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भारत सरकार

Government of India

रेल मंत्रालय

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-46/2020

Issued by

धातु व रसायन निदेशालय

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Schedule of Technical Requirements for Infrastructural, Manufacturing & Testing Facilities and Quality Control for Filler Wire for MIG/MAG Welding as per IRS: M-46/2020

1.0 SCOPE

This schedule covers the technical requirements for manufacture of Filler Wire for MIG/MAG welding as per IRS M-46- 2020 (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	Flux Cored MIG/MAG wire with shielding gas , Class I, II, III, IV, VI & VII
Group VII C	Flux Cored wire, without shielding gas, Class I, II, & V

1.2 **Fresh Approval:** The firms can apply any nos. of class in a group mentioned in STR in single application. Firm has to apply separately for each group. Testing charges shall be levied separately according to number of classes applied in each group

1.3 The firm should have the experience of at least two (2) 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 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 preferably at same location for preparation of test pieces from weld assembly (For Class I, II, III & IV only) i.e.

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

2.1.6 For Class V, VI & VII, following machining facilities, preferably at same location, are required:

i) Power Hacksaw
ii) Shaping

2.1.7 The details of Manufacturing & testing facilities shall be submitted in format of Annexure to STR as per Annex-I.

2.1.8 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 De coiler working in tandem with Wire Drawing Machine.

2.2.3 The firm should have Annealing Furnace, Temp. 900ºC 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 required 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 -20.

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 one metre minimum 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, wherever applicable.

2.3.1.3 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.

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

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

2.3.1.6 The chemical laboratory should consist of Carbon-Sulphur determination apparatus, chemical balance, hot plate, muffle furnace (800ºC), electric oven, barometer, hygrometer, platinum crucible, glass wares and chemicals.

2.3.1.7 Humidity chamber for storage stability & corrosion test.

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

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

2.3.1.9 Radiographic (X–Rays or Gama Rays) test from in-house/outsourced agency (For Classes I, II, III & IV only).

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

2.3.2.1 The firm should have Universal Testing Machine of capacity 20 MT minimum 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, 0ºC -20ºC and -46ºC 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 MIG/MAG WIRE WITH SHIELDING GAS (Group VII B) AND WITHOUT SHIELDING GAS (Group VII C)

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.

3.1.5 Machining facilities preferably at same location for preparation of test pieces from weld assembly *(For Group VII B Class I, II, III & IV and For Group VII C, Class I & II only)* i.e.

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

3.1.6 For Group VII B, Class VI & VII and Group VII C, Class V, following machining preferably at same location facilities is required:

i) Power Hacksaw
ii) Shaping

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. 600ºC. 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 – 20.

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.

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

3.3.1.3 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.

3.3.1.4 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 (800ºC), 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 Group VIIB Class I, II, III and IV, For Group VIIC, Class I & II)

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, 0ºC, -20ºC and - 46ºC.

3.3.3 MECHANICAL TESTING FACILITIES (for Group VII C, Class V only).

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

3.3.4 MECHANICAL TESTING FACILITIES (for Group VII B, Class VI and VII only).

3.3.4.1 Not required

Stake holders comments if any	No comment from stake holder is received.
RDSO's views	Retained as it is.

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):

The Firm shall have an "internal quality assurance system" with proper documentation to sustain quality of products being manufactured. Firm will also prepare quality assurance plan as per RDSO ISO document no-QM-RF-8.1-3 (latest version) - Guidelines for preparing QAP during registration.

4.3 **i)** All the technical personnel responsible for supervision and handling of products and quality control activities should have Diploma/Degree in Mechanical Engineering/Metallurgical Engineering with a minimum of 10/3 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 Certification in respect of all the products applied for and the same shall be covered in the certification.

4.5 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.

4.6 The firm should ensure that all the relevant specifications, IS standards are available with the firm.

4.7 The firm should ensure that proper record of complaints received from users (Railways) is being maintained and corrective action is taken in the format mentioned in RDSO ISO document No. QM-RF-8.1.3 (latest version).

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

4.9 Minimum Qty. specified for up-gradation from RDSO vendors for developmental order to approved vendors 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/E-mail (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 MIG/MAG wire to be supplied as RDSO Vendor for developmental order for consideration for up gradation in Approved Vendor*

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
3.	Group-VIIC	5,000Kg

***NOTE:** A Vendor shall be considered eligible for upgradation to "Approved Vendors" status on completing successful supply of a minimum quantity as mentioned above as a 'list of RDSO vendors for developmental order' along with the fulfillment of other conditions as laid down in RDSO Vendor Registration Guidelines (Apex document) with latest amendment (Document No. QO-D-8.1-11). Vendor registration guidelines are on RDSO website www.rdso.indianrailways.gov.in.

