



संवाद
Sanwaad

Online Workshop

for **Development of Local Suppliers**
for **sourcing of engineering items & raw materials**

5th January 2021, 10.00 AM

#AatmaNirbharBharat



#VocalforLocal

Fourth Workshop – **Welding Consumables of Special Grade**

Hosted by High Pressure Boiler Plant (HPBP), BHEL , Trichy

Major Constraints in Developing Indigenous Sources for Welding consumables

- ❖ Domestic bidders with less than 20% local content
- ❖ Domestic manufacturing capacity is not available in India
- ❖ Necessary Technology not available in India
- ❖ In adequate domestic competition.
- ❖ Manufacturing constraints of domestic bidders.

Support requested from local industry

- ❖ Ensure participation from as many bidders in the Open Tenders floated by BHEL.
- ❖ Prospective suppliers can register themselves with BHEL by accessing Online Supplier Registration Portal of BHEL at <https://supplier.bhel.in/>. The Registration portal is available 24 x 7 and suppliers can apply at any point of time.
- ❖ To be in touch with BHEL officials for developing items indigenously for BHEL.
- ❖ To partner with BHEL for collaborative manufacturing

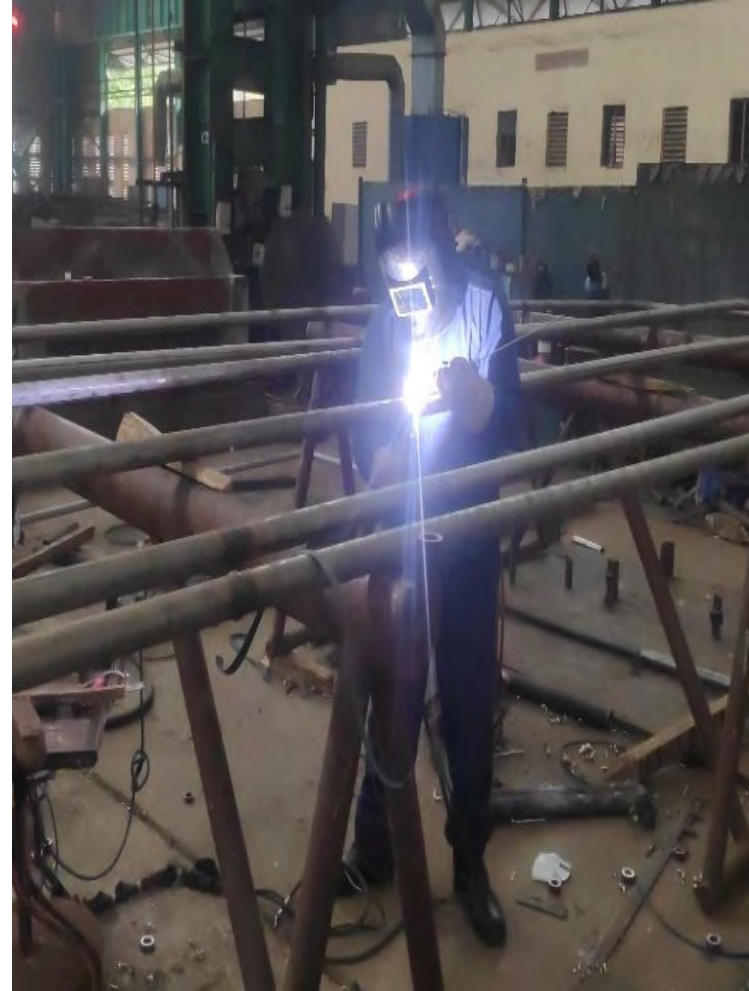
WELDING CONSUMABLES CATEGORIES (BASED ON WELDING PROCESSES)

- | | | |
|---|---|----------|
| 1. SAW (S ubmerged A rc W elding) | : | 6 cases |
| 2. GMAW (G as M etal A rc W elding) / MIG | : | 10 cases |
| 3. GTAW (G as T ungsten A rc W elding) / TIG | : | 5 cases |
| 4. SMAW (S hielded M etal A rc W elding) | : | 8 cases |
| 5. Manual Arc Welding | : | 1 case |
| 6. GTAW & Oxy Fuel Hard facing Rods | : | 2 cases |
| 7. Cobalt base PTAW Powder (Plasma Transferred Arc Welding) | : | 1 case |
| 8. Flux- Cored Arc Welding | : | 1 case |

GMAW



GTAW



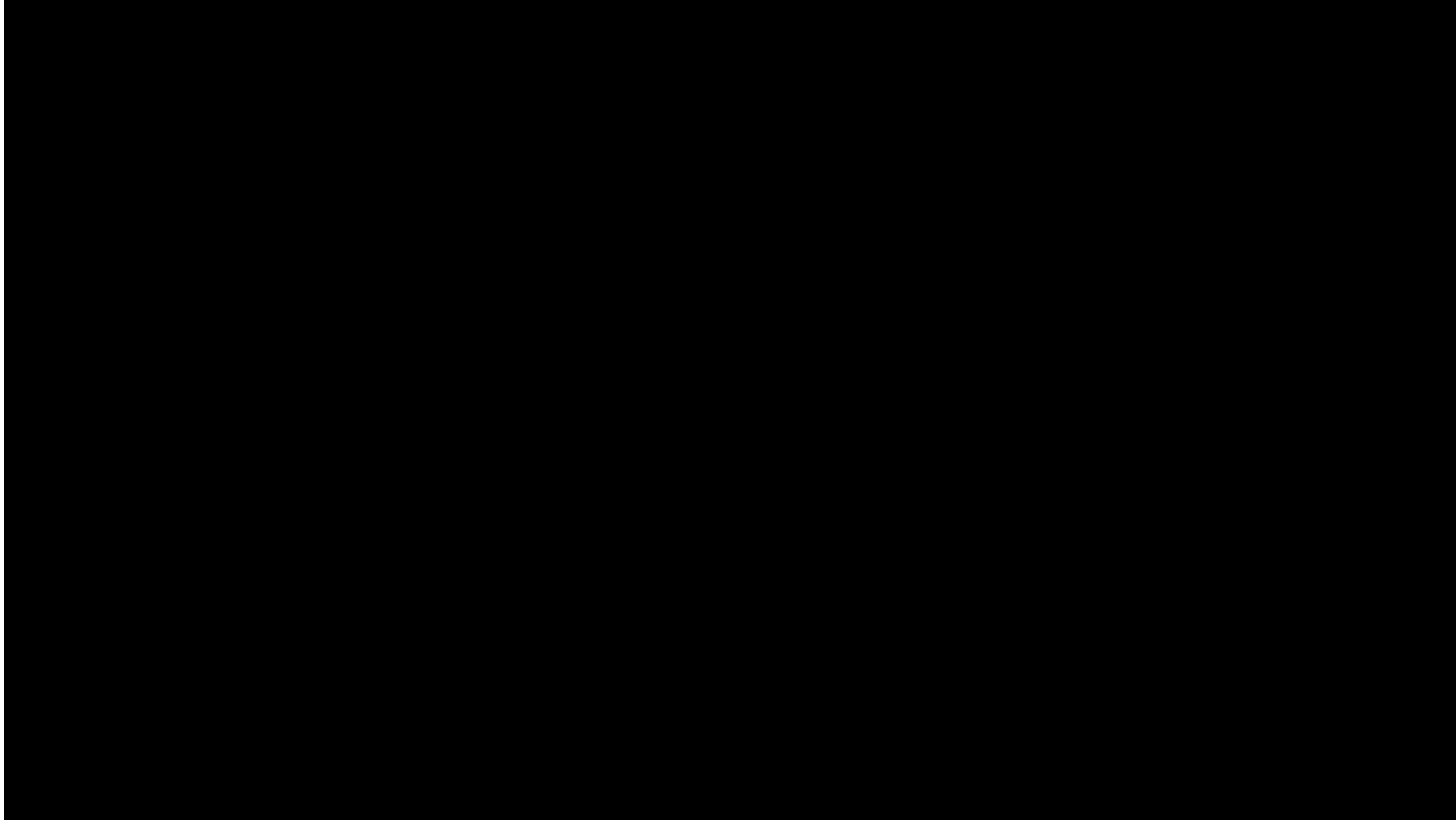
SAW



SAW : Submerged Arc Welding



SAW Process, for HPBP Trichy



Welding Consumables (SAW) – TRICHY

Classification	Application (Butt Welding Combination for header products of Supercritical boilers)	Requirement p.a. (Rs Cr)
SAW EB91 WIRE AND AGGLOMERATED FLUX	SA335 P91 with SA335 P91 Header/piping Joints	1.0

