

JIS

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JAPANESE INDUSTRIAL STANDARD

**25 MPa {250 kgf/cm²}
bite type tube fittings
for hydraulic use**

JIS B 2351—1990

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242

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JAPANESE INDUSTRIAL STANDARD

J I S

25 MPa {250 kgf/cm²}
bite type tube fittings
for hydraulic use

B 2351-1990

1. Scope

This Japanese Industrial Standard specifies the bite type tube fittings ⁽¹⁾ (hereafter referred to as the "fittings") of the maximum working pressure 25 MPa {250 kgf/cm²} chiefly made from the steel pipes specified in Annex, as singled out of the family of the tube fittings for hydraulic pipings of the maximum working temperature of 120°C and the maximum working pressure of 25 MPa {250 kgf/cm²}.

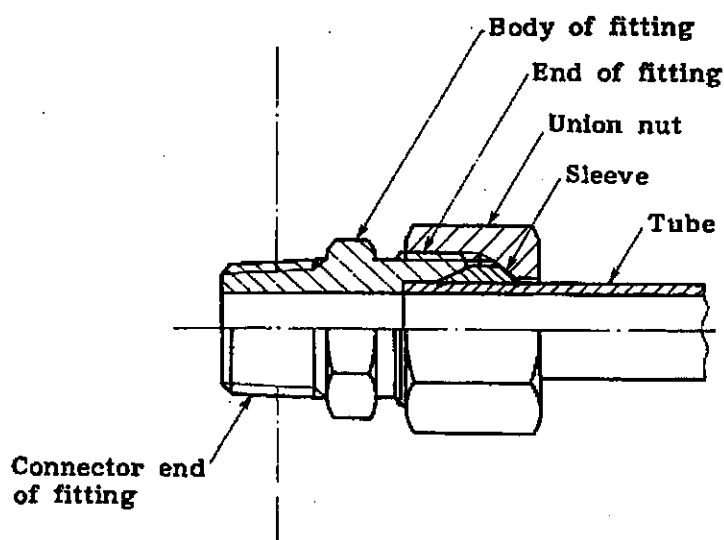
Note ⁽¹⁾ The bite type tube fitting is a type of fitting in which jointing is effected between the body of the fitting and the tube with a sleeve fitted into it, thereby hermetically sealing the pressure liquid, Fig. 1 shows an example.

Remarks 1. Applicable Standards to this Standard are shown in Attached Table 8.

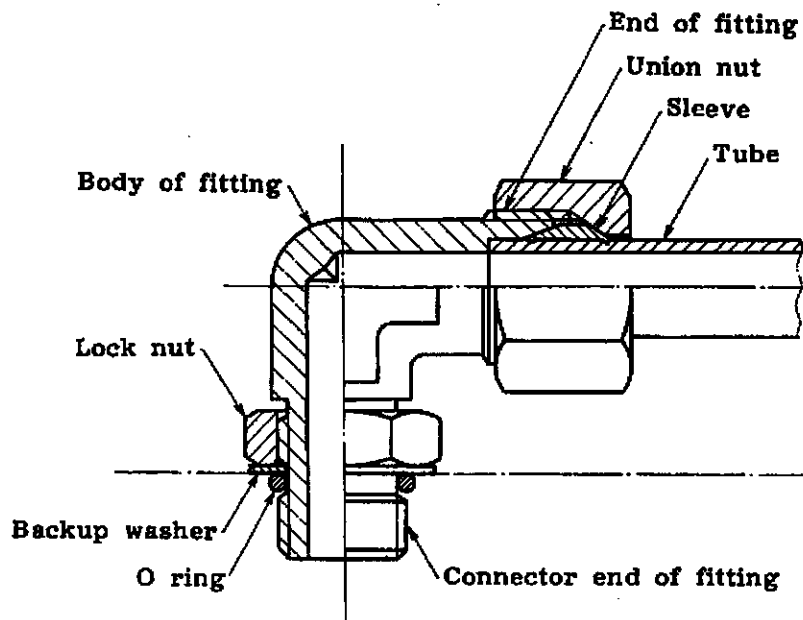
2. The units and numerical values given in { } in this Standard are based on the traditional units and are currently the criteria in force.

Fig. 1. Assembled Structure of Fitting (Example)

(a) Taper Threaded Nipple



(b) Parallel Threaded Elbow



2. Classification

The fittings shall be classified into the categories (hereafter referred to as the "type") according to the shape, the size and the type of the connector end of the fittings. The 17 types according to the shape and the type of the connector end shall be as shown in Table 1. The size types shall be divided into 11 types shown in Attached Tables 1 to 6 according to the applicable size of tube.

Table 1. Type and Symbols of Fittings

Type	Symbol	Remark
Type O parallel threaded nipple	NSO	Attached Table 1
Type E parallel threaded nipple	NSE	Attached Table 1
Taper threaded nipple	NT	Attached Table 1
Welding nipple	NW	Attached Table 2
Union	U	Attached Table 3
Bulkhead-attached threaded union	UP	Attached Table 6
Bulkhead-attached welding union	UW	Attached Table 2
Parallel threaded elbow	LS	Attached Table 4
Taper threaded elbow	LT	Attached Table 5
Union elbow	LU	Attached Table 3
Bulkhead-attached threaded union elbow	LUP	Attached Table 6
Middle T with parallel thread	TSA	Attached Table 4
Middle T with taper thread	TTA	Attached Table 5
End T with parallel thread	TSB	Attached Table 4
End T with taper thread	TTB	Attached Table 5
Union T	TU	Attached Table 3
Bulkhead-attached threaded union T	TUP	Attached Table 6

3. Quality

3.1 Thrust Condition When the fitting is tested by the method of 5.2, its sleeve shall retain a circular notch around the outer surface of the tube. In this case, there shall be no collapse ⁽²⁾ of the tube, no excess swelling in the center of the sleeve, and no cracks on the surface of the sleeve.

Note ⁽²⁾ The words "collapse of the tube" herein means the contraction of the inside diameter due to the biting of the sleeve.

3.2 Capability of Repeated Assembling When a fitting is tested by the method of 5.3.2, it shall show no leakage.

3.3 Pressure Resistance When a fitting is tested by the method of 5.3.3, it shall show neither leakage nor breakage.

3.4 Impulse Resistance When a fitting is tested by the method of 5.3.4, it shall show neither leakage nor breakage.

3.5 Flexure Resistance When a fitting is tested by the method of 5.3.5 (1) using test equipment specified in 5.3.5 (2), it shall show neither leakage nor other abnormalities.

3.6 Hardness of Product The sleeve shall have surface hardness of not less than HV 500 as a result of a suitable surface hardening treatment.

3.7 Shape and Dimensions The shape and dimensions of the fittings shall meet the following requirements:

- (1) The shape and dimensions of the fittings shall be as specified in Attached Tables 1 to 7.
- (2) The O ring used at the connector end of the parallel thread type fitting shall be as specified in JIS B 2401.
- (3) The permissible inaccuracy in the angle formed by each axis of the fittings shall be 5 mm or under for each 300 mm.
- (4) For the types of fittings with a straight fluid passage and with holes drilled from either side, the offset between the drilled holes at their meeting portion shall be moderate.
- (5) The fittings shall have no remarkable local irregularity of thickness.

