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**Aluminium and aluminium alloy
butt-welding pipe fittings**

ICS 23.040.40

Descriptors : aluminium, aluminium alloys, welding, pipe fittings, pipework systems,
forge welding

Reference number : JIS B 2321 : 1995 (E)



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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of International Trade and Industry through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law:

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Aluminium and aluminium alloy butt-welding pipe fittings

1 Scope This Japanese Industrial Standard specifies pipe fittings seamless or with longitudinal joint of aluminium or aluminium alloy ⁽¹⁾ (hereafter referred to as "pipe fittings") intended to be fitted in aluminium or aluminium alloy pipings by means of butt-welding.

Note ⁽¹⁾ **JIS H 4080**

JIS H 4090

Remarks 1. Normative references to this Standard are shown in Attached Table 10.
2. The units, numerical values and formulae given in { } in this Standard are based on the traditional units and are appended for informative reference.

2 Definitions For the purposes of this Standard, the definitions given in **JIS B 0151** apply.

3 Classification Pipe fittings shall be classified by the pressure resistance, shape, use, production method, material, nominal pressure for stub ends and so on, as follows:

- (1) To divide pipe fittings by the pressure resistance into those for general piping and for pressure piping.
 - (a) Pipe fittings for general piping: Stub ends and pipe fittings intended to be used under comparatively low internal pressure.
 - (b) Pipe fittings for pressure piping: Those other than the pipe fittings for general piping.
- (2) Table 1 gives the classification and their symbols by the shape.

Table 1 Classification and symbols by the shape

Classification by the shape		Symbol
Division	Subdivision	
45° elbows	Long bend	45E(L)
90° elbows	Long bend	90E(L)
	Short bend	90E(S)
Reducers	Concentric	Type 1 R(C)1
		Type 2 R(C)2
	Eccentric	Type 1 R(E)1
		Type 2 R(E)2
Tees	Equal	T(S)
	Reducing	T(R)
Caps	—	C
Stub ends	—	SE

- (3) Table 2 gives the classification and their symbols by the use, production method and material.

**Table 2 Classification and symbols by the use,
production method and material**

Alloy No. of material used for pipe fittings	Symbols for material		
	Pipe fittings for general piping	Pipe fittings for pressure piping	
		Seamless	Welded
1070	A1070	A1070S-0	A1070W-0
1050	A1050	A1050S-0	A1050W-0
1100	A1100	A1100S-0	A1100W-0
1200	A1200	A1200S-0	A1200W-0
3003	A3003	A3003S-0	A3003W-0
3203	A3203	A3203S-0	A3203W-0
5052	A5052	A5052S-0	A5052W-0
5154	A5154	A5154S-0	A5154W-0
5454	A5454	A5454S-0	A5454W-0
5056	A5056	A5056S-0	—
5083	A5083	A5083S-0	A5083W-0
(Informative) 6061(²)	A6061	A6061S	A6061W
(Informative) 6063(²)	A6063	A6063S	—

Note (²) Materials of 6061 and 6063, which are defined as informative reference because of difficulties in determining uniformly the mechanical properties due to the various processing and heat treating in production process of pipe fittings, may be used by the agreement between the parties concerned with delivery.

Remarks: Symbols S and W in pipe fittings for pressure piping represent those seamless and welded in longitudinal joint respectively. Those symbols are not applied to designating pipe fittings for general use.

(4) Stub ends shall be divided by the nominal pressure into 5 K and 10 K.

4 Pressure resistance Pipe fittings shall withstand the following hydraulic pressures without leakage:

- (1) For pipe fittings for general piping, take the pressure calculated by the following formula or 1.0 MPa {10 kgf/cm²}, whichever is lower. For stub ends, take 0.5 MPa {5 kgf/cm²} for those nominal pressure 5 K and 1.0 MPa {10 kgf/cm²} for those nominal pressure 10 K, or the pressure calculated by the following formula, whichever is lower.

$$P_1 = \frac{2s_1 \eta t_1}{D} \left\{ P_1 = \frac{200s_1 \eta t_1}{D} \right\}$$

Where, P_1 : test pressure (MPa) {kgf/cm²}
 t_1 : wall thickness of pipe fitting (mm)
 D : outside diameter of pipe fitting (basic diameter) (mm)
 s_1 : 1/4 of the minimum value of tensile strength specified in clause 6.
(N/mm²) {kgf/cm²}
 η : efficiency of longitudinal joint, 0.7 (if having).