- **Dimension :**
 - Diameter of Wire : 3.2mm
 - Weight of the Spool: 25 Kg
- **Technical Properties (Combined): ASME Sec IIC 5.23/5.23M**
 - As per [WCPI 010/05](#) & [413/04](#)
 - Chemical requirement :
 - Flux to match ASME SecIIC SFA 5.23 of EB91 SAW wire
 - **Additional requirement** from ASME
 - : Mn+Ni <= 1.2%, N>=0.5Al+0.03
 - Mechanical requirement :
 - PWHT @ 760 +/- 15 Deg C for 2 hrs
 - Charpy Impact : 27 J at +20 deg C
 - Hardness of weld metal : 195 HV to 320 HV
 - Flux (F62PZ EB9 B91)
 - Diffusible Hydrogen : 4 ml per 100 gram



Welding Consumables (SAW) - TRICHY

Classification	Application (Butt Welding Combination for header products of Supercritical boilers)	Requirement p.a. (Rs Cr)
SAW P92 Wire and Agglomerated Flux	Code SA335 P92 with SA335 P92 Header Joints	0.30

- Dimension :**

- Diameter of Wire : 3.2mm
- Weight of the Spool: 25 Kg

- Technical Properties (Combined):**

- Chemical requirement :
 - Mn+Ni <=1.2%
- Mechanical requirement :
 - PWHT @ 760 +/- 15 Deg C for 2 hrs
 - Hardness of weld metal : 202 to 320 HV

Carbon	0.08-0.13%	Copper	0.25% max
Manganese	1.00% max	Aluminium	0.02% max
Phosphorus	0.010% max	Niobium	0.02-0.09%
Silicon	0.35% max	Nitrogen	0.04-0.07%
Sulphur	0.010% max	Boron	0.002-0.006%
Nickel	0.20% max	Tungsten	1.5-2.0%
Chromium	8.5-9.5%		
Molybdenum	0.30-0.60%		
Vanadium	0.15-0.25%		

Yield Strength	440 Mpa
Tensile Strength	630 Mpa
% Elongation	18 (Min)
Impact Energy	41 J (20 deg C)

Welding Consumables (SAW) - TRICHY

Classification	Application (Butt Welding Combination for header products of Supercritical boilers)	Requirement p.a. (Rs Cr)
EG SAW wire	Gr C with Gr C Header/piping Joints	0.10

- **Process : SAW**
- **Dimension :**
 - Diameter of Wire : 4mm & 4.8mm
 - Weight of the Spool: 25 Kg (B450 basket rim : OD 450, ID 305 and width 100mm)
- **Technical Properties :**
 - As per [WCPI 009/4](#)
 - Chemical requirement :
 - Testing requirement as EA4



Carbon	0.07-0.12 %	Molybdenum	0.45 – 0.60%
Manganese	1.25-1.80 %	Copper	0.30 %
Silicon	0.05 %	Nickel	0.25 %
Sulphur	0.025 %	Chromium	0.15 %
Phosphorus	0.025 %		

Welding Consumables (SAW) - TRICHY

Classification	Application (Butt Welding Combination for header products of Supercritical boilers)	Requirement p.a. (Rs Cr)
EB-2 SAW wire	Gr11/12 with Gr11/12 Header/piping Joints.	0.30

- **Process : SAW**
- **Dimension :**
 - Diameter of Wire : 4mm
 - Weight of the Spool: 25 Kg (B450 basket rim : OD 450, ID 300 and width 100mm)
- **Technical Properties :**
 - As per [WCPI 006/6](#)
 - Chemical requirement :
 - ASME SecIIC SFA 5.23 for EB2



Welding Consumables (SAW) - HARIDWAR

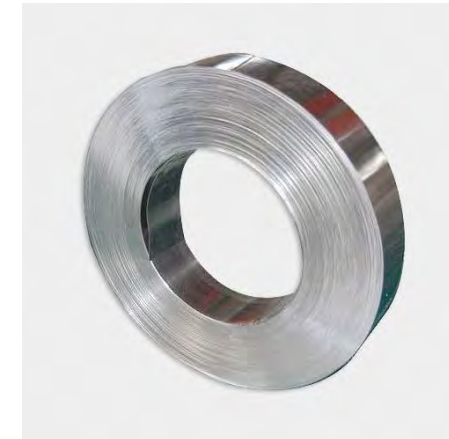
Classification	Application	Requirement p.a. (Rs Cr)
SAW EB2R WIRE AND AGGLOMERATED FLUX	For weld overlay on journal area of HP & IP Rotors of 660/800 MW supercritical sets	0.2

- **Dimension :**
 - Diameter of Wire : 2.0 & 3.2mm
 - Weight of the Spool: 25 Kg
- **Technical Properties (Combined): ASME Sec IIC 5.23/5.23M**
 - Chemical requirement :
 - Flux to match ASME Sec IIC SFA 5.23 of EB2R SAW wire
 - **Additional requirement** from ASME : S & P <0.010%, Cu, As, Sn & Sb < 0.005%
 - Flux (Equivalent to UV 420 TT of Voestalpine make)

Welding Consumables (SAW) - HYDERABAD

Classification	Application (Butt Welding Combination for tubular products of Supercritical boilers)	Requirement p.a. (Rs Cr)
SAW EQ 309L, EQ 308L STRIP ND AGGLOMERATED FLUX	STAINLESS STEEL OVERLAY ON HIGH PRESSURE HEATER TUBE SHEETS	0.7

