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Steel 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 2312 : 2009** is replaced with this Standard.

However, **JIS B 2312 : 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.

This **JIS** document is protected by the Copyright Law.

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 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 steel and nickel-chromium ferro-alloy seamless pipe fittings to be fitted by butt-welding, mainly to pressure service pipings ¹⁾, high pressure service pipings ²⁾, high temperature service pipings ³⁾, alloy steel pipings ⁴⁾, stainless steel pipings ⁵⁾, low temperature service pipings ⁶⁾ and steel pipes for fired heaters ⁷⁾ (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 : 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 pressure service specified in **JIS G 3455**.
- ³⁾ Pipings using the carbon steel pipes for high temperature service specified in **JIS G 3456**.

- 4) Pipings using alloy steel pipes specified in JIS G 3458.
- 5) Pipings using the stainless steel pipes specified in JIS G 3459.
- 6) Pipings using the steel pipes for low temperature service specified in JIS G 3460.
- 7) Pipings using the steel pipes for fired heaters specified in JIS G 3467.

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 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 3202	<i>Carbon steel forgings for pressure vessels</i>
JIS G 3203	<i>Alloy steel forgings for pressure vessels for high-temperature service</i>
JIS G 3205	<i>Carbon and alloy steel forgings for pressure vessels for low-temperature service</i>
JIS G 3214	<i>Stainless steel forgings for pressure vessels</i>
JIS G 3454	<i>Carbon steel tubes for pressure service</i>
JIS G 3455	<i>Carbon steel pipes for high 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 3467	<i>Steel tubes for fired heater</i>
JIS G 4051	<i>Carbon steels for machine structural use</i>
JIS G 4109	<i>Chromium-molybdenum alloy steel plates for boilers and pressure vessels</i>
JIS G 4303	<i>Stainless steel bars</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 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 8401	<i>Guide to the rounding of numbers</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	Concentric	R(C)
	Eccentric	R(E)
Tee	Straight	T(S)
	Reducing	T(R)
Cap	—	C
Note ^{a)} The parentheses in the symbol may be omitted. Example : 45E(L) may be 45EL.		

- b) Symbols of grades according to materials and steel pipes to be connected shall be as given in tables 2 and 3.

“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 of pipe fittings for pipings and steel pipes to be connected

Division	Symbol of grade according to material	Steel pipes to be connected	Remarks
Carbon steel	PG370	STPG370 of JIS G 3454	For pressure service pipings
	PS410	STPG410 of JIS G 3454	
		STS410(STS370) of JIS G 3455	
	PS480	STS480 of JIS G 3455	For high pressure service pipings
	PT370	STPG370 of JIS G 3454	
		STPT370 of JIS G 3456	
	PT410	STPG410 of JIS G 3454	
		STPT410 of JIS G 3456	
	PT480	STPT480 of JIS G 3456	
	PL380	STPL380 of JIS G 3460	For low temperature service pipings
Alloy steel	PA12	STPA12 of JIS G 3458	For high temperature service pipings
	PA22	STPA22 of JIS G 3458	
	PA23	STPA23 of JIS G 3458	
	PA24	STPA24 of JIS G 3458	
	PA25	STPA25 of JIS G 3458	
	PA26	STPA26 of JIS G 3458	
	PL450	STPL450 of JIS G 3460	For low temperature service pipings
	PL690	STPL690 of JIS G 3460	

Table 2 (concluded)

