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|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
|  | <p>Bharat Heavy Electricals Limited, Piping Centre, Chennai</p> <p><b>Technical Delivery Conditions for Seamless pipes conforming to ASME SA106 Gr B and Welded Pipes conforming to ASME SA 671 Grade CC70 Class 32 - PEB SYSTEM</b></p> <p><b>Project: NPCIL Kudankulam-KKNPP Unit 3&amp;4 -2x1000 MWe</b></p> | <p><b>TDG :7430:001 Rev:00</b><br/> Dt : 21.03.2020<br/> Page 1 of 4</p> |
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Records of Revn:00 :- Fresh Issue.

## 1.0 SCOPE

- 1.1 This Technical Delivery Conditions specify the requirements for Seamless pipes conforming to **ASME SA 106 Gr B** and Electric Fusion Welded Pipes conforming to **ASME SA 671 Grade CC70 Class 32**.
- 1.2 The pipes are intended for Nuclear Piping coming under ASME Sec III Sub Section NC.

## 2.0 RAW MATERIAL

Steel shall be made by one or more of the following processes: Open hearth, electric furnace or basic-oxygen. Steel made by Acid Bessemer process shall not be acceptable.

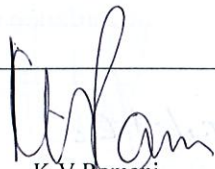
Ladle Analysis: Ladle Analysis shall be done for all materials.

Plates used for SA 671 Gr CC70 Class 32 shall meet the mandatory requirements as per ASME SA 516 Grade 70. Impact test requirement for Plate shall be as per Clause 4.3 b).

100% UT for plates (all thickness) as per SA 578. Acceptance Standard: Level – B.

## 3.0 MANUFACTURING

- 3.1 The pipe shall be of longitudinally welded as indicated in the P.O. All longitudinal welded pipes shall employ only automatic welding. All welds shall be fusion welds made in accordance with qualified procedures as per ASME Sec IX.
- 3.2 In one random length, one welded circumferential seam of same quality as longitudinal weld is permitted. Circumferential weld seams shall be minimum 2500mm apart from each other and from ends.
- 3.3 The longitudinal seams of the two portions shall be staggered by 90 degree.
- 3.4 Fusion welded pipes of diameter less than 900NB shall not have more than one longitudinal joint.
- 3.5 The ends shall be edge prepared as indicated in the P.O.
- 3.6 All pipes shall be completely finished and free from surface, sub surface defects such as pits, cracks, weld spatters & laminations etc..
- 3.7 NPCIL approved brand of electrodes shall be used. (Refer Annexure 1)

|                                                                                                                 |                                                                                                            |                                                                                                                             |                                                                                                                    |
|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| <br>J. Nanthini<br>Dy.Mgr/QA | <br>R. Prabha<br>AGM/MM | <br>C. Vaithianathan<br>AGM/Engg,DTG &MS | <br>K V Ramani<br>AGM/Quality |
| Prepared By                                                                                                     | Reviewed By                                                                                                |                                                                                                                             | Approved By                                                                                                        |

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#### 4.0 HEAT TREATMENT, CHEMICAL & MECHANICAL TESTS

4.1 Heat Treatment : As per respective Material specification.

4.2 Product Analysis :

a) **Seamless Pipes** : Product Analysis as per S1 – Supplementary requirement of SA 106.

b) **Welded Pipes** : Product Analysis of Plate and Weld as per S4 – Supplementary requirement of SA 671.

4.3 Mechanical Test :

a) **Seamless Pipes** : Mechanical tests as per applicable material specification.

b) **Welded Pipes** : Mechanical tests as per applicable material specification. Impact test shall be done as per any one of the below option :

Option 1 : Raw material SA 516 Gr 70 plates used for fabrication of pipes shall be subjected to Charpy V-Notch Impact test as per S5 – Supplementary requirement of SA 516. Fabricated pipe SA671 Gr CC70 Cl32 shall be subjected to Charpy V-Notch Impact test as per S2 – Supplementary requirement of SA 671.

