

KES

**Metal Tubes and Tubing
for Automobiles**

KES C-E003

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Contents

1. Scope of Application
2. Kind
3. Quality
4. Shapes and Sizes
5. Manufacturing Method
6. Testing Method
7. Inspection
8. Alteration of Specification
9. Indication
10. Quoted Standard

Appendix



1. Scope of Application

This standard specifies steel tubes used mainly for brake, clutch, fuel, lubrication, cooling and heating system and others of automobiles (hereunder called the "tube").

However, fuel injection tubing is excepted.

Remark: As for the heat shrinkable tube for preventing the tube from corrosion, refer to the Appendix.

2. Kind

2.1 Kind of tube shall be 3 kinds shown in Table 1.

Table 1

Kind	Symbol
Double wall tube	TDW
Single wall tube	TSW
Carbon steel tube for machine structural purposes	STKM11J (STKM11A)

2.2 Tube shall be divided as shown in Table 2 according to the kind and presence of surface treatment.

Table 2

Kind of Tube (Symbol)	Division according to the Kind and Presence of Surface Treatment									
	Inside surface			Outside surface						
	Copper plating	Nickel plating	Tin and zinc plating	No surface treatment	Molten tin and lead alloy plating	Zinc plating			Zinc plating + organic coating	
						8μ	13μ	25μ	13μ	25μ
TDW	C3		—	N	T	Z8	Z13	Z25	Z13-F	Z25-F
TSW										
STKM11J (A)			A							

Remark: In the case of no surface treatment, the designation of N may be omitted.

3. Quality

- 3.1 Appearance: The finish of tube shall be smooth on both inside and outside and have no defect such as crack, flaw, rust, etc. harmful to use. However, KES B-R001 (Paint Film), TB 2 shall apply to the appearance of the ones with organic material coating.
- 3.2 Chemical composition of material: Chemical composition of tube material shall be as shown in Table 3.

Table 3

Kind	Symbol	Chemical Composition %					
		C	Mn	P	S	Si	Cu
Double wall tube	TDW	≤0.12	≤0.50	≤0.040	≤0.045	—	—
Single wall tube	TSW						
Carbon steel tube for machine structural purposes	STKM11J	≤0.12	0.25 to 0.60	≤0.040	≤0.040	≤0.35	

- 3.3 Mechanical properties: Mechanical properties of tube shall be as shown in Table 4.

Table 4

Symbol	Tension Test			Hardness	Bending, expanding, opening, flat bending and flattening
	Tensile strength kgf/cm ² (N/mm)	Yield point kgf/cm ² (N/mm)	Elongation %		
TDW	≥30	≥18	≥25	HV	(After carrying out the test mentioned in Item 7.in JASO M101), Defects such as flaws, cracks, etc. shall not occur on the wall of the tube
TSW	(≥294)	(≥177)		≤150	
STKM11J	≥30 (≥294)	—	≥30	—	

Remark: Chemical composition and mechanical properties are derived from JASO M 101 (Metal Tube and Tubing for Automobiles).

3.4 Surface Treatment

- 3.4.1 Thickness of surface treatment: Kind, symbol and thickness of surface treatment applied to tubes shall be as shown in Table 5.

Table 5

Unit: m

Kind of Tube (Symbol)	Thickness of Surface Treatment								
	Inside surface			Outside surface					
	Copper plating	Nickel plating	Tin and zinc plating	Molten tin and lead alloy plating	Zinc electro-plating (Chromate treatment)		Organic coating on zinc electro-plating		
	C3	A *3		T	Z8	Z13	Z25	Z13-F	Z25-F
TDW	As copper plating for deposition	—		Average Min. 6				Zinc plating Min. 13	Zinc plating Min. 25
TSW STKM11J (A)	Min. 3	Min. 3	Min. 5	Minimum Min. 3	Min. 8	Min. 13	Min. 25	*2 (F: As shown in Attached Table 1-1)	

*1. Copper plating on inside surface is applied for special designation.

(Symbol constitution is as shown in Example 2 in 9.)

*2. It means Zn-plated tube coated by fluorine resin of uniform film thickness.

Evaluation standard of fluorine resin coating is as shown in Attached Table 1-1 and Item 3.4.2.