Division	Symbol of grade according to material	Steel pipes to be connected	Remarks
Stainless steel	SUS304	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 SUS329J1, SUS329J3L, SUS329J4L, SUS405, SUS409L, SUS430, SUS430LX, SUS430J1L, SUS436L and SUS444.
	SUS304H	SUS304HTP of JIS G 3459	
	SUS304L	SUS304LTP of JIS G 3459	
	SUS309	SUS309TP of JIS G 3459	
	SUS309S	SUS309STP of JIS G 3459	
	SUS310	SUS310TP of JIS G 3459	
	SUS310S	SUS310STP of JIS G 3459	
	SUS316	SUS316TP of JIS G 3459	
	SUS316H	SUS316HTP of JIS G 3459	
	SUS316L	SUS316LTP of JIS G 3459	
	SUS316Ti	SUS316TiTP of JIS G 3459	
	SUS317	SUS317TP of JIS G 3459	
	SUS317L	SUS317LTP of JIS G 3459	
	SUS321	SUS321TP of JIS G 3459	
	SUS321H	SUS321HTP of JIS G 3459	
	SUS347	SUS347TP of JIS G 3459	
	SUS347H	SUS347HTP of JIS G 3459	
	SUS836L	SUS836LTP of JIS G 3459	
	SUS890L	SUS890LTP of JIS G 3459	
	SUS329J1	SUS329J1TP of JIS G 3459	
	SUS329J3L	SUS329J3LTP of JIS G 3459	
	SUS329J4L	SUS329J4LTP of JIS G 3459	
	SUS405	SUS405TP of JIS G 3459	
	SUS409L	SUS409LTP of JIS G 3459	
	SUS430	SUS430TP of JIS G 3459	
	SUS430LX	SUS430LXTP of JIS G 3459	
	SUS430J1L	SUS430J1LTP of JIS G 3459	
	SUS436L	SUS436LTP of JIS G 3459	
	SUS444	SUS444TP of JIS G 3459	

Table 3 Symbols of grades according to materials of pipe fittings for fired heaters and steel pipes to be connected

Division	Symbol of grade according to material	Steel pipes to be connected
Carbon steel	FT410	STF410 of JIS G 3467
Alloy steel	FA12	STFA12 of JIS G 3467
	FA22	STFA22 of JIS G 3467
	FA23	STFA23 of JIS G 3467
	FA24	STFA24 of JIS G 3467
	FA25	STFA25 of JIS G 3467
	FA26	STFA26 of JIS G 3467
Stainless steel	SUS304F	SUS304TF of JIS G 3467
	SUS304HF	SUS304HTF of JIS G 3467
	SUS309F	SUS309TF of JIS G 3467
	SUS310F	SUS310TF of JIS G 3467
	SUS316F	SUS316TF of JIS G 3467
	SUS316HF	SUS316HTF of JIS G 3467
	SUS321F	SUS321TF of JIS G 3467
	SUS321HF	SUS321HTF of JIS G 3467
	SUS347F	SUS347TF of JIS G 3467
	SUS347HF	SUS347HTF of JIS G 3467
Nickel-chromium ferro-alloy	NCF800F	NCF800TF of JIS G 3467
	NCF800HF	NCF800HTF of JIS G 3467

5 Materials

The materials of pipe fittings shall be seamless steel pipes, steel plates, steel strips or other steel material as given in tables 4 and 5 or equivalent materials, and shall be as follows.

- The seamless 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 tables 4 and 5 and shall possess the mechanical properties and the austenite grain size in conformity with 8.1 and 8.2, respectively.
- The steel plates, steel strips or other steel materials for manufacture of pipe fittings shall meet the requirements of the chemical composition, relevant to the material used, prescribed in the Japanese Industrial Standards listed in tables 4 and 5, and shall possess the mechanical properties and the austenite grain size specified in 8.1 and 8.2, respectively. However, the mechanical properties of S25C or S30C of JIS G 4051 shall conform to the requirements prescribed in the Japanese Industrial Standard of steel pipes as listed in table 4.
- “Equivalent materials”, if used for manufacture of pipe fittings, shall meet the following conditions 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 tables 4 and 5.
- 2) Their mechanical properties shall have been confirmed, through the inspection specified in **12.3**, to meet the requirements of the materials specified in tables 4 and 5.
- 3) Their austenite grain size (applicable to SUS321H, SUS321HF and NCF800HF) shall have been confirmed, through the inspection specified in **12.4**, to meet the requirements of steel pipes specified in tables 4 and 5.
- 4) 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 tables 4 and 5.

