

Metal pipes for automobile tubing

1. Scope

This standard specifies the metal pipes for tubing mainly used for brakes, fuel and lubrication of automobiles (hereinafter referred to as the "pipes").

Remarks :

The applicable standards for this standards are shown below.

JIS G 3141	Cold rolled carbon steel sheets and strip
JIS G 3445	Carbon steel tubes for machine structural purposes
JIS G 3472	Electric resistance welded carbon steel tubes for automobile structural purposes
JIS H 3300	Copper and copper alloy-seamless pipes and tubes
JIS Z 2241	Method of tensile test for metallic materials
JIS Z 2244	Method of vickers hardness test
JIS Z 2251	Method of micro hardness test for vickers and knoop hardness
JASO M 104	Testing method for automobile brake tube

2. Classification

2.1 Type of pipe

The pipes shall be classified into the following 4 groups:

Table 1 Pipes for automobile tubing

Type	Code	Example of application
Brazed double wall low carbon steel tubing	TDW	Tubing mainly for brakes
Welded low carbon steel tubing	TSW	Tubing mainly for fuel and lubrication
Carbon steel tubes for machine structural purpose ⁽¹⁾	STKM 11J	Tubing for cooling, etc.
Copper and copper alloy seamless pipes and tubes ⁽²⁾	C1201 or C1220	Tubing mainly for air brakes

Note ⁽¹⁾ Carbon steel tubes for machine structural purposes shall be STKM11A specified in **JIS G 3445** (Carbon Steel Tubes for Machine Structural Purposes) and STAM 30GA or STAM 30GB specified in **JIS G 3472** (Electric Resistance Welded Carbon Steel Tubes for Automobile Structural Purposes) and shall meet requirements of this standards.

⁽²⁾ Copper and copper alloy seamless pipes and tubes shall be pursuant to C1201 or C1220 specified in **JIS H 3300** (Copper and Copper Alloy Seamless Pipes and Tubes).

2.2 Classification of surface treatment

The pipes shall be classified as tabulated below, according to the type of surface treatment :

Table 2 Surface treatment

Type	Code	Type of surface treatment							
		Without surface treatment Without	Dipped tin-lead alloy coating	Electrolytic zinc coating			Organic film on electrolytic zinc coating		
				8μm	13μm	25μm	8μm	13μm	25μm ⁽³⁾
Brazed double wall low carbon steel tubing	TDW	- N	- T	- Z8	- Z13	- Z25	- Z8- OC	- Z13- OC	- Z25- OC
Welded low carbon steel tubing	TSW	- N	- T	- Z8	- Z13	- Z25	- Z8- OC	- Z13- OC	- Z25- OC
Carbon steel tubes for machine structural purpose	STKM 11J	- N	- T	- Z8	- Z13	- Z25	-		
Copper and copper alloy seamless pipes and tubes	C1201 or C1220	-							

Note ⁽³⁾ Numerical values express thickness of electrolytic zinc coating.

3. Quality

3.1 Appearance

Both inside and outside of the finished tubing shall be smooth and free from cracks, flaws, or rusts.

3.2 Chemical composition

Chemical composition of the tubing shall be

pursuant to JIS G 3141, JIS G 3445, JIS G 3472, and JIS H 3300.

3.3 Mechanical property

Mechanical property of the pipes shall be pursuant to **Table 3**.

Table 3 Mechanical property

Type	Code	Tensile strength MPa	Yield point MPa	Elongation %	Hardness HV	Bending expansion, flat bending
Brazed double wall low carbon steel tubing	TDW	Not less than 294	Not less than 176	Not less than 25	Not more than HV150	Wall of the tubing shall be free from flaws or cracks after the tests pursuant to Table 10 are conducted
Welded low carbon steel tubing	TSW					
Carbon steel tubes for machine structural purpose	STKM11J	Not less than 294	—	Not less than 30	—	
Copper and copper alloy seamless pipes and tubes	C1201 or C1220	Not less than 206	—	Not less than 40	—	

3.4 Surface treatment

- (1) Thickness of surface treatment shall be pursuant to **Table 4** and **Table 5**.

