
	SUS316LW	SUS316LTP of JIS G 3459	
		SUS316LTPY of JIS G 3468	
	SUS316TiW	SUS316TiTP of JIS G 3459	
	SUS317W	SUS317TP of JIS G 3459	
		SUS317TPY of JIS G 3468	
	SUS317LW	SUS317LTP of JIS G 3459	
		SUS317LTPY of JIS G 3468	
	SUS321W	SUS321TP of JIS G 3459	
		SUS321TPY of JIS G 3468	
	SUS347W	SUS347TP of JIS G 3459	
		SUS347TPY of JIS G 3468	
	SUS836LW	SUS836LTP of JIS G 3459	
	SUS890LW	SUS890LTP of JIS G 3459	
	SUS329J1W	SUS329J1TP of JIS G 3459	
		SUS329J1TPY of JIS G 3468	
	SUS329J3LW	SUS329J3LTP of JIS G 3459	
	SUS329J4LW	SUS329J4LTP of JIS G 3459	
	SUS405W	SUS405TP of JIS G 3459	
	SUS409LW	SUS409LTP of JIS G 3459	
	SUS430W	SUS430TP of JIS G 3459	
	SUS430LXW	SUS430LXTP of JIS G 3459	
	SUS430J1LW	SUS430J1LTP of JIS G 3459	
	SUS436LW	SUS436LTP of JIS G 3459	
	SUS444W	SUS444TP of JIS G 3459	

5 Materials

The materials of pipe fittings shall be welded steel pipes, steel plates or steel strips as given in table 3 or equivalent materials, and shall be as follows.

- The welded steel pipes for manufacture of pipe fittings shall meet the requirements of chemical composition and hydrostatic test characteristics or non-destructive test characteristics prescribed in the Japanese Industrial Standards of steel pipes listed in table 3 and shall possess the mechanical properties in conformity with 8.1.

- b) The steel plates or steel strips for manufacture of pipe fittings shall meet the requirements of the chemical composition prescribed in the Japanese Industrial Standards listed in table 3, and shall possess the mechanical properties specified in 8.1.
- c) “Equivalent materials”, if used for manufacture of pipe fittings, shall meet the following conditions that are relevant to the type of material.
- 1) Their chemical composition shall have been confirmed, through a cast analysis, to meet the requirements of the materials as specified in table 3.
 - 2) Their mechanical properties shall have been confirmed, through the inspection specified in 12.3, to meet the requirements of the materials specified in table 3.
 - 3) If they are for steel pipes, they shall have been confirmed to meet the hydrostatic or non-destructive test characteristics requirements specified in the Japanese Industrial Standards of steel pipes listed in table 3.

Table 3 Materials for pipe fittings for pipings

Symbol of grade according to material	Material	
	Steel pipe	Steel plate, steel strip
PG370W	STPG370-E of JIS G 3454	SM400B of JIS G 3106
PG410W	STPG410-E of JIS G 3454	SM400B of JIS G 3106 (Tensile strength 410 N/mm ² min.)
PT370W	STPT370-E of JIS G 3456	SB410 of JIS G 3103
PT410W	STPT410-E of JIS G 3456	SB410 of JIS G 3103
PT480W	— a)	SB480 of JIS G 3103
PL380W	STPL380-E of JIS G 3460	SLA325A of JIS G 3126
PA12W	— a)	SB450M of JIS G 3103
PA22W	— a)	SCMV2 of JIS G 4109 (Tensile strength 410 N/mm ² min.)
PA23W	— a)	SCMV3 of JIS G 4109
PA24W	— a)	SCMV4 of JIS G 4109
PA25W	— a)	SCMV6 of JIS G 4109
PA26W	— a)	b)
PL450W	— a)	SL3N255 of JIS G 3127
PL690W	— a)	SL9N520 of JIS G 3127
SUS304W	SUS304TP-A of JIS G 3459 SUS304TP-E of JIS G 3459 SUS304TP-L of JIS G 3459 SUS304TPY of JIS G 3468	SUS304 of JIS G 4304 SUS304 of JIS G 4305
SUS304HW	SUS304HTP-A of JIS G 3459 SUS304HTP-E of JIS G 3459 SUS304HTP-L of JIS G 3459	—
SUS304LW	SUS304LTP-A of JIS G 3459 SUS304LTP-E of JIS G 3459 SUS304LTP-L of JIS G 3459 SUS304LTPY of JIS G 3468	SUS304L of JIS G 4304 SUS304L of JIS G 4305
SUS309SW	SUS309STP-A of JIS G 3459 SUS309STP-E of JIS G 3459 SUS309STP-L of JIS G 3459 SUS309STPY of JIS G 3468	SUS309S of JIS G 4304 SUS309S of JIS G 4305

