

C 2801-1976  
Edition 1

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Japanese Text

Established by Minister of International Trade and Industry

Date of Establishment: 1952-03-08

Date of Revision: 1971-11-01

Date of Public Notice in Official Gazette: 1971-11-20

Investigated by: Japanese Industrial Standards Committee  
Technical Committee on Commutator Bar  
Divisional Council on Electricity

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This English Translation is published by:  
Japanese Standards Association  
1-24, Akasaka 4, Minato-ku  
Tokyo 107 Japan  
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Printed in Tokyo by  
Hohbunsha Co., Ltd.

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Remarks 1.  $II = \frac{\frac{D}{2}}{\tan \frac{\theta}{2}}$   $II' = \frac{\frac{D}{2}}{\tan \frac{\theta}{2}} + E$

where,  $D$  : tolerance on dimension of A or B (mm)

$E$  : tolerance on dimension of C (mm)

$$\frac{\theta}{2} : \tan^{-1} \frac{A-B}{2C}$$

2. The gauge shall be of the steel sheet of 2 mm or more in thickness (the material shall be of SK 3 to SK 5 for example and heat treated as required) and shall have constructional stiffness and endurance to abrasion and deformation.
3. The dimensions of gauge is desired not more than  $\pm 0.01$  mm in tolerance for designated dimensions.
4. The reference line and limit lines shall be 0.08 to 0.12 mm in slenderness.

Reference Following information is for reference and not a part of standard.

Table 1 (Reference values)

Dimension A mm	Tensile strength kgf/mm <sup>2</sup> {MPa}		Elongation %		After heated at 300°C for 1 h	
					Tensile strength kgf/mm <sup>2</sup> {MPa}	Elongation %
	Class 1	Class 2	Class 1	Class 2	Class 2	Class 2
Under 5	32 {314} min.	34 {333} min.	7 min.	5 min.	32 {314} min.	7 min.
5 to 10 excl.	30 {294} min.	32 {314} min.	8 min.	6 min.	30 {294} min.	8 min.
10 to 15 excl.	28 {275} min.	30 {294} min.	9 min.	7 min.	28 {275} min.	9 min.
15 and over	26 {255} min.	28 {275} min.	11 min.	8 min.	26 {255} min.	11 min.

Remark: The values mentioned above are conducted on the test piece of gauge length 50 mm.

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7.2 The test piece for hardness test shall be sampled at random from each lot by the standard of Table 7, by making the same melt, shape and dimensions as one lot.

Table 7

Lot size	Number of test piece
200 max.	2
Over 200 to 1000 incl.	Add one per 200 or its fraction
Over 1000	Add one per 500 or its fraction

7.3 The commutator bar shall be inspected on the appearance and dimensions, and tested in accordance with 6., and shall pass the provisions of 3. and 4. The dimension inspection on A and B, however, shall be conducted with a section gauge.

#### 8. Packaging and Packing

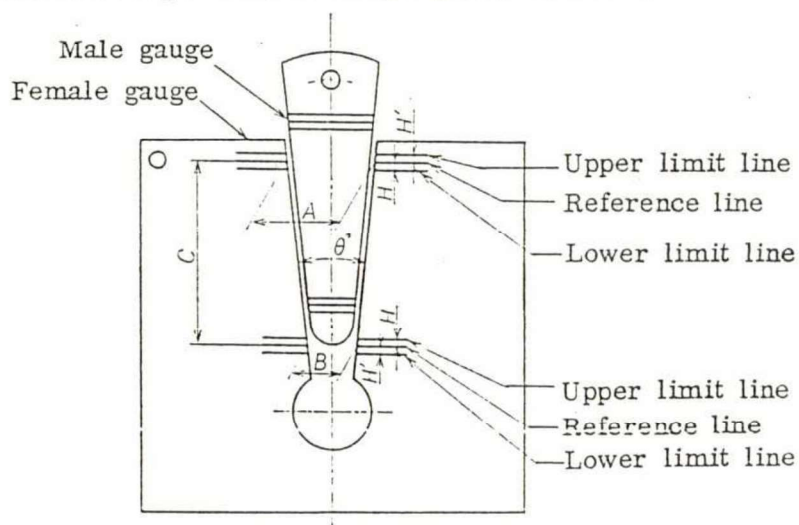
The commutator bars shall be packaged with care so as not to be damaged nor bent.

#### 9. Marking

Following information shall be marked on the commutator bars by suitable way.

- (1) Name • class
- (2) Type number
- (3) Dimensions (A/B x C x length)

Attached Fig. Section Gauge (Refer to 4.3.2)



## 5. Manufacturing Method

Class 1 commutator bar shall be manufactured from electrolytic cathode copper of JIS H 2121 and Class 2 commutator bar, from electrolytic cathode copper of JIS H 2121 and genuine silver by cold drawing or cold rolling method.