Option 2 : Raw material SA 516 Gr 70 plates used for fabrication of pipes is exempted from Impact test according to ASME Sec III NC 2019, Clause NC 2311(a)-8. Impact test shall be done on the weld metal and welding procedure qualification.

Impact values for the SA 516 Gr 70 Plates and Pipe made from SA 516 Gr 70 plates shall meet the requirements of SA 20. Impact Test Temperature = -50°C , Minimum Average value :15J. Minimum Individual value : 12J.

#### 5.0 HYDRO TEST / NON DESTRUCTIVE TEST

5.1 **Seamless Pipes** : Each pipe shall be 100% Ultrasonically tested as per ASTM E 213.

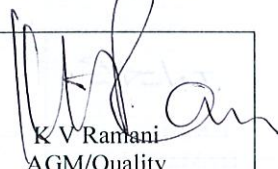
5.2 **Welded Pipes** :

a) Each pipe shall be Hydro tested as per ASTM A 530

b) The full length of each butt weld (Longitudinal & Circumferential seam) shall be Radiographically examined in accordance with and meets the requirements of ASME BPVC Sec III Div.1 NC - 5320.

c) 5% of the butt welds shall be UT tested in accordance with and meets the requirements of ASME BPVC Sec III Div.1 NC - 5330.

d) 100% of the butt welds shall be dye penetrant tested - after root and final pass, in accordance with and meets the requirements of ASME BPVC Sec III Div.1 NC - 5350.

|                                                                                                                 |                                                                                                            |                                                                                                                             |                                                                                                                     |
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| Prepared By                                                                                                     | Reviewed By                                                                                                | Approved By                                                                                                                 |                                                                                                                     |



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**Technical Delivery Conditions for Seamless pipes conforming to ASME SA106 Gr B and Welded Pipes conforming to ASME SA 671 Grade CC70 Class 32 - PEB SYSTEM**

**Project: NPCIL Kudankulam-KKNPP Unit 3&4 -2x1000 MWe**

## 6.0 DIMENSION & TOLERANCES

- 6.1 The tolerance limits shall be as per respective Drawing as mentioned in P.O.  
6.2 Length and Quantity Tolerance as per P.O.

## 7.0 REPAIR

Seamless Pipes : Repair by welding is prohibited. The pipe shall meet the dimensional tolerance (Clause 6.0 above) after any mechanical repair as permitted in the standard.

Welded Pipes : Number of weld repairs at the same spot shall be restricted to maximum two by NPCIL approved procedure. All repaired welds shall be re-examined and re-tested as per the requirements of original weld and shall meet the requirements of the same.

## 8.0 WORKMANSHIP

The Inside & Outside surfaces of the pipes shall be free from any imperfections and defects like laminations, saps, seams, folds, cracks, pitting etc., Weld spatter, Cleats, Sharp corners, projections and indentations shall be removed. Localised imperfections, if any, may be removed by grinding or skin machining only, ensuring the wall thickness, inside and outside diameter to provide workmanship like finish. Local depressions or ground spots are not acceptable. Loose scales shall be removed by blast cleaning in both inside and outside surface.

Internal & External weld profile of Welded pipes shall be ground smooth to make it suitable for application of Coating (done at Site). **Weld finish requirements shall be as per Engineering Drawing.**

## 9.0 MARKING

- 9.1 The pipes despatched to **BHEL Stores** shall be **paint stencilled & hard punched** with the following details.

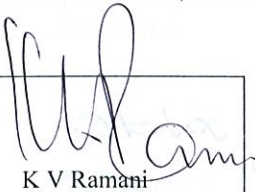
- 1) PO Number      2) Supplier's emblem/code      3) Size & Specification      4) Heat number  
5) Pipe number      6) Inspector's seal

- 9.2 The pipes despatched to Project site as per Enquiry/P.O., the following details (furnished in the P.O. or separately) shall be **paint stencilled & hard punched** on both ends of the pipes in addition to the above.

