

A. Technical Specifications

SL. No	Description and Technical Specification of the item	QTY	UNIT
1.	TIG, ERNiCr3-Dia. 1.6 mm as per ASME Sec.II.C - Latest	55	Nos.
2.	TIG Rod 2.25Cr-1Mo as per Technical Annexure 33040/ SP/ 1002	5	Nos
3.	"SMAW, Dia. 2.5 mm/2.4mm E9015-B3 or E9016-B3 or E9018-B3 as per Technical Annexure 33040/ SP/ 1001"	30	Nos
4.	TIG Modified 9Cr-1Mo (Dia. 1.6 mm) as per Technical Annexure FBTR/33410/0002	35	Nos
5.	TIG Modified 9Cr-1Mo, Dia. 2.4 mm/2.5m as per Technical Annexure FBTR/33410/0002	105	Nos
6.	TIG 9Cr-1Mo Dia.1.6 mm as per Technical Annexure 33040/ SP/ 1002	30	Nos
7.	TIG 9Cr-1Mo (Dia. 2.4 mm/2.5mm) as per Technical Annexure 33040/ SP/ 1002	30	Nos
8.	"SMAW Modified 9Cr-1Mo (Dia.2.4mm/2.5 mm) as per Technical Annexure FBTR/33410/0001"	55	Nos
9.	"SMAW Modified 9Cr-1Mo (Dia. 3.2mm/3.15mm) as per Technical Annexure FBTR/33410/0001"	55	Nos
10.	"SMAW 9Cr-1Mo (Dia.2.5 mm/2.4mm) as per Technical Annexure PFBR/33040/ SP/ 1000/ R-2"	20	Nos
11.	"SMAW 9Cr-1Mo (Dia. 3.2 mm/3.15mm) as per Technical Annexure PFBR/33040/ SP/ 1000/ R-2."	20	Nos

SPECIFICATION FOR RADIOGRAPHIC INSPECTION OF WELDS

1.0 SCOPE

This specification describes the procedure to be employed and its acceptance criteria for the examination of welds for internal discontinuities using radiographic techniques.

2.0 OBJECT

The radiographic examination will reveal defects such as crack, lack of fusion, lack of penetration, undercuts, slag inclusions, gas cavities, tungsten inclusions, worm holes etc.

3.0 APPLICABLE STANDARDS

- i) ASME Section V - 1983 edition
- ii) ASME-SE-94 - 1983 edition
- iii) ASME-SE-142 - 1983 edition

4.0 EQUIPMENT AND MATERIAL

4.1 Radiation Sources

X-ray equipment shall be used as radiation source wherever possible. When this is not possible suitable radioactive sources like γ -ray shall be used depending on the thickness under inspection as per ASME Section V.

4.2 Film

In general, ASME-SE-94 Class 2 films shall be used wherever possible. For welds greater than 50 mm in thickness, the manufacturer shall suitably select the film

depending on the inspection level and radiographic contrast demanded.

4.3 Screens

Screen shall be as per ASME Section V.

4.4 Filters

Objectionable scatter radiation shall be reduced by suitable filtration.

4.5 Penetrators

The penetrators to be used shall be in accordance with ASME-SE-142. The penetrators thickness shall be as per Table 262.1 of ASME Section V.

4.6 Chemical Processing and Film Viewing Facilities

This shall be as per ASME-SE-94

4.7 Other Requirements

Densitometer (or) comparison step wedge films shall be provided for assuring compliance with the film density requirements.

5.0 INSPECTION PROCEDURE

5.1 Weld surfaces that are to be radiographed shall be prepared by a suitable mechanical process to such a degree that the resulting radiographic contrast due to any remaining irregularities cannot mask (or) be confused with the image of any objectionable defect.

All weld surfaces shall merge smoothly into the base metal surfaces. The finished surface of the reinforcement of any

butt welds may be flush with the plate (or) may have a reasonably uniform crown within the following limit.

Reinforcement(S) $\leq L/10 + 1$ mm where L is the width of the weld seam in mm

5.2 Penetrameter

The weld shall be radiographed with a technique which will have sufficient sensitivity to indicate the image of penetrameter and the specified hole as specified in Annexure-I. All other details like location of penetrameter, number of penetrameters, density of film etc shall be as per ASME Section V.