Table 3 (continued)

Symbol of grade according to material	Material	
	Steel pipe	Steel plate, steel strip
SUS310SW	SUS310STP-A of JIS G 3459 SUS310STP-E of JIS G 3459 SUS310STP-L of JIS G 3459 SUS310STPY of JIS G 3468	SUS310S of JIS G 4304 SUS310S of JIS G 4305
SUS316W	SUS316TP-A of JIS G 3459 SUS316TP-E of JIS G 3459 SUS316TP-L of JIS G 3459 SUS316TPY of JIS G 3468	SUS316 of JIS G 4304 SUS316 of JIS G 4305
SUS316LW	SUS316LTP-A of JIS G 3459 SUS316LTP-E of JIS G 3459 SUS316LTP-L of JIS G 3459 SUS316LTPY of JIS G 3468	SUS316L of JIS G 4304 SUS316L of JIS G 4305
SUS316TiW	SUS316TiTP-A of JIS G 3459 SUS316TiTP-E of JIS G 3459 SUS316TiTP-L of JIS G 3459	SUS316Ti of JIS G 4304 SUS316Ti of JIS G 4305
SUS317W	SUS317TP-A of JIS G 3459 SUS317TP-E of JIS G 3459 SUS317TP-L of JIS G 3459 SUS317TPY of JIS G 3468	SUS317 of JIS G 4304 SUS317 of JIS G 4305
SUS317LW	SUS317LTP-A of JIS G 3459 SUS317LTP-E of JIS G 3459 SUS317LTP-L of JIS G 3459 SUS317LTPY of JIS G 3468	SUS317L of JIS G 4304 SUS317L of JIS G 4305
SUS321W	SUS321TP-A of JIS G 3459 SUS321TP-E of JIS G 3459 SUS321TP-L of JIS G 3459 SUS321TPY of JIS G 3468	SUS321 of JIS G 4304 SUS321 of JIS G 4305
SUS347W	SUS347TP-A of JIS G 3459 SUS347TP-E of JIS G 3459 SUS347TP-L of JIS G 3459 SUS347TPY of JIS G 3468	SUS347 of JIS G 4304 SUS347 of JIS G 4305
SUS836LW	SUS836LTP-A of JIS G 3459 SUS836LTP-E of JIS G 3459 SUS836LTP-L of JIS G 3459	SUS836L of JIS G 4304 SUS836L of JIS G 4305
SUS890LW	SUS890LTP-A of JIS G 3459 SUS890LTP-E of JIS G 3459 SUS890LTP-L of JIS G 3459	SUS890L of JIS G 4304 SUS890L of JIS G 4305
SUS329J1W	SUS329J1TP-A of JIS G 3459 SUS329J1TP-E of JIS G 3459 SUS329J1TP-L of JIS G 3459 SUS329J1TP Y of JIS G 3468	SUS329J1 of JIS G 4304 SUS329J1 of JIS G 4305
SUS329J3LW	SUS329J3LTP-A of JIS G 3459 SUS329J3LTP-E of JIS G 3459 SUS329J3LTP-L of JIS G 3459	SUS329J3L of JIS G 4304 SUS329J3L of JIS G 4305
SUS329J4LW	SUS329J4LTP-A of JIS G 3459 SUS329J4LTP-E of JIS G 3459 SUS329J4LTP-L of JIS G 3459	SUS329J4L of JIS G 4304 SUS329J4L of JIS G 4305
SUS405W	SUS405TP-A of JIS G 3459 SUS405TP-E of JIS G 3459 SUS405TP-L of JIS G 3459	SUS405 of JIS G 4304 SUS405 of JIS G 4305

Table 3 (concluded)