- Work order No                      ➤ DU No  
➤ Pipe Length (in mtr)              ➤ Weight per Pipe length

- 9.3 **Any other Marking & Identification which is not mentioned above Sl. No: 9.1 & 9.2 shall be as per Enquiry/P.O.**

- 9.4 Paint or Ink for marking shall not contain any harmful metal or metallic salts such as zinc, lead or copper which cause corrosive attack on heating.

|                                                                                                                 |                                                                                                            |                                                                                                                             |                                                                                                                    |
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| Prepared By                                                                                                     | Reviewed By                                                                                                |                                                                                                                             | Approved By                                                                                                        |



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**Technical Delivery Conditions for Seamless pipes conforming to ASME SA106 Gr B and Welded Pipes conforming to ASME SA 671 Grade CC70 Class 32 - PEB SYSTEM**

**Project: NPCIL Kudankulam-KKNPP Unit 3&4 -2x1000 MWe**

## 10.0 PRESERVATION

- 10.1 The pipes if despatched to BHEL Stores shall be coated with resin type translucent rust preventive on the outside unless otherwise specified in the P.O. Thick black coating which camouflages the surface of the pipes is not permitted.
- 10.2 The pipes if despatched to project site directly shall be painted as following :  
Surface preparation : Blast cleaning to Sa 2 1/2  
Primer : One coat of Inorganic Zinc Silicate primer ; DFT = 70 microns min.  
Total DFT = 70 microns min.
- 10.3 Desiccant material suitable for use in combination with steel (moisture absorbent) shall be placed inside closed pipe to enable corrosion prevention for atleast 2 years.
- 10.4 End Caps are to be provided on both ends of the pipes as per the drawing indicated in the enquiry / Purchase Order. Bevelled pipe ends shall be closed with a leak tight Steel bevel protector combined with Plastic plug.

## 11.0 QUALITY PLAN

Manufacturing and Inspection shall be as per Customer NPCIL approved Quality Plan.

## 12.0 INSPECTION & CERTIFICATION

- 12.1 Inspection shall be by BHEL and Customer – NPCIL as per the Approved Quality Plan.
- 12.2 Three original test certificates typed in English shall be submitted along with the inspection report. The test certificate shall furnish the following details.
- BHEL P.O Number & Amendment Number(if any)
  - BHEL P.O. Serial Number
  - Test Certificate number
  - Specification, grade with year of code, size, quantity
  - Steel & Pipe making process
  - Heat number of plate (or pipe number with traceability to heat number)
  - Chemical composition including incidental elements on Ladle & Product analysis
  - Heat Treatment details with actual temperature and soaking time
  - Mechanical properties including Impact test reports etc.
  - Hydrostatic test, Detailed NDT reports with reference norm, acceptance standard and Test results as applicable.
  - Dimensional report
  - Painting details
- 12.3 Mill test certificate for Raw material (Billet/Bloom/Plate) as per Clause 2.0.

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| Prepared By                                                                                                     | Reviewed By                                                                                                |                                                                                                                             | Approved By                                                                                                        |

## Annexure -1

### NUCLEAR POWER CORPORATION OF INDIA LTD.

(A Government of India Enterprise)