3.8 Appearance The appearance of the fittings shall be as follows:

- (1) The inside and outside surfaces of the fittings shall be free from any defects harmful to use such as cracks, burrs and rust.
- (2) The complete thread portion shall be free from such defects as a scanty or missing thread.

4. Materials

The materials for the fittings shall be as follows:

- (1) The materials for the body, union nut and lock nut shall be those capable of exhibiting the same properties as those of the products of S 15 C to S 45 C specified in JIS G 4051 or similar materials. The materials for the body of the welding type fitting shall be excellent in weldability.
- (2) The materials for sleeve shall be S 10 C or S 09 CK specified in JIS G 4051 or those capable of exhibiting the same properties.
- (3) The materials for backup washer shall be SPCC or SPCD specified in JIS G 3141.

5. Test Methods

5.1 Assembling Order of Test Fitting Prior to the test, the fitting to be tested shall have the attached sleeve thrust into the tube in the procedure given below. In this case, the tube shall be the steel tube specified in Table 2.

Table 2. Dimensions of Steel Tube for Test

Unit: mm

Outside diameter of tube		4	6	8	10	12	16	20	25	30	32	38
Thickness of tube	For bite test	1	1	1	1	1	1.5	1.5	2	2	2.5	2.5
	For pressure test	1	1	1	1.5	1.5	2	2.5	3	3.5	4	4.5

Remark: The tube to serve shall be Class 2 (STPS 2) precision carbon steel tube for the bite type tube fitting specified in Annex.

- (1) Remove traces of oil from the tube.
- (2) Clamp the assembly tool or the body of the fitting in a vice, and apply lubricating oil to the surface of the threaded part and to the taper in the bore.

When the body of a fitting is used, the maximum frequency of use shall be 4 times.

- (3) Apply lubricating oil to the back of the sleeve (contact face with the union nut).
- (4) After assembling, turn the tube gently by hand to tighten the union nut gradually until the tube ceases to turn.
- (5) From the point where the tube has ceased to turn, further tighten the union nut in conformity to the criterion determined by agreement between the parties concerned with delivery.

5.2 Bite Test For the bite test, use the steel tube for the bite test specified in Table 2, assemble the parts in accordance with 5.1, expose the ring-shaped groove produced by the bite of the sleeve, and examine the degree of bite, swelling of the sleeve and for the presence of cracks on the surface.

5.3 Pressure Test

5.3.1 General Requirements for Pressure Test Carry out the pressure test of the fitting on the steel tube for the pressure test specified in Table 2. Disassemble and reassemble the fitting in accordance with 5.1, and further conform to the following requirements.

- (1) **Test Fluid** The fluid for the test shall be of viscosity grade ISO VG 32 or ISO VG 46, both Class 2 (additive) specified in JIS K 2213.
- (2) **Test Fitting** The fitting for test shall, as a rule, be of parallel thread nipple (NSO or NSE). For the flexure test, however, only parallel thread nipple or taper thread nipple (NT) shall be used.

- (3) **Tightening Value** The tightening value for reassembling shall be indicated, for all sizes of fittings, by the turning angle to be effected after the tightening torque of the union nut suddenly increases.

Minimum tightening value $\frac{1}{6}$ turn

Maximum tightening value $\frac{1}{3}$ turn

- (4) **Method of Connecting Fittings** Assemble the fitting to be subjected to the pressure test into the state (fitting assembly) in which it is connected with the steel tube specified in 5.1 and fit the end securely to the manifold of the test equipment. Suitably close the free end of the tube, and except for the flexure test, in no way fix or restrain it.

5.3.2 Repeated Assembly Test Carry out this test for two sets of two types of fittings assembled with the minimum and the maximum tightening values specified in 5.3.1 (3). Repeat a total of eight cycles of assembling and disassembling, and at the 3rd, 6th and 8th assembling, apply a load pressure two times the maximum working pressure and maintain it for 5 min and check for any leakage from junction or other parts.

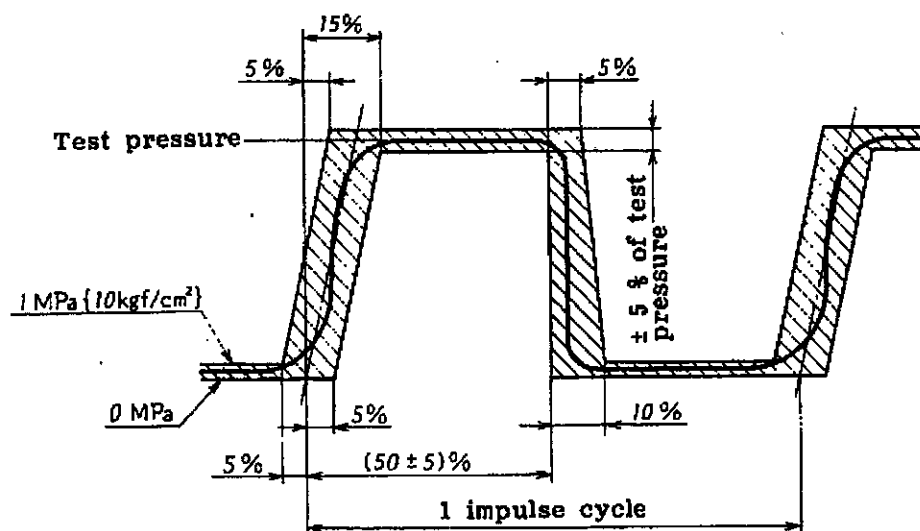
At each time of disassembling, detach the pipe completely from the fitting body, whereas, at the final time, test the assembly as it is tightened with the specified tightening force.

5.3.3 Pressure Resistance Test Carry out this test for the specimen successful in the test of 5.3.2 by applying a pressure four times the maximum working pressure for 5 min and then check for a leakage or damage.

The specimen before this test shall be in the state just after the test of 5.3.2 with no treatment of increase of tightening or others.

5.3.4 Impulse Resistance Test Carry out this test for two sets of fitting assembly assembled with the minimum tightening values specified in 5.3.1 (3). Mount the fitting assemblies on the manifold of the test equipment capable of generating impulse pressure of the pattern shown in Fig. 2. The peak of the impulse pressure shall be $(133 \pm 5) \%$ of the maximum working pressure and the frequency shall be 0.5 to 1.25 Hz {30 to 70 cycle/min}. The impulse pressure shall be measured with an electronic measuring instrument at the manifold on the entrance side. The fitting assemblies shall be tested with a total of 200000 impulse cycles to be checked for any leakage or damage.