Symbol of grade according to material	Material	
	Steel pipe	Steel plate, steel strip
SUS409LW	SUS409LTP-A of JIS G 3459 SUS409LTP-E of JIS G 3459 SUS409LTP-L of JIS G 3459	SUH409L of JIS G 4312
SUS430W	SUS430TP-A of JIS G 3459 SUS430TP-E of JIS G 3459 SUS430TP-L of JIS G 3459	SUS430 of JIS G 4304 SUS430 of JIS G 4305
SUS430LXW	SUS430LXTP-A of JIS G 3459 SUS430LXTP-E of JIS G 3459 SUS430LXTP-L of JIS G 3459	SUS430LX of JIS G 4304 SUS430LX of JIS G 4305
SUS430J1LW	SUS430J1LTP-A of JIS G 3459 SUS430J1LTP-E of JIS G 3459 SUS430J1LTP-L of JIS G 3459	SUS430J1L of JIS G 4304 SUS430J1L of JIS G 4305
SUS436LW	SUS436LTP-A of JIS G 3459 SUS436LTP-E of JIS G 3459 SUS436LTP-L of JIS G 3459	SUS436L of JIS G 4304 SUS436L of JIS G 4305
SUS444W	SUS444TP-A of JIS G 3459 SUS444TP-E of JIS G 3459 SUS444TP-L of JIS G 3459	SUS444 of JIS G 4304 SUS444 of JIS G 4305
NOTE : The suffixed symbol A of steel pipe in the table indicates “automatic arc welded”, the symbol E, “electric resistance welded” and symbol L, “laser beam welded”. Notes a) No established Japanese Industrial Standards relevant to welded steel pipes. b) STPA26 in JIS G 3458 shall apply for the chemical composition, tensile strength and yield point, and SCM V6 in JIS G 4109 shall apply for the shape and elongation of the test piece.		

6 Manufacturing method

The manufacturing method of pipe fittings shall be as follows.

- a) Pipe fittings shall be manufactured from the material specified in clause 5, by hot or cold plastic working, or from steel plates or steel strip by arc welding of the longitudinal seams.
- b) The welding of the longitudinal seams shall be made by both side welding of butt joint, or by one side welding of butt joint which is considered equal or superior thereto.
- c) The welder to perform manual or semi-automatic welding shall have passed the standard qualification procedure for welding technique according to **JIS Z 3801**, **JIS Z 3821** or **JIS Z 3841** or other qualification procedure for welding technique at least equal thereto and shall be a qualified person rated on the technical skills.
- d) The pipe fittings shall be subjected to heat treatment in accordance with table 4. Any other heat treatment than given in the table shall be subject to the agreement between the purchaser and the manufacturer.

Table 4 Heat treatment for pipe fittings

Symbol of grade according to material	Welded steel pipe		Steel plate, steel strip	
	Hot formed products	Cold formed products	Hot formed products	Cold formed products
PG370W, PG410W, PT370W, PT410W	As manufactured, or annealing ^{a)}	Normalizing or annealing ^{a)}	As manufactured, or annealing ^{a)}	
PT480W			As manufactured, or annealing ^{a)}	Normalizing or annealing ^{a)}
PL380W	Annealing ^{a)} , normalizing, or tempering after normalizing			
PA12W ^{b)} , PA22W	Annealing ^{c)} , normalizing, or tempering after normalizing			
PA23W, PA24W, PA25W, PA26W	Annealing ^{d)} , or tempering after normalizing (650 °C or over)			
PL450W	Annealing ^{d)} , normalizing or tempering after normalizing			
PL690W	Tempering after normalizing two times, or tempering after quenching			
SUS304W, SUS304LW, SUS316W, SUS316LW, SUS317W, SUS317LW	Solution treatment (1 010 °C or over, rapid cooling)			
SUS304HW	Solution treatment (1 040 °C or over, rapid cooling)			
SUS309SW, SUS310SW, SUS836LW, SUS890LW	Solution treatment (1 030°C or over, rapid cooling)			
SUS316TiW ^{e)} , SUS321W ^{e)}	Solution treatment (920 °C or over, rapid cooling)			
SUS347W ^{e)}	Solution treatment (980 °C or over, rapid cooling)			
SUS329J1W, SUS329J3LW, SUS329J4LW	Solution treatment (950 °C or over, rapid cooling)			
SUS405W, SUS409LW, SUS430W, SUS430LXW, SUS444W	Annealing (700 °C or over, air cooling or slow cooling)			
SUS430J1LW, SUS436LW	Annealing (720 °C or over, air cooling or slow cooling)			
Notes ^{a)} Low temperature annealing or stress relieving.				
^{b)} For welds of pipe fittings 13 mm or under in nominal thickness that are manufactured from steel plate or steel strip, the heat treatment may be omitted.				
^{c)} Low temperature annealing, stress relieving, full annealing or isothermal annealing.				
^{d)} Stress relieving, full annealing or isothermal annealing.				
^{e)} The purchaser may designate a stabilizing treatment. In this case, heat treatment temperature shall be 850 °C to 930 °C.				

7 Chemical composition

The chemical composition of materials of the pipe fittings shall meet the requirements specified in the Japanese Industrial Standards of materials for pipe fittings as listed in table 3.

