JINDAL POWER LIMITED

4X600MW OPJ STPP, PHASE-III

RAIGARH

VOLUME: II B

SECTION - C

SPECIFIC TECHNICAL REQUIREMENTS FOR STRUCTURAL WORKS

SPECIFICATION NO. PE-TS-329-616-C001

Bharat Heavy Electricals Limited
Project Engineering Management
Power Sector, PPEI Building
Noida -201 301

SPECIFIC TECHNICAL REQUIREMENTS

1. GENERAL

Section-C covers specific technical requirements of contract and should be read in conjunction with BOQ, Section-D and other sections of the contract. In case of any conflict between the contents of BOQ and Section-C/Section-D, BOQ will prevail over Section-C/Section-D. In case of any conflict between Section-C and Section-D, Section-C will prevail over Section-D.

2. STEEL STRUCTURAL WORKS

Structural Steel shall conform to IS: 2062 Grade – A for rolled steel members or plates up to 20 mm thickness. For plates above 20 mm thickness and welded construction steel conforming to IS: 2062 Grade – B (killed and normalized) shall be used. **Steel shall be procured from JINDAL, SAIL or any other approved main producer. The materials are preferably procured from M/s JINDAL STEEL as per the MoU signed between BHEL and the concerned.**

Chequered plate shall conform to IS: 3502 (latest) and minimum thickness of chequered plate for floorings, covers etc. shall be 6 mm O/P.

All gratings shall be electroforged type. The surface shall be blast cleaned to near white metal surface (SA 2 ½) followed by two coats of epoxy resin based Zinc Phosphate Primer and two coats of approved color enameled finish paint. Staircase treads shall be provided with anti-skid nosing.

For hand railings GI pipe of medium grade conforming to IS: 1239 and galvanizing shall be smooth confirming to IS: 2633 shall be used. Hand railing shall be flush welded construction, ground smooth using 32 mm Nominal Bore of 42.2 mm outside diameter pipe, provided with double rail and pipe posts. Top rail shall be provided at 1000 mm above platform or as approved and pipe posts spaced not more than 1500 mm center to center. Hand rails post and rails shall have one coats of epoxy resin based Zinc Phosphate Primer. Final painting shall be same as given for painting on structures.

2.1. CONNECTIONS

Shop connections shall be all welded type and field connections shall generally be bolted type unless specified otherwise. Field bolts, wherever provided, shall be high tensile friction grip bolt of 20 mm dia. or of higher diameter and of property class 8.8 (minimum) as per IS:1367 (latest) for all major connections. All bolts, nuts and washers shall be procured from M/S Guest Keen Whalliams (G.K.W) or any other equivalent source approved by BHEL in future. The bolted joints shall be designed for friction type connection and the H.T. bolts shall be tightened to develop the

required pre-tension during their installation. However, the nominal connections in the field like girts, stairs, wall beams shall be done by means of M.S. black bolts, conforming to IS:1363 unless specified otherwise.

Welding shall be done in accordance with the recommendation of IS:816 – "Code of Practice for use of metal arc welding for general construction in mild steel" and IS:9595 - "Recommendation for Metal arc welding of Carbon and Carbon Manganese Steels". Submerged arc welding process shall be used for welding longitudinal fillet welds (connecting flanges with web) and longitudinal/transverse butt joints for fabrication of columns, framing beams, crane girders & and all other built up members unless manual arc welding is specifically required . All electrodes, flux, bare wire etc shall be procured from BHEL approved manufacturers, viz. Advani-Oerlikon, ESAB, D&H or any other equivalent approved source. All butt welds in beams, girders & columns shall be of full penetration. All butt welds shall be radio-graphically or ultrasonically tested as per relevant IS codes and standard practice. The bare wire electrodes for submerged arc welding shall conform to IS:7280. The combination of wire and flux shall satisfy requirement of IS: 3613.

Flux and wire combination for submerged Arc welding of Structural steel shall be as follows :
Filler wire shall be Automelt Gr-C wire of classification AWS-A-5.17-EH14 and flux shall be of agglomerated type (Automelt Gr.-IV) of classification AWS-A-5.17-F7A2EH 14 of Advani-Oerlikon make.