Table 4 Thickness of inside surface treatment

Type	Code	Thickness of inside surface treatment
Brazed double wall low carbon steel tubing	TDW	As is copper-coated for fusion process.
Welded low carbon steel tubing	TSW	Copper coating not less than 3 μ m ^(*)
Carbon steel tubes for machine structural purpose	STKM 11J	—
Copper and copper alloy seamless pipes and tubes	C1201 or C1220	—

Note (*) Inside surface may not be copper-coated if mutually agreed if mutually agreed upon by the purchaser and manufacturer.

Table 5 Thickness of outside surface treatment

Type	Thickness of outside surface treatment						
	Dipped tin-lead alloy coraing	Electrolytic zinc coating			Organic film on electrolytic zinc coating		
		Z8	Z13	Z25	Z8-OC	Z13-OC	Z25-OC
Brazed double wall low carbon steel tubing	Average 6μm, minimum 3μm,	Not less than 8μ m	Not less than 13μm	Not less than 25μm	Zinc coating not less than 8μm	Zinc coating not less than 13μm	Zinc coating not less than 25μm
Welded low carbon steel tubing					Organic film average 20μm minimum 10μm		
Carbon steel tubes for machine structural purpose					Zinc coating Not less than 8μm	Zinc coating Not less than 13μm	Zinc coating Not less than 25μm
Copper and cooper alloy seamless pipes and tubes	No treatment shall be required.						

(2) Corrosion resistance

The test shall be conducted pursuant to corrosion test specified in **Table 10** and shall meet requirements in **Table 6**.

(3) Performance of organic film

Performance of organic film shall be pursuant to **Table 6** and shall meet requirements in **Table 7**, after the tests pursuant to **Table 10** are conducted as occasion demands.

Table 6 Corrosion resistance

Type and code of coating		Criteria	
		Time elapsed till formation of white corrosion product (h)	Time elapsed till formation of iron rust (red rust) (h)
Electrolytic zinc coating	Z8	72	192
	Z13	72	288
	Z25	72	480
Dipped tin-lead alloy coating	T	Iron rust (red rust) shall appear at 5 spots or less per 50cm ² in 24 hours.	
Organic film on electrolytic zinc coating	Z8-OC	—	2000
	Z13-OC		2500
	Z25-OC		3000

Remark : The criteria in Table 6 shall be applied to straight pipe specimens.

Table 7 Performance of organic film

Test items	Criteria
Bending test	No flaking, cracking, and wrinkles shall occur.
Chipping test	No conspicuous flaking and cracking shall occur.
Heat cycle test	No blisters, flaking, hardening, and cracking shall occur.
Warm water test	No blisters and flaking shall occur.
Fluid resistance test	No blisters, flaking, cracking, and dissolution shall occur.
Ozone resistance test	No flaking and cracking shall occur.

3.5 Guarantee pressure and burst pressure

The Pipes shall be tested pursuant to Table 10

and shall resist the guarantee pressure specified in Table 8 without leaving injurious deformation.

Table 8 Guarantee pressure and burst pressure

Type	Code	Nominal diameter	Guarantee pressure MPa	Burst pressure MPa (°)
Braze double wall low carbon steel tubing	TDW	Not more than 4.76	34.3	108
		6 and 6.35	34.3	83.3
		8	24.5	66.2
		10	24.5	53.9
Welded low carbon steel tubing	TSW	Not more than 6.35	24.5	—
Carbon steel tubes for machine structural purposes	STKM 11J	From 8 to 10	19.6	
		From 11 to 15	14.7	
		From 16 to 22.2	9.8	
Copper and copper alloy seamless pipes and tubes	C1201 or C1220	Pursuant to JIS H 3300.		

Note ⁽⁵⁾ Dynamic burst characteristics accompanied by fatigue shall be pursuant to the agreement between the purchaser and the manufacturer.

4. Method of manufacturing

4.1 Method of manufacturing the brazed double wall low carbon steel pipes

The brazed double wall low carbon steel pipes shall be made by copper-coating both surfaces of SPCC specified in JIS G 3141, shaping them into the form of double wall tubing, and sealing the seams by copper brazing and fusion in a reduction furnace.

4.2 Method of manufacturing the welded low carbon steel pipes

The welded low carbon steel pipes shall be made by copper-coating both surfaces or inner surface of SPCC specified in JIS G 3141, shaping them into a tubular form, and sealing the edges by electric resistance welding, however inside surface may not be copper-coated if mutually agreed upon by the purchaser and the manufacturer.

