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# मानक

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IS 5898 (1970): Copper and Copper Alloy Bare Solid Welding Rods and Electrodes [MTD 11: Welding General]



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“Knowledge is such a treasure which cannot be stolen”



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*Indian Standard*

SPECIFICATION FOR  
COPPER AND COPPER ALLOY BARE SOLID  
WELDING RODS AND ELECTRODES

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INDIAN STANDARDS INSTITUTION  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

# Indian Standard

## SPECIFICATION FOR COPPER AND COPPER ALLOY BARE SOLID WELDING RODS AND ELECTRODES

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# *Indian Standard*

## SPECIFICATION FOR COPPER AND COPPER ALLOY BARE SOLID WELDING RODS AND ELECTRODES

### 0. FOREWORD

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 7 December 1970, after the draft finalized by the Welding General Sectional Committee had been approved by the Structural and Metals Division Council.

**0.2** This standard is one of the series of standards covering comprehensively the requirements for filler rods and wires for gas-shielded arc welding and covers bare solid filler rods and wires for copper and copper alloys. The other standards in the series cover filler rods and wires for inert-gas welding of the following:

- a) Corrosion and heat-resisting chromium-nickel steels,
- b) Aluminium and aluminium alloys and magnesium alloys,
- c) Structural steels, and
- d) Nickel and nickel alloys.

**0.3** The requirements for filler rods and wires suitable only for TIG welding are covered in IS : 2680-1964\*. In this standard, the requirements for filler rods and wires have been covered comprehensively irrespective of the process of welding used. It is intended that with the publication of this standard, IS : 2680-1964\* will be withdrawn.

**0.3.1** The diameters of wires and dimensions of spools, have been based on appropriate ISO Recommendations.

**0.4** This standard keeps in view the manufacturing and trade practices being followed in the country in this field. Assistance has also been derived from the following publications:

ISO/R 546-1966 Lengths and tolerances for drawn or extruded filler rods for welding supplied in straight lengths. International Organization for Standardization.

ISO/R 864-1968 Solid wires for gas-shielded metal-arc welding of mild steel. International Organization for Standardization.

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\*Specification for filler rods and wires for inert gas tungsten arc welding.

**Draft British Standard specification for filler rods and wires for inert-gas arc welding. Part 3. Copper and copper alloys. British Standards Institution.**

**0.5** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960\*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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## **1. SCOPE**

**1.1** The standard prescribes the requirements of bare solid filler rods and wires for welding copper and copper alloys by inert-gas arc process, that is inert-gas tungsten arc welding (TIG) or gas metal-arc welding (MIG). The chemical composition of the rods and wires is also specified.

**1.1.1** The standard does not specify the chemical composition and mechanical properties of the weld deposit.

**1.2** Certain rods and wires specified in this standard are not suitable for use with particular shielding gas. Suitability of their use with a particular shielding gas should, therefore, be ascertained from the manufacturer while purchasing.

## **2. TERMINOLOGY**

**2.1** For the purpose of this standard, the definitions given in IS : 812-1957† shall apply.

## **3. SUPPLY OF MATERIAL**

**3.1** General requirements relating to supply of filler rods and wires for inert-gas arc welding shall be as laid down in IS : 1387-1967‡.

## **4. DIMENSIONS AND TOLERANCES**

**4.1** The diameters of rods and wires shall be as given in Table 1. The tolerances appropriate to the specified diameters shall be as specified in the same table.

NOTE — The preferred sizes are given in parenthesis.

## **5. SPOOLS FOR WIRE**

**5.1** The size and type of spool on which the particular diameter of wire is to be supplied shall be as agreed to between the purchaser and the manufacturer and shall conform to the appropriate dimensions and tolerances given in Fig. 1 and Table 2.

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\*Rules for rounding off numerical values (*revised*).

†Glossary of terms relating to welding and cutting of metals.

‡General requirements for the supply of metallurgical materials (*first revision*).