## 6. Test

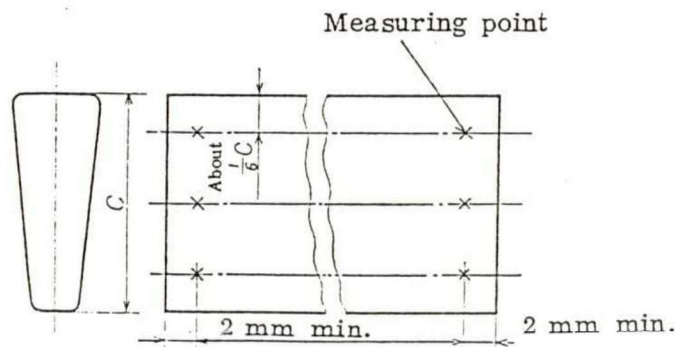
The test of commutator bar shall conform to the following items, and other general items to JIS H 0321.

6.1 Chemical Analysis Test The chemical analysis test shall conform to JIS H 1201.

6.2 Electric Conductivity Test The electric conductivity test shall conform to JIS C 3001.

6.3 Hardness Test Unless otherwise specified, the hardness test shall be conducted, by making the side surface of test piece horizontal, positions of Fig. 3 as reference points, and measured at 6 points in conformity with JIS Z 2244, applying the load of 20 kgf {176 N}. At least 5 points shall conform to provisions of Table 3. Provided that, in the case of conforming to JIS Z 2246, sampling method and other necessary items shall be the subject of agreement between parties concerned.

Fig. 3



6.4 Heat Softening Test After heating the test piece at  $300 \pm 15^\circ\text{C}$  for 1 h, and the test piece being cooled to room temperature, the hardness shall be measured. However, this test shall be conducted on Class 2 only, and sampling method and measuring method shall conform to 7.2 and 6.3.

## 7. Inspection

7.1 The test piece for electric conductivity test shall be sampled from each ingot of the same melt used for manufacture.

4.3.2 When inserting the commutator bar into the section gauge in Attached Fig., the clearance on either side shall conform to the value specified in Table 5, and both the upper and lower ends in dimension C shall lie within the upper and lower limit lines of the section gauge.

The purchaser shall surely consign one set of female and male section gauges to the manufacturer when he gives an order. The reference line and the upper and lower limit lines of the section gauge (refer to Attached Fig.) shall be determined by Table 4.

Table 5

Unit: mm	
C	Clearance
Under 50	0.03 max.
50 and over	0.04 max.

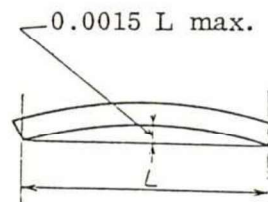
4.3.3 Tolerance on Length The tolerance on length shall conform to Table 6.

Table 6

Unit: mm	
	Tolerance
Single length	+ 2 0
Multiple length	+ 3 0
Specified length	+ 3 0

4.3.4 Tolerance on Distortion in Longitudinal Direction All the camber, twist and bend (<sup>3</sup>) shall be not more than 0.15 % of the length. For bars less than 100 mm in length, however, the tolerance shall conform to the agreement between the parties concerned.

Fig. 2



Note (<sup>3</sup>) The camber, twist and bend shall be measured as shown in Fig. 2. Where,  $L$  : total length of material.

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4.2 Dimensions The preferred dimensional range of the commutator bar shall be as follows:

$A = 1.2$  to  $25$  mm incl.     $B = 0.5$  to  $20$  mm incl.     $C = 5$  to  $125$  mm incl.

$C' = 1$  to  $1.5$  mm incl.     $R_1 = 1/2 A$  or more     $R_2 = \text{about } 1/2 B$

$r_1 = \text{about } 0.4$  mm

$r_2 = \begin{cases} \text{about } 1/2 B \text{ when } B \text{ is under } 5 \text{ mm} \\ \text{about } 2.5 \text{ mm when } B \text{ is } 5 \text{ mm and over} \end{cases}$

The length shall be anyone <sup>(1)</sup> of single length, multiple length and specified length.

Note <sup>(1)</sup> Single length is the length used as a single piece of commutator bar without cutting.  
Multiple length is the length for which the purchaser designates the unit length, number of pieces and allowance of commutator bar pieces to be cut from it.  
Specified length is the length for which the purchaser designates the total length thereof.

