BHARAT HEAVY ELECTRICALS LIMITED
TIRUCHIRAPALLI-620 014

SPECIFICATION NO : WCPS – RH 01, R00

COVERED FERRITIC (E7018-1) SMAW WELDING ELECTRODE

(For Work Order Nos.: D139-142 – Reactor Header)

WCPS RH 01

Rev. No.	00	01	02	03	04	05
Prepared By						
Reviewed By						
Approved By (BHEL)						
Approved By (CUSTOMER)						

Nature of Revision

न्युक्लियर पावर कार्पोरेशन ऑफ इंडिया लिमिटेड
NUCLEAR POWER CORPORATION OF INDIA LTD.
अनुमोदित / APPROVED
25/02/11
समीक्षा/Reviewed 25/2/11
जाँच किया गया/Checked 25/02/11
किए जानेवाले कार्य के परिनिर्धारण का विक्रेता को विवरण की सटीकता के दायित्वों से मुक्त नहीं करता है ।
This Approval of interpretation of the work to be done does not relieve the seller of responsibility of accuracy of details.

1.0 SCOPE

1.1 This specification prescribes requirements for covered ferritic welding electrode for shielded metal arc welding (SMAW) process.

2.0 GENERAL REQUIREMENTS :

2.1 The proposed electrode should have the suitability for use on SA420 Gr. WPL6, SA350 LF2 class1, SA 333 Gr.6 carbon steel materials.

2.2 The electrode should be manufactured and controlled according to ASME Code Section II Part C, SFA 5.1, Section III NB 2400 Class I, 2010 Edition.

2.3 The total quantity delivered shall be in least number of lot. Each lot shall be defined in ASME NB-2420 (d).

2.4 General Purchase Specification (RH-TDC-01-R00) shall be applied (enclosed)

3.0 CHEMICAL COMPOSITION :

3.1 The chemical composition of weld deposit shall conform to the classification AWS A 5.1 E7018-1 / SFA 5.1 with the following restrictions.

C	0.15 % max
Mn	1.60 % max
P	0.035 % max
S	0.035 % max
Cr	0.20 % max
Mo	0.30 % max
Si	0.75 % max
V	0.08% max
Ni	0.30 % max
Mn+Cr+Ni+Mo+V	1.75 % max

4.0 VOLUMETRIC EXAMINATION :

4.1 The electrode with DCEP shall deposit weld metal, which meets Radiographic Soundness requirements (or ultrasonic testing) specified in ASME Section IX or Section II C, SFA-5.1 E7018-1. The electrodes shall produce acceptable radiography quality (or ultrasonic test) on plate / pipe / tube / forgings welds.

5.0 **MECHANICAL PROPERTIES TESTS** (as per ASME Section III NX- 2420)

5.1 The mechanical properties of all weld metal tensile specimen (longitudinal tensile) deposited using the electrode after stress relieving the test plate assembly at 600 ± 10°C for six hours soaking shall be as follows. The preheat and inter-pass temperature for test coupon welding, PWHT soaking time, peak temperature range and the maximum cooling rate used are to be mentioned in the test certificate.

5.2 The mechanical properties of all weld metal tensile specimen (longitudinal tensile) deposited using the electrode after stress relieving the test plate assembly at 600 ± 10°C for six hours soaking time shall be as follows. The minimum preheat of 125°C and maximum inter-pass temperature of 245°C, PWHT soaking time (six hours), peak temperature range (600 ± 10°C) and the maximum cooling rate as per NB-4623 (150°C / hour) used for test coupon welding, are to be mentioned in the test certificate. All weld metal longitudinal tensile test shall be carried out and mechanical test results shall meet the requirement as given below : a), b), c), d), e) & f).

Properties	As-welded	After PWHT
a) Yield strength	: 250 MPa (minimum)	: 250 MPa (minimum)
b) Tensile strength	: 485 – 655 MPa	: 485-655 MPa
c) Elongation in 50 mm	: 22% (minimum)	: 22% (minimum)
d) Impact strength	: 68 J at temp.	: 68 J at temp.
	: not higher than 18°C	: not higher than 18°C
	: (0.90 lateral expansion)	: (0.90 lateral expansion)
e) Absorbed Energy at -45°C Charpy V-Notch Test	: 27 Joules average	: 27 Joules average
f) Drop weight test	: at -15°C : no break performance for 2 Nos	

Heat Input condition (welding parameters) should be given. Drop weight test is required at -15°C. The quantity of electrodes per lot to be indicated in the test certificate.

6.0 **DIFFUSIBLE HYDROGEN CONTENT OF WELD METAL :**

Diffusible Hydrogen content of weld metal deposited using the electrode shall be maximum 8 ml/100 grams. Test to be done as per ASME Sec II C, SFA 5.1 E7018-1.

7.0 **CORE WIRE AND COVERINGS :**

7.1 Core wire and coverings shall be free of defects which would interfere with uniform performance of the electrodes. The covering on the electrode shall be concentric to the extent that the maximum core-plus-one covering dimension shall not exceed the minimum core-plus-one covering dimension by more than 7% of the mean dimension in sizes 2.5mm and smaller, 5% of the mean dimension in sizes 3.15 mm, 4 mm, 4% of the mean dimension in sizes 5.0 mm and larger. The concentricity may be measured by any suitable means.