*3. The evaluation standard of nickel plating and tin and zinc plating in the plating on inside surface is as shown in Attached Table 1-2.

3.4.2 Corrosion resistance: Tube shall be tested according to 6 and conform to standard shown in Table 6.

Table 6

Unit: Hour h

Kind and Symbol of Plating		Judging Standard	
		Time until generating white corrosion compound h	Time until generating iron rust (red rust) h
Zinc electroplating (Colored chromate treatment)	Z8	Min. 72	Min. 192
	Z13		Min. 286
	Z25		Min. 480
Molten tin and lead alloy plating	T	Max. 5 points of iron rust (red rust) per 50 cm ² after 24 hours	
Organic coating on zinc electroplating	Z13-F	—	Min. 2500
	Z25-F	—	Min. 3000

3.5 Proof Pressure: Tube shall be tested according to 6 and be bearable to proof pressure shown in Table 7 without any harmful deformation remained on it.

Table 7

Kind of Tube (Symbol)	Proof Pressure kgf/cm ² {N/cm ² }	
TDW	Nominal diameter 6.35 or less	350 {3430}
	Nominal diameter 8 to 10	250 {2450}
TSW STKM11J (A)	Nominal diameter 6.35 or less	250 {2450}
	Nominal diameter 8 to 10	200 {1960}
	Nominal diameter 12 to 15	150 {1470}
	Nominal diameter 18 to 22	100 {980}

