

STR No. MC/STR/W/01 –Rev-2



Government of India
Ministry of Railways

*Schedule of Technical Requirements
for Infrastructural, Manufacturing & Testing Facilities
and Quality Control
For*

**Manual Metal Arc Welding Electrodes and Gas Welding
Rods as per IRS: M 28-2020**

**Metallurgical & Chemical Directorate
Research Designs & Standards Organisation
Manak Nagar, Lucknow – 226011**

29.06.2020

1.0 SCOPE

This schedule covers the technical requirements for manufacture of manual Metal Arc Welding Electrodes (MMAW) and Gas Welding Rods as per **IRS-M-28-20**. (Except classes H3, H3A, H3B and H3C which are under developmental stage).

1.1 Welding consumables under different classes have been grouped on the basis of infra-structural facilities, manufacturing process, quality control equipment and application at user end as given below:

Group I	Class A1, A2, A3, A4, A5, B1, B2 and E1 (MS Electrode where weld metal chemistry is not specified)
Group II	Class B3, B4, C1, C2, D, E2, F, G, H4A and H4B (Low and medium alloy steel electrode, electrode for cast iron and hard facing electrode where weld metal chemistry is specified)
Group III	Class M1, M2, M3, M4, M5 and M6 (Stainless steel electrode)
Group IV	Class K and L (Non ferrous electrode)
Group V	Class N1, N2 and N3 (Cutting and gouging electrode)
Group VI	Class I, II, III and IV (Gas Welding rods)

1.2 **Fresh Approval** : The firms seeking for approval at RDSO shall apply a minimum of following classes in each groups and will have to qualify all the items of applied group:

Group No.	Minimum Class applied
Group – I	(A1 or A2) + (A3 or B1) + (A4 or B2)
Group – II	(C1 or C2) + D + (E2 or H4A or H4B)
Group – III	(M1 or M2) + (M4 or M5)
Group – IV	(K or L)
Group – V	(N1 or N2 or N3)
Group – VI	(I or IV)

1.3 The firm should have the experience of at least three (3) years of manufacturing and supplying/ exporting the applied welding consumables to the industries manufacturing earth moving equipments, marine industries and thermal power plants (Enclose documentary evidences)

1.4 The firm should have annual turnover of minimum one (1) crore.

2.0 REQUIREMENTS FOR MMAW ELECTRODES

Vendors seeking approval for MMAW electrodes shall comply with all the requirements mentioned below:

2.1 GENERAL

- 2.1.1 The firm should have well illuminated and ventilated covered shed with sufficient height and space for various manufacturing activities such as wire drawing, dry mixing of flux, wet mixing and briquetting of flux, extrusion, air drying, drying in electric oven, baking and packing.
- 2.1.2 The firm should have separate identified area for storage of different raw materials (Wire, flux, binder etc.) finished products and scrap.
- 2.1.3 The firm should have separate quality control lab for welding, chemical testing and mechanical testing.
- 2.1.4 The firm should have sufficient material handling facilities like fork lifter, wooden / metallic trays, trolleys etc.
- 2.1.5 The firm should have separate machining facility for preparation of test pieces for mechanical testing at the same location.
- 2.1.6 The details of Manufacturing & testing facilities shall be submitted in format of Annexure to STR as per Annex-I
- 2.1.7 The details about applied items and its test results as per Annex-III & IV

2.2 MANUFACTURING FACILITIES (for Group I to V)

The firm should have following machines / equipments:

- 2.2.1 Minimum one set of wire drawing machine consisting of at least two drums (for group III and IV this is not mandatory).
- 2.2.2 Minimum one number wire straightening and cutting machine with sufficient capacity and speed matching with production capacity.
- 2.2.3 Sieve with mesh size 10 (or equivalent) or finer for sieving flux ingredients.
- 2.2.4 Minimum one number dry mixer of capacity 50 kg. Min. for mixing different ingredient of flux.
- 2.2.5 Minimum one number of wet mixer of sufficient capacity proportionate with production capacity.
- 2.2.6 At least one number briquetting press for making briquettes out of wet mixed flux.
- 2.2.7 At least one number extrusion press of capacity at par with briquette size.

- 2.2.8 Conveyer belt system with on line end – brushing and chamfering arrangement.
- 2.2.9 Air drying arrangement for initial drying of electrodes before oven drying/baking.
- 2.2.10 At least one drying oven of sufficient capacity with thermostat control and temperature range upto 200°C.
- 2.2.11 Minimum one number high temperature (500°C) electric baking oven of sufficient capacity with thermostat control.
- 2.2.12 Weighing arrangement of sufficient capacity for weighing flux ingredients and finished products accurately.
- 2.2.13 Shrink packing arrangement for packing of electrode as per clause 5.1 of IRS-M-28-02.