Fig. 2. Impulse Resistance Test Waveform



5.3.5 Flexure Resistance Test The flexure resistance test shall be carried out by the following method:

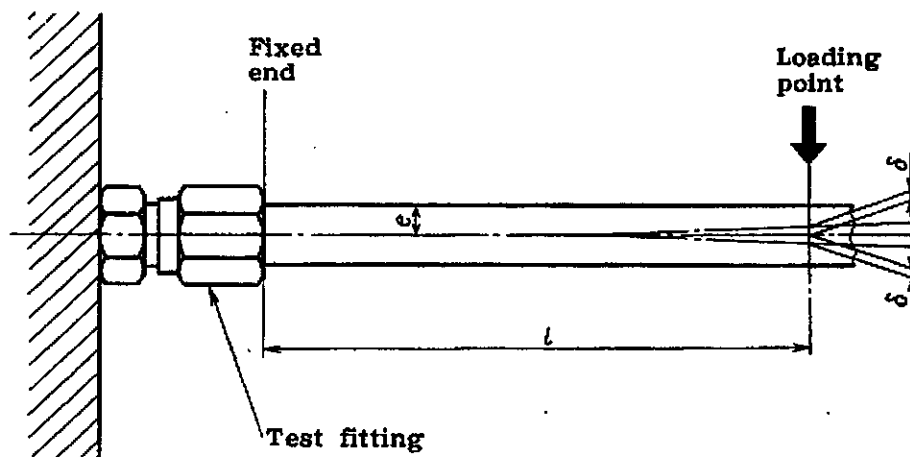
- (1) Carry out this test for two sets of fittings assembled with the maximum tightening value specified in 5.3.1 (3). Mount the fitting assemblies on the manifold of test machine specified in (2) below, apply a repeated load at a rate of 23.3 Hz (400 cycle/min) or over so as to produce a bending stress specified in Table 3 at the fixed end of the tube, simultaneously apply the maximum working pressure up to 10000000 cycles and check for any leakage or other abnormalities.

Table 3. Outside Diameter of Tube and Bending Stress in Flexure Resistance Test

Outside diameter of tube mm	4	6	8	10	12	16	20	25	30	32	38
Bending stress N/mm ² {kgf/mm ² }	98.1 {10}	98.1 {10}	98.1 {10}	98.1 {10}	98.1 {10}	78.5 {8}	58.8 {6}	39.2 {4}	39.2 {4}	39.2 {4}	39.2 {4}

- (2) The test machine to be used for this test shall be of a cantilever type fit for application of a concentrated load as shown in Fig. 3, and shall have a construction ensuring the following functions.

Fig. 3. Flexure Resistance Test Apparatus



- (a) The apparatus shall be capable of imparting a reciprocating or a rotary motion to the fixed end of the tube at a rate of 23.3 Hz or over and of so adjusting the distance l and deflection δ as to satisfy the formula given in (3).
- (b) The apparatus shall be capable of producing the maximum working pressure.
- (3) When the bending stress given in Table 3 is administered to the tube, the distance l from the fixed end of the tube shown in Fig. 3 to the point of application of the load or the displacement δ shall be calculated from the following formula:

$$l = \sqrt{\frac{3\delta E e}{\sigma}}$$

where,

l : distance shown in Fig. 3 (mm)

δ : displacement shown in Fig. 3 (mm)

E : modulus of longitudinal elasticity of tube
(20.6×10^4 N/mm²) (2.1×10^4 kgf/mm²)

e : half the outside diameter of tube (mm)

σ : bending stress of the tube according to Table 3 (N/mm²) (kgf/mm²).

6. Method of Inspection

6.1 Types of Inspection and Items of Inspection The inspection of the fittings shall be divided into two types: type inspection ⁽³⁾ and delivery inspection ⁽⁴⁾. For both types of inspection, the items of inspection shall be as enumerated below.

The sampling inspection plan to be applied to the type inspection and the delivery inspection shall be agreed upon between the parties concerned with delivery.

Notes ⁽³⁾ A type inspection is to check whether or not the quality of the products has attained all the characteristics contemplated at the time of designing.

⁽⁴⁾ A delivery inspection is to check whether or not the products which are identical in design and manufacture with those having already passed the type inspection possess the required characteristics at the time of delivery.

(1) Items of Type Inspection

- (a) Appearance inspection
- (b) Shape and dimension inspection
- (c) Hardness inspection
- (d) Thread accuracy inspection
- (e) Bite inspection
- (f) Repeated assembly inspection
- (g) Pressure resistance inspection
- (h) Impulse resistance inspection
- (i) Flexure resistance inspection

(2) Items of Delivery Inspection

- (a) Appearance inspection
- (b) Shape and dimension inspection
- (c) Hardness inspection
- (d) Thread accuracy inspection

6.2 Appearance Inspection The appearance inspection shall be made visually, and the results shall satisfy the quality requirements specified in 3.8.

6.3 Shape and Dimension Inspection The inspection on shape and dimensions shall be made either by direct measurement or by the use of limit gauges, and the results shall satisfy the quality requirements specified in 3.7.

6.4 Hardness Inspection The hardness inspection shall be made by the method of JIS Z 2244, and the results shall satisfy the quality requirements specified in 3.6.

6.5 Thread Accuracy Inspection The thread accuracy inspection shall be made by the use of limit gauge shown in Table 4 or other inspection instruments having the same function, and the results shall satisfy the requirements specified in Attached Tables 1 to 6.

Table 4. Applicable Standards for Thread Accuracy Inspection

Type of thread	Standard applicable to screw gauge
Metric fine screw thread	JIS B 0252
Parallel tube thread	JIS B 0254
Taper tube thread	JIS B 0253

6.6 Bite Inspection The bite inspection shall be made by the method specified in 5.2, and the results shall satisfy the requirements specified in 3.1.

6.7 Repeated Assembly Inspection The repeated assembly inspection shall be made by the method specified in 5.3.2, and the results shall satisfy the requirements specified in 3.2.

6.8 Pressure Resistance Inspection The pressure resistance inspection shall be made by the method specified in 5.3.3, and the results shall satisfy the requirements specified in 3.3.

6.9 Impulse Resistance Inspection The impulse resistance inspection shall be made by the method specified in 5.3.4, and the results shall satisfy the requirements specified in 3.4.

6.10 Flexure Resistance Inspection The flexure resistance inspection shall be made by the method specified in 5.3.5, and the results shall satisfy the requirements specified in 3.5.

7. Designation of Product

The designation of product shall be made by the number or the title of this Standard, the type or the symbol indicating the type and the nominal size in this order.

Example: For type O parallel threaded nipple of 20 in nominal size,

JIS B 2351 NSO 20 or

25 MPa or 250 kgf/cm² bite type tube fitting
for hydraulic use Type O 20.

8. Marking

The fittings shall be marked with the following details. The fittings not suitable for direct markings on the product may have them on the tag, etc., for each package.

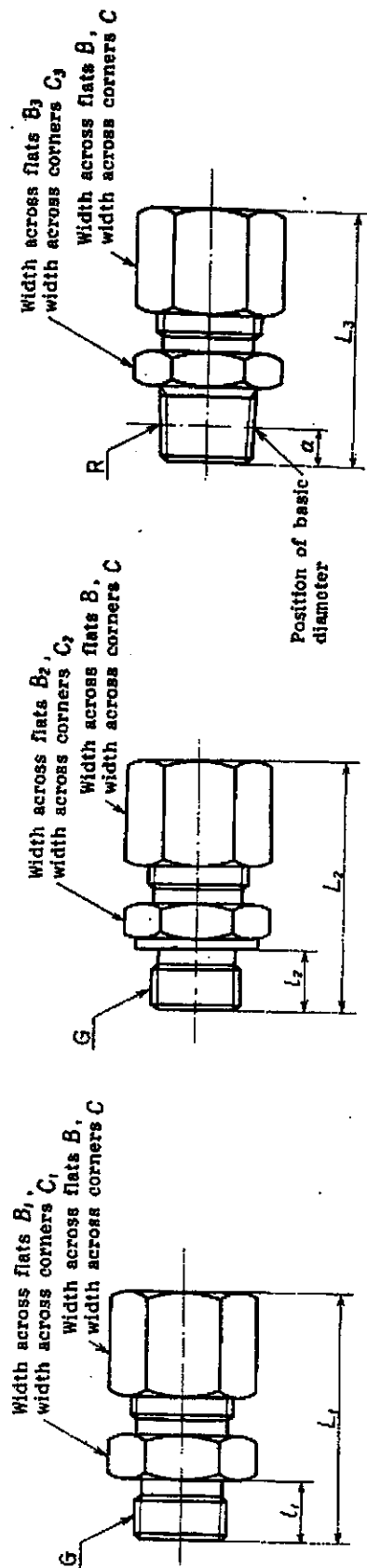
- (1) Manufacturer's name or identification mark
- (2) Type symbol
- (3) Nominal size

