

Indian Standard

**SPECIFICATION FOR
BARE WIRE ELECTRODES FOR SUBMERGED
ARC WELDING OF STRUCTURAL STEELS**

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BUREAU OF INDIAN STANDARDS
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Indian Standard

SPECIFICATION FOR BARE WIRE ELECTRODES FOR SUBMERGED ARC WELDING OF STRUCTURAL STEELS

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Indian Standard

SPECIFICATION FOR BARE WIRE ELECTRODES FOR SUBMERGED ARC WELDING OF STRUCTURAL STEELS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 29 March 1974, 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 intended to serve as a guide for the manufacture and selection of bare wire electrodes for submerged arc welding of structural steels.

0.3 In the preparation of this standard due consideration has been given to the manufacturing and trade practices followed in the field in this country. Assistance has also been derived from Doc: IIS/IIW — 385-72 'Classification and symbolization of bare steel wire electrodes and fluxes for submerged arc welding of structural steels' issued by the Sub-Commission on Submerged Arc Welding of the International Institute of Welding.

0.4 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.

1. SCOPE

1.1 This standard prescribes the requirements of solid filler wires for submerged arc welding of structural steels (28-50 kgf/mm² yield strength and 34-70 kgf/mm² ultimate tensile strength).

2. TERMINOLOGY

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

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

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

3. SUPPLY OF MATERIAL

3.1 General requirements relating to the supply of solid filler wires for submerged arc welding of structural steels shall be as laid down in IS: 1387-1967*.

4. DIMENSIONS AND TOLERANCES

4.1 The diameters of wires shall be as follows:

1.6, 2.0, 2.5, 3.15, 4.0, 5.0, 6.3 and 8.0 mm.

4.2 The tolerance on the diameters of wires shall be ± 0.05 mm.

5. REELS FOR WIRE

5.1 The dimensions of the rims and the coils on which wire may be supplied shall be as agreed to between the purchaser and the manufacturer and they shall conform to one of the appropriate dimensions and tolerances given in Tables 1 and 2.

TABLE 1 DIMENSIONS AND TOLERANCES FOR RIMS

INTERNAL DIAMETER mm	WIDTH mm	NET WEIGHT, Max kg
300 ± 5	100 ± 3	12.5 ± 1
300 ± 5	100 ± 3	25 ± 2
600 ± 5	100 ± 3	80 ± 5

TABLE 2 DIMENSIONS AND TOLERANCES FOR COILS

INTERNAL DIAMETER mm	NET WEIGHT, Max kg
300 ± 25	12.5 ± 1
300 ± 25	25 ± 2
600 ± 25	80 ± 5

6. REELING CONDITIONS

6.1 The wire shall be closely wound in layers on the rim in continuous length; it shall be free from kinks, waves, or sharp bends, and free to unwind without restriction. The adjacent windings within a layer may not necessarily be touching.

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

6.2 Coils shall be properly bound to prevent entanglement of turns in normal handling and when used with tied start and finish ends. The finished end shall be clearly marked for identification. All coils shall contain continuous length of wire made from a single heat or lot.

6.3 Butt welds when present in the wire shall be suitably made so as not to interfere with the uniform uninterrupted feeding of the wire on automatic and semi-automatic equipment.

7. CONDITIONS OF WIRES

7.1 Filler wires shall have smooth finish and they shall be free from surface imperfections, corrosion products, grease, excessive oxide or other foreign matter which would affect adversely the properties of the weld or the operation of the welding equipment. Temper and surface conditions shall be suitable for uniform uninterrupted feeding on automatic or semi-automatic welding equipment. Unless otherwise specified the wires shall have a uniform, unbroken well-bonded and smooth copper coating applied onto the thoroughly cleaned wire surface. The copper content of the coated wire expressed as a percentage of the wire and the coating shall not exceed 0.4 percent by weight.

8. CLASSIFICATION

8.1 The filler wires shall be classified on the basis of their chemical composition.

8.2 In a classification, for example, 'AS-X' 'A' indicates that the wire is used for semi-automatic or automatic submerged arc welding and 'S' indicates solid bare wire. The digit 'X' used as a suffix is equal to twice the amount of the average manganese content of the wire. The presence of molybdenum, silicon, nickel, etc, is indicated by further suffixes like Mo, Si, Ni, etc.

The IS Classification 'AS-2 Mo' means that the solid wire is suitable for automatic and semi-automatic submerged arc welding and it contains 1 percent average content of manganese and an intentional addition of molybdenum.