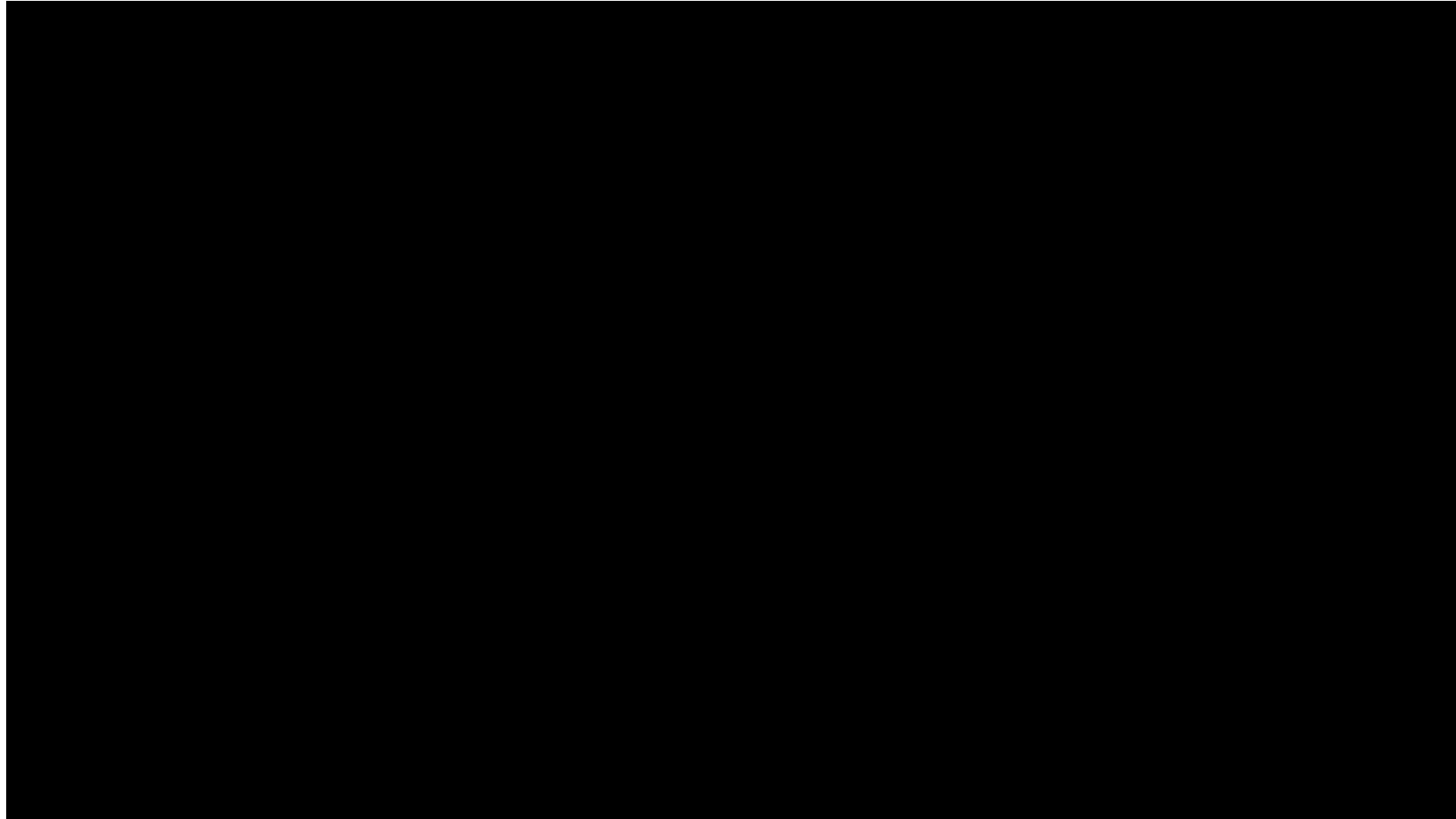
- **Dimension :**
 - Dimension of strip : 60 x 0.5mm
 - Weight of the Spool: 25 Kg (in coil form)
 - Agglomerated flux : Grain Size 14x40ASTM
- **Technical Properties (Combined): ASME Sec IIC 5.9/5.9M**



GMAW : Gas Metal Arc Welding



GMAW Process, for HPBP Trichy



Welding Consumables (GMAW) - TRICHY

Classification	Application (Butt Welding Combination for tubular products of Supercritical boilers)	Requirement p.a. (Rs Cr)
GMAW -ErNiCrFe-7A	Code case UNSS30432 with Gr22/91/92	1.0

- **Process** : GMAW
- **Dimension** :
 - Diameter of Wire : 0.8 /0.9 /1 mm
 - Weight of the Spool: 10 / 12.5 / 15 Kg (S300)
- **Technical Properties** :
 - As per [WCPI 171/0](#)
 - Chemical requirement :
 - As per ASME Sec IIC SFA 5.14 for ERNiCrFe-7A
 - Mechanical requirement :
 - Radiographic Soundness
 - Gas : Ar



Welding Consumables (GMAW) - TRICHY

Classification	Application (Butt Welding Combination for tubular products of Supercritical boilers)	Requirement p.a. (Rs Cr)
GTAW Super 304H wire spool	Code case UNSS30432 with code case UNSS30432	1.60

- **Process** : GTAW Wire Spool
- **Dimension** :
 - Diameter of Wire : 0.8 /0.9 /1 mm
 - Weight of the Spool: 10 / 12.5 / 15 Kg (S300)
- **Technical Properties** :
 - Code case requirement
 - Chemical requirement :
 - To weld UNSS30432 butt joint with itself.
 - Mechanical requirement :
 - Radiographic Soundness
 - Gas : Ar



Welding Consumables (GMAW) - TRICHY

Classification	Application (Butt Welding Combination for tubular products of Supercritical boilers)	Requirement p.a. (Rs Cr)
ER 90SG-GMAW Wire	T22 to T22	0.10

- **Process : GMAW**
- **Dimension :**
 - Diameter of Wire : 0.8mm
 - Weight of the Spool: 10 / 12.5 Kg (S300)
- **Technical Properties :**
 - As per [WCPI 156/0](#)
 - Chemical requirement :Table attached
 - Mechanical requirement :
 - PWHT @ 690 +/- 15 Deg C
 - Gas : Ar + CO2



Carbon	0.15%	Chromium	2.10-2.70%
Manganese	0.80-1.50%	Molybdenum	0.90-1.20%
Silicon	0.40-0.70%	Copper	0.40%
Sulphur	0.025%	Phosphorus	0.025%
Yield Strength		540 Mpa	
Tensile Strength		620 Mpa	
% Elongation		17 (Min)	

Welding Consumables (GMAW) - TRICHY

Classification	Application (Butt Welding Combination for tubular products of Supercritical boilers)	Requirement p.a. (Rs Cr)
ER 80SG-GMAW Wire	T11/T12 to T11/T12	0.10

- **Process : GMAW**
- **Dimension :**
 - Diameter of Wire : 0.8mm
 - Weight of the Spool: 10 / 12.5 Kg (S300)
- **Technical Properties :**
 - As per [WCPI 157/0](#)
 - Chemical requirement :Table attached
 - Mechanical requirement :
 - PWHT @ 620 +/- 15 Deg C
 - Gas : Ar + CO2

Carbon	0.15%	Chromium	1.00-1.60%
Manganese	0.80-1.50%	Molybdenum	0.40-0.65%
Silicon	0.40-0.70%	Copper	0.40%
Sulphur	0.025%	Phosphorus	0.025%
Yield Strength		470 Mpa	
Tensile Strength		550 Mpa	
% Elongation		19 (Min)	



Welding Consumables (GMAW) - TRICHY

Classification	Application (Butt Welding Combination for tubular products of Supercritical boilers)	Requirement p.a. (Rs Cr)
ER 90S-B9 GMAW Wire	T91 to T91	0.60

- **Process : GMAW**
- **Dimension :**
 - Diameter of Wire : 0.8mm
 - Weight of the Spool: 10 / 12.5 Kg (S300)
- **Technical Properties :**
 - As per [WCPI 161/10](#)
 - Chemical requirement :
 - ASME SecIIC SFA 5.28
 - Additional requirement : $Mn+Ni \leq 1.2\%$, $N \geq 0.5Al+0.03$
 - Mechanical requirement :
 - PWHT @ 760 +/- 15 Deg C
 - Gas : Ar + CO₂
 - Hardness : 195 HV to 320 HV



Welding Consumables (GMAW) - HARIDWAR

Classification	Application	Requirement p.a. (Rs Cr)
FCAW wire “ER CCoCr-E” for hard facing of HP Inner Casing	For Hard facing in Groove of HP Inner casing with Groove Stellite Machine	0.3