**TABLE 1 DIMENSIONS OF FILLER RODS AND WIRES  
DIAMETERS AND TOLERANCES**

( Clause 4.1 )

FORM	DIAMETER	TOLERANCES	
		Plus	Minus
	mm	mm	mm
Wire	{ 0.5 }	0.01	0.03
	{ 0.6 }		
	{ 0.8 }		
	{ 0.9 }		
	{ 1.0 }		
Wire and rod	{ 1.2 }	0.01	0.04
	{ 1.6 }		
	{ 2.0 }		
	{ 2.4 }		
	{ 2.5 }		
	{ 3.2 }		
Rod	{ 4.0 }	0.01	0.07
	{ 5.0 }		

**5.2** The flanges of spools shall be sufficiently robust to avoid deformation during normal usage.

**NOTE**— The barrel diameter for spool should be as large as possible to permit satisfactory feeding of wire into the welding equipment.

## 6. REELING CONDITIONS

**6.1** The wire shall be closely wound in layers on the spool in one continuous length and shall be free from kinks, waves, sharp bends or twists and shall be free to unwind without restrictions. The adjacent layers within a layer need not necessarily be touching.

## 7. LENGTH OF RODS

**7.1** Rods less than 2.5 mm in diameter shall preferably be in lengths of 500 or 1 000 mm. Rods 2.5 mm and larger in diameter shall preferably be supplied in lengths of 1 000 mm. Lengths other than these two preferred lengths may be supplied by mutual agreement between the purchaser and the manufacturer.

**7.2** Tolerance on each length of rod shall be  $\pm 5$  mm.

## 8. CONDITIONS OF RODS AND WIRES

**8.1 Finish**— Filler rods and wires shall have smooth finish, free from surface imperfections, corrosion products, grease, excess oxide or oil matter which would adversely affect the properties of the weld or the operation of the welding equipment.

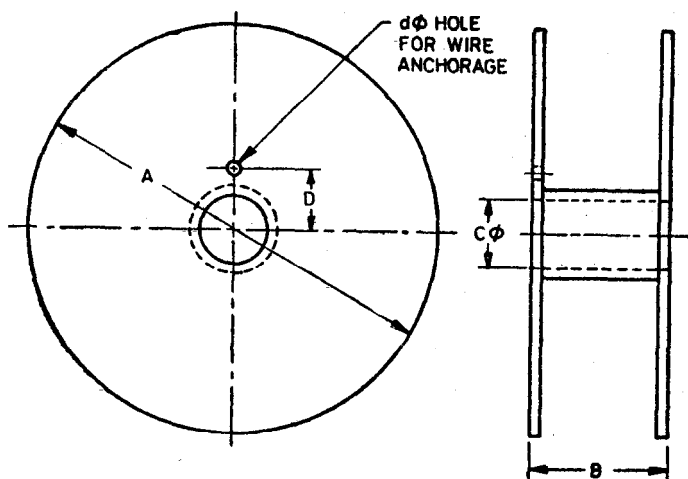


FIG. 1 SPOOL

**8.2 Temper and Cast of Wire**—The temper and cast of wire shall be as agreed to between the purchaser and the manufacturer.

## 9. CLASSIFICATION

**9.1** The filler rods and wires are classified on the basis of their chemical composition.

**9.2** In a classification (for example, S-CuSn2) the letter 'S' indicates bare solid rod or wire. The symbol 'Cu' denotes the main (basic) element copper and 'Sn' denotes the main alloying element tin. The digit used as a suffix indicates the particular classification based on the actual chemical composition of the wire or rod.

## 10. CHEMICAL COMPOSITION

**10.1** The chemical composition of the bare solid filler rods and wires as manufactured, when analysed in accordance with IS:440-1964\* in the case of copper, IS:4027-1967† in the case of bronzes and IS:3685-1966‡ in the case of brasses, shall be as given in 10.3 to 10.16.

**10.1.1** Analysis for silicon, manganese and aluminium in the case of filler rods of IS Designation S-Cu 1 and S-Cu 2; and the analysis for titanium and sulphur in the case of filler rods of IS Designation S-Cu Ni 1, S-Cu Ni 2 and S-Cu Ni 3 shall be as agreed to between the supplier and the purchaser.

\*Methods of chemical analysis of copper (*revised*).

†Methods of chemical analysis of bronzes.

‡Methods of chemical analysis of brasses.

