

TECHNICAL CONDITIONS OF CONTRACT (TCC)



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Chapter I- Project Information

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Chapter I- Project Information

1.0 INTRODUCTION

THDC, a joint venture of Government of India & Government of UP, has awarded the work to BHEL for supply, erection and commissioning of “Turbine Generator and Associated packages” for 2x660MW Coal based Khurja STPP at Khurja, U.P.

The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given here in under is for general guidance and shall not be contractually binding on BHEL/Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.

S.No.	Title	Description
1	Owner	THDC India Limited
2	Consultant	NTPC Limited
3	Project Title	2X660MW KHURJA STPP – STG PACKAGE
4	Project Site Location	Khurja STPP is located in Bulandshahar district of Uttar Pradesh. The site is situated near villages Dushhara-kherli, Jahanpur, Naiphal (Unchagaon) and Rukunpur. The district Headquarters Bulandshahar is about 32Kms. Distance of the project site from Delhi is about 90Kms.
5	Nearest Railway Station	The nearest railway station Danwar on Delhi-Kolkata section (via Aligarh) is approx. 5Km away from the project site. The nearest major railway station is Khurja at a distance of about 11kms.
6	Nearest Airport	The nearest commercial airport is Delhi at about 120 km by road
7	Nearest Highway	NH34
8	Nearest Water Body	The upper Ganga canal passes near by the Khurja STPP at a distance of about 13 Kms
9	Land	Land is in possession of THDC
10	Location Co ordinate	Project is located between 28°08'35" to 28°10'25" Northern latitude and 77°53'47" to 77°55'22" Eastern longitude.
11	Seismic Data	The area falls in Zone III (Moderate), according to the Indian Standard Seismic Zoning Map

Note: - The bidder is advised to visit and examine the site of works and its surroundings and obtain for himself on his own responsibility all information that may be necessary for preparing the bid and entering into the Contract. All costs for and associated with site visits shall be borne by the bidder.

2.0 Scope of work

The work to be carried out under the scope of these specifications is broadly as under:

Detailed drawing preparation based on Input design drawings provided by BHEL for Main Power House and other structures as specified in scope, getting approval from BHEL/ THDC/NTPC, Fabrication and supply of finished factory fabricated structure (Raw steel will be supplied by BHEL) for 2x660MW Khurja STPP as per BOM/Drawings.

Detailed scope of work (Package-A):

- Factory Fabrication and supply of Bolted/welded Structure Work of Power House building of Unit-1 (Grid1 -14a)
- Pipe/cable rack
- Cladding support structural work of Power House
- Miscellaneous structural work

Detailed scope of work (Package-B):

- Factory Fabrication and supply of Bolted/welded Structure Work of Power House building of Unit-2 (Grid 15-27)
- Common Control room
- Cladding support structural work of Power House

Based on input design/engineering drawings of Main Power House preparation of detailed drawings, bill of materials, material codification, obtaining approvals from BHEL/ THDC/NTPC.

- a) Preparation of fabrication drawings using 3-D modelling softwares like TEKLA or equivalent, joint design calculations and all other general and special requirements, including appointment of a separate agency for **preparing & checking of detailed engineering drawing of the above stated work**. Separate agency for detailed engineering shall be in consultation and approval of BHEL/THDC/NTPC. Initially BHEL will supply 500 MT of Structural steel to Vendor based on requirement arrived from drawings by BHEL Engineering, after this Vendor has to place requirement of steel as per terms and condition of contract stipulated elsewhere.
- b) Vendor to take approval from BHEL/THDC/NTPC for detailed fabrication drawings. Approval of fabrication drawing does not relieve the Vendor from the responsibility of its correctness and accuracy.

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- 2.1 Supply of finished factory fabricated structure at site** as per BOM/Drawings. Scope of supply work includes:
- 2.1.1 After receipt of Purchase Order, Vendor shall discuss with Construction Manager of BHEL regarding starting of structural fabrication job. The successful Vendor will tie up with detailers for preparation of detailed fabrication drawing, BOM preparation, and submission of same to BHEL and getting approval from BHEL/THDC/NTPC. Appointment of detailer shall be in consultation and approval of BHEL/THDC/NTPC. On receipt of approval of detailed drawings, successful Vendor will start fabrication job in approved "FABRICATION WORKSHOP / FACTORY" in line with approved drawings, specifications and quality plan. Vendor shall mobilize further resources at workshop as per requirement to commence the job of fabrication, testing, shot blasting, painting etc. to match schedule of the project.
- 2.1.2 The total quantity of steel required for the job will be calculated from the approved fabrication drawings including lugs. In case any such sectional weights are not available in the above documents, the manufacturer recommendation / BHEL Engineer instruction/Indian Standard Code recommendation shall be binding. BHEL reserves the right to reject any material not found satisfactory.
- 2.1.3 BHEL will issue Raw material directly to vendor's work either from the BHEL Steel supplier or from any BHEL Source.
- 2.1.4 Vendor will have to receive & unload the raw material from suppliers' vehicles using vendor's own T&P and manpower at Vendor's facilities/works/factory, stacking, stock keeping, watch & ward of the Material at Vendor's factory. Material shall be stored properly in order to avoid any foreign defect. Proper watch and ward shall be in place for the BHEL Raw material.
- 2.1.5 Vendor shall have in House weigh bridge facility or third party tie up within the factory vicinity of 5 KM. Such weighbridge capacity shall not be less than 40 MT. Weighment tolerance shall be 70 Kg for minimum truck load of 20 MT and above. Vendor must provide exclusive manpower for generation of Material Receipt Voucher (MRV). MRV format will be provided by BHEL during execution of the work. MRV will be duly verified by BHEL Resident engineer.
- 2.1.6 BHEL resident engineer shall duly verify the material sent by BHEL steel supplier or from any BHEL Source, LR receipt of BHEL Steel supplier shall counter verified and signed by Vendor and BHEL resident engineer. MRV & RIV (Receipt issue Voucher) will be separate. RIV will be issued to Vendor by BHEL Resident engineer.
- 2.1.7 Proper Office space with Desktop Computers/Laptop with Internet facility shall be provided to BHEL employees (02 Nos.) by successful Vendor. Further, suitable transportation facility shall be arranged for BHEL Resident engineer for "To and Fro" movement from residing Location to Fabrication Location.
- 2.1.8 Fabrication, welding, destructive, non-destructive and any other tests as per approved