4. Shapes and Sizes

4.1 Nominal diameters and sizes of tube: Nominal diameters and sizes of tube shall be as shown in Attached Table 2.

4.2 Tube joints: System, types, symbols, shapes and sizes of tube joints shall be as shown in Table 8.

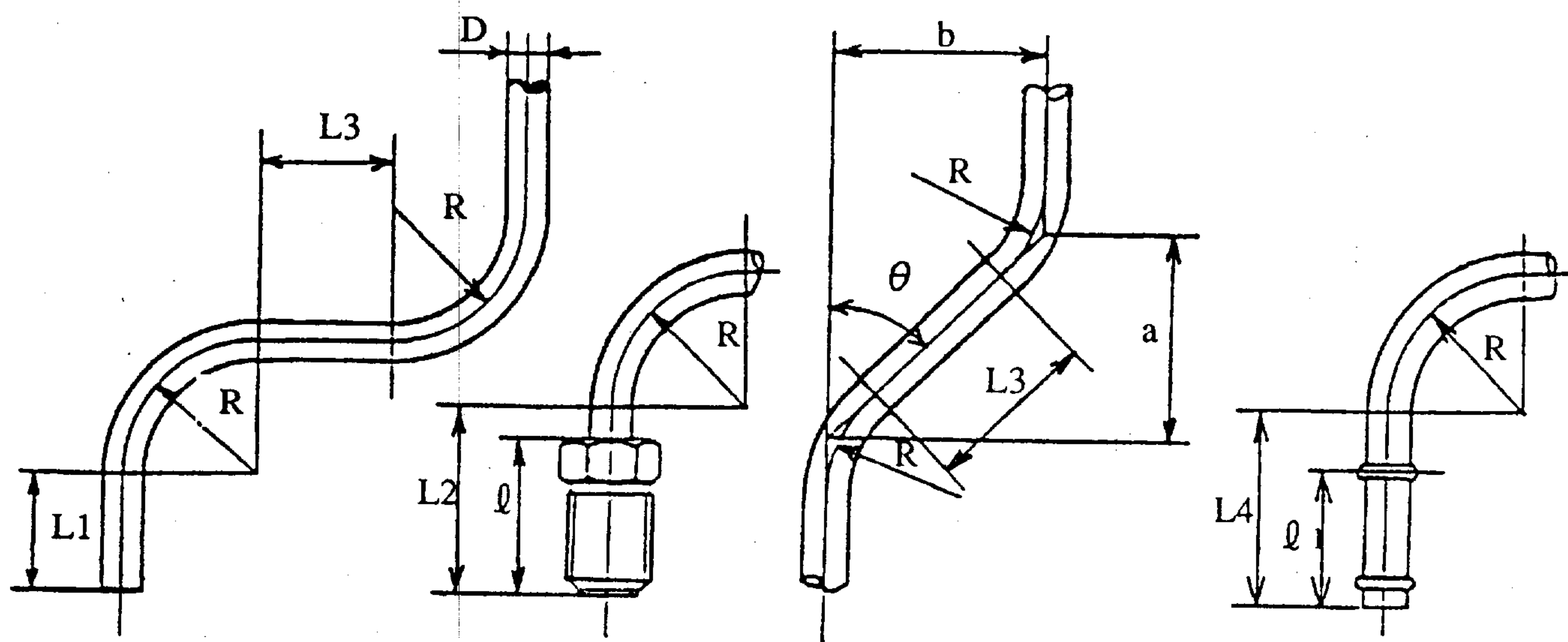
Table 8

Joint System	Type	Symbol	Shape and Size	Remarks
Flare joint	Double flare	JDF	Attached Table 3	JOINT-DOUBLE FLARE
Nozzle joint	Bulge	JB	Attached Table 4	JOINT-BULGE
	Spool	JS		JOINT-SPOOL

4.3 Processing Standard of Tube

4.3.1 Bend of tube: Bend (bending radius and length of straight part), and flatness of tube shall be as shown in Table 9.

Table 9



Unit: mm

Unit: mm

Nominal dia. of tube (D)	Bending Radius (R)			Flatness (%)		Length of Straight Part (Min.)			
	Min.	Standard	Tolerance	Min.	Standard	L1	L2	L3	L4
4.76	15	20	+5 0	Min. 80	Min. 90	3D	ℓ + D	3D	2D + ℓ 1
6.35	20	30							1.5D + ℓ 1
(7.94) 8	30	40							D + ℓ 1
10	35	50							
12, 12.7									
15									
18	50	60							

Remarks 1. Bending radius R and length of straight part L shall be as larger as possible to improve workability.

2. Flatness shall be calculated by following formula:

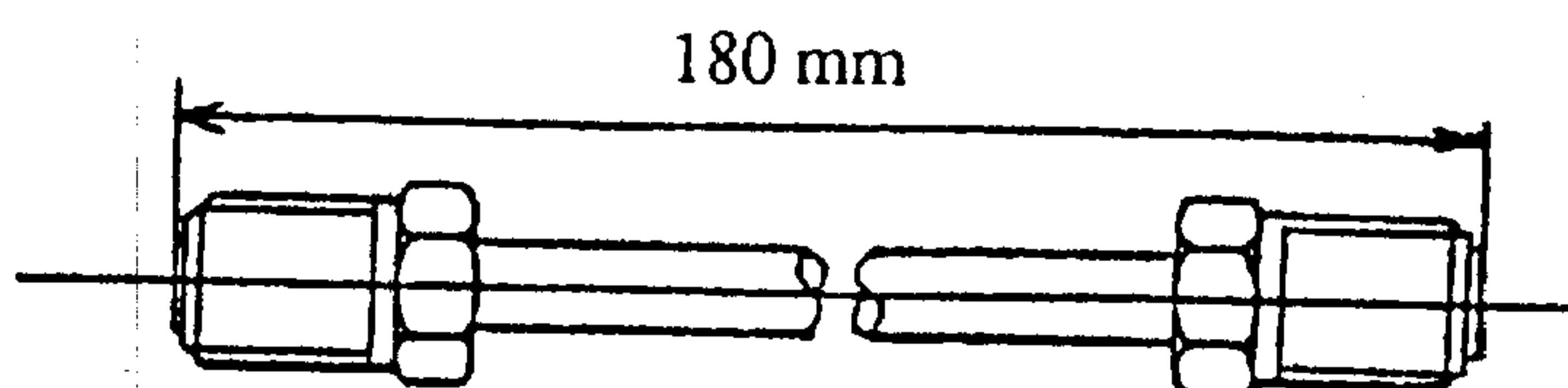
$$\text{Flatness} = \frac{\text{Min. dimension of outside dia. of tube after bending}}{\text{Dimension of outside dia. of tube before bending}} \times 100$$

3. Bending angle (θ) shall be 10° or more. And it shall be indicated in drawings by the distances of a and b.

4. As for tubes of 20 or more in nominal diameter, the details shall be agreed by parties concerned.

4.3.2 Length of tube: Minimum processing length of tube (10 or less in nominal diameter) with flare joints shall be as shown in following Figure.