4.3 Method of manufacturing the carbon steel pipes for machine structural purposes

Manufacture of carbon steel tubes for machine structural purposes shall be pursuant to JIS G 3445 and JIS G 3472.

4.4 Method of the copper and copper alloy seamless pipe and tubes

Manufacture of copper and copper alloy seamless pipes and tubes shall be pursuant to JIS H 3300.

5. Dimension of pipes

5.1 Nominal diameter and dimension of pipe

Nominal diameter and dimension of pipes shall be pursuant to Table 9.

Table 9 Nominal diameter and dimension

Unit : mm

Nominal diameter	Outside diameter		Thickness				Tolerance
	Standard dimension	Tolerance	Standard dimension				
			Braze double wall low Carbon steel tubing	Welded low carbon steel tubing	Carbon steel tubes for machine structural purposes	Copper and copper alloy seamless pipes and tubes	
3.17	3.17	± 0.08	0.7	0.7		0.8	± 0.08
4	4		0.7	0.7			
4.76	4.76		0.7	0.7		0.8	
6	6		0.7	0.7			
6.35	6.35		0.7	0.7 0.8		0.8	
8	8	± 0.1	0.7	0.7 0.8 1.0	0.7 0.8 1.0	1.0	± 0.1
9	9			1.0	1.0		
10	10		0.7	0.7 0.8 1.0	0.7 0.8 1.0	1.0	
11	11		—		0.8 1.0		
12	12			0.9 1.0	0.9 1.0	1.0	
12.7	12.7			0.9 1.0	0.9 1.0	1.0	
14	14			1.0	1.0		
15	15			1.0	1.0	1.0	
16	16			1.0	1.0 1.2		
17	17			1.0	1.0 1.2		
18	18			1.0	1.0 1.2	1.0	
19	19				1.0 1.2		
20	20				1.0 1.2	1.0	
21	21				1.0 1.2		
22	22				1.0 1.2	1.0	
22.2	22.2					1.0 1.2	

Remark : Outside diameter shall be the outside diameter of raw pipe without surface treatment.

5.2 Shape of pipe end

Formed pipe end shall be pursuant to Attached Tables 1~8.

6. Test method

Test method shall be pursuant to Table 10.

Table 10 Test Method

Item	Type									
	Brazed double wall low carbon steel tubing	Welded low carbon steel tubing	Carbon steel tubes for machine structural purpose	Copper and copper alloy seamless pipes and tubes						
Tensile test	Pursuant to JIS Z 2241 (Method of Tensile Test for Metallic Materials).									
Bending test	<div>Examine if any flaws, cracks, or other defects occurred or not when the pipe was bent 360 degrees around a cylinder having the radius as specified below.</div> <div><table><tr><th>Nominal diameter</th><th>Radius (D is outside diameter of pipe)</th></tr><tr><td>8 mm or smaller</td><td>$1.5D$</td></tr><tr><td>over 8 mm</td><td>$2.5D$</td></tr></table><div><div>Cylinder</div><div>Test specimen</div><div>$1.5D$ or $2.5D$</div><div>D</div></div></div>				Nominal diameter	Radius (D is outside diameter of pipe)	8 mm or smaller	$1.5D$	over 8 mm	$2.5D$
Nominal diameter	Radius (D is outside diameter of pipe)									
8 mm or smaller	$1.5D$									
over 8 mm	$2.5D$									
Expansion test	<div>(1) Length of test specimen shall be 100 mm.</div> <div>(2) Examine if any flaws and cracks occurred or not when a conic tool with 1/10 taper was plugged into one end of the specimen and the specimen was expanded until the diameter of end face was increased by 20%.</div>	<div>(1) Length of test specimen shall be 100 mm.</div> <div>(2) Examine if any flaws and cracks occurred or not when a conic tool with angle of 60 degrees was plugged into one end of the specimen and the specimen was expanded until the diameter of end face was increased by 20%.</div>	Pursuant to JIS H 3300.							
Developing test		<div>(1) Length of test specimen shall be 100 mm.</div> <div>(2) Examine if any injurious defects such as cracks and flaking occurred to the weld or not when the test specimen is split longitudinally at 90 degrees on each side of the weld and developed to form a flat plate.</div>								

Table 10 Test Method (Continued)