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Quality plan /THDC/NTPC/BHEL requirement.

- 2.1.9 Straightening, making cutting plan, cutting, bending, rolling, grinding, drilling, bolting, temporary pre assembly- full length column height (Trial assembly), edge preparation, preheating (min preheat and interpass temperature of 20 degree C for welding over 20 mm and up to 40 mm & 66 degree C for welding over 40 mm and up to 63 mm & 110 degree C for thickness over 63 mm & use of low hydrogen/ radiogenic electrodes), post heating, testing of welders, inspection of welds, visual inspection, nondestructive and special testing, rectification and correction of defective welding works, production test plate, inspection and testing as per erection scheme.
- 2.1.10 All Materials shall be procured from the THDC/NTPC approved sources only.
- 2.1.11 Surface preparation and painting as per BHEL/THDC/NTPC specifications.
- 2.1.12 Preassembly of columns (2-3 pieces of 12M Length each column), Trial assembly of finished material at Vendor's works / factory as per BHEL instructions / approved drawings using Vendors T&P at his own cost. No separate cost will be paid for Trial Pre assembly activity. Vendors may quote considering all such hidden activity as extra in their rate price. BHEL/THDC/ NTPC may visit Vendor's factory for inspecting the Trial Pre assembly activity
- 2.1.13 Delivering finished fabricated products from factory to 2x660MW Khurja STPP site as as per BOQ of rate schedule, specification, drawings and instructions of the Engineer.
- 2.1.14 BHEL/THDC/NTPC may visit fabrication shop for checking eligibility/competency of shop. Approval from NTPC is required before start the fabrication job. In any discrepancy Vendor shall be complied as per BHEL/NTPC requirement at any stage of job.
- 2.1.15 **Shop Erection:** The steelwork shall be temporarily shop-erected complete or as directed by the Engineer so that accuracy of fit may be checked before dispatch. The parts shall be shop-erected with a sufficient number of parallel drifts to bring and keep the parts in place. In case of parts drilled or punched using steel jigs to make all similar parts interchangeable, the steelwork shall be shop erected in such a way as will facilitate the check of interchange ability

2.2 Specific for Fabrication and Supply Contract:

- 2.2.1. Raw steel will be supplied by BHEL against Bank Guarantee Equivalent to 50% of steel value as the work will be carried out at vendor's premises.
Raw steel will be delivered to vendor's workshop/premises directly by BHEL.

Separate storage area and Engineer shall be allotted by Vendor for BHEL Material. BHEL will post resident engineer, **BHEL** employee for supervision of day to day work.
- 2.2.2. Items covered under this contract shall be subjected to Inspection / Testing and Quality

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Surveillance. The inspection agency shall at reasonable times, have access to vendor's works. Quality control records. All reasonable facilities required for carrying out the inspection and testing efficiently, shall be provided by the vendor, free of cost. The method of inspection shall be agreed upon in the Approved "Quality Plan" which shall form part of the contract. Wherever possible, standard quality plan, by way of minimum requirements, are included in the bid specification as a guideline.