8 Performance

8.1 Mechanical properties

The mechanical properties of pipe fittings shall be as follows.

- a) The tensile strength, yield point or proof stress, elongation and the test temperature and absorbed energy in Charpy impact test for the pipe fittings of PL380W, PL450W and PL690W shall meet the requirements specified in the Japanese Industrial Standards of materials for pipe fittings listed in table 3.
- b) The tensile strength of welds ⁶⁾ of pipe fittings shall meet the requirements specified in the Japanese Industrial Standards of steel pipes to be connected listed in table 2.
- c) The guide bend resistance of welds ⁶⁾ of pipe fittings shall meet the requirements specified in 2.2 of Annex of **JIS Z 3040**.
- d) The test temperature and absorbed energy in Charpy impact test for welds ⁶⁾ of pipe fittings of PL380W, PL450W and PL690W shall meet the requirements specified for STPL380, STPL450 and STPL690, respectively, given in **JIS G 3460**.

Note ⁶⁾ Requirements for welds apply to welds of pipe fittings manufactured from steel plates or steel strips by welding, and not to welds of welded steel pipes.

8.2 Pressure resistance

The pressure resistance of pipe fittings shall be as follows. For pipe fittings of which the ends have different nominal thickness, the nominal thickness or t/D , whichever is the smaller, shall be used as the pressure resistance requirement value, where t : thickness of pipe fitting (mm), D : outside diameter of pipe fitting (mm).

- a) The pipe fittings shall withstand, without leakage, the same pressure as required for the hydrostatic test characteristics specified in the Japanese Industrial Standards of the steel pipes to be connected as listed in table 2 or the pressure equal to the value calculated by the formula.

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

where, P : test pressure (MPa)
 t : thickness of pipe fitting (mm)
 D : outside diameter of pipe fitting (mm)
 s : 60 % of the minimum yield point or proof stress specified in the Japanese Industrial Standards of steel pipes to be connected listed in table 2 (N/mm²)

- b) Pipe fittings shall not break under the bursting pressure of the steel pipes to be connected, calculated according to the following formula.

$$P_0 = \frac{2s_0t_0}{D_0}$$

where, P_0 : bursting pressure of steel pipe (MPa)
 t_0 : minimum thickness of steel pipe (within tolerance) (mm)
 D_0 : outside diameter of steel pipe (mm)
 s_0 : minimum tensile strength specified in the Japanese Industrial Standards of steel pipes to be connected listed in table 2 (N/mm²)

8.3 Non-destructive test characteristics of welds

The non-destructive test characteristics of welds of pipe fittings manufactured from steel plates or steel strips by welding shall meet the requirements of Class 1 or Class 2 specified in Annex 4 of JIS Z 3104, Annex 4 of JIS Z 3106 or Annex 7 of JIS Z 3060 or any criteria at least equivalent thereto.

9 Shape and dimensions

The shape and dimensions of pipe fittings shall be as follows.

Further, nominal diameter A expresses millimetre system, and B, inch system.

- The outside and inside diameters and thickness of pipe fittings shall be as given in tables 5 and 6.
- The shape and dimensions of pipe fittings shall be as given in tables 7 to 10.
- The dimensional tolerances and permissible values of pipe fittings shall be as given in table 11.
- The permissible values of the off angle and off plane of pipe fittings shall be as given in table 12.
- The shape and dimensions of bevel ends shall be as shown in figure 1. However, pipe fittings with thickness less than 4 mm may be manufactured with plain ends.

Special shape and dimensions of bevel ends, in the case where they are required, shall be subject to the agreement between the purchaser and the manufacturer. The purchaser may select them from Annex JC.