6.0 GEOMETRICAL UNSHARPNESS

6.1 Geometrical unsharpness shall not exceed the values specified below:

Source	Geometrical unsharpness in mm
i) X-rays upto 400 KV (or) Ir 192 (or) Tm 170	0.3
ii) Co 60	0.6

7.0 ACCEPTANCE CRITERIA

The following are unacceptable:

7.1 Class 1 Components

7.1.1 Any crack, lack of fusion, lack of penetration and undercut.

7.1.2 a) Any isolated slag inclusion if its largest dimension is equal to (or) greater than the values given below.

Wall thickness(t) in mm	length in mm
i) $t < 6$	1.5
ii) $6 < t < 10$	3.0
iii) $10 < t < 50$	$t/3$
iv) $t > 50$	20

Note:

1. Two defects are considered as a single defect if the distance between them is less than 6 times the length of the shorter one.

2. For thickness greater than 100 mm, slag inclusion located in the middle third of the wall may be tolerated, provided that their individual length does not exceed 40 mm. For this an additional examination is carried out to ensure that their shadow area does not mask other defects.

b) Any line of slag inclusions whose length total is more than 't' over a length of 12 t.

7.1.3 a) Any gas cavity if its greater dimension is equal to (or) greater than the values given below:

Wall thickness (t) in mm	Length in mm
i) $t < 6$	1.5
ii) $6 < t < 10$	2.0
iii) $10 < t < 25$	2.5
iv) $25 < t < 50$	3.0
v) $t > 50$	4.0

b) Any cluster (or) line of cavities affecting a length of weld exceeding ' $0.5 t$ ' (or) $3\emptyset$ mm whichever is smaller.

Note: Two gas cavities are considered as one if the distance between them is less than 5 times the maximum dimension of the larger one.

7.1.4 Isolated tungsten inclusion whose greater dimension is

> 1 mm where $t < 6$ mm

> 1.5 mm where $t > 6$ mm

Note: Two defects shall be considered as one if the distance between them is less than 6 times the length of the shorter one.

7.1.5 Isolated warm holes except in multi pass welds with a thickness of over 10 mm.

7.2 Class 2 Components

7.2.1 Any crack, lack of fusion, lack of penetration and undercut.

7.2.2 a) Any isolated slag inclusion if its largest dimension is equal to (or) greater than the values given below:

Wall thickness (t) in mm	Length in mm
$t < 10$	5
$10 < t < 50$	$t/2$
$t > 50$	$3\emptyset$

Note:

1. Two defects are considered as a single defect if the distance between them is less than 6 times the length of the shorter one.

2. For thickness greater than 50 mm, slag inclusions located in the middle third of the wall may be tolerated, provided that their individual length does not exceed 60 mm.

b) Any lines of slag inclusions whose length total is more than 't' over a length of '12 t'.

7.2.3 a) Any gas cavity if its greater dimension is equal to (or) greater than the values given below.

Wall thickness (t) in mm	Length in mm
$t \leq 6$	2.0
$6 < t \leq 10$	2.5
$10 < t \leq 25$	3.0
$25 < t \leq 50$	4.0
$t > 50$	5.0

Note: Two gas cavities are considered as one if the distance between them is less than 5 times the maximum dimension of larger one.

b) Any cluster (or) line of cavities affecting a length of weld exceeding '0.5 t' (or) 50 mm whichever is smaller.

7.2.4 Isolated tungsten inclusions whose greater dimension is
> 1 mm where $t < 6$ mm
> 1.5 mm where $t > 6$ mm

Note: Two defects shall be considered one if the distance between them is less than 6 times the length of the shorter one.

7.2.5 Isolated warm holes except in multi pass welds with a thickness of over 10 mm.

7.3 Class 3 Components

7.3.1 Any crack, lack of fusion, lack penetration and undercut.

7.3.2 a) Any isolated slag inclusion if its largest dimension is equal to (or) greater than the values given below:

Wall thickness (t) in mm	Length in mm
$t < 6$	5
$6 < t < 50$	t
$t > 50$	60

Note: Two defects are considered as a single defect if the distance between them is less than 3 times the length of the shorter one.

b) Any lines of slag inclusions whose length total is more than 't' over a length of '4 t'.