- **Dimension :**

- Diameter of Wire : 1.2 mm
- Weight of the Spool: 12-15 Kg

- **Technical Properties: ASME Sec IIC**

5.21/5.21M

- Chemical requirement :Table attached
- Additional requirement
- Hardness- 20-35 HRC

Carbon	0.15-0.4	Copper	-
Manganese	2.00 max	Aluminium	-
Phosphorus	-	Niobium	-
Silicon	1.5 max	Nitrogen	-
Sulphur	-	Boron	-
Nickel	1.5- 4.0	Tungsten	0.5
Chromium	25-30	Iron	5.0 Max
Molybdenum	4.5-7.0	Cobalt	Remaining
Vanadium	-	Others	1.0 max

Welding Consumables (GMAW) - HARIDWAR

Classification	Application	Requirement p.a. (Rs Cr)
GMAW wire “ERNiCr-3” for buffer layer before hard facing of HP Inner Casing of P91 material	For buffer layer before hard facing in Groove of HP Inner casing with Groove Stellite Machine	0.05

- Dimension :**

- Diameter of Wire : 1.2 mm
- Weight of the Spool: 12-15 Kg

- Technical Properties: ASME Sec IIC**

5.14/5.14M

- Chemical requirement :Table attached

Carbon	0.1	Copper	-0.5
Manganese	2.5- 3.5	Aluminium	-
Phosphorus	0.03	Niobium	2.0-3.0
Silicon	0.5	Titanium	0.75
Sulphur	0.015	Boron	-
Nickel	67 (min)	Tungsten	-
Chromium	18-22	Iron	3.0
Molybdenum	-	Cobalt	-
Vanadium	-	Others	0.5

Welding Consumables (GMAW) - HARIDWAR

Classification	Application	Requirement p.a. (Rs Cr)
GMAW wire “ER 90SB9” or equivalent	For welding of P91 grade of material of supercritical sets.	0.08

- **Dimension :**

- Diameter of Wire : 1.2 mm
- Weight of the Spool: 12-15 Kg

- **Technical Properties: ASME Sec IIC**

5.28/5.28M

- Chemical requirement :Table attached
- Additional requirement
- Hardness- 20-35 HRC

Carbon	0.07-0.13	Copper	0.2
Manganese	1.2 max	Aluminium	0.04
Phosphorus	0.01	Niobium	-
Silicon	0.15-0.50 max	Nitrogen	-
Sulphur	0.01	Boron	-
Nickel	0.8	Tungsten	-
Chromium	8.0-10.5	Iron	-
Molybdenum	0.85-1.2	Cobalt	-
Vanadium	0.15-0.3	Others	0.5 max

Welding Consumables (GMAW) - HARIDWAR

Classification	Application	Requirement p.a. (Rs Cr)
GMAW wire “ERNiCrMo-14” for buttering before hard facing of HP Inner Casing	For welding of hastalloy clad plates in FGD	Future requirement for FGD

- **Dimension :**

- Diameter of Wire : 1.2 mm
- Weight of the Spool: 12-15 Kg

- **Technical Properties: ASME Sec IIC**

5.14/5.14M

- Chemical requirement : Table attached

Carbon	0.01	Copper	0.5
Manganese	1.0	Aluminium	0.5
Phosphorus	0.02	Niobium	-
Silicon	0.08	Titanium	0.25
Sulphur	0.02	Boron	-
Nickel	Remaining	Tungsten	3.0-4.4
Chromium	19.0-23.0	Iron	5
Molybdenum	15.0-17.0	Cobalt	-
Vanadium	-	Others	0.5

Welding Consumables (GMAW) - HARIDWAR

Classification	Application	Requirement p.a. (Rs Cr)
GMAW wire “ERNiCrMo-4” for buttering before hard facing of HP Inner Casing	For welding of hastalloy clad plates in FGD	Future requirement for FGD

- **Dimension :**

- Diameter of Wire : 1.2 mm
- Weight of the Spool: 12-15 Kg

- **Technical Properties: ASME Sec IIC**

5.14/5.14M

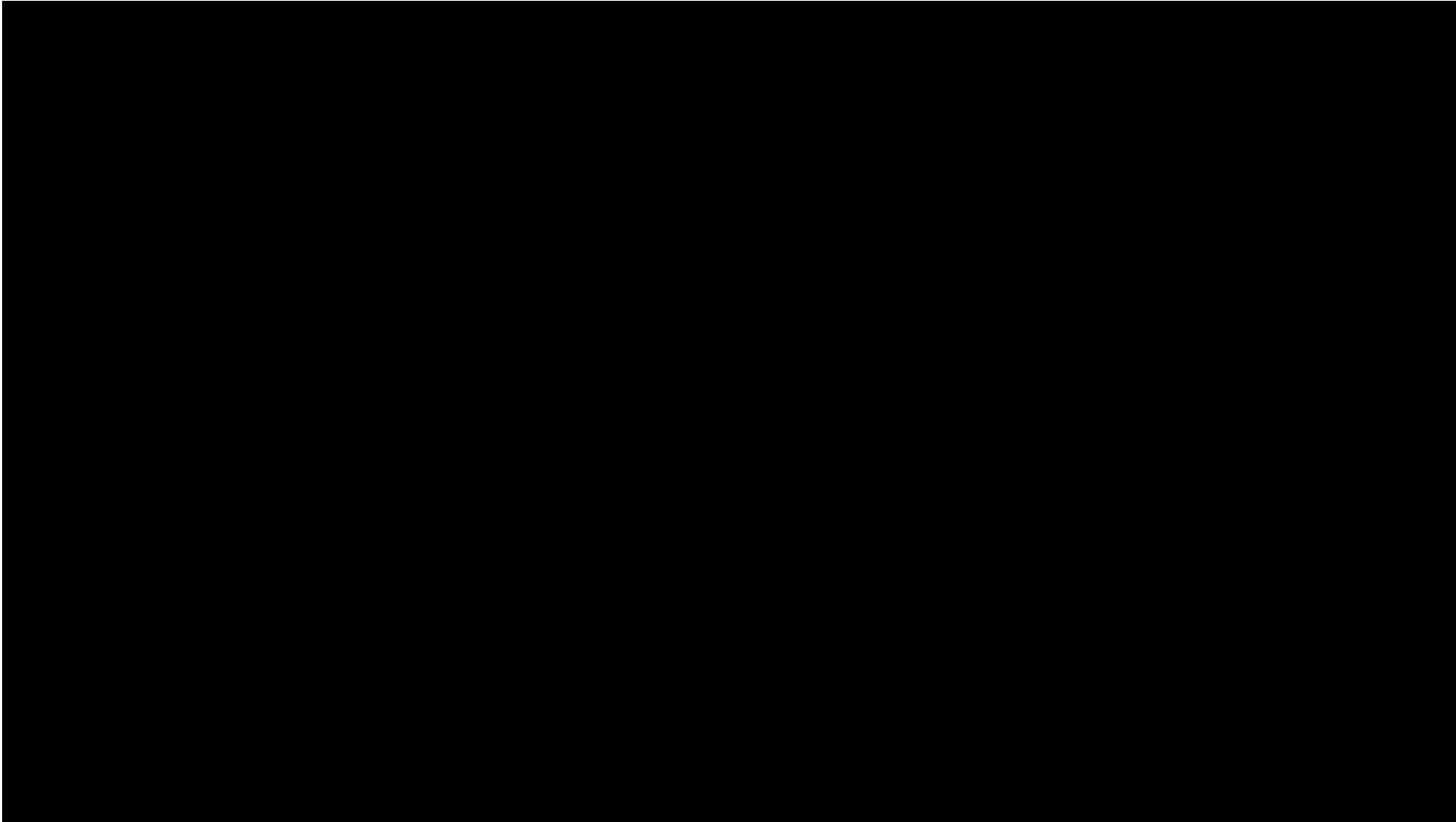
- Chemical requirement : Table attached

Carbon	0.02	Copper	0.5
Manganese	1.0	Aluminium	-
Phosphorus	0.04	Niobium	-
Silicon	0.08	Titanium	-
Sulphur	0.03	Boron	-
Nickel	Remaining	Tungsten	3.0-4.5
Chromium	14.5-16.5	Iron	4.0-7.0
Molybdenum	15.0-17.0	Cobalt	2.5
Vanadium	0.35	Others	0.5