- (2) For pipe fittings for pressure piping, take the value calculated by the following formula.

$$P_2 = \frac{2s_1t_1}{D} \left\{ P_2 = \frac{200s_1t_1}{D} \right\}$$

Where, P_2 : test pressure (MPa) {kgf/cm²}
 t_1 : wall thickness of pipe fitting (mm)
 D : outside diameter of pipe fitting (basic diameter) (mm)
 s_1 : 1/4 of minimum value of tensile strength specified in clause 6.
 (N/mm²) {kgf/cm²}.

Remarks: The efficiency of longitudinal joints, η , shall be taken, based on JIS B 8270, as 0.7 for pipe fittings for general piping and as 1.0 for pipe fittings for pressure piping.

- 5 Chemical composition** The chemical composition of pipe fittings shall be in accordance with the requirements of JIS pertaining to the materials specified in Table 3.

Table 3 Materials used for pipe fittings

Alloy No.	Material					
	JIS H 4000	JIS H 4040		JIS H 4080		JIS H 4090
	Sheet	Extruded bar	Drawn bar	Extruded pipe	Drawn pipe	Arc welded pipe
1070	A1070P	A1070BE	A1070BD	A1070TE	A1070TD	A1070TWA
1050	A1050P	A1050BE	A1050BD	A1050TE	A1050TD	A1050TWA
1100	A1100P	A1100BE	A1100BD	A1100TE	A1100TD	A1100TWA
1200	A1200P	A1200BE	A1200BD	A1200TE	A1200TD	A1200TWA
3003	A3003P	A3003BE	A3003BD	A3003TE	A3003TD	A3003TWA
3203	A3203P	—	—	A3203TE	A3203TD	A3203TWA
5052	A5052P	A5052BE	A5052BD	A5052TE	A5052TD	A5052TWA
5154	A5154P	—	—	A5154TE	A5154TD	A5154TWA
5454	A5454P	—	—	A5454TE	—	—
5056	—	A5056BE	A5056BD	A5056TE	A5056TD	—
5083	A5083P	A5083BE	A5083BD	A5083TE	A5083TD	A5083TWA
(informative) 6061 (°)	A6061P	A6061BE	A6061BD	A6061TE	A6061TD	—
(informative) 6063 (°)	—	A6063BE	A6063BD	A6063TE	A6063TD	—

6 Mechanical properties

6.1 The tensile strength, yield strength and elongation of pipe fittings for pressure piping shall meet the requirements for temper (designation) O of the materials specified in Table 3. However, the yield strength of alloy numbers 1070, 1050, 1100, 1200, 3003, 3203, 5052 and 5056 shall be applied only to those required by the purchaser.

6.2 The upper limit value of the tensile strength of welds is not specified.

7 Shape and dimensions The shape and dimensions of pipe fittings shall be as follows:

- (1) The shape and dimensions of pipe fittings shall be as given in Attached Tables 1 to 7, and the tolerances and permissible deviations, in Attached Tables 8 and 9.
- (2) The shape and dimensions of bevel ends shall conform to V shape shown in Fig. 1. These may be shaped in plane end where the basic size of thickness, t , of the pipe fittings is less than 3 mm.

If any bevel end of special shape and dimensions is required, it may be made as given in Informative reference (U shape) of Fig. 1 by the purchaser's order.