7.3.3 a) Any gas cavity if its greater dimension is equal to (or) greater than the values given below:

Wall thickness (t) in mm	Length in mm
i) $t < 6$	2.0
ii) $6 < t < 10$	2.5
iii) $10 < t < 25$	3.0
iv) $25 < t < 50$	4.0
v) $t > 25$	5.0

Note: Two gas cavities are considered as one if the distance between them is less than 3 times the maximum dimension of the larger one.

b) Any cluster (or) line of cavities affecting a length of a weld exceeding 1.5 t (or) 60 mm whichever is smaller.

- 7.3.4 Isolated tungsten inclusions whose greater dimension is
- > 1 mm where $t < 6$ mm
 - > 1.5 mm where $t > 6$ mm

Note: Two defects shall be considered as one if the distance between them is less than 3 times the length of the shorter one.

- 7.3.5 Isolated worm holes except in multi pass welds with a thickness of over 10 mm.

8.0 EXAMINATION REPORT

- 8.1 The examination report shall at least include the following information:

- a) Identification of manufacturer, purchase order and equipment.
- b) Identification of part, weld (or) area subjected to examination including grade of steel.
- c) Thickness of radiographed area.
- d) Type and characteristics (size) of the radiation source.
- e) Type of film used and film density achieved.
- f) Type, number and thickness of screen & filters used.
- g) Type of penetrometer
- h) Location of radiation source with relation to test area and source to film distance.

IGCAR-PFBR
SPECIFICATION

PFBR-01950-SP-1001-R-1
PAGE 9 OF 11

- i) Exposure time
- j) Diameter of smallest visible hole
- k) Sensitivity achieved
- l) Interpretation of film results
- m) Location of any defects revealed by inspection
- n) Any difficulties (or) unusual occurrence during the inspection
- o) Date of examination and inspectors signature

8.2 A complete set of radiographs for each job shall be retained by the manufacturer/contractor and kept for a period of at least ten years.

ANNEXURE-1
TABLE-1 : (SINGLE WALL TECHNIQUE)

Single wall thickness in mm	Source side penetrater Designation as per ASME	Essential hole size to be seen in mm	Film side penetrater designation	Essential hole size to be seen in mm
1. Upto 6 including	5	0.25 (1T)	5	0.25 (1T)
2. Over 6 to 10	7	0.50 (2T)	7	0.50 (2T)
3. Over 10 to 13	10	0.50 (2T)	10	0.50 (2T)
4. Over 13 to 16	12	0.60 (2T)	12	0.60 (2T)
5. Over 16 to 19	15	0.76 (2T)	12	0.60 (2T)
6. Over 19 to 22	17	0.86 (2T)	15	0.76 (2T)
7. Over 22 to 25	20	1.02 (2T)	15	0.76 (2T)
8. Over 25 to 31	25	1.28 (2T)	17	0.86 (2T)
9. Over 31 to 38	30	1.52 (2T)	20	1.02 (2T)
10. Over 38 to 50	35	1.78 (2T)	25	1.28 (2T)
11. Over 50 to 63	40	2.04 (2T)	30	1.52 (2T)
12. Over 63 to 75	45	2.28 (2T)	35	1.78 (2T)
13. Over 75 to 100	50	2.54 (2T)	40	2.04 (2T)
14. Over 100 to 150	60	3.04 (2T)	45	2.28 (2T)
15. Over 150 to 200	80	4.06 (2T)	50	2.54 (2T)
16. Over 200 to 250	100	5.08 (2T)	60	3.04 (2T)
17. Over 250 to 300	120	6.10 (2T)	80	4.06 (2T)
18. Over 300 to 400	160	8.12 (2T)	100	5.08 (2T)
19. Over 400 to 500	200	10.16 (2T)	120	6.10 (2T)

IGCAR-PFBR
SPECIFICATION

PFBR-01950-SP-1001-R-1
PAGE 11 OF 11

TABLE-II (DOUBLE WALL TECHNIQUE)