GTAW-Gas Tungsten Arc Welding



GTAW Process, for HPBP Trichy



Welding Consumables (GTAW) - TRICHY

Classification	Application (Butt Welding Combination for tubular products of Supercritical boilers)	Requirement p.a. (Rs Cr)
GTAW – ER90S-B3 Filler rod	T22 to T22	0.07

- **Process** : GTAW Filler Rod
- **Dimension** :
 - Diameter of Rod : 2.4mm
 - Length of the Rod : 1000 mm
- **Technical Properties** :
 - As per [WCPI 103/09](#)
 - Chemical requirement :
 - ASME Sec-II C SFA 5.28 for ER90S-B3
 - Mechanical requirement :
 - ASME Sec-II C SFA 5.28 for ER90S-B3
 - Gas : 100 % Ar



Welding Consumables (Hot wire Narrow Gap GTAW) - HARIDWAR

Classification	Application	Requirement p.a. (Rs Cr)
GTAW wire “ERNiCrCoMo-1” For welding of Alloy617M forging grade of material	For welding of Alloy617M forging grade of material	Future requirement for AUSC Project

- Dimension :**

- Diameter of Wire : 1.2 mm
- Weight of the Spool: 12-15 Kg

- Technical Properties: ASME Sec IIC**

5.14/5.14M

- Chemical requirement : Table attached

Carbon	0.05-0.15	Copper	0.5
Manganese	1.0	Aluminium	0.8-1.5
Phosphorus	0.03	Niobium	-
Silicon	1.0	Titanium	-
Sulphur	0.015	Boron	-
Nickel	Remaining	Tungsten	-
Chromium	20.0-24.0	Iron	3.0
Molybdenum	8.0-10.0	Cobalt	10.0-15.0
Vanadium	-	Others	0.5

Welding Consumables (Hot wire Narrow Gap GTAW) - HARIDWAR

Classification	Application	Requirement p.a. (Rs Cr)
GTAW wire “ERNiCrMo-3” For welding of Alloy 625 casting grade of material	For welding of Alloy625 Casting grade of material	Future requirement for AUSC Project

- Dimension :**

- Diameter of Wire : 1.2 mm
- Weight of the Spool: 12-15 Kg

- Technical Properties: ASME Sec IIC**

5.14/5.14M

- Chemical requirement : Table attached

Carbon	0.1	Copper	0.5
Manganese	1.5	Aluminium	0.4
Phosphorus	0.02	Niobium	3.15-4.15
Silicon	0.5	Titanium	0.4
Sulphur	0.015	Boron	-
Nickel	58 (min)	Tungsten	-
Chromium	20.0-23.0	Iron	5
Molybdenum	8.0-10.0	Cobalt	-
Vanadium	-	Others	0.5

Welding Consumables (GTAW) - HARIDWAR

Classification	Application	Requirement p.a. (Rs Cr)
GTAW TITANIUM WELDING WIRE "ERTI-2" & ERTI-1" IN CUT LENGTH	To Welding of Ti material in flue liners of Chimney in FGD	0.2

- Dimension :**

- Diameter of Wire :2.0 mm
- Length of the Wire : 1000 mm

- Technical Properties (Combined):**

- ASME Sec IIC 5.16**

- Process : GTAW**

- Technical Properties :**

- Chemical requirement :Table attached

For ER Ti-2

Carbon	0.03%	Oxygen	0.08-0.16%
Nitrogen	0.015%	Hydrogen	0.008%
Iron	0.12%		

For ER Ti-1

Carbon	0.03%	Oxygen	0.03-0.10%
Nitrogen	0.012%	Hydrogen	0.005%
Iron	0.08%		

Welding Consumables (GTAW) - HYDERABAD

Classification	Application (Butt Welding Combination for tubular products of Supercritical boilers)	Requirement p.a. (Rs Cr)
GTAW Wire ER410	For welding of 410 grade materials “ Welding of compressor impellers”	Rare procurement

- **Dimension :**
 - Diameter of Wire : 1.0 mm
 - Weight of the Spool: 12-15 Kg
- **Technical Properties: ASME Sec II Part C 5.9/5.9M**

SMAW- Shielded Metal Arc Welding

Welding Consumables (SMAW)- HARIDWAR

Classification	Application (Butt Welding Combination for Supercritical Sets)	Requirement p.a. (Rs Cr)
E 9015-B9 Electrode	SA335 P91 with SA335 P91	0.10

- **Process : SMAW**

- **Dimension :**

- Diameter of Electrode: 3.15, 4, 5 mm
- Length of the electrode: 350/450 mm

- **Technical Properties :**

- Chemical requirement :Table attached
- As per ASME Sec-II C SFA 5.5

Carbon	0.08-0.13%	Chromium	8.0-10.5%
Manganese	1.2%	Molybdenum	0.85-1.20%
Silicon	0.3%	Copper	0.25%
Sulphur	0.01%	Phosphorus	0.01%
Aluminium	0.04	Vanadium	0.15-0.30
Niobium	0.02-0.10	Nitrogen	0.02-0.07

Yield Strength	530 Mpa
Tensile Strength	620 Mpa
% Elongation	17 (Min)
Creep Rapture Strength	110 N/mm ² at Temperature 600°C for 10,000 hours and 155 N/mm ² at Temperature 600°C for 1,000 hours

Welding Consumables (SMAW) - HARIDWAR

Classification	Application (Stainless steel Covered Electrode)	Requirement p.a. (Rs Cr)
E 307-15 Electrode	To Weld the Stainless steel material	0.02

- **Process : SMAW**

- **Dimension :**

- Diameter of Electrode: 3.15, 4, 5 mm
- Length of the electrode: 350/450 mm

- **Technical Properties :**

- Chemical requirement :Table attached
- As per ASME Sec-II C SFA 5.4

Carbon	0.04-0.14%	Chromium	18.0-21.5%
Manganese	3.30-4.75%	Molybdenum	0.5-1.5%
Silicon	1.0%	Copper	0.75%
Sulphur	0.03%	Phosphorus	0.04%
Nickel	9.0-10.7%	Vanadium	0.15-0.30
Tensile Strength		590 Mpa(Min)	
% Elongation		30 (Min)	

Welding Consumables (SMAW) - HARIDWAR

Classification	Application (Nickel & Nickel Alloy welding electrode)	Requirement p.a. (Rs Cr)
E NiCrFe-3(Mod.) Electrode or E-NI6082 as per EN14172	These electrodes are used for Ni-Based materials	0.01

• **Process : SMAW**

• **Dimension :**

- Diameter of Electrode: 3.15, 4, 5 mm
- Length of the electrode: 350/450 mm

• **Technical Properties :**

- Chemical requirement :Table attached
- As per EN ENi6082 as per EN14172
- or ASME Sec-II/ SFA 5.11

Carbon	0.1%	Chromium	18.0-22.0%
Manganese	2.0-6.0%	Molybdenum	2.0%
Silicon	0.8%	Copper	0.5%
Sulphur	0.015%	Phosphorus	0.02%
Nickel	63%(Min)	Vanadium	0.15-0.30
Iron	4%	Niobium	1.5-3.0%