Directorate of Quality Assurance

Phone: 022 - 2599 5045, Fax 022 - 2556 5354

#### **1) LIST OF APPROVED CARBON STEEL & LOW ALLOY STEEL WELDING ELECTRODES (2 pages)**

As on 25-01-2018

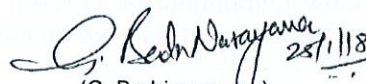
| Sr. No. | Manufacturers                        | Brand name          | AWS No.             | Valid up to |
|---------|--------------------------------------|---------------------|---------------------|-------------|
| 1.      | ADOR Welding Ltd., Silvassa          | SUPABASE X PLUS     | E7018               | FEB2019     |
| 2.      | ADOR Welding Ltd., Silvassa          | MOLYTEN             | E7018-A1            | APR2020     |
| 3.      | ADOR Welding Ltd., Silvassa          | TENALLOY Z PLUS     | E7018-1             | JUN2022     |
| 4.      | ADOR Welding Ltd., Silvassa          | CHROMOTEN           | E8018 B2            | APR2020     |
| 5.      | ADOR Welding Ltd., Silvassa          | CHROMOTEN-C         | E9018 B3            | APR2020     |
| 6.      | D&H SECHERON, Indore                 | MOLYTHERME          | E7018-A1            | JUN2022     |
| 7.      | D&H SECHERON, Indore                 | MEDIO               | E6013               | JUN2020     |
| 8.      | D&H SECHERON, Indore                 | EXOBEL              | E6013               | JUN2020     |
| 9.      | D&H SECHERON, Indore                 | SUPERTHERME         | E7018               | JUN2020     |
| 10.     | D&H SECHERON, Indore                 | SUPERTHERME(SPL)    | E7018-1             | SEP2018     |
| 11.     | D&H India Ltd., Indore               | SUPER -LH (SPL)     | E7018-1 (DCEP Only) | FEB2021     |
| 12.     | D&H India Ltd., Indore               | STANDARD            | E6013               | FEB2021     |
| 13.     | D&H India Ltd., Indore               | SUPER LH            | E7018 (DCEP Only)   | FEB2021     |
| 14.     | D&H India Ltd., Indore               | SUPER -CR-1         | E8018 B2            | DEC2020     |
| 15.     | D&H India Ltd., Indore               | SUPER -CR-2         | E9018 B3            | DEC2020     |
| 16.     | ESAB INDIA LTD, AMBATTUR,<br>CHENNAI | ESAB 28             | E6013               | SEP2018     |
| 17.     | ESAB INDIA LTD, AMBATTUR,<br>CHENNAI | ESAB 36H            | E7018               | SEP2018     |
| 18.     | ESAB INDIA LTD, AMBATTUR,<br>CHENNAI | ESAB 36H(SPL)       | E7018-1             | SEP2018     |
| 19.     | ESAB INDIA LTD, AMBATTUR,<br>CHENNAI | ESAB PIPEWELD 6010R | E6010               | SEP2018     |
| 20.     | HONAVAR ELECTRODES, THANE            | REGULAR S           | E6013               | JAN2020     |
| 21.     | HONAVAR ELECTRODES, THANE            | ULTIMATE - 18       | E7018               | JAN2020     |
| 22.     | HONAVAR ELECTRODES, THANE            | ULTIMATE - 18 SPL   | E7018-1             | JAN2020     |
| 23.     | MAILAM INDIA LTD., PUDUCHERRY        | MAILARC -13R        | E6013               | SEP2020     |
| 24.     | MAILAM INDIA LTD., PUDUCHERRY        | MAILARC -18         | E7018               | SEP2020     |
| 25.     | MAILAM INDIA LTD., PUDUCHERRY        | MAILARC -18 PLUS    | E7018-1             | SEP2020     |
| 26.     | MAILAM INDIA LTD., PUDUCHERRY        | MAILARC -1 CR       | E8018-B2            | DEC2018     |
| 27.     | MAILAM INDIA LTD., PUDUCHERRY        | MAILARC -2 CR       | E9018-B3            | DEC2018     |
| 28.     | ROYAL ARC ELECTRODES, VASAI          | ROYAL THERME        | E7018               | SEP2018     |
| 29.     | ROYAL ARC ELECTRODES, VASAI          | ROYAL S             | E6013               | SEP2018     |
| 30.     | ROYAL ARC ELECTRODES, VASAI          | ROYAL THERM SPL.    | E7018-1             | SEP2021     |
| 31.     | ROYAL ARC ELECTRODES, VASAI          | ROYAL THERM MOLY    | E7018-A1            | FEB2018*    |
| 32.     | ROYAL ARC ELECTRODES, VASAI          | ROYAL CHROM 1       | E8018-B2            | NOV2017*    |
| 33.     | ROYAL ARC ELECTRODES, VASAI          | ROYAL CHROM 2       | E9018-B3            | NOV2017*    |
| 34.     | RAJ KESARI ELECTRODES,<br>UDAIPUR    | SUPERLET 18         | E7018               | AUG2022     |
| 35.     | RAJ KESARI ELECTRODES,<br>UDAIPUR    | SUPERLET 18 (SPL.)  | E7018-1             | AUG2022     |
| 36.     | RAJ KESARI ELECTRODES,<br>UDAIPUR    | RAJCORD 13S         | E6013               | AUG2022     |
| 37.     | RAJRATNA ELECTRODES,<br>AHMEDABAD    | RATNA 7018          | E7018               | FEB2018*    |

