

BHEL Piping Centre	Quality Assurance	Technical Delivery Conditions
Product: Nickel Alloy Fasteners of UNS N06617 for Advanced Ultra Super Critical (AUSC) Boiler		
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Record of Revision: Rev 00: 18/07/2017: Fresh Issue

1. Scope:

This Technical Delivery Conditions pertains to requirements for manufacturing and procurement of Nickel Alloy Fasteners viz - Studs, Nuts, Washer and Spacer Ring for Advanced Ultra Super Critical Boilers. Raw material shall be procured from manufacturers after BHEL approval only.

Requirements: As per drawing and as listed below. Size and Qty.: As per drawing Purchase order

2. Raw Material: (Applies to the ingot producer/roller/forging)

Specification & Grade: ASTM B166/ASME SB166 - Nickel Alloy UNS N06617 (Latest revision on the date of Purchase Order)
Raw Material shall be produced by using vacuum induction melting (VIM) followed by vacuum arc re-melting (VAR) or Electro slag refining (ESR). Bars shall be hot rolled, solution treated and descaled. Ladle analysis: 1 sample per cast. Product analysis: min 1 sample per heat as rolled. Full melt analysis shall be reported in Test certificate.

Element	Cr	Fe	Mn	Mo	Co	Al	C	Cu	B	Si	S	N	Ti	Ni
Wt %	21-23	1.5 max	0.3 max	8-10	11-13	0.8-1.3	0.05-0.08	0.05 max	0.002-0.005	0.3 max	0.008 max	0.05 max	0.3-0.5	Bal.

Raw materials used shall be checked by supplier to ensure freedom from radioactivity.

Heat Treatment (as delivered condition): solution annealed condition - 1150°C to 1175°C.

Mechanical Testing (on as delivered condition): The test sample for each size/heat/HT batch; on final heat treated condition samples in transverse direction. Tensile Strength: Min 655 Mpa, Yield Strength (2% off set): Min 241 Mpa, Elongation: min 35%. Micro: Grain size ASTM 2-5 as per ASTM E112. **NDE: UT: 100%.** Testing method as per A388 and acceptance shall be ASME Sec VIII Div. 2 Cl 3.3.4.

3. In-process: (shall be detailed in Manufacturing and Inspection plan (MIP))

Subsequent to forging, the material shall be solution annealed [1150°C to 1175°C] at in-house heat treatment facility. If any other Stress relieving is done after any operation, the same shall be indicated in detailed MIP

4. Dimensions & Tolerances:

Process: Cold/Hot Forging with dies and tools shall be clean of loose scales and sheet particles.

Dimensions of the studs, Nuts, washers & spacer rings shall be as per drawing.

Threads on the Studs shall be checked with properly calibrated ring gauge with a tolerance class 6g.

Threads on the Nuts shall be checked with properly calibrated ring gauge with a tolerance class 6H.

5. Inspection & Testing: (on heat treated product)

Sample Size for Chemical Test: 1 per Heat/ Heat Treatment Batch. (Chemistry shall be as indicated above)

Mechanical Test & NDE: As per approved sampling plan

STUD – Visual, Dimensional, Chemical, Mechanical, Micro, Hardness, LPI

NUT – Visual, Dimensional, Chemical, Mechanical, Proof load, LPI

WASHER, SPACER RING – Visual, Dimensional, Chemical, Hardness

A detailed testing procedure along with MIP – indicating reference standards and acceptance values shall be submitted for BHEL approval (during enquiry stage)

6. Marking & Packing:

Marking: i) Manufacturers identification symbol ii) Grade indicated in drawing, shall be marked on all the items suitably.

The following details shall be clearly indicated in the tags tied to the bundle: 1) Customer Name, 2) Manufacturers name, 3) Vendor Code, 4) PO Num & internal Work Order, 5) Quantum and weight, 6) Item Description

Packing: All items shall be neatly packed in sealed bags and transported in wooden boxes to avoid damage during transit.

7. Inspection & Certification: (in English only)

All items are to be Inspected at the manufacturer's works as per Quality Plan and Sampling plan and shall be submitted along with the Work Test Certificate (EN 10204 Type 3.2) containing below details:

1. Purchase Order No. (BHEL), TDG No. & Test certificate number.
2. Specification, Grade with applicable year of code, Heat Number, Drawing No., Quantity & Size
3. Details of dimensional test reports, Chemical, Mechanical & NDE done with reference & acceptance standard on the samples
4. Heat treatment chart & details of the materials shall be provided.
5. MTC from the raw material manufacturer shall be provided.

8. Manufacturing Plan & Sampling Plan:

The fastener manufacturer shall submit the Manufacturing & Inspection plan (MIP) and Sampling Plan (as per ISO3269 or equivalent international sampling standard) including the above requirements to BHEL for approval during enquiry stage.

9. Audit Checks at BHEL

BHEL reserves the right to carry out audit checks at any stage of manufacture on representative test bars or product. Supplies found defective during check or subsequent processing at BHEL are liable for rejection.

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