- 2.2.3. The Vendor shall abide fully by all the clauses of Shop inspection and tests covered in Technical Specification. BHEL reserves the right to consider any stage of inspection / test as a "Hold Point", beyond which work shall not proceed without acceptance of that stage.
- 2.2.4. The minimum Inspection / Testing requirements shall conform to relevant codes / standards as well as Statutory Regulations applicable, whether or not specifically mentioned in the specification, in addition to those normally carried out by the vendor.
- 2.2.5. Unless the Inspection / Test is waived, the inspection agency shall attend the Inspection / Test within 15 days of the date of receipt of notice from the vendor, failing which the vendor may proceed with the Inspection / Test and shall forward duly certified copies of the Inspection / Test Reports. After successful completion of the Inspection / Test or receipt of Vendor's Test reports mentioned above, the Inspection agency shall issue within 15 days, the acceptance certificate.
- 2.2.6. Wherever Customer / Consultant "Hold Points" are indicated in the approved Quality Plan an additional 10 days' notice shall be given for Inspection / Testing.
- 2.2.7. Before sending written notice to the Inspection Agency, the Vendor's own inspection staff should have fully inspected / tested the item. If the visit of the Inspection Agency proves to be futile on account of the item not being ready for inspection / Testing or the same being rejected to reasons which could otherwise, have been detected during Vendor's own Inspection / Test, the cost incurred by Inspection Agency on such visits shall be borne by the vendor.
- 2.2.8. Approval or passing of Inspection / Test and thereby issue of the acceptance Certificates or waive of Inspection by the Inspection Agency shall not relieve the vendor of his responsibilities and obligations under the contract and also shall not bind BHEL to accept the item should it, on further tests after receipt at destination, erection / commissioning be found not complying with the Contract.
- 2.2.9. All necessary documents such as test reports, test certificates, test curves, stress relieving charts, radio graphic films and other non-destructive tests, copies of the welding procedure, welder qualification certificates and other documents in support of adherence to Quality plan shall be furnished to the Inspection agency. The Quality Assurance document consisting of certified copies of all of the above complied sequentially by the vendor shall be sent to BHEL prior to dispatch.
- 2.2.10. The vendor shall provide test pieces as required by Inspection agency to enable him to determine the Quality of Material supplied under the contract. If any test piece fails to

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comply with the requirements the inspection agency may reject the whole material represented by the test piece.

- 2.2.11. In the event of inspection revealing poor quality of goods, BHEL shall be at liberty to specify additional Inspection / Test, required ascertaining Vendor's compliance with the equipment specification.
- 2.2.12. All welding shall be carried out in accordance with applicable codes or approved equal. Welding procedure and Welder's qualification shall be got approved. Welding consumables used shall be approved by the inspection agency.
- 2.2.13. Approved methods of radiographic, ultrasonic or other non-destructive testing as applicable shall be used for the welding of critical components / assembly.
- 2.2.14. None of the item shall be dispatched without the receipt of "Quality Surveillance Note" from the Inspection Agency as well as the written approval in the form of Material Dispatch Clearance Certificate (MDCC) unless specifically agreed.
- 2.2.15. All supplied fabricated structures shall be marked with clearly identifiable erection mark numbers as shown in the fabrication/ detailed drawings. This will be duly verified at site during material receipt based on which MRC shall be prepared.
- 2.2.16. To address any mismatch during erection stage, the successful Vendor shall deploy a technical person on continuous basis at site for proper co-ordination with various agencies so that problem is attended / rectified without any time gap.
- 2.2.17. Material Despatch Clearance Certificate (MDCC) for Supply of Fabricated Structures to be issued by customer/BHEL before supply of finished material.
- 2.2.18. The affixing of Inspection Stamp on the item by the Inspection Agency is for the purpose of identification only and shall not be considered as a token of acceptance.
- 2.2.19. The above conditions are equally applicable to the agency on which the vendor has sub ordered as it shall be construed as if the works are manufactured or assembled at Vendor's own premises of works.

2.3 Quality Plan:

- 2.3.1. The Quality Plan is a document, which presents in a tabular form the Quality control checks exercised by the vendor during the various stages of manufacture and dispatch in order to meet the requirements of this specification. This plan details, step by step, the operations, components and characteristics being controlled, method of exercising such controls, the importance (criticality) of the control (critical major or minor) with respect to the functioning of the item the extent to which the controls are exercised (100% samples, one per heat, etc.). Acceptance norms for the characteristics, method of maintaining records thereof as a proof of having exercised the control successfully, the agency responsible for performing and witnessing the checks and for verifying the

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records thereof.

- 2.3.2. The Vendors shall furnish the Quality Plan for approval from BHEL / THDC/NTPC. In case the Standard Quality plans are included in tender specification, the Vendor shall furnish his Quality Plan strictly in line with the same. Instructions for filling the Quality Plan format are given on the back of the format.
- 2.3.3. Copies of Vendor's/Vendor's Collaborators catalogues/ drawings/ standards/ specifications/ procedures etc. as mentioned in reference document of the Quality Plan shall be furnished for approval.
- 2.3.4. In the Quality Plan, the Vendor shall give in detail, the quality control checks exercised by him during the various stages of fabrication / manufacture such as:
 - (a) All bought out items and incoming material checks carried out at sources and on receipt.
 - (b) Process of manufacture i.e. welding, heat treatment etc.
 - (c) Manufacture of various components, sub-assemblies and assembly.
 - (d) Final Inspection and Testing including Performance Test at shop.
 - (e) Surface preparation and painting.
 - (f) Packing, Marking and Dispatch.

2.4 Inspection Agency:

Inspection of packages shall be carried out by agency as per below Inspection category of packages:

- 1. **Cat I:** - Inspection shall be done jointly by THDC/NTPC, BHEL & Successful Vendor.
- 2. **Cat-II:** - Inspection shall be done by BHEL & Successful Vendor.
- 3. **Cat-III:** - Certificate of Compliance shall be furnished by Successful Vendor.

Please note, for Cat I & II items BHEL reserve the right to carry inspection by themselves or through nominated third party. For Inspection agency for various items, vendor may refer to Quality Plan.