Table 4 Materials for pipe fittings for pipings

Symbol of grade according to material	Material	
	Steel pipe	Steel plate, steel strip or other steel material
PG370	STPG370 – S of JIS G 3454 STS370 – S of JIS G 3455	SM400B of JIS G 3106 SFVC2A of JIS G 3202 S25C of JIS G 4051
PS410	STS410 – S of JIS G 3455	SM400B of JIS G 3106 (tensile strength 410 N/mm ² min.) SFVC2A of JIS G 3202 S25C of JIS G 4051
PS480	STS480 – S of JIS G 3455	SB480 of JIS G 3103 SFVC2A of JIS G 3202 S30C of JIS G 4051
PT370	STPT370 – S of JIS G 3456	SB410 of JIS G 3103 SFVC2A of JIS G 3202 S25C of JIS G 4051
PT410	STPT410 – S of JIS G 3456	SB410 of JIS G 3103 SFVC2A of JIS G 3202 S25C of JIS G 4051
PT480	STPT480 – S of JIS G 3456	SB480 of JIS G 3103 SFVC2A of JIS G 3202 S30C of JIS G 4051
PL380	STPL380 – S of JIS G 3460	SLA325A of JIS G 3126 SFL2 of JIS G 3205
PA12	STPA12 – S of JIS G 3458	SB450M of JIS G 3103 SFVAF1 of JIS G 3203
PA22	STPA22 – S of JIS G 3458	SCMV2 of JIS G 4109 (tensile strength 410 N/mm ² min.) SFVAF12 of JIS G 3203
PA23	STPA23 – S of JIS G 3458	SCMV3 of JIS G 4109 SFVAF11A of JIS G 3203
PA24	STPA24 – S of JIS G 3458	SCMV4 of JIS G 4109 SFVAF22A of JIS G 3203
PA25	STPA25 – S of JIS G 3458	SCMV6 of JIS G 4109 SFVAF5A of JIS G 3203
PA26	STPA26 – S of JIS G 3458	SFVAF9 ^{a)} of JIS G 3203
PL450	STPL450 – S of JIS G 3460	SL3N255 of JIS G 3127 SFL3 of JIS G 3205
PL690	STPL690 – S of JIS G 3460	SL9N520 of JIS G 3127
SUS304	SUS304TP – S of JIS G 3459	SUS304 of JIS G 4304 SUS304 of JIS G 4305 SUS304 of JIS G 4303 SUSF304 of JIS G 3214
SUS304H	SUS304HTP – S of JIS G 3459	SUSF304H of JIS G 3214
SUS304L	SUS304LTP – S of JIS G 3459	SUS304L of JIS G 4304 SUS304L of JIS G 4305 SUS304L of JIS G 4303 SUSF304L of JIS G 3214

Table 4 (continued)

Symbol of grade according to material	Material	
	Steel pipe	Steel plate, steel strip or other steel material
SUS309	SUS309TP—S of JIS G 3459	—
SUS309S	SUS309STP—S of JIS G 3459	SUS309S of JIS G 4304 SUS309S of JIS G 4305 SUS309S of JIS G 4303
SUS310	SUS310TP—S of JIS G 3459	SUSF310 of JIS G 3214
SUS310S	SUS310STP—S of JIS G 3459	SUS310S of JIS G 4304 SUS310S of JIS G 4305 SUS310S of JIS G 4303
SUS316	SUS316TP—S of JIS G 3459	SUS316 of JIS G 4304 SUS316 of JIS G 4305 SUS316 of JIS G 4303 SUSF316 of JIS G 3214
SUS316H	SUS316HTP—S of JIS G 3459	SUSF316H of JIS G 3214
SUS316L	SUS316LTP—S of JIS G 3459	SUS316L of JIS G 4304 SUS316L of JIS G 4305 SUS316L of JIS G 4303 SUSF316L of JIS G 3214
SUS316Ti	SUS316TiTP—S of JIS G 3459	SUS316Ti of JIS G 4304 SUS316Ti of JIS G 4305 SUS316Ti of JIS G 4303
SUS317	SUS317TP—S of JIS G 3459	SUS317 of JIS G 4304 SUS317 of JIS G 4305 SUS317 of JIS G 4303
SUS317L	SUS317LTP—S of JIS G 3459	SUS317L of JIS G 4304 SUS317L of JIS G 4305 SUS317L of JIS G 4303
SUS321	SUS321TP—S of JIS G 3459	SUS321 of JIS G 4304 SUS321 of JIS G 4305 SUS321 of JIS G 4303 SUSF321 of JIS G 3214
SUS321H	SUS321HTP—S of JIS G 3459	SUSF321H of JIS G 3214
SUS347	SUS347TP—S of JIS G 3459	SUS347 of JIS G 4304 SUS347 of JIS G 4305 SUS347 of JIS G 4303 SUSF347 of JIS G 3214
SUS347H	SUS347HTP—S of JIS G 3459	SUSF347H of JIS G 3214
SUS836L	SUS836LTP—S of JIS G 3459	SUS836L of JIS G 4304 SUS836L of JIS G 4305 SUS836L of JIS G 4303
SUS890L	SUS890LTP—S of JIS G 3459	SUS890L of JIS G 4304 SUS890L of JIS G 4305 SUS890L of JIS G 4303
SUS329J1	SUS329J1TP—S of JIS G 3459	SUS329J1 of JIS G 4304 SUS329J1 of JIS G 4305 SUS329J1 of JIS G 4303