Annex-III

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

Questionnaire Form in connection with assessment of 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/E-mail			
2.	**Particulars of the brand offered for Assessment (Please enclose technical leaflet):**			
2.1	Name of brand			
2.2	Class as per IRS M-46/20 for which required to be assessed			
2.3	Code No. as per BIS Specn. No. & Year			
2.4	AWS Specification & Code			
2.5	**Sizes manufactured & current conditions:**			
	Diameter of wire (mm)	Voltage (Volts)	Current range (Amp)	Wire feed rate
2.6	Type of wire	Solid/ Flux cored		
2.7	Type of surface protection			
2.8	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:M-46/2020 for 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 (for information only)	Size Rs…..
8.	Special characteristics/ recommendation for the electrode, if any :	

Note : All the items are to be filled properly. Please write N.A. if not applicable.

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

Annex- IV

BTC STANDARD FORMAT FOR Test Results for MIG/MAG Filler Wire

Test No…….. **Dt : ……**

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 - 46/20										

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/ HRC	Macro Exam
					Ind. Values (min.3 values)	Av.	Temp ºC		
All Weld Specimen									
Specified as per IRS M-46/20									

4. Cast & Helix:-

5. Fillet Weld Test:-

6. %Copper in coating (by weight):-

7. Radiography test as per IIW Blue Std./ASTM E390:-

8. Corrosion resistance test:-

9. Hydrogen in Weld Metal:- ……..ml/100 gm

10. Storage Stability Test:-

11. Running Performance Test:-

12. Any other test (Pl. specify):-

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

Signature of QC Incharge/Chemist

Annex- V

Performance test report of MIG/MAG Welding Filler Wire (with & without shielding gas)

Test No…… **Date:……..**

1. **Sample No.** 2. **Brand Name/Code No.**
3. **Sample details**

S. No.	Sizes	Batch No.	Date of Manufacture

4. **a) IRS Class……..** **b) Code as per IS/AWS……..**
5. **General Examination-**

(a) Packing conditions as per RDSO stipulation: Yes/No

(b) Dimension check:

Size	Diameter (mm)	Weight of spool (Kg)	Cast (mm)	Helix (mm)

(c) Type of coating - Copper coated/ Other coating

(d) Condition of wire - Rusted/Not rusted

(e) Type of shielding gas - CO_2 gas/Other gas/Gas mixture

6. **Welding performance test:**

(a) To weld in flat position (Current to be selected from the range given by the manufacturer in the packet)

Size	Lowest Current		Highest Current	
	Actual value of current	Performance (Whether arc is stable)	Actual value of current	Performance (Whether arc is stable)

Annex-V (Contd.)

(b) Performance report of 1.2 mm diameter filler wire with shielding gas/1.0 mm diameter filler wire without shielding gas at mid range of current (±20 Amps of mid value):

i)	Arc	- **a)** Stable/Unstable	**b)** Striking easy/Difficult
ii)	Spatter	- **a)** Little/Normal Excessive	**b)** Soft/Forceful/Spray type
iii)	Nature of slag	- **a)** Fluid/Viscous/Friable	
		- **b)** Self detachable/Easily removable/Difficult to remove	
		- **c)** Black/Brown/Grey/Other Colour	
iv)	Appearance of weld	- **a)** Smooth and evenly rippled/Unevenly rippled	
		b) Flat/Flat to convex/Flat to concave	
		c) Crack/Porosity/Slag inclusion/Any other defect	
v)	Smoke	- Normal/Excessive	
vi)	Tendency to undercut	- Nil/Slight/Excessive	
vii)	Running performance in feeder wire	- Normal/Abnormal	

7. Test for positional welding (Carried out with 1.2mm diameter filler wire with shielding gas/1.0mm diameter filler wire without gas at recommended range of currents)

Welding Position	**Actual current used**	**Performance**
Flat	Amp/Volt	Satisfactory/Unsatisfactory/Not applicable
Horizontal	Amp/Volt	Satisfactory/Unsatisfactory/Not applicable
Vertical Up	Amp/Volt	Satisfactory/Unsatisfactory/Not applicable
Vertical Down	Amp/Volt	Satisfactory/Unsatisfactory/Not applicable
Over head	Amp/Volt	Satisfactory/Unsatisfactory/Not applicable

8. Any other defect

Name & Signature of welder with date

Overall performance verified by Quality Control Officer- Satisfactory/Unsatisfactory

Name & Signature of quality control officer with date

Reviewed by Inspecting Official with remarks, if any

Name & Signature of inspecting official with date