Unit: mm

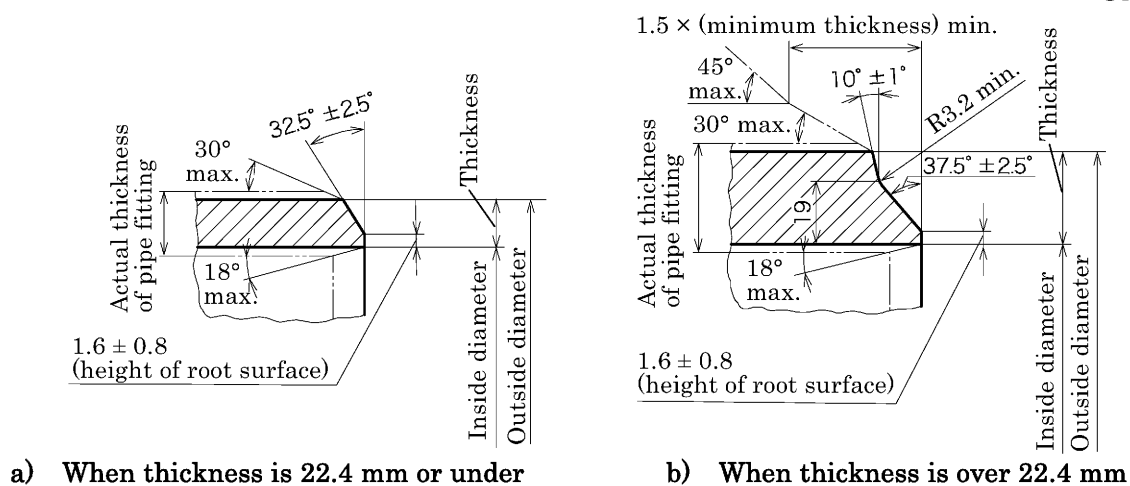


Figure 1 Shape and dimensions of bevel end

10 Appearance

The appearance of pipe fittings shall be as follows.

- a) The pipe fittings shall be free from flaws, wrinkles and other defects which might be detrimental to service on both inside and outside surfaces.
- b) The appearance of the beads of pipe fittings manufactured by welding shall be smooth and free from unevenness detrimental to service.
- c) The pipe fittings surfaces may be repaired by grinding, machining or other methods, provided that the product thickness after repair satisfies the specified thickness tolerances.
- d) The surface of the repaired part shall be smooth along the contour of the pipe fitting.

11 Tests

11.1 Chemical analysis

The chemical analysis shall be as specified in the Japanese Industrial Standards of the materials for pipe fittings listed in table 3.

11.2 Mechanical properties test

The mechanical properties test of pipe fittings shall be as follows.

- a) **Test piece** Take one sample from each material lot as defined in the Japanese Industrial Standards of the materials for pipe fittings listed in table 3, and after subjecting it to the heat treatment under the same heat treatment conditions as for the pipe fitting, take one test piece from it for the tensile test.

For the materials to be used for the pipe fittings of PL380W, PL450W and PL690W, take additionally one set (three pieces) of Charpy impact test pieces.

- b) **Shape of test pieces and test methods** The shape of test pieces and test methods shall be as specified in the Japanese Industrial Standards of the materials for pipe fittings listed in table 3.
- c) **Welds of pipe fittings manufactured from steel plates or steel strips by welding** For the mechanical properties of welds, the manufacturer shall qualify the welding procedure in accordance with **JIS Z 3040**.

This qualification test shall be carried out on the test material after giving it the heat treatment under the same conditions as for the pipe fittings.

11.3 Pressure resistance test

Weld a steel pipe to a pipe fitting, apply hydrostatic pressure to the fitting gradually until the internal pressure reaches the test pressure required for the hydrostatic test characteristics of steel pipes to be connected specified in 8.2, and hold the fitting under this pressure for 5 s or longer. Check if the fitting has withstood the pressure without leakage. Then, further increase the test pressure and see if the fitting has withstood

the bursting pressure required for the steel pipes to be connected for 3 min without bursting.

11.4 Non-destructive test of welds

The non-destructive test of welds of pipe fittings manufactured from steel plates or steel strips by welding, shall be carried out in accordance with methods specified in **JIS Z 3104, JIS Z 3106, JIS Z 3060** or by any equivalent non-destructive test method.

12 Inspection

12.1 Type of inspection and inspection items

The inspection of pipe fittings shall be the type inspection ⁷⁾ and the acceptance inspection ⁸⁾, each consisting of inspection items as shown below.

The sampling system for the acceptance inspection shall be subject to the agreement between the purchaser and the manufacturer.

Notes ⁷⁾ An inspection to judge whether the quality of a pipe fitting product satisfies all the characteristics stated in the design.

⁸⁾ An inspection performed on acceptance of a product which is identical in design and manufacture to those already accepted in the type inspection to judge whether it satisfies the required characteristics.

a) Type inspection items

- 1) Chemical analysis
- 2) Mechanical properties
- 3) Pressure resistance
- 4) Shape and dimensions
- 5) Appearance
- 6) Non-destructive inspection of welds

b) Acceptance inspection items

- 1) Chemical analysis
- 2) Mechanical properties
- 3) Shape and dimensions
- 4) Appearance

12.2 Chemical analysis

The chemical composition shall be tested in accordance with 11.1, and shall meet the requirements given in clause 7.

12.3 Mechanical properties inspection

The mechanical properties shall be tested in accordance with 11.2, and shall meet the requirements given in 8.1.