2.5 Material Dispatch Clearance Certificate (MDCC)

- 2.5.1 When the tests have been satisfactorily completed at the vendor's works, the Inspection Agency shall issue a certificate to that effect within fifteen (15) days after completion of tests, but if the tests were not witnessed by the Inspection Agency or his representative, the certificate would be issued within fifteen (15) days of the receipt of the test certificates by the Inspection Agency.
- 2.5.2 BHEL / THDC will issue MDCC to the Vendor based on the QS Note/Report from the Inspection Agency.
- 2.5.3 Vendor will not dispatch any material before issue of MDCC by BHEL/THDC.

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- 2.5.4 The satisfactory completion of these tests or the issue of MDCC, shall not bind BHEL / THDC to accept the supply/equipment, should it, on further tests after erection, be found not to comply with the contract provisions.

For Cat-I item, MDCC shall be issued by THDC and it's the responsibility of vendor to arrange MDCC from them, and original MDCC shall be attached with Invoice by Vendor for claiming payment from BHEL

For Cat-II & Cat-III items, MDCC shall be issued by THDC/BHEL, which shall be valid for vendor payment.

2.6 GENERAL INSTRUCTION FOR DISPATCH:

- 2.6.1 No equipment / material shall be dispatched without prior consent of BHEL / THDC. Vendor shall dispatch the equipment / material only after receipt of "Quality Surveillance Note" and Material dispatch Clearance Certificate (MDCC) issued by BHEL / THDC.

- 2.6.2 Vendor shall notify in writing to site at least within 15 days in advance of shipment, the probable date, when the equipment / material shall be ready for dispatch.

- 2.6.3 Immediately after the shipment is made, necessary shipping / transport documents shall be sent by the vendor in accordance with the instructions of BHEL. The shipping documents / transport documents shall comprise of the following:

- a) Railway Receipt / Lorry Receipt as applicable
- b) Freight invoice
- c) FOR Invoice
- d) Packing List (No of copies as required)
- e) Certificate of origin
- f) Letter to Insurers
- g) Quality Surveillance Note

- 2.6.4 The distribution procedure for the above documents shall be as per the "dispatch instructions".

A) Consignee Address:

Construction Manager / BHEL Site Office,
2x660MW Khurja STPP
Village & Post- Dashera Kherli, Tehsil- Khurja
Distt – Bulandshahar, State- Uttar Pradesh- 203131

Note:

1. Consignee address in LR should be strictly as per above.
2. Seller / vendor to note that to effect "Sale in Transit", BHEL shall issue "Delivery Note" to the Transporter for transferring the ownership from BHEL to customer (THDC).

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3. Delivery note shall be carried by transporter along with other dispatch documents.

B) Road Permit Requirement: As per requirement.

C) Mode of Dispatch: By Road

Note: It is Seller / vendor responsibility to ensure availability of vehicle well in advance for dispatch of material to meet contractual delivery requirement and as per instruction of BHEL engineer.

D) Transit Insurance: In BHEL Scope

Prior dispatch intimation shall be issued to Insurance agency about the value of consignment, dispatch details, along with one set of documents consisting of LR/RR copy, packing list / Challan indicating the items dispatched (with their weights.) A copy of above should be sent to BHEL Khurja site office (address same as consignee address).

E) Packing:

1. The packing shall be in conformity with specification and shall be such as to ensure prevention of damages, corrosion, deterioration, shortages, pilferage and loss in transit or storage.
2. Packing list shall be submitted as per standard format along with advance set of documents for claiming payment which shall also indicate: -
 - a) Packing size.
 - b) Gross weight and net weight of each package.
 - c) Contents of the package with quantity of each item separately.

F) Transportation & Freight Charges:

1. All road dispatches shall be through the carriers, assigned in consultation with BHEL.
2. Owing to any reason, in case the seller / vendor has to resort to a mode of transport other than what was contemplated, to keep up the delivery / completion schedule incurring extra expenditure, such extra expenditure shall be borne by the seller / vendor .
3. Any charge against ODC consignment shall be borne by seller / vendor
4. Freight charges shall be borne by the seller / vendor .
5. Any charges related to the transportation of fabricated material till site is to be borne by the seller / vendor .

2.7 MATERIAL RECEIPT CERTIFICATE:

The Seller/vendor shall arrange Material Receipt Certificate (MRC) at project site, duly signed by the BHEL/THDC Site Engineer, after receipt of the material at site and its physical verification.

2.8 SHORTAGES/DAMAGES:

Any shortages or damages during transit, transportation or handling at site, including at the time of erection and commissioning, shall be made good by the Seller/ Vendor at his risk and costs, to meet the project schedule. In case of faults/discrepancies in any material, component, sub-assembly, assembly, etc., the same shall be supplied/replenished free of cost to enable the equipment to be put in service. Shortages in some cases shall also be replenished free of cost.

2.9 Dispatch Documents required (to be furnished by vendor):

A: For customer billing by PSNR, the vendor shall provide the following documents to BHEL-PSNR in 4 sets:

1. Copy of vendor Invoice
2. Copy of Packing List Indicating Quantity / Gross weight/Net Weight and NTPC approved BBU item no. wherever applicable against each item dispatched.
3. MDCC (Original THDC/NTPC MDCC, if applicable).
4. CHP issued by THDC/NTPC – Original (if applicable).
5. Insurance intimation copy
6. Test certificate / Inspection Reports- Original (For Cat II & III packages).