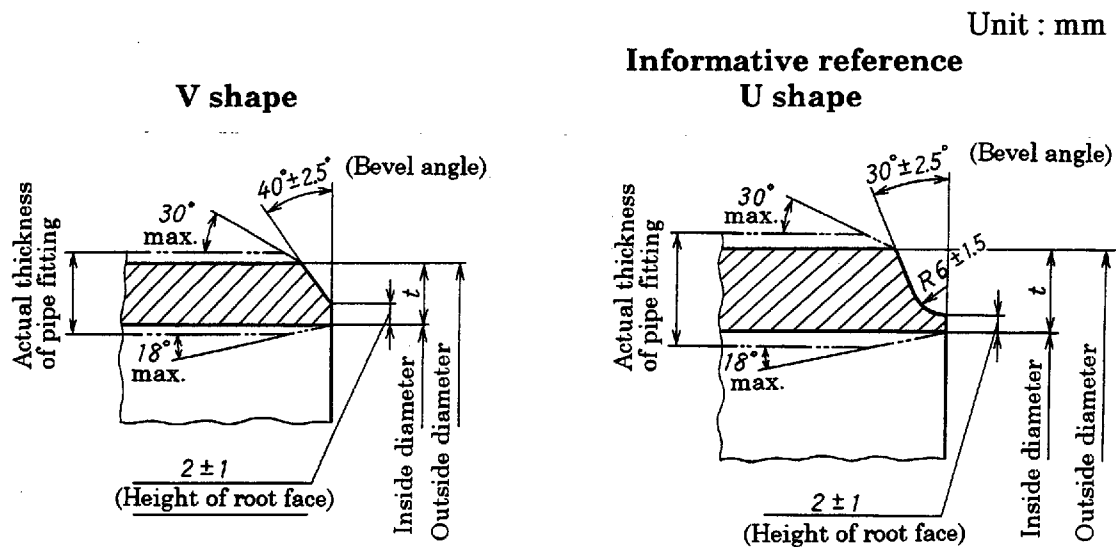


Fig. 1 Shape and dimensions of bevel end

8 Appearance Pipe fittings shall be free from flaws, wrinkles and other defects harmful to use on the inner and outer surfaces.

9 Welds The welds of pipe fittings shall be as follows:

- (1) Welds shall have sufficient penetration.
- (2) In appearance the beads shall be smooth and free from unevenness harmful to use.
- (3) The welds of pipe fittings for pressure pipings, when subjected to the radiographic inspection specified in JIS Z 3105 for the whole weld line, shall be at least grade 2 of classification for flaw image.

10 Optional qualities The purchaser may designate, according to the agreement with the manufacturer, all or a part of the following optional qualities, which are specified in Annex, besides the requirements of clauses 4. to 9.

- (1) Liquid penetrant test on pipe fittings
- (2) Mechanical test on welds of pipe fittings
- (3) Material analysis on pipe fitting products
- (4) Tensile test on pipe fittings

11 Materials The materials of pipe fittings shall be sheets, bars or pipes of aluminium or aluminium alloys as given in Table 3.

12 Production methods Pipe fittings shall be produced by the following methods.

- (1) Pipe fittings shall be produced either seamlessly or with longitudinal joint by welding sheets from the materials given in Table 3.

- (2) For the longitudinal joint of pipe fittings, butt-welding shall be applied.
- (3) The welding rod and welding wire to be used shall be in compliance with JIS Z 3232.
- (4) The welding shall be operated according to JIS Z 3604.
- (5) The welding operator shall be that has been approved qualification specified in JIS Z 3811.
- (6) Pipe fittings shall be heat treated with temper designation O. This may be omitted according to the agreement between the parties concerned with delivery.

13 Inspection

13.1 Pressure resistance inspection The pressure resistance inspection of pipe fittings shall be applied not on the products to be dealt but, previously by the manufacturer, on the products of typical several sizes for every product method of pipe fittings. In the inspection, the pipe fitting shall be welded to a pipe to be subjected to internal pressure by water pressure gradually, and shall meet the requirements of clause 4.