Attached Table 1. Shapes and Dimensions of Parallel Threaded Nipple Type O, Parallel Threaded Nipple Type E and Taper Threaded Nipple

NSO

NSE

NT

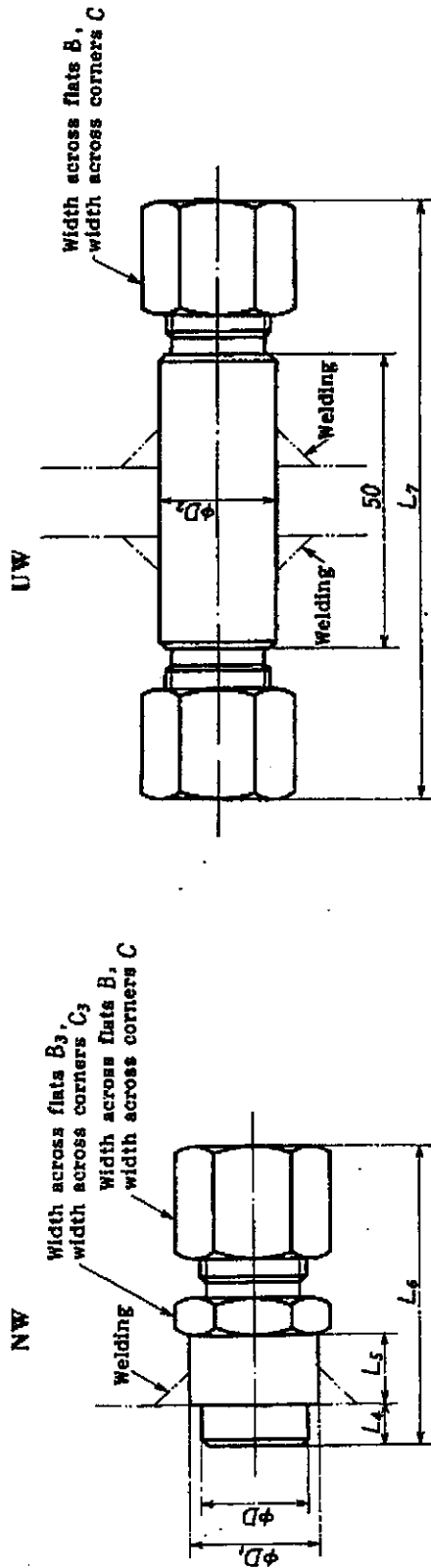


Nominal size	Outside diameter of applicable tube	Inside diameter of fitting (Min.)	Nominal size of pipe thread		l_1 (Max.)	l_2 (Max.)	a	L_1 (Hand tightening) (Max.)	L_2 (Hand tightening) (Max.)	L_3 (Hand tightening) (Max.)	Width across flats x width across corners			
			G	R							$B \times C$	$B_1 \times C_1$	$B_2 \times C_2$	$B_3 \times C_3$
4	4	2.5	1/8		10	7.4	3.97	36	33	34	12×13.9	14×16.2	14×16.2	12×13.9
6	6	4	1/8		10	7.4	3.97	41	38	39	14×16.2	14×16.2	14×16.2	14×16.2
8	8	6	3/8		12	11	6.01	45	44	44	17×19.6	19×21.9	19×21.9	17×19.6
10	10	7	3/4		12	11	6.01	46	45	45	19×21.9	19×21.9	19×21.9	19×21.9
12	12	9	3/8		12	11.4	6.35	47	46	47	22×25.4	22×25.4	22×25.4	22×25.4
16	16	12	1/2		16	15	8.16	56	55	55	30×34.6	27×31.2	27×31.2	27×31.2
20	20	16	3/4		17	16.3		62	61		36×41.6	36×41.6	32×37.0	
25	25	20	1		21	19.1		69	67		46×53.1	41×47.3	41×47.3	
30	30	25	1 1/4		21	21.4	—	73	73	—	50×57.7	50×57.7	50×57.7	—
32	32	26	1 1/4		21	21.4		75	75		55×63.5	50×57.7	50×57.7	50×57.7
38	38	32	1 1/2		21	21.4		77	77		60×69.3	55×63.5	55×63.5	55×63.5

Unit: mm

- Remarks
- The connector end of Type NSO and Type NSE shall be as detailed for Type O and Type E in Attached Table 7.
 - Hand tightening of L_1 , L_2 , and L_3 indicates the length of the fittings assembled to tube without using tools.
 - The thread on the fitting end (on union nut side) shall conform to JIS B 0207 and its precision shall be Class 2 of JIS B 0211. The thread on the connector end of fitting shall be Class A of the thread C of JIS B 0202 for the parallel thread type, and the thread R of JIS B 0203 for the taper thread type.
 - The thread G shall be Class A of parallel pipe thread of JIS B 0202, and the thread R shall be taper pipe thread of JIS B 0203.
 - The tolerance on the widths across flats B , B_1 , B_2 , and B_3 shall be h 15 of JIS B 1021.

Attached Table 2. Shapes and Dimensions of Welding Nipple and Bulkhead-attached Welding Union



Nominal size	Outside diameter of applicable tube	Inside diameter of fitting (Min.)	$D_{-0.1}^{+0.3}$	D_1	$D_{-0.2}^{+0}$	L_4	L_5	L_1 (Hand tightening) (Max.)	L_2 (Hand tightening) (Max.)	Width across flats		Unit: mm
										$B \times C$	width across corners	
4	4	2.5	10	12	12	5	10	39	90	12×13.9	12×13.9	mm
6	6	4	10	14	16	5	10	44	100	14×16.2	14×16.2	
8	8	6	15	17	16	5	12	47	100	17×19.6	17×19.6	
10	10	7	15	19	19	5	12	48	102	19×21.9	19×21.9	
12	12	9	18	22	20	7	12	51	102	22×25.4	22×25.4	
16	16	12	25	27	28	7	15	58	110	30×34.6	27×31.2	
20	20	16	28	32	32	7	15	63	116	36×41.6	32×37.0	
25	25	20	37	41	38	10	15	70	116	46×53.1	41×47.3	
30	30	25	42	46	46	10	15	73	118	50×57.7	46×53.1	
32	32	26	42	46	46	10	15	73	118	55×63.5	46×53.1	
38	38	32	50	55	55	10	15	73	118	60×69.3	55×63.5	

