

STR No. MC/STR/W/02 –Rev-1



Government of India
Ministry of Railways

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

For

**Filler Wire for MIG/MAG Welding as per
IRS M-46- 2003 (with amendment No.1)**

**METALLURGICAL & CHEMICAL DIRECTORATE
Research Designs & Standards Organisation
Manak Nagar, Lucknow – 226011**

21.03.2011

1.0 SCOPE

This schedule covers the technical requirements for manufacture of Filler Wire for MIG/MAG welding as per IRS M-46- 2003 (with or without shielding gas)

- 1.1 The filler wire for MIG/MAG welding have been grouped as below on the basis of infrastructure facilities, manufacturing process, quality control and application at users end.

Group VII A	Solid MIG/MAG wire with shielding gas , Class I, II, III, IV, V, VI & VII
Group VII B	i) Flux Cored MIG/MAG wire with shielding gas , Class I, II, III, IV, V, VI & VII ii) Flux Cored wire, without shielding gas, Class I, II, & V

- 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 – VII A	Solid wire with shielding gas- (I)+ (II or III or IV or V or VI or VII)
Group – VII B	i) Flux Cored wire with shielding gas- (I or II)+(III or IV or V or VI or VII)
	ii) Flux Cored wire without shielding gas- (I or II or V)

- 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 turn over of minimum one (1) crore.

2.0 REQUIREMENTS FOR SOLID MIG/MAG WIRE (Group VIIA)

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 like Decoiling, Wire drawing, Annealing, Wet wire drawing, Pickling, Washing, Copper Coating, Finished drawing, Spooling, Packing etc.

2.1.2 Separate identified area for storage of raw materials and finished products and scrap.

2.1.3 The firm should have separate welding room for carrying out performance test and test weld preparations.

2.1.4 Separate quality control laboratory for mechanical and chemical testing.

2.1.5 Machining facilities at same location for preparation of test pieces from weld assembly .

2.1.5.1 **Group VII A & VIIB** (except class V, VI & VII)

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

2.1.5.2 **Group VII B** (Class V, VI & VII) (flux cored with shielding gas)

i) Power Hacksaw

ii) Shaping

2.1.5.3 Group VII A (Class VI & VII) – No machining facility is required.

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 **MINIMUM PRODUCTION FACILITIES**

2.2.1 The firm should have Dry wire drawing machine with facilities for cleaning and at least two stage reduction of wire. (This is exempted for stainless steel wire , class VI & VII)

2.2.2 The firm should have Decoiler working in tandem with Wire Drawing Machine or separately installed for straightening and cutting the wire in standard length.

- 2.2.3 The firm should have Annealing Furnace, Temp. 900°C of suitable size and capacity for inter-stage annealing of wire. This is mandatory for firms working with wire/rod of initial diameter of 8 mm or more. (This is exempted for stainless steel wire , class VI & VII).
- 2.2.4 The firm should have Automatic/Semi-automatic continuous type Wet wire drawing machine.
- 2.2.5 The firm should have Pickling and Washing bath of suitable capacity for continuous cleaning and rinsing of drawn wire.
- 2.2.6 The firm should have Coppering bath for copper coating of the wire or have alternate arrangement for surface protection. (This is not mandatory for stainless steel wire, class VI & VII).
- 2.2.7 The firm should have Finished Drawing Machine and Spooling machine for layered winding of finished wires.
- 2.2.8 The firm should have butt welding machine for joining of wire.
- 2.2.9 The firm should have weighing machine of capacity 20 kg. for weighing the spool of finished wire.
- 2.2.10 The firm should have packing arrangement as per clause 5 of IRS M 46 - 03.

