STR No. MC/STR/W/03 –Rev-2

Government of India
Ministry of Railways

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

For

Wire and Flux for Submerged Arc Welding as per IRS- M: 39 - 2020

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

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1.0 SCOPE

This schedule covers the technical requirements for manufacture of Wire and Flux for Submerged Arc Welding (SAW) as per IRS–M–39-20.

1.1 The welding consumables for submerged arc welding have been grouped as below on the basis of infrastructure facilities, manufacturing process, quality control and application at users end.

Group VIII A	SAW Wire, Class W_1, W_2, W_3, W_4, W_5
Group VIII B	SAW Flux, Class F_1, F_2, F_3, F_4, F_5

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 – VIII A	(W_1) +(W_2 or W_3 or W_4 or W_5)
Group – VII B	(F_1) +(F_2 or F_3 or F_4 or F_5)

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

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

1.6 The details about applied items and its test results as per Annex-III , IV&V

2.0 REQUIREMENTS FOR SAW WIRE (Class W_1, W_2, W_3, W_4, W_5)

2.1 GENERAL

2.1.1 The firm should have well illuminated and ventilated covered shed with sufficient height and space for performing various manufacturing activities like Decoiling, Wire drawing, 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 product and scraps.

2.1.3 Separate quality control laboratory for physical and chemical testing.

2.1.4 Humidity chamber for storage stability & corrosion test.

2.2 MINIMUM PRODUCTION FACILITIES

The firm should have the following facilities:

2.2.1 Wire drawing and Copper coating facilities consisting of Decoiler, Wire drawing set, Pickling bath, Washing bath , Coppering bath, Rinsing bath, Finish drawing and Coiling arrangement

2.2.2 Butt welding machine of suitable capacity for joining wires.

2.2.3 Automatic Spooling machine for winding of wire.

2.2.4 Weighing facilities.

2.2.5 Packing facilities as per clause 4.4 of IRS–M–39-20.

2.3 TESTING FACILITIES

2.3.1 GENERAL

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

2.3.1.2 The firm should have arrangement for measurement of copper coating thickness of wire by colorimeter/wet analysis method.

2.3.1.3 The firm should have SAW (Submerged Arc Welding) machine of capacity minimum 500 Ampere and nozzle of various sizes for carrying out performance test of wire.

2.3.2 MECHANICAL TESTING OF WIRE

2.3.2.1 The firm should have one duly calibrated universal testing machine of capacity 5 MT min. for carrying out UTS of finished wire.

2.3.3 CHEMICAL TESTING

2.3.3.1 The firm should have chemical testing laboratory consisting of Carbon-Sulphur determination apparatus, Chemical balance, Hot plate, Muffle furnace (800ºC), Electric oven, Barometer, Hygrometer, Platinum crucible, Glass-wares and Chemicals.

3.0 REQUIREMENTS FOR SUBMERGED ARC WELDING FLUX(F1,F2,F3,F4,&F5)

3.1 GENERAL

3.1.1 The firm manufacturing **agglomerated** flux should have well illuminated and ventilated covered shed with sufficient height and space for various manufacturing activities consisting of weighing of flux ingredients, Dry mixing, Wet mixing, Agglomerating, Sieving of final product, Weighing of final flux product and Packing.

The firm manufacturing **fused** flux should have well illuminated and ventilated

covered shed with sufficient height and space for various manufacturing activities consisting of melting in a furnace, quenching, drying, crushing of lump flux, sieving of final product, weighing 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 performance test and test weld preparations.

3.1.4 The firm should have separate laboratory for physical and chemical testing of raw material and weld metal.

3.1.5 The firm should have mechanical testing laboratory for carrying out mechanical test of weld metal.

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

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) Power Hacksaw

3.2 MINIMUM MANUFACTURING FACILITIES

3.2.1 Requirement for Agglomerated Flux

The firm should have following machines/equipment

3.2.1.1 Sieve (B.S. Mesh size 10 or equivalent) for coarse screening of raw material.

3.2.1.2 Dry mixer, capacity 100 Kg. minimum, (generally electrically operated).

3.2.1.3 Wet mixer, capacity 100 Kg. minimum, (generally electrically operated).

3.2.1.4 Drying Oven, 200^0C, electrically operated of suitable capacity.

3.2.1.5 Agglomerating Furnace, 600^0C of suitable capacity with automatic temperature control.

3.2.1.6 Sieving set of B.S. mesh size 10, 40, 100 mesh or equivalent for sieving of finished product.

3.2.1.7 Packing arrangement as per **clause 5.6.2** or **alternatively as per Clause 5.6.3 to IRS- M- 39 –20.**

3.2.2 Requirement for fused Flux

The firm should have following machines/equipment

3.2.2.1 Sieve (B.S. Mesh size 10) for coarse screening of raw material.

3.2.2.2 Dry mixer, capacity 100 Kg. minimum, (generally electrically operated).

3.2.2.3 Oil fired/Gas fired/Electric melting furnace, 1500^0C min. of adequate capacity, for melting of charged dry mix.

3.2.2.4 Quenching System consisting of Quenching Tanks with arrangement of continuous flow of water for effective quenching of melted flux.