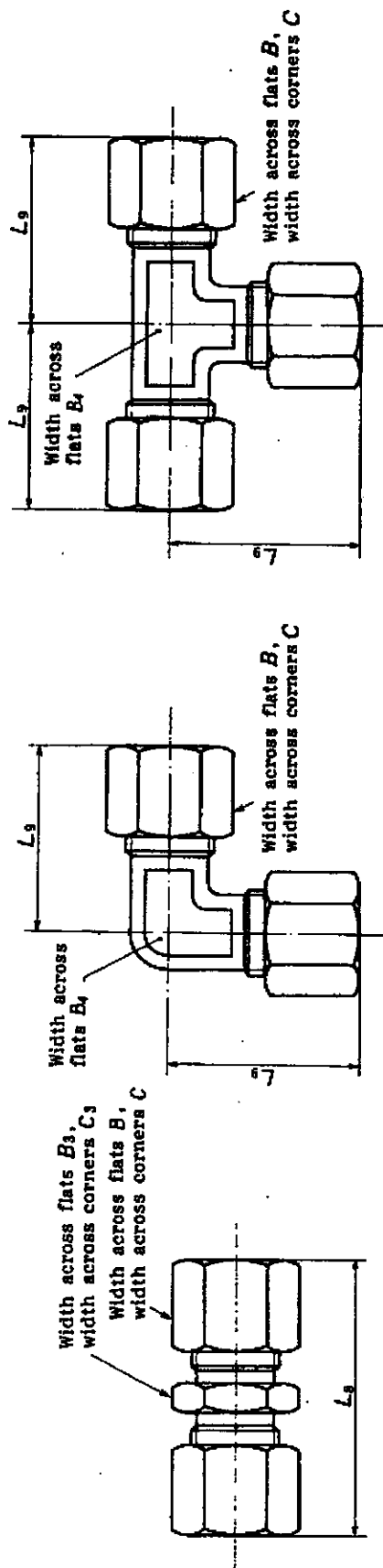
- Remarks
1. Hand tightening of L_4 and L_5 indicates the length of the fitting assembled to tube without using tools.
 2. The thread on the fitting end (on union nut side) shall conform to JIS B 0207 and its precision shall be Class 2 of JIS B 0211. The thread on the connector end of fitting shall be Class A of the thread G of JIS B 0202 for the parallel thread type, and the thread R of JIS B 0203 for the taper thread type.
 3. The tolerance on the widths across flats B and C shall be h 15 of JIS B 1021.
 4. The tolerance on dimensions for D_1 , L_4 , and L_5 shall be the middle class of JIS B 0405.

Attached Table 3. Shapes and Dimensions of Union, Union Elbow and Union T

U

LU

TU

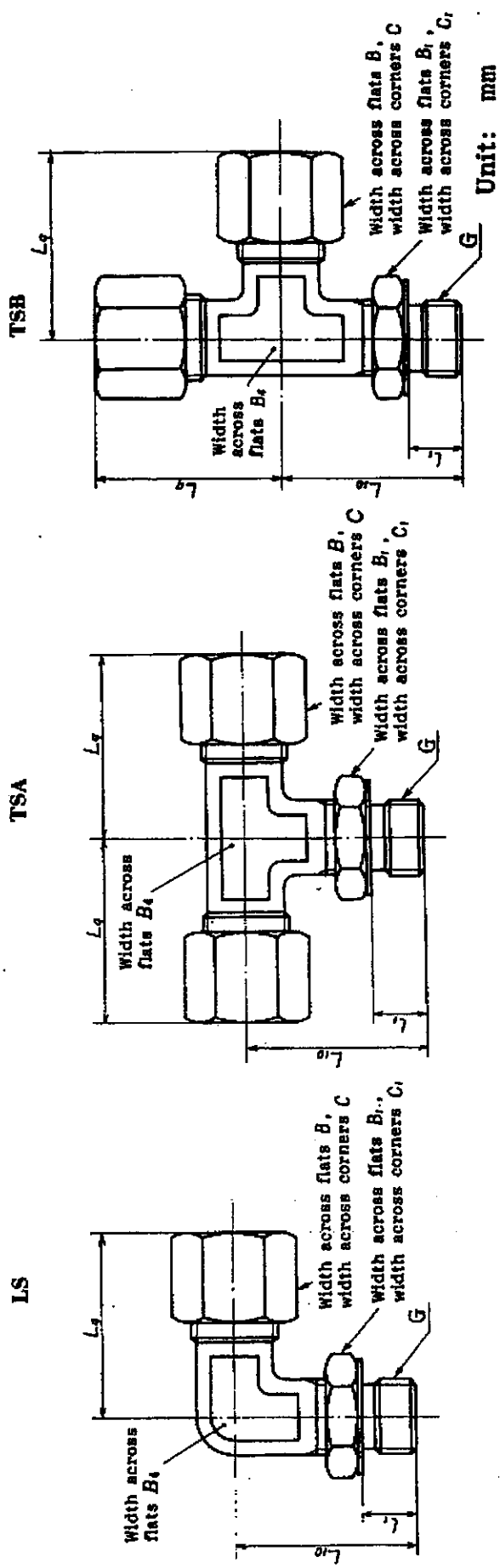


Unit: mm

Nominal size	Outside diameter of applicable tube	Inside diameter of fitting (Min.)	L ₁ (Hand tightening) (Max.)	L ₂ (Hand tightening) (Max.)	Width across flats × width across corners		Width across flats of body (Max.)
					B ₁ × C ₁	B ₂ × C ₂	
4	4	2.5	44	30	12 × 13.9	12 × 13.9	10
6	6	4	54	33	14 × 16.2	14 × 16.2	12
8	8	6	55	35	17 × 19.6	17 × 19.6	14
10	10	7	57	37	19 × 21.9	19 × 21.9	17
12	12	9	58	39	22 × 25.4	22 × 25.4	19
16	16	12	66	48	30 × 34.6	27 × 31.2	24
20	20	16	74	54	36 × 41.6	32 × 37.0	30
25	25	20	78	60	46 × 53.1	41 × 47.3	36
30	30	25	80	65	50 × 57.7	46 × 53.1	41
32	32	26	83	68	55 × 63.8	46 × 53.1	46
38	38	32	86	71	60 × 69.3	55 × 63.5	50

- Remarks
1. Hand tightening of L₁ and L₂ indicates the length of the fitting assembled to tube without using tools.
 2. The thread on the fitting end (on union nut side) shall conform to JIS B 0207 and its precision shall be Class 2 of JIS B 0211. The thread on the connector end of fitting shall be Class A of the thread G of JIS B 0207 for the parallel thread type, and the thread R of JIS B 0203 for the thread type.
 3. The tolerance on the widths across flats B₁, B₂ and B₃ shall be h 15 of JIS B 1021.