Following connections shall be provided during erection :

1. **Welded Connections** :

   i. Connection of 'Secondary Beam' to 'Main Beam'.
   ii. Connection of 'Vertical Bracing' to 'Column'.
   iii. Connection of 'Brackets' to 'column'.
   iv. Connection of 'Vertical Bracing' to 'Horizontal Bracing'.
   v. Connection of 'Horizontal Bracing' to 'Column'.
   vi. Connection of 'Bracket for Spandrel (Wall) Beam' to 'Column'.
   vii. Connection of other secondary structures.

2. HSFG connection (Grade 8.8 bolts)

   i. Connection of 'Crane Girder' to 'Column'.
   ii. Splice of 'Column' & Splice of 'Transverse Frame Girders'.
   iii. Connection between Crane Girders.
   iv. Connection of members where tension shall be in the fastener.

3. Bearing Type conection (H.T. bolts Grade 8.8)

   i. All removable type connections.
   ii. Connection of 'Purlins' to 'Roof Truss'.

4. <u>M.S Bolts (Gr. 4.6)</u>

i. Girts, Stairs, Wall beams.

5. <u>Low Hydrogen Electrodes</u> as approved by the Engineer shall invariably be used in the following cases :

i. For welding of all important joints such as Butt joints in Columns (flange or web), Butt joints in Main frame Beams (Flange or web) etc.

ii. For welding steel having thickness more than 20 mm.

In case of fillet weld between two components, the thickness of the thicker part shall be considered as the limit for (ii)

<u>Minimum preheat & inter pass temperatures</u> for welding over 40mm to 63 mm (thickness of the thicker part at the point of welding) shall be 66° C and for over 63 mm, it shall be 110° C. However, higher preheat & inter pass temperatures may be required due to joint restraint etc and shall be followed as per approved welding procedure.

Shop primer paint shall be two coats of epoxy resin based Zinc Phosphate Primer and shall conform to IS: 2074 in all respects. The surface preparation shall be done in accordance with IS: 1477 (Part I & II) – Code of Practice for finishing of Ferrous Metals in Buildings.

Stainless steel liner in the coal Bunkers shall be of grade AISI – 304 Finish Grade 2 B (Cold Rolled, Annealed & Pickled and Skin passed) and shall be provided on the inner faces of entire inclined portion of Hoppers and mouth of the Hoppers, without allowing any projections in coal flow path. The electrode classification as per AWS shall be as follows :

i/ For welding of stainless steel to stainless steel : E308L
ii/ For welding of stainless steel to mild steel : E309

<u>Design Of Connections</u>

i/ Fabrication drawings shall be prepared according to the provision of IS:800, IS:816, IS:9595, IS:1367 and IS:9178.

ii/ Connection of vertical bracings with connecting members and diagonals of truss members shall be designed for full tensile capacity of the bracings.

iii/ Size of fillet weld for flange to web connection for built up section shall be as follows :

a. Full shear capacity or actual shear which ever is more for box section.

b. 80% of full shear capacity or actual shear (if indicated in drawings) or 0.5 times of the web thickness which ever is more. For I section Weld shall be double fillet.

c. All welds shall be continuous. The minimum size of the fillet weld shall be as per relevant IS code.

iv/ Shear connections shall be designed for 75% of section strength for rolled sections and 80% of section strength for built up section or rolled section with cover plates. Designed shear force shall be more than actual shear.

v/ Moment connections between beam and column shall be designed for 100% of moment capacity of the beam section.

vi/ All butt welds shall be full penetration butt welds.

vii/ The connection between top flange & web of crane girder shall be full penetration butt weld & for bottom flange, connection may be fillet weld.

viii/Connection of base plate & gusset members with the columns shall be done considering that total load gets transferred through weld.

ix/ Splicing : All splicing work shall be full strength. Field splicing shall be done with web /flange cover plates. For, exceptional cases the field splicing shall be designed for 50% of load carried by the cover plates and remaining 50% load through full penetration butt weld. Shop splicing for all sections other than rolled shall be carried out by full penetration butt welds with no cover plates. Splicing for all rolled sections shall be carried out using web and flange cover plate.