Yield Strength	360 MPA(Min)
Tensile Strength	600 MPA(Min)
% Elongation	35 (Min)
Creep Rapture Strength	110 N/mm2 at Temperature 600°C for 10,000 hours and 155 N/mm2 at Temperature 600°C for 1,000 hours

Welding Consumables (SMAW) - HARIDWAR

Classification	Application (Nickel & Nickel Alloy welding electrode)	Requirement p.a. (Rs Cr)
E NiCrCoMo-1 Electrode	These Electrodes are required to weld Ni Based Material	Future requirement

- **Process : SMAW**
- **Dimension :**
 - Diameter of Electrode: 3.15, 4, 5 mm
 - Length of the electrode: 350/450 mm
- **Technical Properties :**
 - Chemical requirement :Table attached
 - ASME Sec-II/ SFA 5.11

Carbon	0.05-0.15%	Chromium	21.0-26.0%
Manganese	0.3-2.5%	Molybdenum	8.0-10.0%
Silicon	0.75%	Copper	0.5%
Sulphur	0.015%	Phosphorus	0.03%
Nickel	Remaining	Vanadium	-
Iron	5%	Cobalt	9-15%
Tensile Strength		620 MPA(Min)	
% Elongation		25%(Min)	

Welding Consumables (SMAW) - HARIDWAR

Classification	Application (Nickel & Nickel Alloy welding electrode)	Requirement p.a. (Rs Cr)
E NiCrMo-3 Electrode	These Electrodes are required to weld Ni Based Material	0.01

- **Process : SMAW**
- **Dimension :**
 - Diameter of Electrode: 3.15, 4, 5 mm
 - Length of the electrode: 350/450 mm
- **Technical Properties :**
 - Chemical requirement :Table attached
 - ASME Sec-IIC/ SFA 5.11

Carbon	0.1%	Chromium	20.0-23.0%
Manganese	1.0%	Molybdenum	8.0-10.0%
Silicon	0.75%	Copper	0.5%
Sulphur	0.02%	Phosphorus	0.03%
Nickel	55%(Min)	Other Elements	0.50
Iron	7%	Nb+Cb	3.15-4.15%

Tensile Strength	760 MPA(Min)
% Elongation	30%(Min)

Welding Consumables (SMAW) - HARIDWAR

Classification in	Application (Nickel & Nickel Alloy welding electrode)	Requirement p.a. (Rs Cr)
E NiCrMo-4 Electrode	These Electrodes are required to weld Hastelloy based Material	0.01

- **Process : SMAW**
- **Dimension :**
 - Diameter of Electrode: 3.15, 4, 5 mm
 - Length of the electrode: 350/450 mm
- **Technical Properties :**
 - Chemical requirement :Table attached
 - ASME Sec-II/ SFA 5.11

Carbon	0.02%	Chromium	14.5-16.5%
Manganese	1.0%	Molybdenum	15.0-17.0%
Silicon	0.2%	Copper	0.5%
Sulphur	0.03%	Phosphorus	0.04%
Nickel	Remaining	Other Elements	0.50
Iron	4.0-7.0%	Cobalt	2.5%
Tungsten	3.0-4.5%	---	----

Tensile Strength	690 MPA(Min)
% Elongation	25%(Min)

Welding Consumables (SMAW) - HARIDWAR

Classification	Application (Nickel & Nickel Alloy welding electrode)	Requirement p.a. (Rs Cr)
E NiCrMo-14 Electrode	These Electrodes are required to weld Hastelloy based Material in FGD	Future requirement

- **Process : SMAW**
- **Dimension :**
 - Diameter of Electrode: 3.15, 4, 5 mm
 - Length of the electrode: 350/450 mm
- **Technical Properties :**
 - Chemical requirement :Table attached
 - ASME Sec-IIC/ SFA 5.11

Carbon	0.02%	Chromium	19.0-23.0%
Manganese	1.0%	Molybdenum	15.0-17.0%
Silicon	0.25%	Copper	0.5%
Sulphur	0.02%	Phosphorus	0.02%
Nickel	Remaining	Other Elements	0.50
Iron	5.0%	Titanium	0.25%
Tungsten	3.0-4.5 %	--	----

Tensile Strength	690 MPA(Min)
% Elongation	30%(Min)

Welding Consumables (SMAW) - HARIDWAR

Classification	Application	Requirement p.a. (Rs Cr)
SHIELD METAL ARC WELDING ELECTRODE "ENiFeCl "FOR NODULAR CAST IRON AS PER ASME, SFA- 5.15,	For minor repair Nodular cast Iron material casting	0.02

- **Dimension :**
 - Diameter of Electrode :
2.5mm/3.15mm/4.0mm
- **Technical Properties (Combined): ASME Sec IIC 5.15**
 - Chemical requirement :Table attached

Carbon	2.0 %	Copper	2.5%
Manganese	2.5 %	Aluminium	1.0 %
Phosphorus	-	Niobium	-
Silicon	4.0 %	Nitrogen	-
Sulphur	0.03 %	Boron	-
Nickel	45-60 %	Tungsten	-
Chromium	-	Fe	Rem
Molybdenum	-	Other Element	1%
Vanadium	-		

Manual Arc Welding

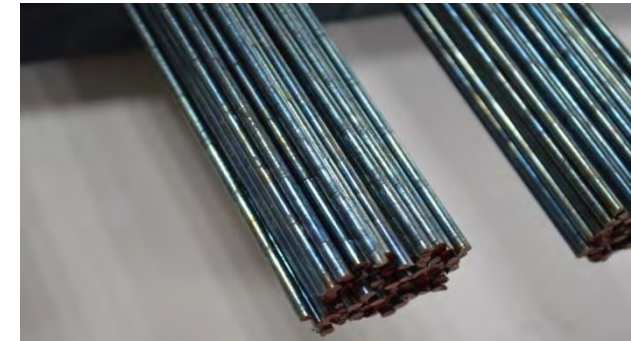
Welding Consumables- CFFP HARIDWAR

Classification	Application	Requirement p.a. (Rs Cr)
Extra Low Hydrogen type non Synthetic Covered Arc Welding Electrodes for Welding of GX12CrMoWVNbN1011 Steel	Electrodes Shall be suitable for Radiography quality welding of cast Steel GX12CrMoWVNbN1011 Steel.	0.12

- **Process : Manual Arc Welding (Castings)**
- **Dimension :**
 - Diameter of Rod : 3.2,4.00 and 5.00mm
 - Length of the Rod : 450 mm
- **Technical Properties :**
 - As per ASME Sec IIC –SFA 5.5 E9018-B9
(Modified)
 - Chemical requirement :
 - ASME Sec-IIC SFA 5.5, Class E9018B9
 - Usability :
 - Flows freely, uniformly without spatters

Carbon	0.08-0.13%	Molybdenum	0.9-1.1%
Manganese	0.5-1% (max)	Vanadium	0.18-0.23%
Silicon	0.18-0.5% (max)	Niobium	0.05-0.08% (max)
Chromium	25 – 30 %	Nitrogen	0.04-0.7% (max)
Tungsten	0.9-0.1.1 % (max)	Chromium	0.9-1.1 % (max)
Phosphorus	0.015% (max)		

Cont ...