Attached Table 4. Shapes and Dimensions of Parallel Threaded Elbow, Middle T with Parallel Thread and End T with Parallel Thread



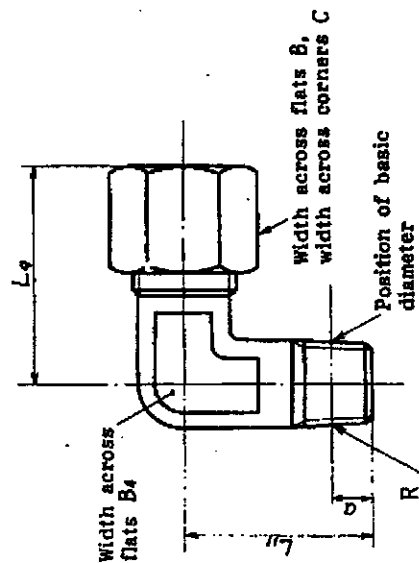
Unit: mm

Nominal size	Outside diameter of appl-cable tube	Inside diameter of fitting (Min.)	Nominal size of pipe thread G	L ₁ (Max.)	L ₂ (Hand tightening) (Max.)	L ₁₀ (Max.)	Width across flats		Width across flats of body (Max.) B ₄
							B × C	B ₁ × C ₁	
4	4	2.5	1/8	10	30	29	12 × 13.9	14 × 16.2	10
6	6	4	1/8	10	33	30	14 × 16.2	14 × 16.2	12
8	8	6	1/4	12	35	34	17 × 19.6	19 × 21.9	14
10	10	7	1/4	12	37	35	19 × 21.9	19 × 21.9	17
12	12	9	3/8	12	39	36	22 × 25.4	22 × 25.4	19
16	16	12	1/2	16	48	46	30 × 34.6	27 × 31.2	24
20	20	16	3/4	17	54	53	36 × 41.6	36 × 41.6	30
25	25	20	1	21	60	65	46 × 53.1	41 × 47.3	36
30	30	25	1 1/4	21	65	70	50 × 57.7	50 × 57.7	41
32	32	26	1 1/4	21	68	73	55 × 63.5	50 × 57.7	46
38	38	32	1 1/2	21	71	77	60 × 69.3	55 × 63.5	50

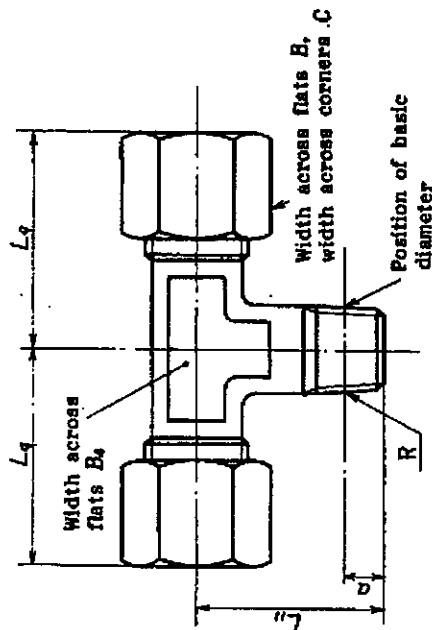
- Remarks
1. The connector end of the fitting shall be as detailed for Type 0 in Attached Table 7.
 2. Hand tightening of L₂ indicates the length of the fittings assembled to tube without using tools.
 3. The thread on the fitting end (on union nut side) shall conform to JIS B 0207 and its precision shall be Class 2 of JIS B 0211. The thread on the connector end of fitting shall be Class A of the thread G of JIS B 0202 for the parallel thread type, and the thread R of JIS B 0203 for the taper thread type.
 4. The thread G shall be Class A of parallel pipe thread of JIS B 0202.
 5. The tolerance on the widths across flats B₁, B₂, and B₃ shall be h 15 of JIS B 1021.

Attached Table 5. Shapes and Dimensions of Taper Threaded Elbow, Middle T with Taper Thread and End T with Taper Thread

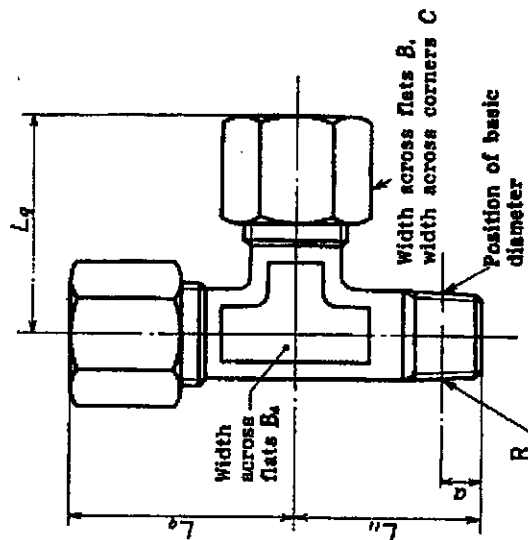
LT



TTA



TTB

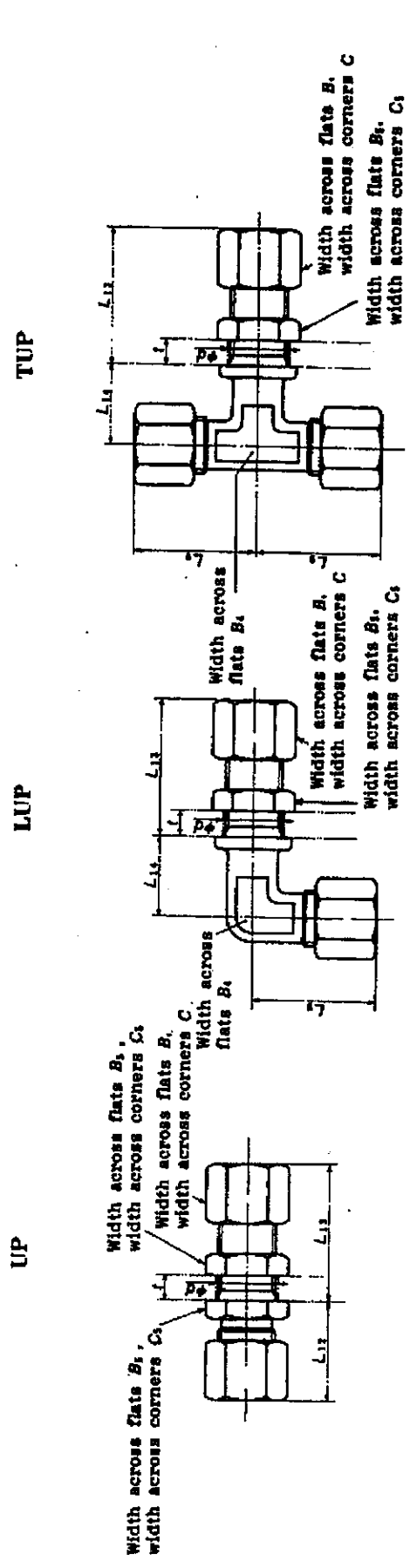


Unit: mm

Nominal size	Outside diameter of applicable tube	Inside diameter of fitting (Min.)	Nominal size of pipe thread R	a	L _s (Hand tightening) (Max.)	L ₁₁	Width across flats B ₄	Width across flats of body (Max.) B ₄
4	4	2.5	1/8	3.97	30	20	12×13.9	10
6	6	4	1/8	3.97	33	20	14×16.2	12
8	8	6	1/4	6.01	35	25	17×19.6	14
10	10	7	1/4	6.01	37	27	19×21.9	17
12	12	9	3/8	6.35	39	30	22×25.4	19
16	16	12	1/2	8.16	48	35	30×34.6	24

- Remarks
1. Hand tightening of L_s indicates the length of the fitting assembled to tube without using tools.
 2. The thread on the fitting end (on union nut side) shall conform to JIS B 0207 and its precision shall be Class 2 of JIS B 0211. The thread on the connector end of fitting shall be Class A of the thread G of JIS B 0202 for the parallel thread type, and the thread R of JIS B 0203 for the taper thread type.
 3. The thread R shall be of taper pipe thread of JIS B 0203.
 4. The tolerance on the widths across flats B and B₄ shall be h 15 of JIS B 1021.
 5. The tolerance on L₁₁ shall be the rough class of JIS B 0405.