For the pipe fitting for pressure piping, the test pressure shall be more increased, and when kept it at the value calculated by the following formula for three min, the pipe fitting shall not burst.

$$P_3 = \frac{2s_3t_3}{D} \left\{ P_3 = \frac{200s_3t_3}{D} \right\}$$

Where, P_3 : burst pressure of pipe fitting (MPa) {kgf/cm²}
 t_3 : minimum wall thickness of pipe fitting (within the permissible deviation) (mm)
 D : outside diameter of pipe fitting (basic diameter) (mm)
 s_3 : minimum value of tensile strength specified in clause 6.
 (N/mm²) {kgf/cm²}

13.2 Inspection for chemical composition The chemical composition of the material of pipe fittings shall be inspected by melting analysis, and shall be resulted in meeting clause 5.

13.3 Inspection of mechanical property Confirm mechanical properties of the material on the certification submitted by the material manufacturer, or carry out a tensile test, on a piece of test specimen sampled from every lot ^(*) of the material to be used for pipe fittings and heat treated under the same heat treatment condition as the products, and the results shall meet the requirements of clause 6.

Note ^(*) The lots of the material to be used for pipe fittings shall be in the same melting.

13.4 Inspection for shape and dimensions The shape and dimensions of pipe fittings shall be inspected by means of direct measurement or using limit gauge, and shall meet the requirements of clause 7.

13.5 Appearance inspection The appearance of pipe fittings shall be inspected visually and shall meet the requirements of clause 8.

13.6 Weld inspection The weld of pipe fittings shall be inspected as follows:

- (1) The welding procedure of pipe fittings shall be checked by the methods specified in JIS B 8285 or JIS Z 3040.
- (2) The radiographic test of pipe fittings for pressure piping shall be applied according to JIS Z 3105 for all the weld line, and shall meet the requirements of 9 (3).

13.7 Optional quality inspection The pipe fittings on which optional qualities are required shall meet the corresponding requirements for the quality items applied.

14 Designation Pipe fittings shall be designated by the number or title of this Standard, symbol of classification by the shape, use, symbol of classification by the production method and material, and nominal size [nominal diameter ⁽⁴⁾ × nominal thickness or thickness].

The nominal size of reducing pipe fittings shall be as follows:

- (1) For those having two outlets: To be designated in order of ① ② by numbering the larger outlet as ① and the smaller as ② (see Attached Table 4.)
- (2) For those having three outlets: To be designated in order of ① ② ③ by numbering those on the same axis as ① and ② and the rest as ③ (see Attached Table 6). One of those on the same axis may be omitted.

Note ⁽⁴⁾ For the nominal diameter any of the designations A and B may be used. It shall be indicated by adding a symbol of A for the designation A used and B for the designation B used following each numeral.

15 Marking Pipe fittings shall be marked with the following information by an indelible means. The ordering of marking items is not designated.

- (1) Symbols of classification by the use, production method and material (see Table 2)
- (2) Nominal size [nominal diameter ⁽⁵⁾ × nominal thickness ⁽⁷⁾ or thickness (mm)]
- (3) Distinction between long and short bends ⁽⁶⁾ of elbows
- (4) Nominal pressure ⁽⁸⁾
- (5) Manufacturer's name or abbreviation

Notes ⁽⁵⁾ Where the nominal diameter is marked with the designation A, a letter of A shall be added following the numeral.

⁽⁶⁾ If it is difficult for a small pipe fitting to be marked with all of the required particulars above, omissions are permitted in the following order.

(a) Distinction between long and short bends of elbows

(b) Nominal diameter

⁽⁷⁾ The nominal thickness schedule shall be expressed by Sch or S.

⁽⁸⁾ To be marked with L for long bend, and S for short bend.

⁽⁹⁾ This applies only to stub ends.

16 Report Where requested previously by the purchaser, the manufacturer shall submit a detailed report describing the type of the pipe fitting, nominal size, chemical composition, results of mechanical properties and the like.