Item	Type			
	Brazed double wall low carbon steel tubing	Welded low carbon steel tubing	Carbon steel tubes for machine structural purpose	Copper and copper alloy seamless pipes and tubes
Flattening and bending test	(1) Length of test specimen shall be 100 mm. (2) Examine if any flaws and cracks occurred or not when the specimen is held between parallel plates, which are pressed in such a manner as the inside of tube comes to a close contact to make the specimen flat, and the flat specimen is once bent 90 degrees to the direction of axis around a cylinder having a diameter of 3 times the wall thickness of the tube and then stretched straight.			
Flattening test		(1) Length of test specimen shall be 100 mm. (2) Examine if any flaws and cracks occurred or not when the specimen is held between parallel plates, which are pressed in such a manner as the distance between the plates comes to 3 times the wall thickness of the tube. When the plates are pressed, the weld of tube shall be placed at 90 degrees to the direction of applied force.		Pursuant to JIS H 3300.
Guarantee pressure test	Examine if any leak of other defects occurred or not when pipe is applied with specified hydraulic pressure and held for 5 minutes.			—
Burst pressure test	Pursuant to 5.10 specified in JASO M 104.			—
Surface treatment thickness test	The standard practice shall be microscopic test.			—
Corrosion resistance test	Pursuant to 5.6, Neutral Salt Water Spray Test, specified in JASO M 104.			—
Film performance test	Pursuant to 5. (Test Method) specified in JASO M 104.			—
Hardness test	Pursuant to JIS Z 2244 or JIS Z 2251			—

7. Inspection

7.1 Inspection of appearance

Inspection results shall meet requirements specified in the above 3.1.

7.2 Inspection of mechanical properties

Inspection shall be conducted pursuant to the above 6 and the results shall meet requirements specified in the above 4.3.

7.3 Inspection of dimensions

Inspection results shall meet requirements specified in the above 5.

7.4 Inspection of surface treatment

Inspection shall be conducted by the above 6 and the results shall meet requirements specified in the above 3.4.

7.5 Inspection of guarantee pressure

Inspection results shall meet requirements specified in the above 6.

8. Designation of product

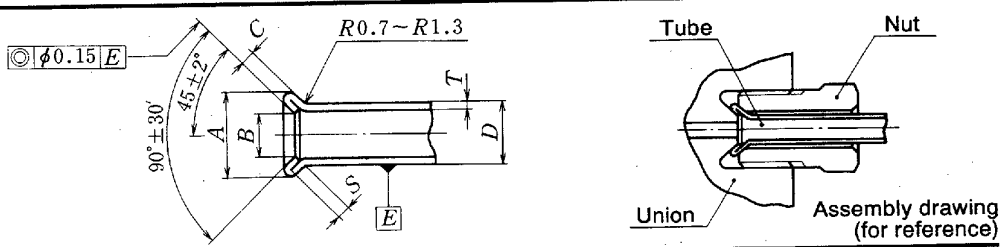
Designation of products shall be pursuant to the standard number, type of tubing, and type and nominal diameter of outside surface.

<u>JASO M 101</u>	<u>TDW - Z25 - OC</u>	<u>4.76</u>	
Standard No.	Type of tubing	Type of outside surface	Nominal diameter
<u>JASO M 101</u>	<u>TSW - Z8</u>	<u>15</u>	<u>Without copper coating on inner surface</u>
Standard No.	Type of tubing	Type of outside surface	Specified matter

Attached table 1 Shape and dimensions of double flares for tubing

Shape and dimensions of double flares for tubing shall be pursuant to Attached table 1.