#### 4.3 Dimensional Tolerance

4.3.1 The dimensional tolerances on A, B and C shall conform to Table 4.

Table 4

Unit: mm

A	$\frac{A - B}{C}$	Tolerance		
		A	B	C <sup>(2)</sup>
10 and over	0.02 and over	$\pm 0.05$	$\pm 0.05$	+0.40
Under 10		$\pm 0.04$	$\pm 0.04$	0
-	Under 0.02	$\pm 0.035$	$\pm 0.035$	+0.40 0
Remarks		Measuring by the limit line of gauge		Measuring directly

Note <sup>(2)</sup> In the case of Type I:  $C + C'$

3.3 The hardness shall conform to Table 3.

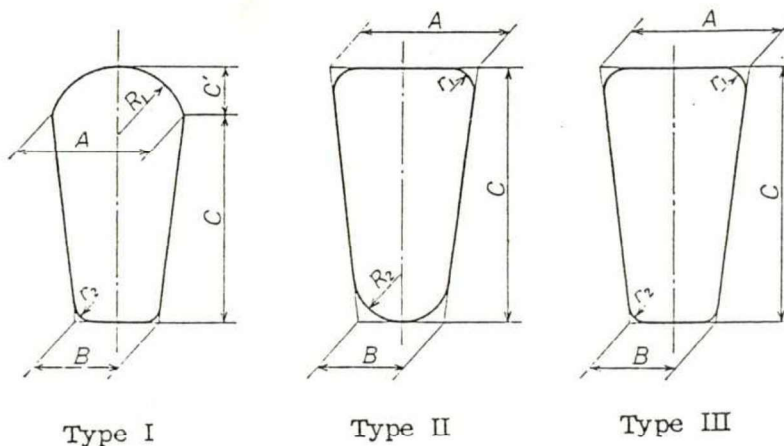
Table 3

Dimension		Hardness				Hardness after heating for one hour at 300°C	
A	C	Vickers hardness Hv (20)		Shore hardness Hs		Vickers hardness Hv (20)	Shore hardness Hs
mm	mm	Class 1	Class 2	Class 1	Class 2	Class 2	Class 2
Under 5	60 or less	108 min.	110 min.	20 min.	21 min.	108 min.	20 min.
	Over 60	105 min.	108 min.	19 min.	20 min.	105 min.	19 min.
5 to 10 excl.	60 or less	105 min.	108 min.	19 min.	20 min.	105 min.	19 min.
	Over 60	103 min.	105 min.	18 min.	19 min.	103 min.	18 min.
10 to 15 excl.	60 or less	103 min.	105 min.	18 min.	19 min.	103 min.	18 min.
	Over 60	100 min.	103 min.	17 min.	18 min.	100 min.	17 min.
15 and over	60 or less	100 min.	103 min.	17 min.	18 min.	100 min.	17 min.
	Over 60	98 min.	100 min.	16 min.	17 min.	98 min.	16 min.

#### 4. Shape, Dimensions and Tolerance

4.1 Shape The shape of vertical section to the longitudinal direction of the commutator bar shall be of three types of Fig. 1, and both side surfaces in wedge form shall be flat. Both ends shall be cut off exactly at right angles to the longitudinal direction.

Fig. 1



2. Classification

The commutator bar shall be classified as given in Table 1 according to the material.

Table 1

Class	Symbol	Material
Class 1	CMB 1	Copper
Class 2	CMB 2	Silver-bearing copper

3. Quality

3.1 The commutator bar shall be well finished, uniform in quality and free from injurious defects for use.

3.2 The chemical composition and electric conductivity shall conform to Table 2.

Table 2

Class	Chemical composition %			Electric conductivity %
	Cu	Cu + Ag	Ag	
Class 1	99.9 min.	-	-	98 min.
Class 2	-	99.9 min.	0.15 to 0.25 incl.	97 min.

UDC 621.3.047.24



JAPANESE INDUSTRIAL STANDARD

J I S

Commutator Bar

C 2801-1976

# 1. Scope

This Japanese Industrial Standard specifies commutator bar used for commutator of electrical machinery and apparatus.

Remark: In this standard, the units and numerical values in { } are in accordance with the International System of Units ( SI ) and given for reference only.

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## Applicable Standards:

- JIS C 3001-Conductivity of Copper Materials for Electrical Purposes
- JIS H 0321-General Rules for Inspections on Non-ferrous Metal Materials
- JIS H 1201-Methods for Chemical Analysis of Copper Products
- JIS H 2121-Electrolytic Cathode Copper
- JIS Z 2244-Method of Vickers Hardness Test
- JIS Z 2246-Method of Shore Hardness Test for Metallic Materials

Translation without guarantee  
In the event of any doubt arising, the original  
standard in Japanese is to be evidence

# JIS

JAPANESE INDUSTRIAL STANDARD

Commutator Bar

Ⓔ JIS C 2801 -1976

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