2.2. Minimum Tests To Be Carried Out During Fabrication & Erection Of Structural Steel

1. **Steel**

Ultrasonic test: plates above 25mm thickness shall be subjected to ultrasonic test as per ASTM-A435 or equivalent to check the presence of Lamination.

2. **Fillet Weld**

Dye penetration test : 5% of the total length, Dye penetration shall be carried out to the root run.

3. **Butt Weld**

Dye penetration test: 10% of the total length, Dye penetration test shall be carried out to the root run after back gouging.

Radiography: Generally, splicing shall not be provided in tension flange of Bunker Girders. Spot radiography shall be carried out on 100% joints in Tension zone &10%

joints in compression zone. Minimum 300 mm length shall be spot radio-graphed. When radiograph is not possible ultrasonic test shall be carried out after grinding the surface with prior approval of Engineer.

Ultrasonic Test: 10% of all other Butt welds shall be subject to spot radiographic test and the entire balance butt weld for ultrasonic test.

2.3. Painting of Structures

Material

Material shall be highest- grade products and shall be delivered to the site in original sealed containers, bearing brand name, manufactures name and colour shade with labels intact and seals unbroken. All materials shall be subject to the inspection, analysis and approved by the Engineer. For satisfactory results, it is desired that primer and finishing paints etc. are to be obtained by the bidder from the same manufacturer. All paints shall be subject to analysis from random sample taken at site from painters bucket, if so desired by the Engineer. Paint shall be stirred frequently to keep the pigment in suspension. Paint shall be ready mixed in original sealed container as packed by the paint manufacturer. Paints purchased for the work shall be brought to site in sealed container and shall be opened in the presence of the Engineer or his authorized representative.

Paints, primers etc required under this contract should be procured from approved manufacturers, viz. Berger Paints or any other equivalent sources approved by BHEL. In this regard, BHEL's decision is final and binding to the bidder. Each and every supply of primer, finishing paints, etc. should be accompanied by manufacturer's test certificates. At the time of procurement, the bidder should furnish all the procurement details to BHEL i.e., the type of material procured (primer, finishing paints etc.), quantity, source of procurement and shall submit all test certificates to BHEL. Bidder shall supply the paints in the exact colour / shade and type of finish of the paint, as per direction of BHEL and no extra payment shall be entertained by BHEL for the above.

All colors shall be approved by Engineer and tinting and matching shall be done to the satisfaction of the Engineer. In such case where samples are required they shall be executed in advance with the specified materials for the approval of the Engineer.

Primer (Epoxy Resin based Zinc Phosphate)

The primer shall be two coats of **epoxy resin based Zinc Phosphate** conforming to the requirements of IS: 2074 (Latest). Total DFT will be 100 microns in two layers of 50 micron each after fabrication and intermediate coat (or under coat). The primer should conform all the requirements of IS code and any deviation in any respect from IS code shall not be accepted. The paint should be approved by the Engineer. The surface preparation will be done in accordance with IS: 1477 (Part I & II) – Code of Practice for finishing of Ferrous Metals in Buildings.

Finishing Coats (Epoxy resin based paint pigmented with Titanium dioxide)

The finishing coat shall be of epoxy resin based paint pigmented with Titanium dioxide with min. DFT of 100 microns. Top coat shall consist of one coat of epoxy paint suitably pigmented of approved shade and colour with glossy finish and DFT of 75 microns. Additionally finishing coat of polyurethane of minimum DFT of 25 microns shall be provided. The paint shall give a smooth, hard, durable and glossy finish to all surfaces. Bidder shall supply the paints in the exact colour / shade and type of finish of the paint, as per direction of BHEL and no extra payment shall be entertained by BHEL for the above. The paint should conform to all the requirements of IS code and any deviation in any respect from IS code shall not be accepted. The paint should be approved by the Engineer.

Surface Preparation And Pre-Treatment (Structure)

The surface preparation shall be done in accordance with IS: 1477- Part-I (latest)- "Code of Practice for painting of Ferrous Metals in Buildings: Part I (Pre-Treatment)" and as directed by the Engineer.