B: For vendor payments by PSNR, the following documents are required in 4 sets:

1. Original vendor Invoice
2. LR copy (Consignee address shall be BHEL Khurja site).
3. Packing list.
4. Copy of insurance intimation letter / e-mail. (Intimation to Insurance agency to be sent on the same day of dispatch.)
5. Guarantee certificates in line with PO terms- Original.
6. MDCC – Copy.
7. Material Receipt certificate by BHEL/site

In addition to the above, vendor may furnish mfg. clearance/drg/docs approval date for the purpose of determining contractual delivery for expeditious processing of Invoices.

C: Checklist for submission of Bills:

Vendor should ensure that the following documents are submitted for bill processing to avoid any delay in processing of payment:

- a) Invoice – duly signed by Vendor with seal. Vendor shall submit 100% Invoice.
- b) Invoice Annexures - duly signed by Vendor with seal.
- c) GST Invoice – Original for buyer and Duplicate for transporter copies
- d) Original Inspection Reports (IRs) – with relevant painting/SB remarks and ODC details (if applicable) - duly signed by BHEL QC inspector and Vendor with seal.

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2.10 Raw Material issue and its Accountal:

The Vendor shall ensure Material Accounting within 365 days from date of issue of materials. This is a statutory requirement and must be strictly complied with. In case Material Accounting within 365 days from the date of first issue of raw material due to vendor's default, the amount payable by BHEL to Government (i.e. GST @ 18% of input material value + applicable interest for 365 days) will be recovered from the Vendor as penalty. The recovery/ penalty will be calculated separately for each material gate pass wherever the period crosses 365 days under a purchase order/ contract.

2.11 Reconciliation of steel issued by BHEL (free of cost):

- 2.11.1 All steel like structural steel as specified in relevant BOQ shall be issued free of cost by BHEL unless specified otherwise in BOQ for use in the work covered in this contract from BHEL stores/storage yard/BHEL direct issue upto Vendor shop. The Vendor shall collect these materials from BHEL at vendors work at his own cost and store the same at the work site or in his stores as per standard norms.
- 2.11.2 BHEL reserves the right to recover from the Vendor any loss arising out of damage/ theft or any other causes or during verification/stacking or at any time under the custody of the vendor.
- 2.11.3 The Vendor shall in no case be entitled for any compensation on account of any delay in supply or non-supply thereof for all or any such materials. However, in case of non-availability of any specific section(s) which delays the completion of work, such cases shall be recorded separately in monthly planning format (F14) and shall be considered for time extension of contract.
- 2.11.4 Vendor will have to make his own arrangement at his own cost for procurement of any other materials except as mentioned above, as required for the works and of such quality as acceptable to BHEL.
- 2.11.5 The Vendor shall maintain proper store account for all the BHEL issued materials and shall give Three (03) copies of monthly-computerized reconciliation statement of such account showing total receipt, consumption and balance at Vendor works to the BHEL. BHEL Engineer's certification for the reconciliation of steel shall be final. The detailed reconciliation (dia. Wise or as required) shall be done at least once in three months (03) or before submission of final bill which comes earlier.
- 2.11.6 Vendor shall also carryout in complete association with BHEL, the material management functions and execution like day-to-day update of materials, issued to vendor, accounting for surplus/scrap material returned etc. These functions shall also be carried out through computerized system utilizing suitable software. Vendor shall engage experienced software personnel to associate on dedicated basis for efficient discharge of the same in time.
- 2.11.7 The Vendor shall solely be responsible for the safety & security of material after it is handed over and issued to Vendor by the BHEL.

2.12 HANDLING OF MATERIALS ISSUED BY BHEL:

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- 2.12.1 Materials shall be issued by BHEL based on the **weightment basis**. Direct issues shall be as per the Challan/dispatch document/LR received with the consignment. In such cases, Vendor shall do unloading of materials from trucks/lorry at their own cost.
- 2.12.2 All materials issued by BHEL shall be stacked, stored above ground level by use of concrete or wooden sleepers. No materials shall remain on ground at any time. All concrete or wooden sleepers required for stacking the materials shall be arranged by Vendor (successful Vendor of this package) at his own cost within the quoted rates.
- 2.12.3 Materials issued will be used only for construction of permanent works. The Vendor shall take care of material issued by BHEL and shall protect the same from theft, damage and weathering. Excessive rusting of steel in custody of agency/Vendor must be avoided. In case, due to any cause attributable to the vendor, such rusting of steel occur rendering the same unusable, then such quantity of steel shall be recovered from the interim payment at the penal rate specified in the tender.

2.13 ISSUE OF STEEL

The steel shall be issued to the Vendor on the following basis:

Structural Steel: Weightment Basis (Unit – MT)

All the steel (structural) issued by BHEL shall be properly accounted for. The total quantity of steel required for the work will be calculated from the approved, fabrication drawings, lugs etc. The measurement for payment as well as for accounting shall be based on the sectional weights as indicated in the applicable IS/BS/EN specifications.

In case any such sectional weights are not available in the IS/BS/EN specifications, the manufacturer recommendation shall be binding.