**TABLE 2 DIMENSIONS AND TOLERANCES FOR SPOOLS**

( Clause 5·1 )

<i>A</i>		<i>B</i>		<i>C</i>		<i>D</i>		<i>d</i>	
Diameter of Flanges	Tolerance	Width of Spool	Tolerance	Diameter	Tolerance	Distance Between Axes	Tolerance	Diameter	Tolerance
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
100	± 2	45	+ 0 - 2	16·0	+ 1·0 - 0	—	—	—	—
300	± 5	103	+ 0 - 3	50·5	+ 2·5 - 0	44·5	± 0·5	10	+ 1 - 0
350	± 5	103	+ 0 - 3	50·5	+ 2·5 - 0	44·5	± 0·5	10	+ 1 - 0
435	± 5	103	+ 0 - 3	50·5	+ 2·5 - 0	44·5	± 0·5	10	+ 1 - 0

**10.2** The manufacturer shall carry out analysis from each cast of material and when required by the purchaser, shall supply a certified cast analysis of a sample from each cast.

**10.2.1** If required by the purchaser, adequate quantity of rod or wire representing each cast shall be made available to perform a check analysis and ensure that the chemical composition conforms to the specified requirements.

**10.3 IS Designation S-Cu 1 — Copper Filler Rods and Wires:**

	Percent	
	Min	Max
Copper	98.5	—
Silicon	0.2	0.35
Manganese	0.15	0.35
Iron	—	0.03
Aluminium	—	0.03
Nickel	—	0.10
Tin	—	1.0
Lead	—	0.010
Arsenic	—	0.05
Antimony	—	0.005
Bismuth	—	0.003
Phosphorus	—	0.015

**10.3.1 Application** — These rods and wires are intended for welding copper, using argon or helium as the shielding gas.

**10.4 IS Designation S-Cu 2 — Copper Filler Rods and Wires:**

	Percent	
	Min	Max
Copper	99.4	—
Titanium	0.1	0.3
Aluminium	0.1	0.3
Titanium + Aluminium	0.25	0.5
Iron	—	0.03
Nickel	—	0.10
Lead	—	0.010
Arsenic	—	0.05
Antimony	—	0.005
Bismuth	—	0.003
Phosphorus	—	0.015

**10.4.1 Application**— These rods and wires are intended for welding copper using nitrogen as the shielding gas, although argon or helium may be used.

**10.5 IS Designation S-Cu Si 1 — Silicon Bronze Filler Rods and Wires ( Copper-Silicon ):**

	Percent	
	Min	Max
Silicon	2.75	3.25
Manganese	0.75	1.25
Iron	—	0.10
Aluminium	—	0.03
Zinc	—	0.5
Lead	—	0.02
Copper	Remainder	

**10.5.1 Application**— These rods and wires are intended for welding material of the same or similar composition.

**10.6 IS Designation S-CuSn 1 — Phosphor Bronze Filler Rods and Wires ( Copper-Tin ):**

	Percent	
	Min	Max
Copper	93.8	—
Tin	4.5	6.0
Phosphorus	0.02	0.40
Aluminium	—	0.03
Lead	—	0.02

**10.6.1 Application**— These rods and wires are intended for welding material of the same or similar composition.

**10.7 IS Designation S-CuSn 2 — Phosphor Bronze Filler Rods and Wires ( Copper-Tin ):**

	Percent	
	Min	Max
Copper	92.3	—
Tin	6.0	7.5
Phosphorus	0.02	0.40
Aluminium	—	0.03
Lead	—	0.02

**10.7.1 Application**— These rods and wires are intended for welding material of the same or similar composition.

**10.8 IS Designation S-CuAl 1 — Aluminium Bronze Filler Rods and Wires ( Copper-Aluminium ):**

	Percent	
	Min	Max
Copper	90.0	—
Aluminium	6.0	7.5
Iron + Manganese + Nickel	1.0	2.5
Zinc	—	0.2
Silicon	—	0.10
Lead	—	0.007

Bismuth content shall be as low as possible.

**10.8.1 Application**— These rods and wires are intended for welding material of the same or similar composition.

**10.9 IS Designation S-CuAl 2 — Aluminium Bronze Filler Rods and Wires ( Copper-Aluminium ):**

	Percent	
	Min	Max
Copper	90.0	—
Aluminium	6.5	8.5
Iron	2.5	3.5
Zinc	—	0.2
Silicon	—	0.10
Lead	—	0.007

Bismuth content shall be kept as low as possible.

**10.9.1 Application** — These rods and wires are intended for welding material of the same or similar composition.

**10.10 IS Designation S-CuAl 3 — Aluminium Bronze Filler Rods and Wires (Copper-Aluminium):**

	Percent	
	Min	Max
Copper	86.0	—
Aluminium	9.0	11.0
Iron	0.75	1.5
Manganese	—	1.0
Nickel	—	1.0
Zinc	—	0.2
Silicon	—	0.10
Lead	—	0.007

Bismuth content shall be kept as low as possible.