Figure Minimum Processing Length of Tube



4.3.3 Tolerance: Dimensional tolerances of straight tube and bend tube shall be as shown in Table 10. And it shall apply to new products since March, 1986.

Table 10

Straight Tube

Bend Tube

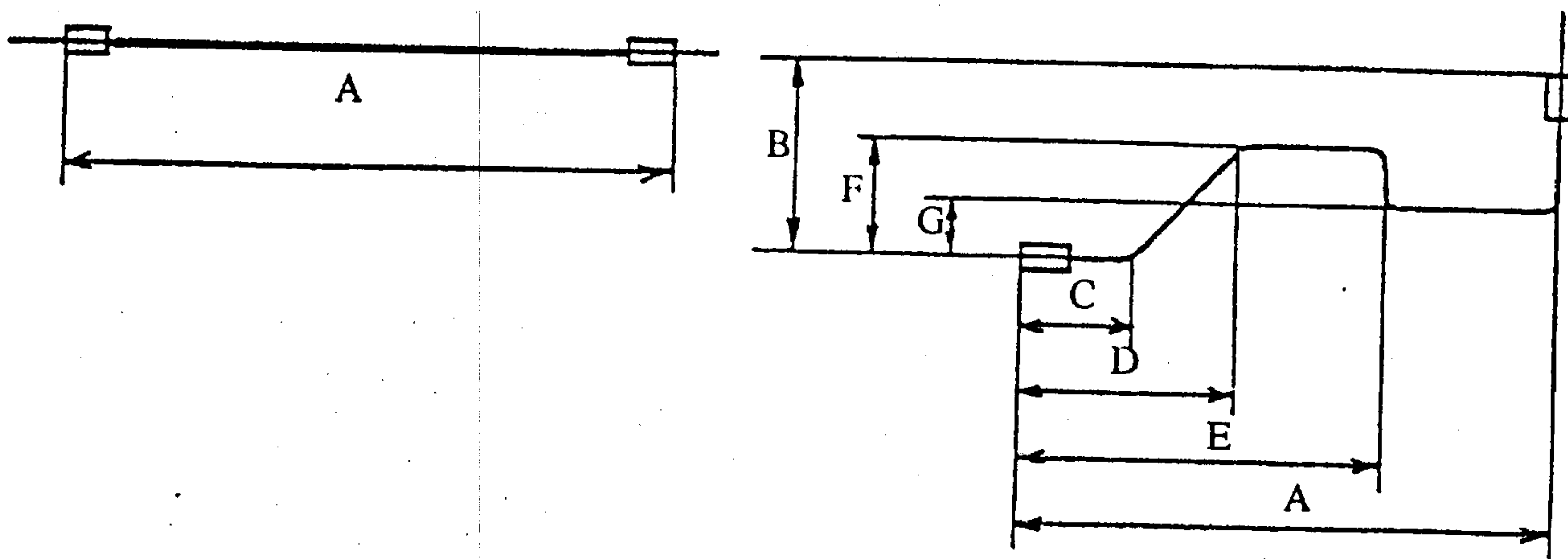


Table 10 (Continued)

Unit: mm

Division of Sizes	Tolerance	
	A, B	C, D, E, F, G, ...
50 or smaller	±1.5	±2.0
51 to 100	±2.0	±2.0
101 to 250	±3.0	±3.0
251 to 500	±3.0	±3.0
501 to 1000	±3.0	±3.5
1001 to 2000	±3.5	±3.5
2001 to 3000	±4.0	±4.0
3001 to 4000	±4.5	±4.5
4001 or larger	±5.0	±5.0

5. Manufacturing Method

5.1 Double wall steel tube shall be manufactured by applying copper plating on both surfaces of SPCC (Cold Rolled Steel Strip) specified in JIS G 3141, forming it into double wall tube shape and soldering it with copper solder in reducing furnace.

5.2 Single wall steel tube shall be manufactured from SPCC (Cold Rolled Steel Strip) specified in JIS G 3141, by electric resistance welding.

6. Testing Method

Testing methods of proof pressure, corrosion resistance and mechanical properties of tube shall be in accordance with JASO M 101, 7. And corrosion resistance test specified in Table 11 shall be added to brake tube with organic material coating.