Related standards :

JIS B 2203

Tolerances for pipe flanges

JIS B 2220

Steel welding pipe flanges

JIS H 0001

Temper designation for aluminium and aluminium alloys



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Attached Table 1 Outside and inside diameters and thickness of pipe fittings

Unit: mm

Nominal diameter		Out-side diam-eter	Nominal thickness							
A	B		Schedule 10S		Schedule 20S		Schedule 40		Schedule 80	
			Inside diameter	Thick-ness	Inside diameter	Thick-ness	Inside diameter	Thick-ness	Inside diameter	Thick-ness
15	1/2	21.7	17.5	2.1	16.7	2.5	16.1	2.8	14.3	3.7
20	3/4	27.2	23.0	2.1	22.2	2.5	21.4	2.9	19.4	3.9
25	1	34.0	28.4	2.8	28.0	3.0	27.2	3.4	25.0	4.5
32	1 1/4	42.7	37.1	2.8	36.7	3.0	35.5	3.6	32.9	4.9
40	1 1/2	48.6	43.0	2.8	42.6	3.0	41.2	3.7	38.4	5.1
50	2	60.5	54.9	2.8	53.5	3.5	52.7	3.9	49.5	5.5
65	2 1/2	76.3	70.3	3.0	69.3	3.5	65.9	5.2	62.3	7.0
80	3	89.1	83.1	3.0	81.1	4.0	78.1	5.5	73.9	7.6
90	3 1/2	101.6	95.6	3.0	93.6	4.0	90.2	5.7	85.4	8.1
100	4	114.3	108.3	3.0	106.3	4.0	102.3	6.0	97.1	8.6
125	5	139.8	133.0	3.4	129.8	5.0	126.6	6.6	120.8	9.5
150	6	165.2	158.4	3.4	155.2	5.0	151.0	7.1	143.2	11.0
200	8	216.3	208.3	4.0	203.3	6.5	199.9	8.2	190.9	12.7
250	10	267.4	259.4	4.0	254.4	6.5	248.8	9.3	237.2	15.1
300	12	318.5	309.5	4.5	305.5	6.5	297.9	10.3	283.7	17.4
350	14	355.6	346.0	5.0	339.8	8.0	333.4	11.1	317.6	19.0
400	16	406.4	396.8	5.0	390.6	8.0	381.0	12.7	363.6	21.4
450	18	457.2	447.6	5.0	441.4	8.0	428.6	14.3	409.6	23.8
500	20	508.0	497.0	5.5	492.2	9.5	477.8	15.1	455.6	26.2
550	22	558.8	547.8	5.5	—	—	—	—	501.6	28.6
600	24	609.6	596.8	6.5	—	—	574.8	17.5	547.6	31.0
750	30	762.0	746.2	7.9	—	—	—	—	—	—
800	32	812.8	—	—	—	—	778.0	17.5	—	—
850	34	863.6	—	—	—	—	828.8	17.5	—	—
900	36	914.4	—	—	—	—	876.4	19.1	—	—

Remarks: Where any other thickness than those listed here is particularly required, those specified in **JIS B 2313**, **JIS H 4080** or **JIS H 4090** may be used by the agreement between the parties concerned with delivery.

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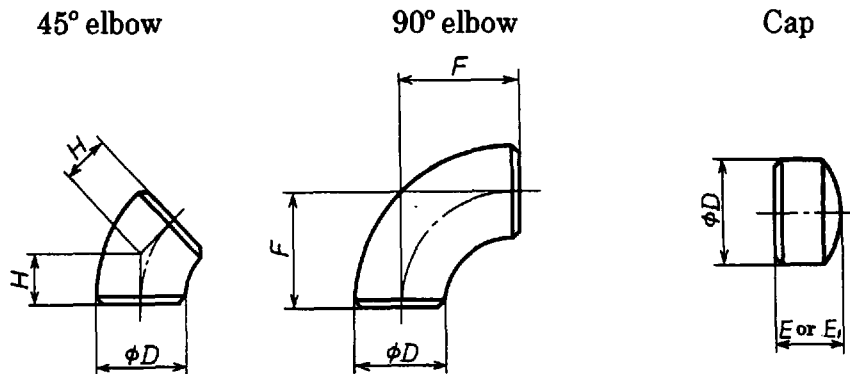
Attached Table 2 Outside diameter and thickness of pipe fittings

