An ISO 9001
Company

Bharat Heavy Electricals Limited
(High Pressure Boiler Plant)
Tiruchirappalli – 620014, TAMIL NADU, INDIA
MATERIALS MANAGEMENT

TITLE : **SUPPLY OF HSFG BOLT, NUT & WASHER**	Phone: +91 **431 2577419** Email : **cmuthuvel@bheltry.co.in**

Reference Number: **Enquiry 1901500091-27**	**Enquiry Date:** 12.03.2015	**Due date for submission of quotation:** **27.03.2015**
You are requested to quote the Enquiry number date and due date in all your correspondences. This is only a request for quotation and not an order		

CORRIGENDUM

Details of Corrigendum
With reference to the above tender, the Technical Delivery Condition (TDC:5:211 Rev.02 Dt.28.10.2014) for the HSFG fasteners is attached herewith. Vendors have to confirm the specification by submitting the document along with your offer.

BHEL tender document, commercial terms & conditions with Price Bid formats and all annexures can be downloaded from BHEL's website http://www.bhel.com (Tenders notification page) or from the Govt. Tenders website http://tenders.gov.in (Public Sector Units > Bharat Heavy Electricals page) against Ref. No. **NIT_21776** or from http://eprocure.gov.in against Ref No: **2015_BHEL_286676_1**

Tenders should reach us before 14:00 hours on the due date Technical bid will be opened at 14:30 hours on the due date Tenders would be opened in presence of the tenderers who have submitted their offers and who may like to be present.	Yours faithfully, For **Bharat Heavy Electricals Limited** 13/3/15 **MUTHUVEL. C** Manager Purchase / PSS Materials Management BHEL, TRICHY - 620 014.

Revision record:

Rev 00: 18/10/2011 Fresh Issue released and Test Sampling Plan Rev 00

Rev 01: 19/04/2012 Cl 2: Requirement if the Carbon content is below 0.6% - Added for Bolts; Mn for Nuts: limited to 0.25 min instead of 0.25 max. Cl 5: Hardness of Bolt & Nut: Acceptance values changed. Cl 7: Preservation and Packing added and Test Sampling Plan Rev 01

Rev 02: 28/10/2014 Property class Bolt 10.9 and Nut 10 and its requirements added (for Neyveli 2x500MW Tower boiler) in all clauses and Test Sampling Plan Rev 02

1. SCOPE:

This technical delivery condition covers the requirements for the High strength structural steel bolts, Nuts and Washers applicable for boiler structures and shall be procured from the BHEL approved manufacturers only. The mandatory requirements, test methods and procedures from the applicable IS standards to confirm a product to its relevant latest IS standard shall be met with. TDC is in addition to specification.

Size, Specification and Qty: As per the BHEL Purchase order (PO) / BHEL Drawing. The bolts, nuts and washers shall be supplied in the dull black heat treated condition with residual coating of light oil.

For Bolts: IS: 3757 (Latest) Property class: 8.8 or 10.9. Product Grade C of IS Specification IS: 1367 Part 2 (Latest).

For Nuts: IS: 6623 (Latest) Property class: 8 or 10, Product Grade B

For Washers: IS: 6649 (Latest) Material: 45C8, Type-A: Plain hole Circular Washers. Grade: Ordinary

2. RAW MATERIAL:

- Bolts and Nuts: Rolled/Forged bar of Carbon steel. Washer: as per IS 1571 Part 2 (Latest)
- **Chemical composition:** Shall be checked on receipt of raw material at supplier works for every heat
  Bolts: Plain Carbon Steel, Carbon steel with additives (eg Br, Mn or Cr) – As per Table 2 of IS: 1367 Part 3 (Latest)
  Nuts: As per Table 4 of IS 1367 Part 6 (Latest)
  Washers: As per IS 1570 Part 2 and Sulphur, Phosphorous <0.06% in check analysis

3. DIMENSIONS AND TOLERANCES:

- Process: Cold/Hot Forging with Dies and tools clean of loose scale and sheet particles.
- Threads on the bolts shall be checked with a properly calibrated ring gauge with a tolerance class 6g. Threads on the nuts shall be checked with a properly calibrated plug gauge with tolerance class 6H (in an NABL accredited LAB).
- Dimensions of the Bolts shall be as per the table given in IS 3757 (Latest)
- Dimensions of the Nuts shall be as per the table given in IS: 6623 (Latest)
- Dimensions of the Washers shall be as per the table given in IS 6649 (Latest)

Note: The washers shall be flat with a maximum deviation not exceeding 0.25 mm from the straight edge laid along a line passing through the center of the hole. The hole of the washer shall be concentric with the outside dimensions within 0.50 mm. washers are required to be clipped to provide clearance, the clipped edge shall not be closer to the center of the washer than 0.9 of the bolt diameter.