Nominal single wall thickness (mm)	DWDI Technique		DWSI Technique	
	Source side penetrameter designation	Essential hole to be seen (mm)	Film side penetra- meter des- ignation	Essential hole to be seen (mm)
1. Upto 3 incl.	5	0.25 (1T)	5	0.25 (1T)
2. Over 3 to 6	5	0.50 (2T)	5	0.25 (1T)
3. Over 6 to 8	7	0.50 (2T)	5	0.50 (2T)
4. Over 8 to 10	10	0.50 (2T)	7	0.50 (2T)
5. Over 10 to 16	12	0.60 (2T)	10	0.50 (2T)
6. Over 16 to 22	-	-	12	0.60 (2T)
7. Over 22 to 25	-	-	15	0.76 (2T)

33040/SP/1001

SPECIFICATION FOR 2Cr-Mo ELECTRODES

Electrodes shall conform to E9015-B3 or E9016-B3 or E9018-B3 of SFA 5.5 specification with the following modified requirements.

A. MODIFIED REQUIREMENTS

1) Chemical Composition of the Deposited Weld Metal

Elements	C	Cr	Mo	Mn	Si	S max	P max	Cu max
Composition % by weight	0.05 to 0.08	2.0 to 2.5	0.9 to 1.2	0.6 to 0.9	0.2 to 0.5	0.02	0.02	0.25

ii) Soundness Test

Radiographic examination shall be carried out on weld pad prepared in flat position for each electrode size. The test shall conform to SFA 5.5 requirements.

iii) All Weld Metal Tension & Impact Tests (ASTM A 370 or equivalent)

After subjecting the weld to a heat treatment of 700°C for 2 hours (rate of heating and cooling as per SFA 5.5 specification) the all weld metal tension and impact tests shall meet the following requirements. These tests shall be done for each electrode size with welding executed in flat position.

Tensile Test at Ambient Temperature

Ultimate Tensile Strength : Min 620 MPa

Yield Strength $E_{0.2\%}$: Min 530 MPa

% elongation on $L = 5.65\sqrt{A}$: Min 20

% reduction in area shall be reported

Charpy U Impact Strength at 20°C : Min 10 daJ/cm²
(As per ASTM E 23 or equivalent) (3 specimens shall be tested)

RT NDT Temperature

This value as determined in accordance with ASME Section III Class 1 shall be reported for 3.2 mm electrode size only (Heat treatment and welding position as above).

Tensile Test at 500°C (ASTM E 21 or equivalent)

Ultimate Tensile Strength : Min 430 MPa

Yield strength $E_{0.2\%}$: Min 370 MPa

% elongation (on $L = 5.65\sqrt{A}$) and % reduction in area shall be reported.

iv) Definition of Lot

A lot of electrodes shall consist of electrodes of the same diameter, with a core from the same heat and a coating made from the same mix which form part of same manufacturing cycle. No lot shall exceed the following limits.

Dia. mm	No. of electrodes
2.5	100,000
3.2	83,000
4	55,000
5	40,000
6	25,000

B. PACKING AND STORAGE

The electrodes shall first be put in plastic boxes with plastic covers and sealed with leaktight adhesive tapes. Three boxes shall be kept together in one cardboard packing. The cardboard boxes shall be put in wooden crates lined internally with water proof paper.

Supplier shall indicate at the time of quotation the details as regards to preservation of the electrodes and shelf life under those conditions.

C. ACCEPTANCE REPORTS

For each lot, the supplier shall prepare an acceptance report. The following test results shall be indicated in the report.

- Dimensional checks
- Chemical composition
- Mechanical properties
- RT_{NDT} temperature (for 3.2 mm electrode only)
- Fillet weld test (for electrode sizes as required in SFA 5.5 specification)
- Soundness test

33040/SP/1002

SPECIFICATION FOR 2½Cr-1Mo AND 9Cr-1Mo FILLER WIRES

Filler wires are for execution of root pass by TIG welding with argon as shielding and purging gas.

2½Cr-1Mo filler wire shall conform to SG Cr Mo 2 of DIN 8575 with the following modified requirements. 9Cr-1Mo filler wire shall conform to AWS classification ER 505 of SFA 5.9 or SG Cr Mo 9 of DIN 8575 with the following modified requirements.