Unit: mm

Nominal diameter		Out-side diameter	Nominal thickness											
A	B		6	7	8	9	10	12	15	20	25	30	35	40
350	14	355.6	○	○	○	○	○	○	○	○				
400	16	406.4	○	○	○	○	○	○	○	○				
450	18	457.2	○	○	○	○	○	○	○	○				
500	20	508.0	○	○	○	○	○	○	○	○				
550	22	558.8	○	○	○	○	○	○	○	○				
600	24	609.6	○	○	○	○	○	○	○	○				
650	26	660.4		○	○	○	○	○	○	○	○			
700	28	711.2		○	○	○	○	○	○	○	○			
750	30	762.0			○	○	○	○	○	○	○	○		
800	32	812.8			○	○	○	○	○	○	○	○		
850	34	863.6				○	○	○	○	○	○	○	○	
900	36	914.4				○	○	○	○	○	○	○	○	
950	38	965.2					○	○	○	○	○	○	○	
1000	40	1 016.0					○	○	○	○	○	○	○	○
1050	42	1 066.8					○	○	○	○	○	○	○	○
1100	44	1 117.6					○	○	○	○	○	○	○	○
1150	46	1 168.4						○	○	○	○	○	○	○
1200	48	1 219.2						○	○	○	○	○	○	○

Remarks: Where any other thickness than those given here is particularly required, those specified in **JIS B 2313**, **JIS H 4080** or **JIS H 4090** may be used by the agreement between the parties concerned with delivery.

Attached Table 3 Shape and dimensions of 45° elbows, 90° elbows and caps



Unit: mm

Nominal diameter		Out-side diameter <i>D</i>	End face-to-center dimension			End face-to-back dimension ⁽¹⁰⁾		Limited thickness
			45° elbows	90° elbows		Caps		
			<i>H</i>	<i>F</i>				
A	B		Long	Long	Short	<i>E</i>	<i>E</i> ₁	
15	1/2	21.7	15.8	38.1	—	—	—	—
20	3/4	27.2	15.8	38.1	—	—	—	—
25	1	34.0	15.8	38.1	25.4	38.1	—	—
32	1 1/4	42.7	19.7	47.6	31.8	38.1	—	—
40	1 1/2	48.6	23.7	57.2	38.1	38.1	—	—
50	2	60.5	31.6	76.2	50.8	38.1	44.5	5.5
65	2 1/2	76.3	39.5	95.3	63.5	38.1	50.8	7.0
80	3	89.1	47.3	114.3	76.2	50.8	63.5	7.6
90	3 1/2	101.6	55.3	133.4	88.9	63.5	76.2	8.1
100	4	114.3	63.1	152.4	101.6	63.5	76.2	8.6
125	5	139.8	78.9	190.5	127.0	76.2	88.9	9.5
150	6	165.2	94.7	228.6	152.4	88.9	101.6	11.0
200	8	216.3	126.3	304.8	203.2	101.6	127.0	12.7
250	10	267.4	157.8	381.0	254.0	127.0	152.4	12.7
300	12	318.5	189.4	457.2	304.8	152.4	177.8	12.7
350	14	355.6	220.9	533.4	355.6	165.1	190.5	12.7
400	16	406.4	252.5	609.6	406.4	177.8	203.2	12.7
450	18	457.2	284.1	685.8	457.2	203.2	228.6	12.7
500	20	508.0	315.6	762.0	508.0	228.6	254.0	12.7
550	22	558.8	347.2	838.2	558.8	—	—	—
600	24	609.6	378.7	914.4	609.6	—	—	—
650	26	660.4	410.3	990.6	660.4	—	—	—
700	28	711.2	441.9	1 066.8	711.2	—	—	—
750	30	762.0	473.4	1 143.0	762.0	—	—	—
800	32	812.8	505.0	1 219.2	812.8	—	—	—
850	34	863.6	536.6	1 295.4	863.6	—	—	—
900	36	914.4	568.1	1 371.6	914.4	—	—	—