4. Post Forming Heat Treatment (HT):

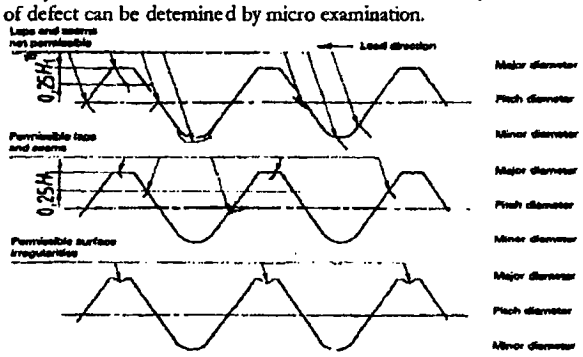
- Bolt: After forming shall be quenched (HT at AC 3 temperature, with soaking time 30minutes per inch followed by quenching) and tempered (at 425°C min, 60 minutes per inch). There should be a sufficient hardenability to ensure a structure consisting of approximately 90 % martensitic in the core of the threaded sections for the fasteners in the as-hardened condition before tempering.
- Nut: Shall be hardened and then tempered (at a temperature of 425°C minimum).
- Washer: Shall be hardened and tempered. Carburized washers are not permitted.

5. CHEMICAL & MECHANICAL & NDE: (on Heat Treated finished product)

Sample Size for Mechanical test: & NDE: As per Sampling Plan

BOLT :

Sl	Test	Test Method - As per Table 3 of IS: 1367 Part 3 (Latest)	Acceptance
1	Chemistry	Spectro / Wet Analysis Method – One sample for every heat Of raw material and One sample/HT batch on product	As per Cl 2.0 of this TDC
2	Hardness Test	Note: Surface hardness shall not be more than 30 Vickers above the measured core Hardness on the product when readings of both surface and core are carried out at HV 0.30. For property class 10.9, any increase in hardness at the surface which indicates that the surface hardness exceeds 390 HV is not acceptable.	8.8 – Min 255 HV Max 335 HV 10.9 – Min 320HV, Max 380HV
3	Minimum Tensile Strength, %Elongation on $5.65\sqrt{A}$, % Reduction in Area after fracture	*if wedge load test is satisfactory the axial tensile test is not required	8.8 – 830N/mm², 12 min, 52% min 10.9 – 1040 N/mm², 9 min, 48% min
4	Proof Load Test	8.8 – Proof Load of M16(91KN), M20 (147KN), M24 (212KN), M30 (337KN), M36 (490KN); 10.9 – Proof Load of M16(130KN), M20 (203KN), M24 (293KN), M30 (466KN), M36 (678KN) shall be applied axially to the bolt in a calibrated tensile testing machine for 15sec.	Length of the bolt after loading shall be the same as before loading within a tolerance of ± 12.5 µm allowed for measuremnt error.
5	Strength under Wedge load test	IS: 1367 Part 3 (Latest)	8.8 – ≮ 830N/mm2 10.9 – ≮ 1040 N/mm2
6	Decarburization Test at 200X min magnification	Determination of the following by MICROSCOPIC Method a)Minimum Height of non decarburized thread zone – E b)Maximum depth of complete decarburization – G	E = 2/3 H1 G = 0.015 mm
7	Hardness after Retempering	IS: 1367 Part 3 (Latest) # test not mandatory, to be applied in case of dispute only	Reduction of hardness 20 HV max.
8	NDE for Surface Intergrity	**before machining –** For bar Diameter ≥ 40 mm: UT as per ASTM A388. For bar Diameter < 40 mm: MPI as per ASTM E 709 **After machining –** MPI as per ASTM E 709 or as per ISO 6157 Part 3 (Latest)	UT – ASME SEC-VIII. Div-II Part: 3.3.4 (Latest). MPI – Linear indications like cracks, folds & other injurious defects are notacceptable.

9	Micro Examination for Surface Integrity – Laps at threaded region.	If any defectives found in visual and NDE examinations, the extent of defect can be detemined by micro examination. 	Max depth of laps in thread = 0.41 mm Laps of any depth or length are not permitted in the following places: • at the root of the thread • at the loaded flank of screw thread below the pitch diameter, even if they start beyond the pitch diameter. The following laps are permissible : • laps in the crest of the threads of 0.25 H1 max.; • crest of the threads not entirely rolled out, maximum half a turn on one thread; • laps below the pitch diameter, if they run on the non-loaded flank towards the major diameter and not deeper than 0.25 H1 and not longer than half a turn on one thread.

NUT: (on Heat Treated finished product)

Sl	Test	Test Method	Acceptance Value
1.	Chemistry	Spectro / Wet Analysis Method – For every heat Of raw material and, One sample/HT batch on product	As per Cl 2.0 of this TDC
2.	Hardness Test	Hardness of the test mandrel shall be minimum 45 HRC.	8S – Min 188 HV Max 372 HV 10S – Min 272 HV Max 372 HV
3.	Proof Load Test	Proof Load of 8S – M16(168.9KN), M20 (263.4KN), M24 (379.5KN), M30 (603.1KN), M36 (878.3KN) 10S – M16(195.5KN), M20 (305KN), M24 (439.5KN), M30 (698.4KN), M36 (1017.2KN) shall be applied axially to the nut in a tensile testing machine for 15sec.	The nut shall resist the load without failure by stripping or rupture, and shall be removble by the fingers after the load is released.
4.	NDE for Surface Intergrity	Before coating, as per IS 1367 Part 10 Cl 4.2 (Latest)	Linear indications like cracks, folds & Other injurious defects are not acceptable.