A. MODIFIED REQUIREMENTS

i) Chemical Composition of bare wire

2½Cr-1Mo Type

Elements	C	Cr	Mo	Mn	Si	P max	S max
Composition	0.03	2.2	0.9	0.5	0.2	0.02	0.02
% by weight	to 0.10	to 3.0	to 1.1	to 1.2	to 0.8		

9Cr-1Mo Type

Elements	C	Cr	Mo	Mn	Si	P max	S max	Cu max	Ni max
Composition	0.03	8	0.8	0.4	0.2	0.02	0.02	0.5	0.5
% by weight	to 0.10	to 10.5	to 1.2	to 0.7	to 0.8				

ii) Definition of lot

Wires from the same heat and forming part of the same manufacturing cycle (same diameter at the end of run) shall constitute a lot.

B. PACKING AND STORAGE

The straight filler wires in lengths of either 900 or 1000 mm shall be packed in cardboard cartons and these cartons shall be put in suitable wooden crates. Sea worthy packing shall be ensured by the supplier.

C. ACCEPTANCE REPORTS

For each lot, the supplier shall prepare an acceptance report. The following test results shall be indicated in the report.

- Dimensional checks
- Chemical composition

SPECIFICATION FORGRADE 91 (MODIFIED 9Cr-1Mo) FILLER WIRES1.0 SCOPE

The Grade 91 (modified 9Cr-1Mo steel) filler wires are meant for execution of TIG welding (GTAW process) with argon as shielding and purging gas. These filler wires shall meet the requirements given below.

2.0 GENERAL

Each lot shall be subjected to tests indicated below in Clause 3.1 to 3.6. A lot shall consist of wires from the same heat and forming part of same manufacturing cycle with same diameter at the end of run.

3.0 REQUIREMENTS3.1 Test Weld Pads

Test weld pads using Grade 91 (modified 9Cr-1Mo steel) material shall be prepared by TIG welding process in flat position as per AWS SFA 5.4. The minimum preheat temperature shall be 250 °C and interpass temperature shall be between 200 and 250 °C.

The test weld pads shall be subjected to a heat treatment of 760±10 °C. The heating rate and cooling rate shall be 150 °C/hour maximum and the soaking time shall be 2 hours.

3.2 Radiographic Examination

After removal of support plate from the weld test pad,

100% radiographic examination of the weld shall be carried out and acceptance criteria shall be as given in specification No. PFBR/01950/SP/1001/R-1. The examination shall be carried out after heat treatment. The acceptance criteria shall be as applicable for Class-1 components.

3.3 Chemical Analysis of Weld Deposit

The chemical composition of the deposited weld metal shall meet the requirements as given below:

Elements	Composition % by weight
C	0.08-0.12
Cr	8-9.5
Mo	0.85-1.05
Mn	0.5-1.2
Si	0.2-0.4
S max	0.01
P max	0.015
Ni	0.6-1.0
Nb	0.04-0.07
V	0.15-0.22
N	0.03-0.07
Fe	Balance

3.4 All Weld-metal Tension Tests

After subjecting the weld to heat treatment all weld-metal tension tests at room temperature and at 515 C as per AWS SFA 5.4 and ASTM E21 respectively shall be carried out. The test results shall meet the following requirements.

	<u>Room</u>	<u>At 515</u>
	<u>Temp.</u>	<u>deg.C</u>
Ultimate tensile strength, MPa, min	: 585	to be noted
Yield strength (E 0.2%) MPa, min.	: 415	310
Elongation on 5d, % min	: 16	to be noted

3.5 Charpy V-Notch Impact Test at 20 deg.C

After heat treatment, 3 nos. of weld specimens (10 mm x 10 mm size) shall be subject to Charpy V-notch impact test at 20 C as per ASTM E23. The minimum impact strength shall be 100 J.

3.6 Hardness Test

The hardness of as-welded and post weld heat treated weld pads shall be measured and reported.

4.0 PACKAGING

The straight filler wires in lengths of 1000 mm shall be first put in plastic boxes and sealed with leaktight adhesive tapes. These boxes shall be kept in cardboard cartons and then these cartons shall be put in suitable wooden crates lined internally with water proof paper. Sea-worthy packing shall be ensured by the supplier. The information to be marked on each unit of package shall be as per AWS SFA 5.9.

5.0 ACCEPTANCE REPORTS

For each lot, the supplier shall prepare an acceptance report. The following test results/details shall be

indicated in the report.