The metal surfaces shall be absolutely clean, dry and free from rust, scales, weld stag, flux deposit, soap films, wax, dirt, oil, grease, foreign matters like cement mortar, etc. and free from existing loose epoxy resin based Zinc Phosphate Primer and should be removed by means of wire brushes. Hand-scrappers, sand paper, emery cloth, emery papers, mechanical power tools, etc. or by other effective methods, Such as using solvent cleaning etc. where necessary and as per relevant IS codes and as directed by the Engineer. It should be remembered that perfectly clean surface is of great importance while dealing with die painting of ferrous metal. The surfaces should be carefully inspected and in cases, where the existing epoxy resin based Zinc Phosphate Primer is removed while cleaning the surfaces, the damaged portion should be thoroughly degreased by clean solvent swabbing, any corrosion products formed should be thoroughly removed and touched up with a coat of epoxy resin based Zinc Phosphate Primer. No extra payment shall be entertained by BHEL for the above. The actual painting work should be commenced only after obtaining clearance from the Engineer or his authorized representative regarding proper cleaning of the surface.

Application (Structure)

General

The painting work shall be carried out as per the colour scheme of BHEL or as per direction of the Engineer and the Bidder shall procure the paints accordingly. The method of application shall be as recommended by the manufacturer. In case of selection of special shades and colour (not available in standard shades) the Bidder

shall mix different shades and prepare test panels of minimum size 1 meter square as per instruction of the Engineer and obtain his approval prior of application of finishing paints.

Immediately after the preparation of the surface, and providing the touch of primer in the damaged area, the first coat of primer shall be provided by brush and ensuring a continuous film without 'holidays'. After the first coat is hard dry, apply a second coat of primer so that a film perfectly free from 'holidays' is obtained. The second or subsequent finishing coats may be applied after the first finishing coat is hard dry and its gloss is knocked off by scuffing with a very fine cutting device. The surface should be dry, clean, and free from dust and moisture before subsequent coat is applied. it is essential to avoid corrosion or any other paint defects, which may result due to trapped of foreign materials in the paint film. All painting work shall be done in accordance with relevant I. S codes.

Proper tools and implements shall be used. Scaffoldings, if used, shall be independent of the surface to be painted to avoid shade differences of the freshly repaired anchor holes. Painting shall be done by skilled labours in a workman like manner. All materials shall be applied evenly and thoroughly so as to be free of sags, runs, crawls or other defects. All coats shall be of proper consistency. In case of application by brush, no brush marks shall be visible. The brushes shall be clean and in good condition before application of paint. The use, conditioning and maintenance of brushes for painting shall conform to the requirements given in Appendix-A of IS: 1477-part-II (latest).

No work shall be done under conditions that are unsuitable for production of good results. Application of paint which seals the surface to moisture shall. Only be done after the moisture on and below the surface has dried out. All coats shall be thoroughly dry before succeeding coat is applied. Coats of painting as specified are intended to cover surfaces perfectly. In case the surface is not covered properly by applying specified number of coats, further coats shall be applied by the Bidder to conform the paint as per acceptance criteria of this contract. Approval of the Engineer is to be obtained by the Bidder before application of each coat and no paint shall be applied until the surface for painting has been accepted by the Engineer. The sequence of painting of the structural members shall be as per direction of BHEL and binding to the bidder. Finishing coats shall be of exact colour and shade as per approved samples and all finish shall be uniform in colour and texture. All parts of mouldings and ornaments shall be left clean and true to finish.

The surface, which has to be connected using friction type joint, shall not be applied with primer and finish paint before the completion of site connection. Similarly the portion of columns, which shall be encased in concrete, shall not be applied with primer and finish paint and shall be given a coat of neat cement wash.

Minimum Total Thickness Of Paint

Painting on ferrous metal surface shall be done as per IS: 1477(part I &II). The total dry film thickness of the finished paint should not be less than 100 microns, including whatever may be available dry film thickness of the existing epoxy resin based Zinc Phosphate Primer. The thickness shall be measured by alcometer or any other approved method as directed by the Engineer.

Structural steel work Tolerances

Tolerances on dimensions for fabrication of steel structures shall be according to IS: 7215.

Tolerances on dimensions for erection of steel structures shall be according to IS: 12843.