2.3 TESTING FACILITIES

2.3.1 GENERAL AND CHEMICAL TESTING

- 2.3.1.1 The firm should have duly calibrated micrometer with least count 0.01mm. for measurement of diameter of wire and straight edge metallic scale (least count 1mm), length 1 metre min. for measurement of cast & helix.
- 2.3.1.2 The firm should have arrangement for measurement of copper coating thickness of wire by absorption spectrometer/wet analysis method.
- 2.3.1.3 The firm should have one Tensile Testing Machine, capacity 5 MT min. for carrying tensile testing of finished wire. (This is not mandatory for class VI & VII). 20 MT UTM may be used if it has scale for testing of 5MT.
- 2.3.1.4 The firm should have one MIG/MAG Welding machine, cap 500Amps min., complete with wire feeder unit, Nozzle of various sizes and Shielding gas as per requirement of the class for carrying out performance test & making test welds.
- 2.3.1.5 The firm should have one Hydrogen Determination Apparatus for measuring diffusible Hydrogen content in weld metal. (This is not required for class VI & VII)

2.3.1.6 The firm should have chemical testing laboratory for chemical analysis of raw materials and weld metal.

2.3.1.7 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.

2.3.1.8 Humidity chamber for storage stability & corrosion test.

2.3.1.9 Ferrite meter for measuring of Ferrite in SS (for class VI & VII).

Note: Use of Spectrometer or any other modern facility for determination of elements is permissible.

2.3.1.10 Radiographic(X –Rays or Gama Rays) test facility(Applicable for firms applying for radiographic Quality welding consumables)

2.3.1.11 Metallurgical Microscope

2.3.2 MECHANICAL TESTING FACILITIES (for Class I, II, III & IV)

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 of the weld metal. 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.

2.3.3 MECHANICAL TESTING FACILITIES (for Class V only).

2.3.3.1 The firm should have duly calibrated Hardness Testing Machine, Rockwell/Vicker’s type for measuring weld metal hardness.

2.3.4 MECHANICAL TESTING FACILITIES FOR (Class VI and VII only).

2.3.4.1 Not required

3.0 REQUIREMENTS FOR FLUX CORED WIRE MIG/MAG WIRE/WITH WITHOUT SHIELDING GAS (Group VII B)

3.1 GENERAL

3.1.1 The firm manufacturing flux-cored wire should have well illuminated and ventilated covered shed with sufficient height and space for various manufacturing activities consisting of Sieving of flux, Dry mixing, Wet mixing, Agglomerating, Continuous Flux-cored Wire manufacturing, void detection, Copper Coating/Surface Protection, Spooling and Packing.

- 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 welding room for carrying out performance test and test weld preparations.
- 3.1.4 The firm should have separate laboratory for mechanical and chemical testing of raw material and weld metal.

3.2 MINIMUM MANUFACTURING FACILITIES

- 3.2.1 The firm should have Sieve of suitable mesh size for coarse separation of the ingredients.
- 3.2.2 The firm should have Automatic/Semi-automatic Dry Mixer of suitable capacity for dry mixing of flux ingredients.
- 3.2.3 The firm should have Automatic/Semi-automatic Wet Mixer of suitable capacity for wet mixing of flux ingredients with the binder, if wet mixing is necessary for flux preparation .**
- 3.2.4 The firm should have Drying Oven ,Temp. 250°C. min. for initial drying of flux.
- 3.2.5 The firm should have Agglomerating Furnace, Temp. 600°C. Min. with automatic temperature control for agglomeration of flux , , if agglomeration is necessary for flux preparation .**
- 3.2.6 The firm should have Sieve Sets for proper sizing of flux
- 3.2.7 The firm should have proper packing and storing arrangements for the flux.
- 3.2.8 The firm should have Continuous Flux Cored Wire Manufacturing Plant with arrangement for uniform filling of flux.
- 3.2.9 The firm should have butt welding machine for joining of wire.
- 3.2.10 The firm should have arrangement for copper coating or any other coating arrangement for protection of wire.
- 3.2.11 The firm should have Automatic/Semi-automatic Spooling machine for layered winding of finished wire.
- 3.2.12 The firm should have weighing machine of capacity 20 kg. for weighing the spool of finished wire.

3.2.13 The firm should have packing arrangement as per clause 5 of IRS M 46 - 03.

3.3 TESTING FACILITIES

3.3.1 GENERAL AND CHEMICAL TESTING

3.3.1.1 The firm should have duly calibrated micrometer with least count 0.01mm. for measurement of diameter of wire.

3.3.1.1 The firm should have arrangement for measurement of copper coating thickness of wire by colorimeter/wet analysis method (for Copper Coated wire only).