Unit : mm

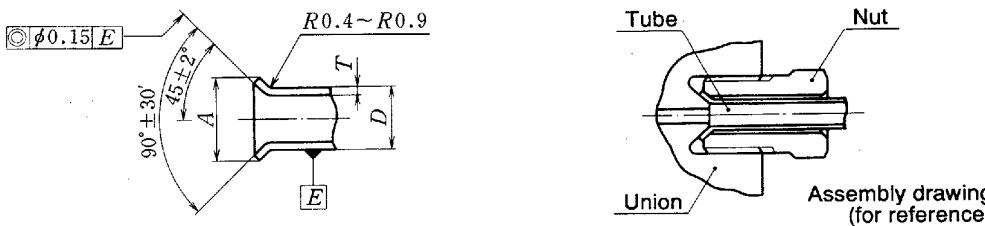
Type	Double flare									
Shape										
Nominal diameter	D		A	B	T		C		S	Min.
	Standard dimension	Tolerance			Standard dimension	Tolerance	Standard dimension	Tolerance		
3.17	3.17	± 0.08	4.9~5.4	1.4~2.1	0.7	± 0.08	1.4	± 0.2	1	1
4.76	4.76		6.6~7.1	3.0~3.7	0.7		1.4		1	1
6.35	6.35		8.6~9.1	4.5~5.2	0.7		1.4		1	1
8	8	± 0.1	10.5~11.0	6.2~6.9	0.7	± 0.1	1.4		1.6	1.6
10	10		13.0~13.5	8.2~8.9	0.7		1.4		1.6	1.6
12	12		15.0~15.7	9.8~10.5	0.9		1.8		1.6	1.6
12.7	12.7		15.6~16.3	10.3~11.0	0.9		1.8		1.6	1.6
15	15		18.1~18.8	12.7~13.4	1.0		2.0		1.6	1.6
18	18		21.5~22.2	15.7~16.4	1.0		2.0		1.6	1.6

Remark : Nominal diameters and dimensions of wall thickness which are not specified in Attached table 1 shall be mutually agreed upon by the purchaser and the manufacturer.

Attached table 2 Shape and dimensions of single flares for tubing

Shape and dimensions of single flare for tubing shall be pursuant to Attached table 2.

Unit : mm

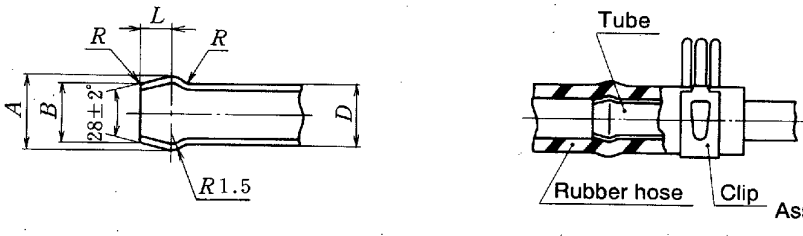
Type	Single flare									
Shape										
Nominal diameter	D		A	B						
	Standard Dimension	Tolerance								
3.17	3.17	± 0.08	4.2~4.8	0.7						
4.76	4.76		6.2~6.8	0.7						
6.35	6.35		8.1~8.7	0.7						
8	8	± 0.1	10.0~10.6	1.0						
10	10		12.1~12.7	1.0						
12	12		14.7~15.3	1.0						
12.7	—		—	—						
15	—		—	—						
18	—		—	—						

Remark : Nominal diameters which are not specified in Attached table 2 shall be mutually agreed upon by the purchaser and the manufacturer.

Attached table 3 Shape and dimensions of bulge for tubing

Shape and dimensions of Bluge for tubing shall be pursuant to Attached table 3.

Unit : mm

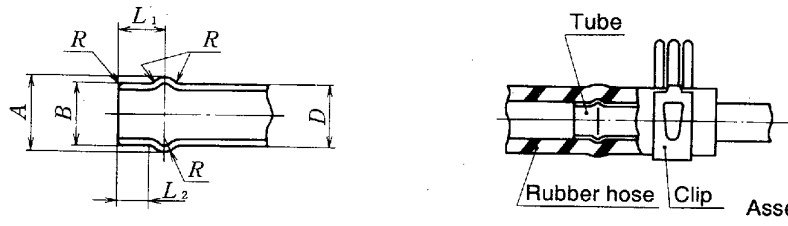
Type	Bulge				
Shape					
Nominal diameter	D		A	B	L
	Standard dimension	Tolerance			(for ref.)
4.76	4.76	± 0.08	5.3~5.9	4.3~4.9	2.2
6.35	6.35		7.1~7.7	5.8~6.4	2.8
8	8		9.0~9.6	7.6~8.2	3.2
10	10	± 0.1	11.2~11.8	9.7~10.3	3.2
12	12		13.2~13.8	11.7~12.3	3.2
12.7	12.7		13.9~14.5	12.4~13.0	3.2
15	15		16.4~17.0	14.7~15.3	3.6
18	18		19.4~20.0	17.7~18.3	3.6

Remark : Nominal diameters which are not specified in Attached table 3 shall be mutually agreed upon by the purchaser and the manufacturer.