- Welding parameters (voltage, current, speed, heat input, preheat temp., interpass temp., thickness of pad plate etc.) used for preparation of weld pads for each size of filler wire.
- Heat treatment details of test weld pad
- Radiographic examination
- Chemical composition of weld metal
- All weld-metal tension tests at room temperature and at 515 C
- Charpy V-Notch impact test
- Hardness test
- Dimensional checks of filler wires being supplied

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SPECIFICATION FOR
GRADE 91 (MODIFIED 9Cr-1Mo) ELECTRODES

1.0 SCOPE

The Grade 91 (modified 9Cr-1Mo steel) electrodes shall be basic flux coated and to be used for SMAW Process. These electrodes shall meet the requirements as given below.

2.0 GENERAL

The electrodes shall be suitable for welding in all positions except that its usability in vertical down position is not mandatory.

Each lot shall be subjected to tests indicated below in Clause 3.1 to 3.8. A lot shall consist of electrodes of the same diameter, with a core from the same heat and a coating made from the same mix which form part of same manufacturing cycle.

3.0 REQUIREMENTS

3.1 Weld Test Pads

Weld test pads shall be prepared from Grade 91 (modified 9Cr-1Mo) material by using SMAW process in flat position as per AWS SFA 5.4. The minimum preheat temperature shall be 250 °C and the interpass temperature shall be between 200 and 250 °C.

The test weld pads shall be subjected to a heat treatment of 760 ± 10 °C. The heating rate and cooling rate shall be 150 °C/hour maximum and the soaking time shall

be 2 hours.

3.2 Radiographic Examination

After the removal of support plate from the weld test pad, 100% radiographic examination of the weld shall be carried out and shall conform to requirements given in specification No. PFBR/01950/SP/1001/R-1. The examination shall be carried out after heat treatment. The acceptance criteria shall be as applicable for Class-1 components.

3.3 Chemical Analysis of Weld Deposit

The chemical composition of the deposited weld metal shall be as given below:

Elements	Composition % by weight
C	0.08-0.12
Cr	8 - 9.5
Mo	0.85-1.05
Mn	0.5-.1.2
Si	0.2-0.4
S max	0.01
P max	0.015
Ni	0.6-1.0
Nb	0.04-0.07
V	0.15-0.22
N	0.03-0.07
Fe	Balance

3.4 All Weld-metal Tension Tests

After subjecting the weld to heat treatment all weld-metal tension tests shall be carried out at room temperature and at 515 C respectively as per AWS SFA 5.4 and ASTM E21. The results shall meet the following requirements.

	Room Temp.	At 515 deg.C
Ultimate tensile strength, MPa, min :	585	to be noted
Yield strength (E 0.2%) MPa, min. :	415	310
Elongation on 5 d, % min :	16	to be noted

3.5 Charpy V-Noth Impact Test at 20 deg.C

This test shall be carried out on 3 specimens (10 mm x 10 mm size) after heat treatment of the weld test pad as per ASTM E23 and the minimum impact strength at 20^o C shall be 45 J.

3.6 Fillet Weld Test

The fillet weld test shall be carried out as per AWS SFA 5.4 for 3.2 mm diameter and above size electrodes.

3.7 Hardness Test

The hardness of as-welded and post-welded heat treated weld pads shall be measured and reported.

3.8 Moisture Content

The moisture content of the deposited weld metal shall be measured. The maximum hydrogen level shall be less than 5 ml/100 g in weld metal.

4.0 PACKAGING

The electrodes shall first be put in plastic boxes and sealed with leak tight adhesive tapes. These boxes shall be kept in cardboard cartons and then these cartons shall be put in suitable wooden crates lined internally with water proof paper. Sea-worthy packing shall be

ensured by the supplier. Each unit of package shall be marked as per AWS SFA 5.4.

5.0 ACCEPTANCE REPORTS

For each lot, the supplier shall prepare an acceptance report. The following test results/details shall be indicated in the report.

- Welding parameters (voltage, current, speed, heat input, preheat temp., interpass temp., thickness of pad plate etc.) used for preparation of weld pads for each size of electrodes.
- Heat treatment details of test weld pads
- Radiographic examination
- Chemical composition of weld metal
- All weld-metal tension tests at room temperature and at 515 C
- Charpy V-Notch impact test
- Fillet weld test
- Hardness test
- Moisture content test
- Dimensional checks of electrodes being supplied
- Details of baking and storage conditions for the electrodes along with the shelf life.