Table 4 (concluded)

Symbol of grade according to material	Material	
	Steel pipe	Steel plate, steel strip or other steel material
SUS329J3L	SUS329J3LTP—S of JIS G 3459	SUS329J3L of JIS G 4304 SUS329J3L of JIS G 4305 SUS329J3L of JIS G 4303
SUS329J4L	SUS329J4LTP—S of JIS G 3459	SUS329J4L of JIS G 4304 SUS329J4L of JIS G 4305 SUS329J4L of JIS G 4303
SUS405	SUS405TP—S of JIS G 3459	SUS405 of JIS G 4304 SUS405 of JIS G 4305 SUS405 of JIS G 4303
SUS409L	SUS409LTP—S of JIS G 3459	SUS409L of JIS G 4312
SUS430	SUS430TP—S of JIS G 3459	SUS430 of JIS G 4304 SUS430 of JIS G 4305 SUS430 of JIS G 4303
SUS430LX	SUS430LXTP—S of JIS G 3459	SUS430LX of JIS G 4304 SUS430LX of JIS G 4305
SUS430J1L	SUS430J1LTP—S of JIS G 3459	SUS430J1L of JIS G 4304 SUS430J1L of JIS G 4305
SUS436L	SUS436LTP—S of JIS G 3459	SUS436L of JIS G 4304 SUS436L of JIS G 4305
SUS444	SUS444TP—S of JIS G 3459	SUS444 of JIS G 4304 SUS444 of JIS G 4305
NOTE : The suffixed symbol S of steel pipe in the table indicates “seamless”. Note ^{a)} In the case of the steel plates or steel strips, 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.		

Table 5 Materials for pipe fittings for fired heaters

Symbol of grade according to material	Material
	Steel pipe
FT410	STF410 of JIS G 3467
FA12	STFA12 of JIS G 3467
FA22	STFA22 of JIS G 3467
FA23	STFA23 of JIS G 3467
FA24	STFA24 of JIS G 3467
FA25	STFA25 of JIS G 3467
FA26	STFA26 of JIS G 3467
SUS304F	SUS304TF of JIS G 3467
SUS304HF	SUS304HTF of JIS G 3467
SUS309F	SUS309TF of JIS G 3467
SUS310F	SUS310TF of JIS G 3467
SUS316F	SUS316TF of JIS G 3467
SUS316HF	SUS316HTF of JIS G 3467
SUS321F	SUS321TF of JIS G 3467
SUS321HF	SUS321HTF of JIS G 3467
SUS347F	SUS347TF of JIS G 3467
SUS347HF	SUS347HTF of JIS G 3467
NCF800F	NCF800TF of JIS G 3467
NCF800HF	NCF800HTF of JIS G 3467

6 Manufacturing method

The manufacturing method of pipe fittings shall be as follows.