2.3 TESTING FACILITIES

2.3.1 GENERAL AND CHEMICAL TESTING

- 2.3.1.1 Firm should have duly calibrated straight edge metallic scale (with least count 1 mm). Vernier calipers/Screw Gauge (least count 0.01 mm) and Eccentricity Tester.
- 2.3.1.2 The firm should have Welding machine (Transformer/Rectifier type) with capacity 300 Amps min. for carrying out performance test of the electrodes and making test weld assembly. Firm should have duly calibrated Tong Tester for measuring welding current and OCV.
- 2.3.1.3 The firm should have Hydrogen Determination Apparatus for measuring diffusible hydrogen in weld metal. This is mandatory for firms manufacturing low hydrogen type of electrodes.
- 2.3.1.4 The firm should have chemical testing laboratory for chemical analysis of raw materials (wire, flux, binder etc.) and weld metal.
- 2.3.1.5 The chemical laboratory should consist of carbon-Sulphur determination apparatus, chemical balance, hot plate, muffle furnace (800°C), electric oven, barometer, hygrometer, platinum crucible, glass wares and chemicals.
- 2.3.1.6 Humidity Chamber for Storage Stability & corrosion test.
- 2.3.1.7 Radiographic (X –Rays or Gama Rays) test facility (Applicable for firms applying for Radiographic Quality welding consumables)
- 2.3.1.8 **Metallurgical Microscope**

GROUP SPECIFIC ADDITIONAL TESTING FACILITIES

(In addition to testing facilities at 2.3.1)

2.3.2 MECHANICAL TESTING (for Group I and II)

2.3.2.1 The firm should have Universal Testing Machine of capacity 20 MT min. with necessary attachment for measuring Yield Load & Breaking Load and carrying out Bend Test. The machine should be calibrated by a recognized agency.

2.3.2.2 The firm should have duly calibrated Impact Testing Machine capacity 30 kgfm (Charpy 'V' notch type test piece) with testing facilities at room temperature, 0°C -20°C and -46°C depending on the requirement of the product offered.

2.3.2.3 The firm should have duly calibrated Hardness Testing Machine, Brinell/Vickers/Rockwell type for measuring weld metal hardness. This is mandatory for the firms seeking approval for class G, H4A and H4B under group II and optional for other classes.

2.3.3 PHYSICAL TESTING REQUIREMENT (for group III only).

2.3.3.1 The firm should have Ferrite Meter for direct measurement of ferrite content in weld metal.

2.3.4 MECHANICAL TESTING FACILITIES (for group IV only).

2.3.4.1 The firm should have Universal Testing Machine, capacity 5 MT min. for measuring UTS and carrying out Bend Test.

2.3.2 MECHANICAL TESTING FACILITIES (for Group V only)

2.3.5.1 Not required.

2.4 Machining facilities for preparation of test pieces from weld assembly.

2.4.1 **For Group I & II** (except classes F, G, H₄A & H₄B).

- i) Lathe Machine for preparation of All Weld tensile test pieces.
- ii) Shaping Machine – for shaping of test pieces, edge preparations on plates & back gouging of welds.
- iii) V-notch cutter with gauge for cutting of V notch on impact test pieces.
- iv) Hand Grinder/Surface Grinder – for surface Grinding/General Grinding
- v) Power Hacksaw

2.4.2 **Group III , IV & Class F, G, H₄A & H₄B**

- i) Shaping Machine
- ii) Power Hacksaw Machine

2.4.3 **For Group V & VI** - Not Required

3.0 REQUIREMENT FOR GAS WELDING RODS

The firms seeking approval for gas welding rods shall comply with the requirements given below :

3.1 GENERAL

- 3.1.1 The firm should have well illuminated and ventilated covered shed with sufficient height and space for various manufacturing activities such as wire drawing, copper coating, melting, moulding, annealing, rolling, packing etc.
- 3.1.2 The firm should have separate identified area for storage of raw material, finished product and scrap.
- 3.1.3 The firm should have separate quality control lab for welding and chemical testing.
- 3.1.4 The firm should have sufficient material handling facilities. .

3.2 MINIMUM MANUFACTURING FACILITIES (for Class I, II, III)

The firm should have following machines/equipments.

- 3.2.1 Minimum 1 set of wire drawing machine consisting of at least 2 drums.
- 3.2.2 Minimum 1 set of grinding/die polishing system.
- 3.2.3 Wire cutting and straightening machine.
- 3.2.4 Copper coating system consisting of pickling tanks washing tank and copper bath.
- 3.2.5 Packing system as per clause 5.3 of IRS M-28-2020.