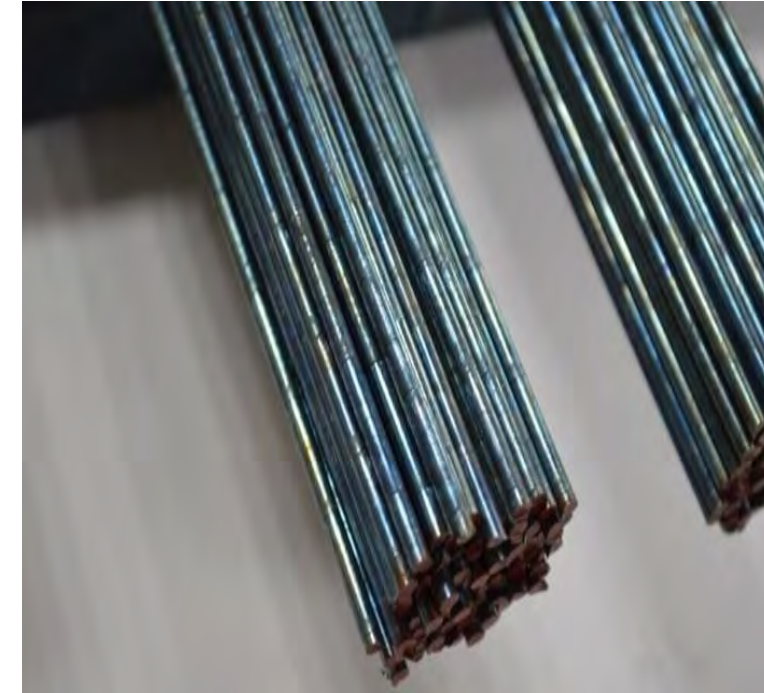
Welding Consumables CFFP HARIDWAR

... Cont

Classification	Application	Requirement p.a. (Rs Cr)
Extra Low Hydrogen type non Synthetic Covered Arc Welding Electrodes for Welding of GX12CrMoWVNbN1011 Steel	Electrodes Shall be suitable for Radiography quality welding of cast Steel GX12CrMoWVNbN1011 Steel.	0.12

- Mechanical Properties :- The Mechanical Properties of weld metal deposited using the electrodes after SR the test plate assembly at $740^{\circ}\text{C} \pm 10^{\circ}\text{C}$ for 120 minutes shall be as follow

Yield Strength (at 0.2% proof stress)	530MPa(Min)
UTS	650-850MPa
%Elongation	17%min.
%Reduction in area	40%min.
Impact Strength (Charpy V notch at 20°C)	35 joules min.
Hardness	210-265 BHN



Flux- Cored Arc Welding (FCAW) – BHOPAL



Welding Consumables (FCAW) - Bhopal

Classification	Application	Requirement p.a. (Rs Cr)	HSN Code	Whether required by other clients
E 410NiMo T1-1/4	For welding of martensitic SS like CA6NM & SA240 Tp 416	1.45 (approx.)	83112000	Hydro Power Clients

Table B1

Carbon	0.06%(Max)	Phosphorous	0.03% (Max)
Chromium	11-12.5%	Molybdenum	0.4-0.7 %
Nickel	4-5 %	Manganese	0.6%(Max)
Silicon	0.5%(Max)	Copper	0.75%(Max)
Sulphur	0.02%(Max)		

- **Process : FCAW**

- **Dimension :**

- Diameter of Wire: 1.6 mm
- Weight of the Spool : 12.5Kg to 15 Kgs

- **Technical Properties :**

- As per FBM/WD&T/TS02
- Chemical requirement : As per Table B1
- Mechanical requirement(in both AW & PWHT conditions) :
 - Tensile Strength: 760 MPA(min)
Elongation: 15% (min)
Impact Strength: 50 J (min) @ Room Temp.
 - PWHT : 600-620° C (Soaking time: 8Hrs(max))
- Diffusible Hydrogen: 5 ml/100g(Max)
- Shielding Gas: Pure CO2 or Ar + CO2 (80:20)



GTAW & Oxy Fuel Hard facing Rods

Welding Consumables (GTAW & Oxy Fuel Gas Welding) - TRICHY

Classification	Application	Requirement p.a. (Rs Cr)
ER Co Cr E Filler Rod for Hardfacing	The rod is used as a filler for overlaying using oxy fuel gas welding or Gas Tungsten Arc Welding process.	0.2

- **Process : GTAW and Oxy Fuel Gas Welding (Hard Facing Purpose)**

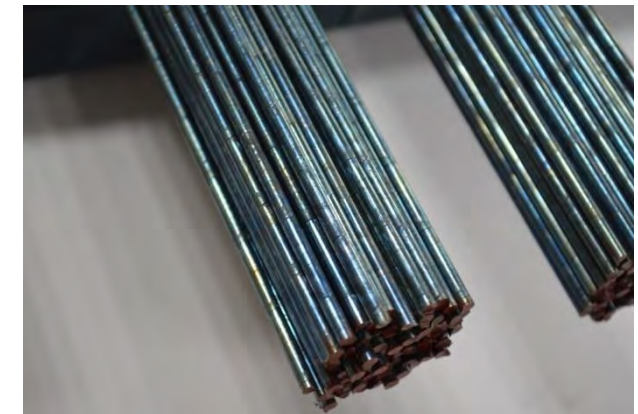
- **Dimension :**

- Diameter of Rod : 3.2,4.00 and 5.00mm
- Length of the Rod : 1000 mm

- **Technical Properties :**

- As per [WCPI 112/05](#)
- Chemical requirement :
 - ASME SecIIC SFA 5.21 for ERCoCr-E
- Usability :
 - Gas : 100 % Ar
 - Flows freely, uniformly without spatters
 - Two layer Hard Facing overlay Yield
 - Hardness : 20 to 30 HRC
 - 2.5mm to 3.00mm deposit.

Carbon	0.15-0.45%	Molybdenum	4.50-7.00%
Manganese	1.50% (max)	Nickel	1.5-4.00%
Silicon	1.50% (max)	Iron	3.0% (max)
Chromium	25 – 30 %	Cobalt	Balance
Tungsten	0.50 % (max)	Others	0.50 % (max)



Welding Consumables - TRICHY

Classification	Application	Requirement p.a. (Rs Cr)
Cobalt based welding Rod HA 25	Used for Hard Surfacing	0.4

- **Process** : Oxy Fuel Welding (Hard Surfacing Purpose)

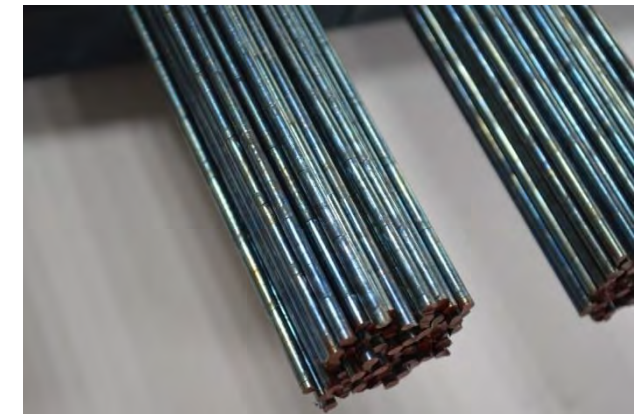
- **Dimension** :

- Diameter of Rod : 5mm
- Length of the Rod : 1000 mm

- **Technical Properties** :

- As per [WCPI 113/05](#)
- Chemical requirement :As per WCPI
- Usability :
 - Shall be of uniform quality
 - Free from segregation, oxides, silvers

Carbon	0.09-0.15%	Molybdenum	-
Manganese	1.20% (max)	Nickel	9-12.00%
Silicon	1.50% (max)	Iron	3.0% (max)
Chromium	18 – 21 %	Cobalt	Balance
Tungsten	14-16%	Others	-



Plasma Transferred Arc Welding (PTAW)