Attached table 4 Shape and dimensions of spool for tubing

Shape and dimensions of spool for tubing shall be pursuant to Attached table 2.

Unit : mm

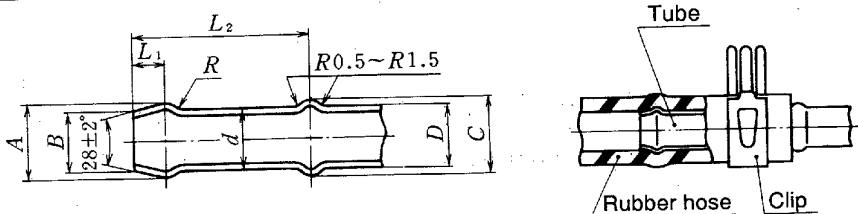
Type	Bulge				
Shape					
Nominal diameter	D		A	B	L ₁ L ₂
	Standard dimension	Tolerance			
4.76	4.76	± 0.08	5.3~5.9	4.76	4.5 3.5
6.35	6.35		7.1~7.7	6.35	4.5 3.5
8	8		9.0~9.6	8	4.5 3.5
10	10	± 0.1	11.2~11.8	10	4.5 3.5
12	12		13.2~13.8	12	4.5 3.5
12.7	12.7		13.9~14.5	12.7	4.5 3.5
15	15		16.4~17.0	15	4.5 3.5
18	18		19.4~20.0	18	4.5 3.5

Remark : Nominal diameters which are not specified in Attached table 4 shall be mutually agreed upon by the purchaser and the manufacturer.

Attached table 5 Shape and dimensions of bulge spool for tubing

Shape and dimensions of bulge spool for tubing shall be pursuant to Attached table 5.

Unit : mm

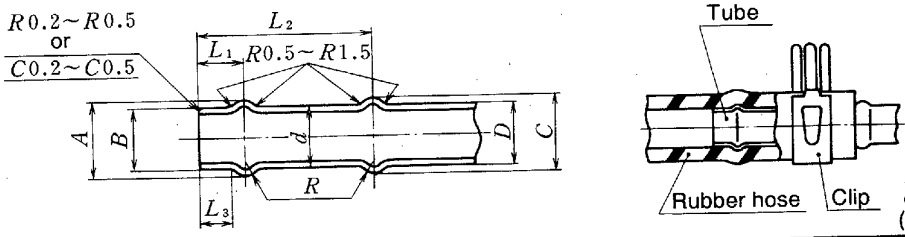
Type	Bulge spool												
Shape													
	Assembly drawing (for reference)												
Nominal diameter	D		A		B		C		L ₁		L ₂		d
	*1	Tolerance	*1	Tolerance	*1	Tolerance	*1	Tolerance	*1	Tolerance	*1	Tolerance	*1
4.76	4.76	±0.08	5.6	±0.3	4.6	±0.3	5.6	±0.3	2.2	±0.5	28	±0.2	4.76
6.35	6.35		7.4		6.1		7.4		2.8		28		6.35
8	8		9.3		7.9		9.3		3.2		33		8.0
10	10	±0.1	11.5	±0.3	10.0	±0.3	11.5	±0.3	3.2	±0.5	33	±0.2	10.0
12	12		13.5		12.0		13.5		3.2		33		12.0
15	15		16.7		15.0		16.7		3.6		33		15.0
18	18		19.7		18.0		19.7		3.6		33		18.0

Remark : Nominal diameters which are not specified in Attached table 5 shall be mutually agreed upon by the purchaser and the manufacturer.

Attached table 6 Shape and dimensions of double spools for tubing

Shape and dimensions of double spools for tubing shall be pursuant to Attached table 6.

Unit : mm

Type	Double spool															
Shape																
	Assembly drawing (for reference)															
Nominal diameter	D		A		B		C		L ₁		L ₂		d		L ₃	
	*1	Tolerance	*1	Tolerance	*1	Tolerance	*1	Tolerance	*1	Tolerance	*1	Tolerance	*1	Tolerance	*1	Tolerance
4.76	4.76	±0.08	5.6	±0.3	4.76	±0.3	5.6	±0.5	4.5	±1.0	28	±2.0	4.76	±0.2	3.5	-0.1
6.35	6.35		7.4		6.35		7.4				28		6.35			
8	8		9.3		8.0		9.3				33		8.0			
10	10	±0.1	11.5	±0.3	10.0	±0.3	11.5	±0.5	4.5	±1.0	33	±2.0	10.0	±0.2	3.5	-0.1
12	12		15.5		12.0		13.5				33		12.0			
15	15		16.7		15.0		16.7				33		15.0			
18	18		19.7		18.0		19.7				33		18.0			