- i. The steel issued to the vendor shall be mainly in standard length and sections as received from the supplier. However, the Vendor shall be bound to accept the steel in length as available in the project stores, no claims for extra payment because of issue of non-standard length will be entertained.
- ii. The Vendor shall satisfy himself of the quality and quantity of the materials at the time of taking delivery from BHEL deployed trucks. No claims whatsoever will be entertained by BHEL because of quality or quantity after the materials are taken by the Vendor from BHEL deployed trucks.
- iii. The Vendor shall submit to BHEL, a statement indicating estimated quantity of steel required during a quarter. In addition, the Vendors shall also furnish the estimated requirement of steel during a month by the third week of the previous month indicating his requirement. Vendor during his indenting should specify the required dimension in order to minimize the scrap generation and utilizing the standard available lengths.
- iv. Following shall be limit for the maximum quantity of BHEL issue materials that would be with the Vendor at any point of time when work is in progress (excluding

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what has already been incorporated in the works).

Sl. No.	ISSUE OF MATERIALS	MAX QUANTITY IN VENDOR'S STORE
01	Structural Steel	Three Month

Vendors shall ensure that no lamination material is taken over by them from BHEL.

Vendor to give requirement of Material in BHEL Scope well in advance of before Three month from requirement. Any delay in raising the requirement of these item leading to delay in placement of order, will be Vendor responsibility and its attributable delay in erection will be responsibility of Vendor only.

2.14 RETURN OF MATERIALS

Return Structural Steel including Scrap: All surplus steel will be taken back on weightment basis. Surplus, unused and untampered steel shall be sorted section-wise and returned separately which will be transported by Vendor to Project Premise. As regard to the scrap generated will be the property of Vendor & the amount for same will be recovered from the Vendor at the rate as per BHEL scrap policy mentioned below.

2.15 SCRAP RECOVERY RATES:

For all the categories of scrap recovery, quarterly floating rate shall be followed based on the latest disposal rate of BHEL/JCM. Wherever the latest scrap rates are not available the existing rates available as on date of recovery shall prevail. Recovery shall be based on Scrap Rate as on the date of last GR posting for the P.O. Subsequent revision of scrap rates shall be updated every financial quarter. The revised scrap rates will be updated during first week of every financial quarter (i.e.) in the month of Apr, Jul, Oct & Jan.

2.16 SCRAP AND SERVICEABLE MATERIALS:

All structural steel of length above 2 M except M.S Plate shall be considered as **serviceable materials** provided the materials is in good and acceptable condition. Structural steel in length less than 2 M shall be treated as scrap.

Plates having both side greater than 1 Meter OR if any side is less than 1 M but greater than 0.5 M and the total area is equal or greater than 2 sq. Meter shall be considered as **serviceable material**.

All pipe measuring 2 M and above in length shall be treated **serviceable materials** provided they are in good and acceptable condition. Pipe in less than 2 M length shall be treated as Scrap.

2.17 Steel Consumption and wastage:

2.17.1 Structural Steel (Rolled Sections and Plates etc.) Consumption

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The theoretical consumption of various sections shall be based on approved drawings. Weights shall be calculated considering the sectional weights as per applicable IS/BS/EN specifications. No extra shall payable to the Vendor for any deviation in weights for the two different procedures adopted for issue and calculation of the theoretical consumption including rolling tolerances.

- (a) Actual consumption = Issue – Surplus.
- (b) Surplus = un-tampered, unused, uncut quantity of steel including serviceable material returned by the Vendor to BHEL.
- (c) Wastage = Actual consumption – Theoretical consumption.

2.17.2 Structural Steel Wastage for Plates, Rolled Section, Tubular etc.

Allowable wastage: 4% (FOUR percent) of the theoretical consumption shall be considered. Wastage shall be considered as cut pieces and scrap material, measured as per actual weight basis. Invisible wastage, if any, shall be considered to be included in the specified 4 % allowable wastage.

Sl no	Structural steel including SS plate	Basis of issue & penal recovery
S-1	Theoretical consumption (without considering any wastage, scrap or loss) as per specification & drg.	Free
S-2	Wastage limited to plus four percent (+4%) of the aforesaid theoretical consumption (S-1) towards allowable wastage.	Free
S-3	Wastage beyond four percent (4%) of the aforesaid theoretical consumption (S-1).	Penal rate

2.18 Reconciliation of Materials:

- (a) The Vendor shall submit a reconciliation statement of steel issued to the Vendor with each RA Bill.
- (b) At the time of submission of bills, the Vendor shall properly account for the material issued to him as specified herein to the satisfaction of BHEL certifying that the balance material is available in the Vendor custody at site.
- (c) At the time of submission of bills, if it is noticed by BHEL that the wastage is high and calls recovery at the penal rate, then, BHEL will proceed for recovery for the excess wastage as per penal recovery rates as specified.
- (d) The reference drawings for actual material consumption to be used for the purpose of reconciliation shall be drawings prepared by the BHEL and drawings approved by BHEL for fabrication works and such other drawings approved by BHEL.