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Technical Annexure PFBR/33040/SP/1000/R-2

PFBR/33040/SP/1000/R-2

PAGE 1 OF 3

SPECIFICATION FOR 9Cr-1Mo ELECTRODES

Electrodes shall be basic coated and conform to AWS classification E 505-15 of SFA 5.4 specification with the following modified requirements.

A. SUPPLEMENTARY REQUIREMENTS

i) Chemical composition of the deposited weld metal:

Elements	Composition % by weight	
C	0.06	- 0.10
Cr	8	- 9.5
Mo	0.85	- 1.0
Mn	0.7	- 1.0
Si	0.35	- 0.6
S max	0.015	
P max	0.02	
Cu max	0.15	
Ni max	0.3	
V max	0.05	

ii) Radiographic Examination

After the removal of support plate, 100% radiographic examination of the weld shall be carried out and shall meet the acceptance criteria specified for Class 1 components in the enclosed specification PFBR/01950/SP/1001/R-1. The examination shall be carried out after heat treatment.

iii) All Weld Metal Tension & Impact Tests

After subjecting the weld to a heat treatment of 730^o ±10 C, (heating rate: max. 150 C/h, soaking time 1 h cooling rate max. 150 C/h) the all weld metal tension and impact tests shall meet the following

Technical Annexure PFBR/33040/SP/1000/R-2

PFBR/33040/SP/1000/R-2

PAGE 2 OF 3

requirements. These tests shall be done for each electrode size.

Tensile Test at Ambient Temperature

Ultimate tensile strength	Min. 590 MPa
Yield Strength (E 0.2%)	Min. 398 MPa
% elongation on L = $5.65 \sqrt{A}$	Min. 18%

Charpy V Impact Strength at 20 °C (As per ASTM E 23)

Min. 6.5 daj/cm² (3 specimens shall be tested).

iv) Definition of Lot

A lot of electrodes shall consist of electrodes of the same diameter, with a core from the same heat and a coating made from the same mix which form part of same manufacturing cycle. No lot shall exceed the following limits.

<u>Dia. mm</u>	<u>No. of electrodes</u>
2.5	100,000
3.2	83,000
4	55,000

B. PACKING AND STORAGE

The electrodes shall first be put in plastic boxes with plastic covers and sealed with leaktight adhesive tapes. Three boxes shall be kept together in one cardboard packing. The cardboard boxes shall be put in wooden crates lined internally with water proof paper.

Technical Annexure PFBR/33040/SP/1000/R-2

PFBR/33040/SP/1000/R-2

PAGE 3 OF 3

C. ACCEPTANCE REPORTS

For each lot, the supplier shall prepare an acceptance report. The following test results shall be indicated in the report.

- Dimensional checks
- Chemical composition
- Mechanical properties (with heat treatment details)
- Fillet weld test
- Radiographic examination

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C108/D20

Sl. No.	Pre –Qualification Criteria -132258175	Bidder remark
1	Bidder shall be a manufacturer of the Quoted item or an authorized dealer of the same. If the offer is quoted by agent, letter of authorization or agreement duly signed by the manufacturer is required to consider the offer.	
2	Quoted Welding Consumables brand name.	
3	Mill address (manufacturing address).	
4	Manufacturer shall submit manufacturing process flow chart (Raw material to finished product) along with offer for Quoted Item.	
5	Manufacturer (Principle Supplier) shall submit a valid ISO 9001 certificate or Quality management system certificate or Written down procedure.	
6	<p>Technical Specification for diameter 2.4 mm and 2.5 mm shall be taken as same. Technical Specification for diameter 3.15 mm and 3.2 mm shall be taken as same.</p> <p>Vendor should give confirmation to BHEL’s Technical Specification. Any deviation from the Specification are to be mentioned in the “Bidder remark Space”.</p> <p>If There is no deviation vendor should indicate “No Deviation”.</p>	

Seal and sign of Authorized person

Page 1 of 1

**ADITYA
KUMAR**

Digitally signed by
ADITYA KUMAR
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