WASHER: As per IS 5369. The washers shall be free from cracks, burrs, pits and other defects. All sharp edges shall be removed. **(on Heat Treated finished product)**

Sl	Test	Test Method	Acceptance Value
1.	Chemistry	Spectro / Wet Analysis Method – For every heat Of raw material and One sample/HT batch batch on product.	As per Cl 2.0 of this TDC
2.	Hardness Test	IS 1586 (latest)	Min 35 HRC Max 45 HRC

6. MARKING, PRESERVATION AND PACKING:

The following to be hot stamped or embossed on the top surface of the bolt and nut:
Bolt – Manufacturer's Identification Symbol and 8.8S/10.9S
Nut – Manufacturer's Identification Symbol and 8S/ 10S
Washers – Shall be identified by – the provision of 2 nibs and manufacturers identification symbol being placed as near to the outer edge as possible.
The following details shall be clearly indicated in the tags tied to the bundle:
1) Customer Name 2) Manufacturer's Name 3) Vendor Code 4) Purchase Order No and Supplier internal W.O No 5) Quantum and Weight 6) BHEL Material Code 7) Item Description with diameter, length
Shall be packed in bituminous coated Polythene lined Hessian Cloth/Bag. Each bag shall contain only the same size of bolts/ nuts/ washers respectively and the same shall be indicated in the tags.

7. INSPECTION AND CERTIFICATION:

All the finished components shall be visually and dimensionally inspected as per sampling plan. All the test results shall be documented and maintained. Products to be inspected at works & test certificates (in English) shall be submitted with the following details counter signed by BHEL/BHEL Authorized Inspection agency as indicated in the PO. Manufacturers Test certificate (MTC) shall contain the following:

1) Purchase Order No. (BHEL), TDC No, Specification and Grade.
2) Name of raw material bar supplier.
3) Forming process
4) Dimensional reports for each product.
5) Chemistry including incidental elements on the raw material and final product checked in NABL lab/ suppliers own lab.
6) HT details of materials temperature, soaking time, ROH/ROC medium etc.
7) All Mechanical test result report including hardness.
8) MPI, Micro examination and decarburization test report with the reference & acceptance standard.
9) TC of raw material, UT/MPI report done on raw material shall accompany the MTC.

8. AUDITS AT BHEL:

BHEL reserve the right to reject any item found to be not meeting the requirements during tests at supplier works or during subsequent processing at BHEL.

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Prepared By		Reviewed By				Approved By

BHEL: TRICHY – 14

TEST SAMPLING PLAN FOR HSFG BOLTS, NUTS & WASHERS AS PER BHEL TDC: 5:211 Rev 02

Lot Size (In nos.)	SAMPLE SIZE										Remarks
	Visual (nos.)	Dimensional (nos.)	MPI (nos.)	Physical Tests							
				Total nos.	Hardness (nos.)	Hardness after Re-tempering (nos.)	Proof Load (nos.)	Wedge Load (nos.)	Min Tensile Strength (nos.)	Decarb (nos.)	
Upto 100	20	8	15	5	5	5	2	2	2	1	
101 to 300	32	13	15	5	5	5	2	2	2	1	
301 to 500	50	20	15	5	5	5	2	2	2	1	
501 to 1000	80	32	15	5	5	5	2	2	2	1	
1001 to 3000	125	50	25	8	8	8	2	4	2	1	Upto 1500 nos. 15 nos. for MPI
3001 to 10000	200	80	50	13	13	13	2	6	2	1	Upto 5000 nos. 25 nos. for MPI
10001 to 35000	315	125	75	20	20	20	4	10	4	2	Upto 15000 nos. 50 nos. for MPI
Above 35000	500	200	100	32	32	32	6	15	6	3	Upto 50000 nos. 75 nos. for MPI
Inspection by BHEL/BHEL AIA	W	W	W		W	W	W	W	W	W	

Remarks:

1. Acceptance Number is zero. If the sample is having deviations in Visual, Dimensional and MPI then the entire lot shall be 100% inspected. In case of deviations in Physical tests a second sample of twice the sample size of initial sample shall be taken. The lot will get rejected if the second sample fails.
2. Preservation & Packing: The bolts shall be supplied in the dull black heat treated condition with a residual coating of light oil. Finished products shall be packed in a bituminous coated Polythene lined Hessian cloth/bag. Each bag shall contain only the same size of bolts/nuts/washers respectively and the same shall be indicated in the tags.
3. Inspection by BHEL / BHEL AIA shown as "W" shall be witnessed for the sample size indicated against the lot size.

28/10/14	R. Venkanna 28/10/2014	28/X/2014	28/10/14	
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