3.2.2.5 Crushing Arrangement, Gyratory/Jaw crusher to crush the lumps to the required grain size.

3.2.2.6 Drying oven, 200^0C, of suitable capacity for drying of crushed flux.

3.2.2.7 Sieving set of B.S. mesh size 10, 40, 100 mesh or equivalent for sieving of finished product.

3.2.2.8 Packing arrangement as per **clause 5.6.2** or **alternatively as per Clause 5.6.3 to IRS- M- 39 –20.**

3.3 TESTING FACILITIES

3.3.1 GENERAL

3.3.1.1 The firm should have facilities for determination of grain size distribution of flux, measurement of tap density and moisture content of flux.

3.3.1.2 The firm should have facilities for determination of Basicity Index of flux by XRF method or by Chemical Analysis method.

3.3.1.3 The firm should have SAW machine of capacity 1000 Amp. for performance test and welding of test weld samples.

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

3.3.1.5 Metallurgical Microscope

3.3.2 MECHANICAL TESTING

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

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 depending upon the requirement of the product offered.

3.3.3 CHEMICAL TESTING

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

3.3.5.2 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 facilities for determination of element present is permissible.

4.0 QUALITY CONTROL REQUIREMENTS

4.1 There should exist a system to ensure trace ability 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-9001-2015 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	Specifica-tion	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	Frequncy	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 and IS standards are available with them.

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 Calibrated quality control measuring equipment/instrument like UTM, Impact testing machine, Vernier callipers/Screw guage, 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: **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.
3.

Date: **Signature**

Place:

Name in capitals & Designation

Stamp of the firm

Annex-II

Minimum essential quantity of SAW Wire & Flux to be supplied to be on part-II list for consideration for up gradation in part-I

Sr. No.	Group of SAW wire & flux	Minimum Quantity to be supplied of each class to Zonal Railways, Production units & wagon Builders only
1	Group-VIIIA	3,000Kg
2	Group-VIIIB	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 SAW Wire & Fluxes for Submerged Arc Welding 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 Classes/Grades as per IRSM-39/01 for which required to be assessed :

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

   2.3 AWS Specification & Code :

   2.4 Current Conditions
   i) Sizes manufactured, current Conditions with corresponding grade of flux :
   ii) current Conditions with corresponding grade of wire :

Diameter of Wire(mm)	Voltage	Current range (Amp)	Travel speed

   3.5 Type of wire/Flux:

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 wire/ properties of flux & weld metal test results made with to sizes of corresponding grade of wire.

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 brand, 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 wire/ Flux(properties of flux & weld deposit in combination with respective grade of wire)

Signature of competent authority
with designation and seal

Annex-IV

BTC STANDARD FORMAT FOR
Test Results For SAW Wire

Test No..... **Dt : .....**

1. Sample Details :

Sample Code No./Brand	IRS Grade of Wire	Batch No.	Date of manufacture	Size (mm)	Packaging as per IRS : M-39-01	Quality of wire & Wire spool (as per IRS M 39-01)	
						Wire	Wire spool

2. Chemical Composition of wire :

Elements%	C	Mn	Si	S	P	Ni	Cr	Mo	Cu	Any other element
Bare Wire										
Specified value as per IRSM -39/01										

3. Cast & Helix :

4. Percentage of copper in coating (by Wt.) :

5. Storage Stability Test

6. 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

BTC STANDARD FORMAT FOR
Test Results For SAW Flux

Test No..... Dt : .....

1. Sample Details :

Sample Code No./Brand	IRS Grade of Flux	Batch No.	Date of manufacture	Type of Flux	Packaging (as per IRS : M-39-01)	Grade, Brand & Size of Wire Used in combination	Weld Parameters*		
							Voltage	Current	Travel speed

2. Chemical Composition of weld metal :

Elements%	C	Mn	Si	S	P	Ni	Cr	Mo	Cu	Any other element
As obtained										
Specified value as per IRSM -39/01										

3. Mechanical Properties:

a) Multirun All weld :

Properties	Radiography/Ultrasonic IIW Blue/RDSO procedure No. MC-4	UTS N/mm^2	YS N/ mm^2	%age El. on 5d G.L.	%age R.A.	Charpy impact value (Joule)		
						Ind. Values (min.3 values)	Av.	Temp ^oC
As obtained								
Specified value as per IRSM -39/01								

b) Two run weld :

Properties	Radiography/Ultrasonic IIW Blue/RDSO procedure No. MC-4	Transverse Tensile strength N/ mm^2	Bend Test at 90^o using 3T mandrel	Charpy impact value (Joule)		
				Ind. Values (min.3 values)	Av.	Temp ^oC
As obtained						
Specified value as per IRSM -39/01						

4. Grain Size 5. Basicity Index 6. Tap density 7. Moisture Content

8. Hydrogen in weld metal (....ml/100gm) 9. Any other test (Pl. specify)

Note : Please fill up all the boxes. Write N.A. if not applicable. *Please indicate the name of RDSO approved wire used.

Signature of QC Incharge/Chemist