3.3 MINIMUM MANUFACTURING FACILITIES (for Class IV)

3.4 The firm should have following equipment / machines

- 3.3.1. Oil fired / Gas fired / Electrically operated melting furnace (800°C)
- 3.3.2 Moulds in required quantity.
- 3.3.3 Annealing furnace with automatic temperature controller.
- 3.3.4 Rolling and Pointing machine of sufficient capacity.

- 3.3.5 Wire drawing machine with minimum 2 die set of reduction in diameter.
- 3.3.6 Wire straightening and cutting arrangement of sufficient speed and capacity.
- 3.3.7 Packing system as per clause 5.3 of IRS M-28-2020

3.4 TESTING FACILITIES

- 3.4.1.1 Firm should have duly calibrated straight edge metallic scale (least count 1 mm) for measuring length and vernier callipers/screw gauge (least count 0.01mm) for measuring diameter of the wire.
- 3.4.1.2 The firm should have Gas Welding Plant consisting of Oxygen cylinder, Acetylene cylinder and burner sets of different sizes for performance test of welding rods of different diameter.

3.4.2 CHEMICAL TESTING FACILITIES

- 3.4.2.1 The firm should have chemical testing laboratory for chemical analysis of raw materials and finished products.
- 3.4.2.2 The chemical laboratory should consist of Carbon-Sulphur determination apparatus, chemical balance, hot plate, muffle furnace (800°C), electric oven, barometer, hygrometer, platinum crucible, glass wares and chemicals.

4.0 QUALITY CONTROL REQUIREMENTS

- 4.1 There should exist a system to ensure traceability of the product from raw material stage to finished product stage.
- 4.2 Quality Assurance Plan (QAP) of the product to be submitted as per Guidelines by vendor in duplicate shall cover the following details-

GUIDE LINES FOR QUALITY ASSURANCE PLAN(QAP)

1.	Firm's Name
2.	Firm's address (i) Head Office (ii) Works/Factory (iii) PHONE/FAX

3.	Applied FOR TYPE OF CONSUMABLES :
4	Quality Policy
5.	Valid ISO-9001-2000 Certificate for applied item
6.	Organisation Chart showing Key personnel (Name, Designation, Qualification, Experience, responsibilities)
7.	Q.A. Organisation Chart (Name, Designation, Qualification, Experience, responsibilities)
8.	Process Flow Chart /Description of Manufacturing Process It shall have various stages of manufacturing of Finished Product. Brief Description of manufacturing of applied items.
9.	Format of Inspection Plan of Raw Material, In process, Finished product, packing material

Format of Sr.9

S. No.	Item	Sample Size	Frequency	Parameters for Inspection	Specification	Acceptance Test Criteria/Value	Traceability
10.	Laid Down Procedure regarding identification of accepted/rejected material						
11.	Laid down procedure regarding disposal of rejected Material at every stages from raw materials to Finished Product.						
12.	Corrective & Preventive Action after rejection of material.						
13.	Storage Plan for raw material & Finished Product						
14.	List of Sub vendor & items supplied by them						
15.	Criteria for selection of vendor						
16.	List of relevant IRS/IS/AWS/RDSO etc. available						
17.	Laid Down Procedure for Handling customer complaint						
18.	Detailed Policy of calibration of equipment/gauges & records.						
19.	In House Testing facilities available for calibration with the firm						

S. No.	Name of Master	Make	Range	Frequency of calibration	Traceability to National Standard	
20.	Personnel Trained for In-House Calibration					
S. No.	Name	Qualification	Experience			
21.	Calibration Plan of the items identified for specified calibration in STR/Specification.					
S. No.	Measuring Equipments	Ref.Para of STR/Specn.	Range/ Accuracy	Frequency	In-House/ Out Source	Name of Agency
22.	Calibration Plan for other measuring equipment					
S. No.	Measuring Equipments	Range/ Accuracy	Frequency	In-House/ Out Source	Name of Agency	
23.	Process Capability Calculation					
24.	Signature of quality Control Incharge on each Page No. of QAP (X of Y)					

- 4.3 i) All the technical personnel responsible for supervision and handling of products and quality control activities should have Degree in Mechanical Engineering / Metallurgical Engineering with a minimum of three (3) years experience and should be working in the firm as regular employees.
- ii) Artisan staff like machinist, welder and fitter should have ITI qualification in respective trade and time to time they should have been imparted training from recognized institution in the respective trades(Enclose training documents)
- iii) All employees should be on regular role.
- 4.4 The vendor shall have acquired ISO Certification “ISO: 9001:2015” version in respect of all the products applied for and the same shall be covered in the certification.
- 4.5 There should exist a quality manual of the firm indicating the extent of control over production and testing.
- 4.6 The firm should ensure that proper analysis is being done on monthly basis to study the rejection at various internal stages and it is documented.
- 4.7 The firm should ensure that all the relevant specifications, IS standards are available with the firm.
- 4.8 The firm should ensure that proper record of complaints received from user (Railways) is being maintained and corrective action is taken.
- 4.9 Calibrated quality control measuring equipment / instrument like UTM, Impact testing machine, Vernier Calipers / Screw gauge, Tong tester, Weight boxes etc. shall be used.
- 4.10 Minimum Qty. specified for up-gradation from Pt-II to Pt-I status as per Annex -II