**10.10.1 Application** — These rods and wires are intended for welding material of the same or similar composition.

**10.11 IS Designation S-CuZnA 1 — Aluminium Brass Filler Rods and Wires:**

	Percent	
	Min	Max
Copper	76.0	78.0
Aluminium	1.80	2.30
Iron	—	0.06
Arsenic	0.02	0.06
Lead	—	0.05
Zinc	Remainder	

**10.11.1 Application** — These rods and wires are intended for welding aluminium brass.

**10.12 IS Designation S-CuNi 1 — 90/10 Cupro-Nickel Filler Rods and Wires:**

	Percent	
	Min	Max
Copper	remainder	
Nickel	10.0	12.0
Titanium	0.20	0.50
Manganese	0.5	1.0
Iron	1.5	1.8
Lead	—	0.007
Phosphorus	—	0.02
Sulphur	—	0.01
Silicon	—	0.01
Aluminium	—	0.03



**10.12.1 Application**—These rods and wires are intended for welding 90/10 cupro-nickel rods and wires.

**10.13 IS Designation S-CuNi 2—70/30 Cupro-Nickel Filler Rods and Wires:**

	Percent	
	Min	Max
Copper	66.5	—
Nickel	30.0	32.0
Titanium	0.20	0.50
Manganese	0.5	1.5
Iron	0.4	1.0
Lead	—	0.007
Phosphorus	—	0.02
Sulphur	—	0.01
Silicon	—	0.01
Aluminium	—	0.03

**10.13.1 Application**—These rods and wires are intended for welding 70/30 cupro-nickel filler alloy.

**10.14 IS Designation S-CuNi 3—Copper-Nickel-Iron Alloy Filler Rods and Wires:**

	Percent	
	Min	Max
Copper	91.3	—
Nickel	5.0	6.0
Iron	1.05	1.35
Titanium	0.20	0.50
Manganese	0.30	0.80
Lead	—	0.007
Phosphorus	—	0.02
Sulphur	—	0.01
Silicon	—	0.01
Aluminium	—	0.03

**10.14.1 Application**—These rods and wires are intended for welding copper-nickel-iron alloy.

**10.15 IS Designation S. CuAlNi—Aluminium Bronze Filler Rods and Wires (Copper-Aluminium-Nickel):**

	Percent	
	Min	Max
Copper	78.0	85.0
Aluminium	8.0	10.0
Iron	1.5	3.5
Nickel	4.0	7.0
Manganese	0.5	2.0
Zinc	—	0.20
Silicon	—	0.10
Lead	—	0.005

Bismuth content shall be kept as low as possible.

**10.15.1 Application**—These are intended for welding aluminium-bronze of similar composition.

**10.16 IS Designation S-CuMnAl 1—Copper-Manganese Aluminium Alloy Filler Rods and Wires:**

	Percent	
	Min	Max
Manganese	11.0	14.0
Aluminium	7.0	8.5
Iron	2.0	4.0
Nickel	1.5	3.0
Copper	remainder	

**10.16.1 Application**—These are intended for welding the alloy of similar composition.

## 11. METHOD OF SAMPLING

**11.1** The location and the method of sampling shall be as agreed to between the supplier and the purchaser.

**11.2** The area to be sampled shall be from the combined transverse sections obtained by bundling the rods or wires after cutting into suitable lengths, or by folding. The area shall be cleaned by grinding or pickling. The sample shall be collected by milling out the area.

**11.2.1** When heat treatment is required to reduce the hardness of the sample piece before machining, the annealing temperature and time shall be kept to a minimum and a suitable discard of the decarburized surface layer shall precede collection of the sample for analysis.

## **12. PACKING**

**12.1** Filler rods and spools of wires shall be suitably packed to guard against damage, contamination or deterioration during storage, transit and inspection.

## **13. MARKING**

**13.1** Each spool of wire and each spool shall be normally marked with the following information:

- a) IS classification,
- b) Name of manufacturer,
- c) Trade designation of rods and wires,
- d) Size, and
- e) Cast number/batch number.

**13.2** The package of spools may also be marked with the ISI Certification Mark.

**NOTE** — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution ( Certification Marks ) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.