3.3.1.2 The firm should have one MIG/MAG Welding machine, cap 500Amps min., complete with wire feeder unit, Nozzle of various sizes and Shielding gas as per requirement of the class for carrying out performance test & making test welds. Firms seeking approval for Flux-cored wire without shielding gas, should have suitable welding machine for carrying out performance test & making test welds using the filler wire without any shielding gas.

3.3.1.3 The firm should have one Hydrogen Determination Apparatus for measuring diffusible Hydrogen content in weld metal. (This is not required for class VI &VII).

3.3.1.4 The firm should have chemical testing laboratory for chemical analysis of raw materials and weld metal.

3.3.1.5 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.

Note: Use of Spectrometer or any other modern facility for determination of elements is permissible.

3.3.2 MECHANICAL TESTING (for Class I, II, III and IV)

3.3.2.1 The firm should have Universal Testing Machine of capacity 20 MT min. with necessary attachment for measuring Yield Load & Breaking Load of the weld metal. The machine should be calibrated by a recognized agency.

3.3.2.2 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.

3.3.3 MECHANICAL TESTING FACILITIES (for Class V only).

3.3.3.1 The firm should have duly calibrated Hardness Testing Machine, Vicker's/Rockwell type for measuring weld metal hardness.

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 : 2000 Certification 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 users (Railways) is being maintained and corrective action is taken.

4.9 Quality control measuring equipment/instrument like UTM, Impact testing machine, Vernier calipers /Screw gauge, Tong tester, Weight boxes etc. shall be periodically calibrated.

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

Annex- II

Minimum essential quantity of MIG/MAG wire to be supplied to be on part-II list for consideration for up gradation in part-I

Sr. No.	Group of MIG/MAG wire	Minimum Quantity to be supplied of each class to Zonal Railways, Production units & wagon Builders only
1	Group-VIIA	5,000Kg
2	Group-VIIB	5,000Kg

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 MIG/MAG
welding filler wires 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-46/03 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 wire (mm)	Voltage (Volts)	Current range (Amp)	Wire feed rate

2.5 Type of wire: Solid/Flux cored

2.6 Type of surface protection

2.7 Type of shielding gas
required

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 . (Including all the tests needed as per IRS:M46-03for offered class)
5. Whether the brand has been approved by NTH/BIS/LLOYODS Shipping or other approving Agency, If yes, submit a copy of approval Certificate :
6. Whether the brand offered is in regular production? If yes, please indicate average annual production :
7. Price per Kg : Size Rs.....
(for information only)
8. Special characteristics/
recommendation for the
electrode, if any :

Note :

1. All the items are to be filled properly. Please write N.A. if not applicable. Form will be rejected without any further reference.
2. In case of customer complaint or failure to adhere to delivery schedule causing inconvenience to consignee, appropriate action will be taken against the firm as per extant DOP, RDSO's decision in this regard shall be final.
3. All dispute subject to Lucknow jurisdiction.

It is certified that QAP approved by RDSO is being followed and recipe and process have not been changed.

- Encl :
1. Tech. Leaflet
 2. BTC in standard format for at least Two sizes
(preferably 0.8 mm & 1.2 mm)

Signature of competent authority
with designation and seal

**BTC STANDARD FORMAT FOR
Test Results For MIG/MAG Filler Wire**

Test No.....

Dt :

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1. Sample Details :

Sample Code No./Brand	IRS Class	Type of Wire	Batch No.	Date of manufacture	Size (mm)	Shielding gas	Test Parameters		
							Voltage	Current	Wire feed rate

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 -46/03										

3. Mechanical Properties of weld metal :

Properties	UTS N/mm ²	YS N/ mm ²	%age El. On 5d G.L.	%age R.A.	Charpy impact value (Joule)			Hardness BHN/HR _c	Macro Exam
					Ind. Values (min.3 values)	Av.	Temp °C		
All Weld Specimen									
Specified value as per IRSM-46/03									

4. Cast & Helix :

5. Fillet Weld Test

6. Percentage of copper in coating (by Wt.)

7. Radiographic test as per IIW Blue Std.

8. Corrosion Test :

9. Hydrogen in weld metal (...mg/100gm)

10. Any other test (Pl. specify)

Signature of QC Incharge/Chemist