Annex-I**ANNEXURE TO STR**

S.No.	STR para no.	Requirement of M&P/T&P as per STR		Details of the M&P/T&P available with the firm						
		Name of M&P/T&P	Range / Capacity of M&P/T&P	Name of M&P/T&P	Model	Make	Machine no.	Year of Built	Range/ Capacity	Proof of ownership

UNDERTAKING OF THE FIRM

"I hereby give an undertaking that if at any time after approval is accorded, some machinery is found deficient without intimation to RDSO, and then it will be presumed that machinery was not there since beginning and firm's approval will be withdrawn immediately."

Date:**Place:****Signature****Name in capitals & Designation****Stamp of the firm****Note :**

1. Details of M & P should be furnished by vendor in complete as per format given above and also furnish the details of the ownership.
2. It should be mandatory to inform the RDSO through FAX (followed by confirmation copy through courier/speed post)as soon as any machinery is removed from the firm's premises (even for repair etc.). RDSO should be informed again, when is brought back and made operational.

Date:**Place:****Signature****Name in capitals & Designation****Stamp of the firm**

Annex-II

**Minimum essential quantity of MMAW electrodes to be supplied to be
on part-II list for consideration for
up gradation in part-I**

Sr. No.	Group of electrodes	Minimum Quantity to be supplied of each class to Zonal Railways, Production units & Wagon Builders only
1	Group-I	25,000 Running meters
2	Group-II	15,000 Running meters
3	Group-III	10,000 Running meters
4	Group-IV	5,000 Running meters
5	Group-V	10,000 Running meters
6	Group-VI	500Kg

Annex-III

GOVERNMENT OF INDIA – MINISTRY OF RAILWAYS
RESEARCH DESIGNS & STANDARDS ORGANISATION
MANAK NAGAR, Lucknow -226 011

Questionnaire Form in connection with assessment of indigenous MMAW Electrodes & Gas
Welding Rods for use on Indian Railways
(Please fill up one form for each brand)

1. Name and address of the manufacturer

Head Office :

Works/Factory :

PHONE/FAX :

2. Particulars of the brand offered for
Assessment (Please enclose technical
leaflet) :
Name of brand :

2.1 Class as per IRSM-28/02 for
which required to be assessed :

2.2 Code No. as per BIS Specn.
No. & Year :

2.3 AWS Specification & Code :

2.4 Sizes manufactured, current
conditions & coating factor :

Diameter of Electrode (mm)	Length of Electrode (mm)	Current range (Amp)	Coating factor

2.5 Whether core wire is of SS:
(For SS electrodes)

3. Whether offered for initial assessment
or periodic check :
4. Whether the offered brand is being
checked at periodic intervals for
production control. If yes, please
indicate test results for minimum two
sizes of electrode/G.W. Rods in standard

Annex-IV

**BTC STANDARD FORMAT FOR
Test Results of MMAW Electrodes & Gas Welding Rods**

Test No.....
.....

Dt :

1. Sample Details :

Sample Code No./Brand	IRS Class	Batch No.	Date of manufacturing	Size	Welding Parameters	
					OCV	Current

2. Chemical Composition :

Elements %	C	Mn	Si	S	P	Ni	Cr	Mo	Cu	Any Other element
Weld Metal/Core Wire										
Specified value as per IRSM-28/02										

3. Mechanical Properties :

a) All Weld

Properties	UTS N/mm ²	YS N/mm ²	%age El. (GL=5d)	%age R.A.	Charpy Impact Value (Joule)			HardnessB HN/HR _c	Macro Exam
					Individual (min 3 values)	Av.	Temp		
All weld specimen									
Specified value as per IRSM-28/02									

b) Butt Weld

Radiography as per IIW Blue Std.	Transverse Bend Test	
	Face	Root
Butt Weld specimen		

4. Fillet Weld Test :

5. Storage stability test :

6. Corrosion resistance test :

7. Hydrogen in Weld Metal (.....ml/100 gm)

Note : Please fill up all the boxes. Write N.A. if not applicable.

Signature of QC Incharge/Chemist