Welding Consumables - TRICHY

Classification	Application	Requirement p.a. (Rs Cr)
PTAW powder CoCrA	The powder is used in PTAW machines for overlays of high pressure valve components	2.3

- **Process** : Plasma Transferred Arc Welding
- **Dimension** :
 - Powder suitable for PTAW
- **Technical Properties** :
 - As per [WCPI 302/03](#)
 - Chemical requirement :
 - Particle size : 50 to 150 microns
 - Mechanical requirement :
 - Hardness : 35 to 42 HRC



Carbon	0.90 – 1.40 %	Iron	3.00 % (max)
Chromium	26.50 – 30.00 %	Molybdenum	1.00 % (max)
Tungsten	3.50 – 5.00 %	Manganese	1.00% (max)
Silicon	0.70 – 1.50 %	Cobalt	Balance
Nickel	3.00 % (max)		

BHEL support for Development of Suppliers



24x7 Online portal for registration

- Simple registration form
- Timebound evaluation



Product development support

- Drawings, specifications
- Tooling

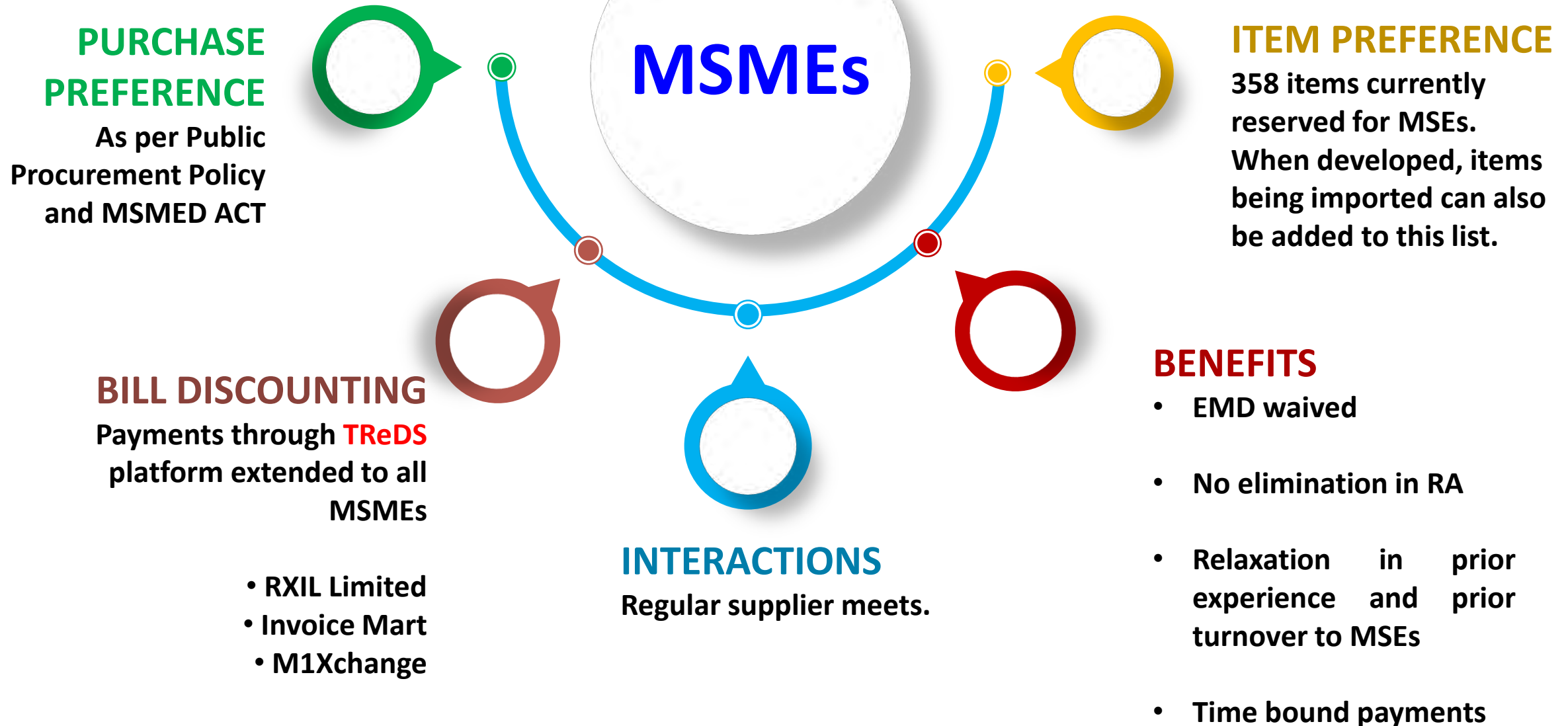


Hand holding with R&D and type testing



No LD/ penalty for developmental orders

BHEL support for MSMEs



BHEL support for Start-ups



BENEFITS

**Relaxation in prior
experience and turnover**



STARTUP RUNWAY

**BHEL is tendering its
requirements on GeM
wherein Startups can
supply goods as per the
Startup Runway on GeM**

Calendar for BHEL SAMVAAD

[Detailed list](#)

SNO	Category of Material	Date	Day	TIME
1	Raw Materials-Special/ Alloy/ Electrical Steel	29.12.2020	Tuesday	10:00 AM - 12:00 PM
2	Consumables for Foundry Applications	01.01.2021	Friday	10:00 AM - 12:00 PM
3	Welding Consumables of Special Grade	05.01.2021	Tuesday	10:00 AM - 12:00 PM
4	Castings & Forgings	08.01.2021	Friday	10:00 AM - 12:00 PM
5	Components-Mechanical	12.01.2021	Tuesday	10:00 AM - 12:00 PM
6	Insulating Materials	15.01.2021	Friday	10:00 AM - 12:00 PM
7	Components - Electrical & Electronics	19.01.2021	Tuesday	10:00 AM - 12:00 PM
8	Components – Solar	22.01.2021	Friday	10:00 AM - 12:00 PM
9	Systems & Packages	27.01.2021	Wednesday	10:00 AM - 12:00 PM

[Click here for filling up your details regarding your participation](#)

For any queries, please contact us on samvaad@bhel.in

Enrollment for BHEL SAMVAAD – Online Form submission

BHEL SAMVAAD

"An interaction forum with local industry for strengthening the cause of Aatma Nirbhar Bharat"

***Required**

Supplier Name and address *

Your answer

Contact person Name *

Your answer

Contact person's email address *

Your answer

Contact person's Mobile No. *

Your answer

Category of Material (Kindly select your option, so that VC link invite is shared with you separately for the scheduled date and time) *

- ☐ Raw Materials-Special/ Alloy/ Electrical Steel - 29.12.2020 - 10:00 AM - 12:00 PM
- ☐ Consumables For Foundry Applications - 01.01.2021 - 10:00 AM - 12:00 PM
- ☐ Welding Consumables of Special Grade - 05.01.2021 - 10:00 AM - 12:00 PM
- ☐ Castings & Forgings - 08.01.2021 - 10:00 AM - 12:00 PM
- ☐ Components-Mechanical - 12.01.2021 - 10:00 AM - 12:00 PM
- ☐ Insulating Materials - 15.01.2021 - 10:00 AM - 12:00 PM
- ☐ Components - Electrical & Electronics - 19.01.2021 - 10:00 AM - 12:00 PM
- ☐ Components - Solar - 22.01.2021 - 10:00 AM - 12:00 PM
- ☐ System & Packages - 27.01.2021 - 10:00 AM - 12:00 PM

List of items proposed to be developed for BHEL *

Your answer

Submit



Thank You

Write to samvaad@bhel.in to convey your interest