2.19 Recovery of Materials (Penal Rates):

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If wastage exceeds the specified limit, the recovery of excess wastage shall be made from monthly RA Bills as per following penal rates if material Supply is in BHEL SCOPE:

Sl. No.	Item	Penal rate (Rs)
P-3	Chequered Plates(if supplied by BHEL) and MS plates	65,000 per MT
P-4	MS Flats, beams, channel, angels etc. (Rolled Sections)	60,000 per MT

- a) The weights of P.O. items as per Specification/Drawing shall be the basis for accounting of the raw materials issued. The raw materials shall be issued with a process allowance of 3% for Sheets and 4% for Plates. This includes an invisible wastage of 2% for Sheets and Plates.

For Structural, 1% is allowed towards process allowance; this includes invisible wastage (beam, channel, angle, UC, UB, rods, pipes etc.)

- b) All balance materials (off cut) /serviceable are to be returned to designated Stores of BHEL, at vendor's cost.
- c) All scraps under BHEL supplied materials shall not be returned to BHEL. In case, scrap generated beyond permissible limit shall be charged as per penal rate as well as recover scrap value as per recovery rate.
- d) Recovery of the cost of the scrap along with GST and other statutory levies, if any, shall be made from the Vendor.
- e) Wherever attested materials are issued, the balance materials are to be returned in the attested condition only.
- f) The material rejected as PDO (Part Disposition Order) due to faulty workmanship of Vendor shall entail recovery of the cost of prime material as per relevant penal clause. In addition, conversion and service charges shall also be recovered in case of part-processed item.
- g) The material rejected as PDO (Part Disposition Order) due to reasons other than faulty workmanship of Vendor shall be returned to BHEL Stores, failing which recovery shall be made as per relevant penal clause.
- h) The Vendor should properly utilize materials issued by BHEL/PSNR as per the drawings/QWIs (Quality Work Instructions) in order to meet design and quality requirements of the product.
- i) After material issue, the Vendor should submit cutting plan within 15 days from the date of material issue
- j) However, in working out such economic cutting plans, it is to be ensured that the details as prescribed in each QWIs are adhered to. After the approval of the cutting

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plans, any balance material available from the issues made either in original or in supplementary shall be returned to our Stores at vendor's cost. The cutting plans as approved by BHEL shall be kept at vendor's premises for a minimum period of 3 years from date of cutting plan approval. They should be made available whenever required by BHEL officials or representatives of BHEL. It should be ensured that the jobs are fabricated and welds are made as per the layout of approved cutting plans.

- k) Whenever fabrication is done without proper cutting plans, the excess issue over and above the net weight shall attract recovery as prime material as per relevant penal clause.
- l) In case joint is specified in the cutting plan by BHEL, necessary quality requirements such as WPS should be adhered to by the Vendor.
- m) Failure to return the prime / offcut material shall entail recovery of the value of material as fixed by BHEL from time to time which is inclusive of departmental/financing charges, etc. In addition, statutory taxes, duties and levies as applicable shall also be recovered.
- n) Normally, all the indirect materials falling within the scope of the Vendor for doing the job is to be taken care of by the Vendor themselves.
- o) For the purpose of material accountability, Vendor shall submit a provisional material reconciliation statement on Quarterly basis, considering the Scrap percentage as applicable (Including Invisible scrap) and Serviceable offcut material (Certified by engineer).

2.20 Provisional Material accounting method: -

- (i) Agency shall submit with the Provisional monthly reconciliation statement along with applicable MDCC, MRC Detailed BOM for receipt of material at vendor works, detail of finished goods supply and resident engineer certified material under work in progress and serviceable off cut material. In case of deviation from the reconciliation statement, amount any discrepancy such as weight mismatches etc. shall be settled in before final bill.
- (ii) Recovery towards unreturned balance material as per FMAS (Final Material Accounting Statement) shall be done as per BHEL norms along with applicable statutory levies from the vendor. Hence, any correction after the generation of the FMAS shall not be entertained. After the issue of FMAS, the purchase order shall be treated as closed in all respects; therefore, requests toward refund of recovery shall not be entertained.
- (iii) The Vendor shall be responsible for prompt material accounting. Repeated occurrence of inordinate delay in returning and settling the material accounts shall

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entitle BHEL the right to terminate the contract forthwith or to impose a temporary suspension on further loading at the discretion of BHEL.