7.3 The diameter of the core wire shall not vary more than ± 0.05 mm from the standard size specified. The length shall not vary more than ± 10 mm from that specified.

8.0 EXPOSED CORE :

8.1 One end of each electrode shall be bare for a distance of 12 mm but not more than 30 mm for electrodes to provide for electrical contact with the holder

8.2 The arc end of each electrodes shall be sufficiently bare and the covering sufficiently tapered to permit easy striking of the arc. The length of the bare portion of the arc end of the electrode shall not exceed 1.6 mm or one half of the diameter of the core wire whichever is less.

9.0 REQUIRED TESTS (SFA 5.1 Table 4)

1. Chemical Analysis
2. Radiographic test or ultrasonic test
3. All-weld metal tension test
4. Impact test
5. Fillet weld test
6. Moisture test
7. Drop weight test

9.1 Chemical Analysis and Moisture Content :

The chemical composition of the weld deposit shall be analysed and reported. The same shall be as per para 3.0. The moisture content shall be within the specified limits as per ASME section II C SFA 5.1.

9.2 The tests as per para 9.0 shall be carried out for each batch of electrodes. Test certificate to be sent to BHEL for approval before despatch. The welding and testing procedures used shall be subjected to Purchaser's approval.

10.0 ELECTRODE IDENTIFICATION :

All electrodes shall be identified in accordance with the following :

10.1 At least one legible imprint of the applicable AWS classification, shall be applied to the electrode covering as near as practical to the grip end of the electrode and within 65 mm of that grip end.

10.2 The numbers and letters of the imprint shall be of bold block type and of sufficient size to be easily readable.

10.3 The ink used for imprinting shall provide sufficient contrasts with the electrode covering in order that the numbers and letters of the electrode classification shall be readable before and after recommended baking at user's works and after normal welding applications.

11.0 MARKING :

11.1 The outside of each unit package shall be legibly marked with the following information :

1. AWS specification number and classification.
2. Supplier's name and Trade designation.
3. Size and Net weight.
4. Lot, Control, Batch number.

12.0 CERTIFICATION AND TESTING :

12.1 Each consignment of electrodes shall be from one Batch only.

12.2 One copy of test certificate shall contain following test results along with approval no. and date which was accepted by BHEL, Trichy.

a) Chemical composition of Weld deposit
b) Test for Mechanical Properties as-welded and after PWHT
c) Test for Moisture content of Covering (for diameter 4.0 mm, 5.0 mm).
d) Test for Diffusible Hydrogen content of Weld Metal. (for diameter 4.0 mm, 5.0 mm).
e) Impact test result
f) Fillet weld test
g) Drop weight test

13.0 PACKAGING :

Electrodes shall be suitably packed to insure against damage during shipment and storage under tropical conditions. The package weight shall be as agreed upon by the supplier and purchaser.

Prequalification Criteria

The Pre-qualification criteria given below shall be filled separately for each consumable being offered by the supplier.

S No	Pre –Qualification Criteria	Bidder remarks
1	Bidder shall be a manufacturer of Welding Consumables being tendered or an agent of the same. If the offer is quoted by agent, letter of authorization duly signed by the manufacturer is required.	
2	Bidder shall have successfully supplied E7018-1 SMAW electrodes to any govt. Organizations/ PSUs/ Public ltd./ Company/Reputed Industries, as per ASME SEC.II.C. Purchase orders copies (01.01.2017 or later is only acceptable) and related material test certificates to be submitted along with offer. Note: Successfully supplied means – supplied and accepted.	
3	Welding Consumables brand name and its data sheet shall be provided along with offer.	
4	The Lot Classification of the consumable shall be Lot Class C3, as defined in ASME Section II Part C. Supplier shall confirm.	
5	Manufacturing plant address of the quoted electrode shall be provided along with offer.	
6	BHEL/End customer reserve the right to inspect the item ordered at vendor's works.	
7	Suppliers shall submit manufacturing process flow chart (Raw material to finished product) along with offer.	
8	Supplier shall have NPCIL's brand approval for the product being offered. In the absence of NPCIL's brand approval, suppliers shall submit a valid ISO 9001 certificate and Quality Management System (QMS) Manual along with the offer. The acceptance of such offers is subject to acceptance of supplier's QMS by BHEL's customer NPCIL.	
9	Bidder shall confirm to meet WCPS RH 01 rev 00. Any deviations shall be specified with offer. Acceptance of such offers is subject to acceptance by BHEL's customer NPCIL.	

E7018-1 SMAW Electrode dia 3.15 mm & E7018-1 SMAW Electrode dia 4.0 mm

Supply shall be as per WCPS RH 01 rev 00. Lot Qualification testing shall be done at BHEL Trichy. A pilot quantity shall be sent to BHEL Trichy after manufacture of electrodes for Lot Qualification. Upon successful Lot qualification, BHEL shall give dispatch clearance for bulk quantity. The bulk quantity shall be from the same batch as the pilot quantity.