9. CHEMICAL COMPOSITION

9.1 The chemical composition of filler wires, when analyzed in accordance with IS: 228-1959*, IS: 228 (Part I)-1972†, IS: 228 (Part II)-1972‡,

*Methods of chemical analysis of pig iron, cast iron and plain carbon and low-alloy steels (*revised*).

†Methods of chemical analysis of steels: Part I Determination of carbon by volumetric method (for carbon ≥ 0.1 percent) (*second revision*).

‡Methods of chemical analysis of steels: Part II Determination of manganese in plain carbon and low alloy steels by arsenite method (*second revision*).

TABLE 3 CHEMICAL COMPOSITION OF FILLER WIRES

(Clause 9.1)

IS CLASSIFICATION	CHEMICAL COMPOSITION, PERCENT						
	Carbon	Silicon	Manganese	Molybdenum	Nickel	Phosphorus Max	Sulphur Max
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
AS-1	0.10 (Max)	0.03 (Max)	0.40-0.60	—	—	0.03	0.03
AS-1 Si	0.08-0.15	0.10-0.40	0.40-0.60	—	—	0.03	0.03
AS-2	0.08-0.15	0.05-0.15	0.80-1.20	—	—	0.03	0.03
AS-2 Si	0.08-0.15	0.15-0.40	0.80-1.20	—	—	0.03	0.03
AS-2 Mo	0.08-0.15	0.05-0.15	0.80-1.20	0.45-0.60	—	0.03	0.03
AS-2 Ni	0.06-0.12	0.05-0.15	0.80-1.20	—	0.80-1.20	0.02	0.02
AS-3	0.08-0.15	0.05-0.25	1.30-1.70	—	—	0.03	0.03
AS-3 Mo	0.08-0.15	0.05-0.25	1.30-1.70	0.45-0.60	—	0.03	0.03
AS-3 Mo Ni	0.08-0.12	0.05-0.25	1.30-1.70	0.45-0.60	1.30-1.70	0.02	0.02
AS-4	0.08-0.16	0.05-0.25	1.80-2.20	—	—	0.03	0.03
AS-4 Mo	0.08-0.17	0.15-0.30	1.80-2.20	0.45-0.60	—	0.03	0.03
AS-6	0.08-0.17	0.20-0.30	2.80-3.20	—	—	0.03	0.03
AS-6 Mo	0.08-0.17	0.15-0.30	2.80-3.20	0.45-0.60	—	0.03	0.03

IS : 228 (Part III)-1972*, IS : 228 (Part IV)-1974†, IS : 228 (Part V)-1974‡, IS : 228 (Part VI)-1974§ and IS : 228 (Part VII)-1974||, shall be as given in Table 3. Where the wire is copper-coated, the analysis shall be made after the copper has been removed.

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

9.3 Regarding residual elements the acceptance limits shall be as agreed to between the manufacturer and the purchaser.

10. METHOD OF SAMPLING

10.1 The location and the method of sampling shall be as agreed to between the purchaser and the manufacturer.

10.2 The area to be sampled shall be obtained from the combined transverse sections by bundling the rods or wires after cutting into suitable lengths or by folding. The area shall be cleaned by grinding. The copper coating shall be removed to expose the base metal before grinding. The sample shall be collected by milling out the areas.

11. PACKING

11.1 Reels of wire shall be suitably packed to guard against atmospheric influence, damage, combination or deterioration during storage, transit and inspection.

11.2 If the condition of the wire is such that special protection during storage or special treatment before use is desirable, the manufacturer shall give details of such special protection or treatment on the package.

12. MARKING

12.1 Each reel or coil of wire shall be clearly marked with the following information:

- a) Classification coding,
- b) Name of manufacturer,

*Methods of chemical analysis of steels: Part III Determination of phosphorus by alkalimetric method (*second revision*).

†Methods of chemical analysis of steels: Part IV Determination of carbon (gravimetric method) for carbon ≥ 0.1 percent (*second revision*).

‡Methods of chemical analysis of steels: Part V Determination of nickel by dimethylglyoxime (gravimetric) method (for nickel ≥ 0.5 percent) (*second revision*).

§Methods of chemical analysis of steels: Part VI Determination of chromium by persulphate oxidation method (for chromium ≥ 0.5 percent) (*second revision*).

||Methods of chemical analysis of steels: Part VII Determination of molybdenum by alpha benzoinoxime method (for molybdenum above 1 percent) (*second revision*).

- c) Trade designation of wire,
- d) Wire size,
- e) Cast number, and
- f) Net weight of the reel/coil.

12.1.1 The reel 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.

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