- Pipe fittings shall be manufactured seamlessly from the material specified in clause 5, by hot or cold plastic working. Pipe fittings of nominal diameter 100A (4B) or under may be manufactured by machining.
- Pipe fitting shall be given the heat treatment as specified in table 6.
- When using the cold-finished material S25C or S30C specified in **JIS G 4051**, pipe fittings shall be manufactured by machining the material after normalizing or quenching and tempering.

Table 6 Heat treatment for pipe fittings

Symbol of grade according to material	Type of heat treatment	
	Hot formed products	Cold formed products
PG370, PT370, PT410, FT410, PS410, PT480	As manufactured, annealing ^{a)} , normalizing, tempering after normalizing, or tempering after quenching	Annealing ^{a)} , normalizing, tempering after normalizing, or tempering after quenching
PS480	Annealing ^{a)} , normalizing, tempering after normalizing, or tempering after quenching	
PL380	Normalizing, tempering after normalizing, or tempering after quenching	
PA12, FA12	Annealing ^{b)} , normalizing, or tempering after normalizing	
PA22, FA22	Annealing ^{b)} , or tempering after normalizing	
PA23, PA24, PA25, PA26, FA23, FA24, FA25, FA26	Annealing ^{c)} , tempering after normalizing (650 °C or over), or tempering after quenching (650 °C or over)	
PL450	Normalizing, tempering after normalizing, or tempering after quenching	
PL690	Tempering after normalizing two times, or tempering after quenching	
SUS304, SUS304L, SUS316, SUS316L, SUS317, SUS317L, SUS304F, SUS316F	Solution treatment (1 010 °C or over, rapid cooling)	
SUS304H, SUS316H, SUS304HF, SUS316HF	Solution treatment (1 040 °C or over, rapid cooling)	
SUS309, SUS310, SUS309S, SUS310S, SUS309F, SUS310F, SUS836L, SUS890L	Solution treatment (1 030 °C or over, rapid cooling)	
SUS321 ^{d)} , SUS321F ^{d)} , SUS316Ti ^{d)}	Solution treatment (920 °C or over, rapid cooling)	
SUS321H, SUS347H, SUS321HF, SUS347HF	Solution treatment (1 050 °C or over, rapid cooling)	Solution treatment (1 095 °C or over, rapid cooling)
SUS347 ^{d)} , SUS347F ^{d)}	Solution treatment (980 °C or over, rapid cooling)	
SUS329J1, SUS329J3L, SUS329J4L	Solution treatment (950 °C or over, rapid cooling)	
SUS405, SUS409L, SUS430, SUS430LX, SUS444	Annealing (700 °C or over, air cooling or slow cooling)	
SUS430J1L, SUS436L	Annealing (720 °C or over, air cooling or slow cooling)	
NCF800F	Annealing (950 °C or over, rapid cooling)	
NCF800HF	Solution treatment (1 100 °C or over, rapid cooling)	
Notes ^{a)}	Low temperature annealing or stress relieving.	
^{b)}	Low temperature annealing, full annealing or isothermal annealing.	
^{c)}	Full annealing or isothermal annealing.	
^{d)}	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 tables 4 and 5.

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, and elongation of the pipe fittings shall meet the requirements specified in the Japanese Industrial Standards of materials for pipe fittings listed in tables 4 and 5.
- b) The mechanical properties of the pipe fittings for which S25C and S30C of JIS G 4051 are used as material shall meet the requirements specified in the Japanese Industrial Standards of steel pipes listed in table 4.
- c) The test temperature and absorbed energy in Charpy impact test for the pipe fittings of PL380, PL450 and PL690 shall meet the requirements specified in the Japanese Industrial Standards of materials for pipe fittings listed in table 4.

8.2 Austenite grain size

The austenite grain size of the pipe fittings of SUS321H, SUS321HF and NCF800HF shall meet the requirements specified in the Japanese Industrial Standards of steel pipes listed in tables 4 and 5.

8.3 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 tables 2 and 3.
- 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 tables 2 and 3 (N/mm²)