Attached Table 6. Shapes and Dimensions of Bulkhead-attached Threaded Union, Bulkhead-attached Threaded Union Elbow and Bulkhead-attached Threaded Union T

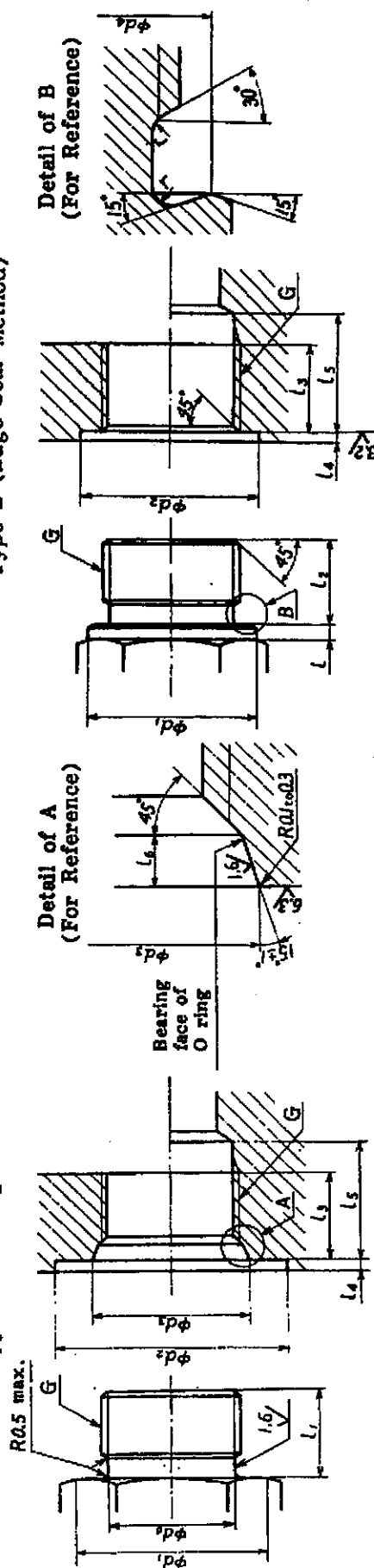


Nominal size	Outside diameter of appl-cable tube	Inside diameter of fitting (Min.)	L_9 (Hand tightening) (Max.)	L_{11} (Hand tightening) (Max.)	L_{13} (Hand tightening) (Max.)	L_{14}	Width across flats		Width across flats of body (Max.) B_4	For reference			Unit: mm
							$B \times C$	width across corners $B_3 \times C_3$		d (Diameter of hole)	t (Max.)	t (Min.)	
4	4	2.5	30	24	38	15	12×13.9	14×16.2	10	11	12	4	
6	6	4	33	29	43	18	14×16.2	17×19.6	12	13	12	5	
8	8	6	35	30	43	21	17×19.6	19×21.9	14	15	12	5	
10	10	7	37	31	44	23	19×21.9	22×25.4	17	17	12	5	
12	12	9	39	32	44	26	22×25.4	22×25.4	19	19	12	5	
16	16	12	48	36	50	34	30×34.6	30×34.6	24	25	12	6	
20	20	16	54	41	53	41	36×41.6	36×41.6	30	31	12	6	
25	25	20	60	45	53	51	46×53.1	46×53.1	36	37	12	6	
30	30	25	65	48	54	55	50×57.7	50×57.7	41	43	12	6	
32	32	26	68	50	55	60	55×63.5	55×63.5	46	46	12	6	
38	38	32	71	55	56	66	60×69.3	60×69.3	50	53	12	6	

- Remarks
1. Hand tightening of L₁, L₁₂ and L₁₃ indicates the length of the fitting assembled to tube without using tools.
 2. The thread on the fitting end (on union nut side) shall conform to JIS B 0207 and its precision shall be Class 2 of JIS B 0211. The thread on the connector end shall be Class A of the thread G of JIS B 0202 for the parallel thread type, and the thread R of JIS B 0203 for the taper thread type.
 3. The tolerance on the width across flats B₁, B₂ and B₃ shall be h 15 of JIS B 1021.
 4. The tolerance on L₁ shall be the rough class of JIS B 0405.

Attached Table 7. Shapes and Dimensions of Connector end of Parallel Thread Type Fitting and Mating Port

Type O (O Ring Seal Method)



Type E (Edge Seal Method)

Nominal size G	$d_1 \pm 0.1$		$d_2 \pm 0.3$		$d_3^{+0.1}_0$	l (Min.)	l_1 (Min.)	l_1 (Max.)	l_2 (Min.)	$l_2^{+0.4}_0$	Nominal No. of O ring used	d_4 (For reference)	r (For reference)
	Type O	Type E	Type O	Type E									
$1/8$	8	14	18	15	11.6	1.5	10	1	15	2	P 8	12	1
$1/4$	11	19	24	19	15.6	2	12	1.5	18	2.5	P 11	15.5	1.2
$3/8$	14	22	28	23	18.6	2.5	12	2	18	2.5	P 14	19.5	1.2
$1/2$	18	27	34	27	22.6	3	16	2.5	24	2.5	P 18	23.5	1.6
$3/4$	23	36	45	33	29.8	3	17	2.5	25	3.5	P 22.4	29.5	1.6
1	29	41	51	40	35.8	3	21	2.5	30	3.5	P 29	36	2.5
$1 1/4$	38	50	62	50	44.8	3	21.4	2.5	30	3.5	P 38	45.5	2.5
$1 1/2$	44	55	68	56	50.8	3	21.4	2.5	30	3.5	P 44	51.6	2.5

Unit: mm

- Remarks
- The thread G shall be of Class A of parallel pipe thread of JIS B 0202.
 - The bearing face of O ring of Type O shall not have no flaws or streaky tool marks in the direction of axis.
 - The facing d_4 in Type E shall not have no flaws or streaky tool marks in radial direction.
 - The facing d_4 shall be at right angle to the axis of screw and flat.
 - The depth of counter bore l_2 may be zero, provided that it satisfies the requirements given in Remark 2.
 - The length l_1 and l_2 in the figure shall be in accordance with l_1 and l_2 in Attached Table 1 or 4.
 - O ring used in Type O calls for selection of materials so as to suit the nature of applicable liquid, but for petroleum type hydraulic fluid in common use, Class 1 B of JIS B 2401 shall, as a rule, be used.