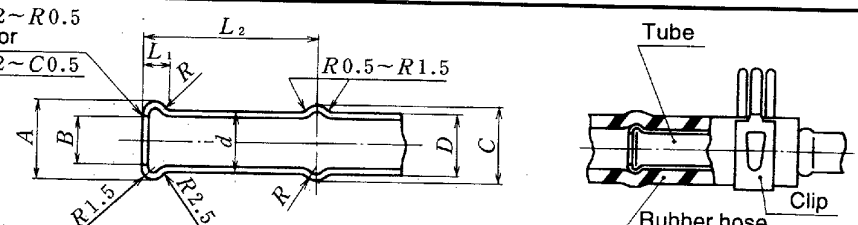
Remark : Nominal diameters which are not specified in Attached table 6 shall be mutually agreed upon by the purchaser and the manufacturer.

*1 : Standard dimension

Attached table 7 Shape and dimensions of curl spool for tubing

Shape and dimensions of spool for tubing shall be pursuant to Attached table 7.

Unit : mm

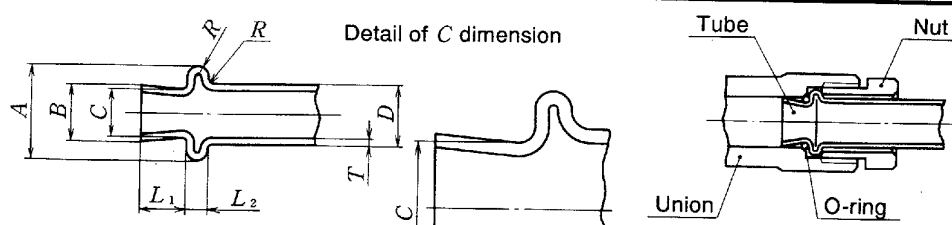
Type	Curl spool													
Shape														
Nominal diameter	Assembly drawing (for reference)													
	D		A		B		C		L ₁		L ₂		d	
	*1	Tolerance	*1	Tolerance	*1	Tolerance	*1	Tolerance	*1	Tolerance	*1	Tolerance	*1	Tolerance
4.76	4.76		5.6		3.0		5.6				28		4.76	
6.35	6.35	±0.08	7.4		4.3		7.4				28		6.35	
8	8		9.3		6.1		9.3				33		8.0	
10	10	±0.1	11.5	±0.3	7.0	±0.3	11.9	±0.5	3.0	±0.1	33	±2.0	10.0	+0.2 -0.1
12	12		13.5		8.0		13.5				33		12.0	
15	15		16.7		11.0		16.7				33		15.0	
18	18		19.7		14.0		19.7				33		18.0	

Remark : Nominal diameters which are not specified in Attached table 7 shall be mutually agreed upon by the purchaser and the manufacturer.

Attached table 8 Shape and dimensions of O-ring flare for tubing

Shape and dimensions of O-ring flare for tubing shall be pursuant to Attached table 8.

Unit : mm

Type	O-ring flare															
Shape																
Nominal diameter	D		A		B		C		L ₁		L ₂		T		R ₁	
	*1	Tolerance	*1	Tolerance	*1	Tolerance	*1	Tolerance	*1	Tolerance	*1	Tolerance	*1	Tolerance	—	
6.35	6.35	±0.08	9.5	0	5.2	+0.1	4.6		4.5		1.8		0.7	±0.08	0.3~0.6	
8.0	8.0	±0.1	11.8	-0.3	7.2	-0.2	6.4	±0.1	5.0	0 -0.5	1.8	±2.0	0.7	±0.1	0.3<	
10	10		13.5	+0.3 0	9.2	±0.2	8.0		5.0		22.6		1.0		0.75~1.0	

Remark : Nominal diameters which are not specified in Attached table 8 shall be mutually agreed upon by the purchaser and the manufacturer.

*1 : Standard dimension

In the event of any doubt, the original standards in Japanese should be referred.

□ : SI PHASE UNRELATED STANDARD

(The standard to which SI units are not given or which dose not use units.)

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