*G. Radh Narayan*  
25/1/18

| Sr. No. | Manufacturers                                  | Brand name             | AWS No.  | Valid up to |
|---------|------------------------------------------------|------------------------|----------|-------------|
| 38.     | RAJRATNA ELECTRODES,<br>AHMEDABAD              | RATNA 7018 SPL.        | E7018-1  | MAR2020     |
| 39.     | SUPERON SCHWEISSTECHNIK<br>INDIA LTD. DELHI    | GARANT MO              | E7018-A1 | SEP2020     |
| 40.     | SUPERON SCHWEISSTECHNIK<br>INDIA LTD. DELHI    | SUPERCITO              | E7018    | SEP2019     |
| 41.     | SUPERON SCHWEISSTECHNIK<br>INDIA LTD. DELHI    | SUPERCITO 7018-S       | E7018-1  | SEP2019     |
| 42.     | SUPERON SCHWEISSTECHNIK<br>INDIA LTD. DELHI    | OVERCORD S             | E6013    | SEP2019     |
| 43.     | SUPERON SCHWEISSTECHNIK<br>INDIA LTD., DELHI   | SUPER CROMO 1B         | E8018-B2 | DEC2020     |
| 44.     | SUPERON SCHWEISSTECHNIK<br>INDIA LTD., DELHI   | SUPER CROMO 2B         | E9018-B3 | DEC2020     |
| 45.     | VIJEY ELECTRODES & WIRES PVT.<br>LTD., CHENNAI | VJ 6013 X              | E6013    | SEP2020     |
| 46.     | VIJEY ELECTRODES & WIRES PVT.<br>LTD., CHENNAI | VJ 7018                | E7018    | SEP2020     |
| 47.     | VIJEY ELECTRODES & WIRES PVT.<br>LTD., CHENNAI | VJ 7018 - 1            | E7018-1  | SEP2020     |
| 48.     | WELD FAST ELECTRODES,<br>NAGPUR                | WELDFAST LH 18         | E-7018   | MAR2020     |
| 49.     | WELD FAST ELECTRODES,<br>NAGPUR                | WELDFAST LH-18-1       | E-7018-1 | MAR2020     |
| 50.     | WELD FAST ELECTRODES,<br>NAGPUR                | WELDFAST CROMO<br>0500 | E7018-A1 | JAN2018*    |
| 51.     | WELD FAST ELECTRODES,<br>NAGPUR                | WELDFAST CROMO<br>1500 | E8018-B2 | JAN2018*    |
| 52.     | WELD FAST ELECTRODES,<br>NAGPUR                | WELDFAST CROMO<br>2251 | E9018-B3 | JAN2018*    |

The approvals are granted in conformance to the requirements stipulated in latest edition of ASME Section II Part C. However, batch qualification wherever called for in specific cases, will have to be carried out separately.

Note: \* Indicates renewal of approval is under progress

  
(G. Badrinarayana)  
AD (QA), QA Analysis & Gr.3