Attached Table 8. Applicable Standards

JIS B 0202-Parallel Pipe Threads
JIS B 0203-Taper Pipe Threads
JIS B 0207-Metric Fine Screw Threads
JIS B 0211-Limits of Sizes and Tolerances for Metric Fine Screw
Threads
JIS B 0252-Limit Gauges for Metric Fine Screw Threads
JIS B 0253-Gauges for Taper Pipe Threads
JIS B 0254-Screw Thread Limit Gauges for Parallel Pipe Threads
JIS B 0405-Permissible Machining Deviations in Dimensions without
Tolerance Indication
JIS B 1021-Tolerance System for Threaded Fasteners
JIS B 2401-O Rings
JIS G 3141-Cold Rolled Carbon Steel Sheets and Strip
JIS G 4051-Carbon Steels for Machine Structural Use
JIS K 2213-Turbine Oils
JIS Z 2241-Method of Tensile Test for Metallic Materials
JIS Z 2244-Method of Vickers Hardness Test
JIS Z 8401-Rules for Rounding off of Numerical Values

Annex Precision Carbon Steel Tube for Bite Type Tube Fittings

1. Scope

This appendix specifies the precision carbon steel tube for the pipings using the bite type tube fitting for hydraulic use specified in the main body of this Standard (hereafter referred to as the "tube").

2. Classification of Tube

The tubes are categorized into the following two classes of Annex Table 1.

Annex Table 1. Types and Symbols of Tube

Class	Symbol
Class 1	STPS 1
Class 2	STPS 2

Remark: As a rule, Class 1 is used for the maximum working pressure 10 MPa {100 kgf/cm²} or under.

3. Manufacture

3.1 Class 1 tubes shall be manufactured from electric resistance welding steel tube or seamless steel tube, and Class 2 tubes from seamless steel tube, both finally subjected to cold finish.

3.2 All the tubes shall be annealed ⁽¹⁾ or normalized ⁽¹⁾ after manufacture.

Note ⁽¹⁾. Bright annealing or bright normalizing is preferable to other methods, but when the bright heat treatment is not employed, a process for remove scales is required.

4. Quality

4.1 The tube shall be substantially straight and its both ends shall be at right angles to the axis of the tube.

4.2 The inside and outside of the tube shall have a workmanlike finish and shall be free from defects harmful to use.

4.3 The inside surface of the tube shall be free from grease, additives used in drawing, oxides, scales, carbon adherent, alkali cleanser or substances not easily removed with organic cleansers.

4.4 The tube to be washed with acid for descaling shall not incur brittleness through the acid washing.

4.5 The chemical composition of the tube shall be as specified in Annex Table 2.

Annex Table 2. Chemical Composition of Tube

Class	Symbol	Chemical composition %					
		C	Si	Mn	P	S	Cu
Class 1	STPS1	0.20 max.	0.35 max.	0.25 ~ 0.60	0.040 max.	0.040 max.	—
Class 2	STPS2	0.08 ~ 0.18	0.10 ~ 0.35	0.30 ~ 0.60	0.035 max.	0.035 max.	0.20 max.

Remark: The values of chemical compositions in the above table shall be those obtained by ladle analysis.

4.6 The mechanical properties and the bending test results of the tube shall meet the requirements specified in Annex Table 3. When the bending test is made, the test piece shall not show any marks or cracks left on the wall of the tube.

Annex Table 3. Mechanical Properties of Tube

Class	Symbol	Tensile strength	Yield point	Elongation No. 11 test piece No. 12 test piece %	Bending test	
		N/mm ² {kgf/mm ² }			Bending angle	Radius of inner surface
Class 1	STPS1	441.3 {45} max.	176.5 {18} min.	35 min.	180°	4 times the outside diameter of tube
Class 2	STPS2					

Remarks 1. At the completion of the tensile test using No. 12 test piece, obtain the minimum value of elongation by subtracting 1.5 % of the elongation value of the above Annex Table 3 for each 1 mm decrease of the tube thickness from 8 mm, and round off the result to an integral in accordance with JIS Z 8401.

2. The minimum elongation values for the tubes of the outside diameter 10 mm or over to and excluding 20 mm and under 10 mm shall be 5 % and 8 % less than the value given in the above Annex Table 3, respectively.

4.7 The tubes shall be subjected to the pressure of 5 MPa (50 kgf/cm²) under the test of 6.3, and shall show no leakage.

5. Dimensions and Dimensional Tolerances

5.1 The outside diameter, thickness and the tolerances of the tubes shall conform to Annex Table 4.

Annex Table 4. Outside Diameter, Thickness and Tolerances

Unit: mm

Thickness	Basic dimension	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	7
Tolerance		±0.15	±0.2	±0.2	±0.25	±0.3	±0.35	±0.4	±0.45	±0.5	±0.55	±0.6	±0.7
Outside diameter of tube													
Basic dimension	Tolerance												
4	±0.1	○											
6		○	○										
8		○	○										
10		○	○	○									
12		○	○		○								
16			○	○		○							
20			○	○	○		○						
25	±0.15			○		○			○				
30				○	○		○				○		
32					○			○				○	
38					○		○		○				○

Remarks 1. The enclosure formed by thick lines indicates the range of the tube thickness corresponding to the outside diameter.

2. Unless required for some particular reasons, it is recommended to use the thickness value indicated by the mark ○.

5.2 The length of one tube shall be at least 3000 mm, and when the length is specified, the tolerance for the nominal length shall be as specified in Annex Table 5.

Annex Table 5. Tube Length and Tolerance

Unit: mm

Division of length	Tolerance on length
6000 or under	+10 0
Over 6000	+15 0

6. Test Methods

6.1 Tensile Test The tensile test shall be carried out in accordance with JIS Z 2241.

6.2 Bending Test Take a test piece of suitable length from one end of the tube, bend it around a cylinder of eight times the tube diameter through an angle of 180° at normal temperature, and examine for the existence of flaws or cracks produced on the tube wall. In the case of Class 1 electric resistance welded steel tube, the welded seam shall be at the outermost position of the bent portion.

6.3 Hydrostatic Test Subject a tube to the hydrostatic pressure specified in 4.7 for the fixed duration, and examine for the existence of leakage.

7. Inspection

The inspection shall be carried out on appearance, dimensions, chemical composition, tensile strength, bending and hydrostatic pressure, and the results shall satisfy the requirements specified in 4.1 to 4.7 and 5.

The sampling inspection plan shall be subjected to agreement between the parties concerned with delivery.

8. Packaging

The tubes shall be treated with a suitable rust prevention.

When grease is used for rust prevention, it shall be of the quality to be readily removed with an alkali cleanser or an organic cleanser.

9. Designation of Product

The tube shall be designated either by title, class of tube and dimensions (outside diameter x thickness) (see example 1), or by class symbol and dimensions (outside diameter x thickness) (see example 2).

Example 1. Precision carbon steel tube for bite type fittings
Class 2 12 x 1

Example 2. STPS 2-12 x 1

10. Marking

The following details shall be marked on the outside of the tube. Tubes of small diameter may be bundled together, and each bundle shall be marked with the following details by suitable means.

- (1) Class symbol
- (2) Symbol indicating the manufacturing method ⁽²⁾
- (3) Dimensions (outside diameter x thickness)
- (4) Manufacturer's name or its identification mark
- (5) Date of manufacture

Example: STPS 2-S-C-12 x 1 - manufacturer's name -5'90

Note ⁽²⁾ The symbol indicating the manufacturing method shall be as follows:

For cold drawn finish seamless tube: -S-C

For cold drawn finish electric resistance welded steel tube: -E-C

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