2.21 Custody of materials issued by BHEL to Vendor:

- 2.21.1 The raw material issued to the Vendor in connection with the fabrication contract shall remain the property of BHEL PSNR, Noida. The Vendor shall use the above materials only for the execution of BHEL's POs for which the materials have been issued, and for no other purpose whatsoever. The Vendor shall be responsible for the full value thereof to be assessed by BHEL PSNR, Noida, whose decision shall be binding on the Vendor.
- 2.21.2 The Vendor shall be liable for the loss or damage to such property from whatever the cause may be while such property is in the possession or under the control of the Vendor, their employees, workmen or agents or any other person connected with the Vendor. All the materials of BHEL PSNR, Noida shall under no circumstance be sold/hypothecated to any bank or to any lending institution or to any party whomsoever. Such materials should not be shown as the Vendor's assets in any of the statements of the Vendor to any party.
- 2.21.3 The Vendor shall produce the materials supplied by BHEL, PSNR in the form of raw material, semi-finished structure to BHEL officials visiting the Vendor's unit for verification purposes.
- 2.21.4 Inventory statement has to be submitted every month by the Vendor for the materials issued. If the Vendor fails to produce or properly account the materials so issued, BHEL, PSNR shall have the right to take further action as deemed fit including recovery of the value of the materials along with the respective administrative charges and statutory levies from the running bills of the Vendor and/or temporary suspension of load and/or termination of contract and/or de-listing.
- 2.21.5 Any act of Vendor resulting in dishonest misappropriation or conversion of the materials so issued for his own use shall constitute the offence of Civil / Criminal Breach of Trust under Indian Penal Code and/or such other offences under any other provisions of law and the Contractee (BHEL) shall have every right to proceed against the Vendor under Civil/Criminal Law in order to ensure proper punishment to such perpetrator(s) for the said offence(s). In such cases, BHEL shall take all necessary steps to recover the material available with those firms.
- 2.21.6 Wherever availability of material becomes critical for certain work orders, BHEL, PSNR shall transfer the balance material available with the Vendor including the scrap sizes from one Vendor to the other. For this, necessary credit shall be given during material accounting. The material transfer emanating from BHEL, PSNR is to be honored immediately or otherwise, recovery shall be made at the prime material cost. Any difficulty for affecting such transfer shall be brought to the knowledge of BHEL officials immediately.

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Chapter - II: Scope of Work

2.22 MATERIAL PROCUREMENT BY VENDOR

Based on prior approval of BHEL, Vendor shall make their own arrangement for raw material to value limited to Rs. 10,00,000/- for each package in case the same is not available for issue from BHEL depending on the dispatch criticality. **BHEL / QC shall clear the use of such materials. Further, BHEL committee shall approve such proposal and it is the sole responsibility of the Vendor to obtain confirmation from BHEL prior to commencement of Procurement of such items.** Amount so incurred shall be adjusted in RA bills of the vendor subject to the submission of all supporting documents.

2.23 GUARANTEE FOR THE FINISHED GOODS

The Vendor shall warrant that the fabrications comply fully with the drawings and other technical conditions specified by BHEL. If the fabrications are found defective owing to faulty workmanship/incomplete work within a period of eighteen months from the date of dispatch, the Vendor shall do the necessary repair/rework or replace the defective items free of cost. Alternatively, the rework/replacement charges shall be recovered.

For Supply Contract

Vendor must be possessing established fabrication work shop / factory equipped with all kinds of T & P's and other necessary requirement for supply of finished material as per specification at their own cost Tentative requirement of Factory is stipulated in Annexure - A. All other equipments and T&Ps (if required) for supply of finished material, shall be arranged by Vendor.

Chapter - III, IV & V - Not applicable for this contract.

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Chapter - VI: Time Schedule

6.1 TIME SCHEDULE

6.1.1 Start of Work (For Supply)

After receipt of Purchase Order, Vendor shall discuss with Construction Manager regarding initial start of the work. The successful Vendor will tie up with detailers for preparation of detailed fabrication drawing, submission of same to BHEL/THDC/NTPC and approval from them. Appointment of detailer shall be in consultation and approval of BHEL/THDC/NTPC. Appointed detailers by the successful Vendor will co-ordinate with BHEL/NTPC for approval of drawing and day to day routine co-ordination with site team (Vendor/BHEL/NTPC) for any clarification during fabrication and erection.

On receipt of structural materials from BHEL and approval of detailed drawings, successful Vendor will start fabrication work in their factory. They will prepare cutting plan, get it approved with BHEL/NTPC official and proceed with fabrication.

Vendor shall mobilize further resources as per requirement to commence the work of fabrication, testing, shot blasting, painting etc. to match schedule of the project.

6.1.2 Zero date and tentative schedule: -

Fifteen Days (15 Days) from date of issue of letter of award (LOA) shall be reckoned as the zero date of the contract and the Vendor must start action of drawing approval on receipt of letter of award.

The vendor has to subsequently augment his resources in such a manner that the entire work is completed to achieve the following tentative schedule: -

01. Fabrication of entire structures as per scope including surface preparation and application of finish paint shall be completed within 18 months from the date of start of work.

Sl.	Package-A (Unit#1)	Completion from Zero date
01	Power House Bldg:- Main Column, Girder, Truss, Main beam, secondary beam, Tie Beam, Bracing	12 months
02	Power House Bldg:- Secondary Column & Structure, Runners, miscellaneous work	14 months
03	Pipe/Cable racks & Miscellaneous structure	18 months
Sl.	Package-B (Unit#2 & Common Control Room)	Completion from Zero date
01	Power House Bldg:- Main Column, Girder, Truss, Main beam, secondary beam, Tie Beam, Bracing	12 months
02	Power House Bldg:- Secondary Column & Structure, Runners, miscellaneous work	14 months
03	Common Control Room structure	15 months

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - VI: Time Schedule

04	Other miscellaneous structure	18 months
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Vendor has to engage adequate resources to meet BHEL's commitments to their customer as indicated from time to time. In the event the Vendor fails to respond to these requirements, BHEL shall take appropriate actions to meet customer's commitments in line with the provisions of General Conditions of Contract

Detailed L-2 Schedule shall be prepared and submitted by Vendor for approval of BHEL.

In order to meet above schedule in general, and any other intermediate targets set, to meet customer/project schedule requirements, vendor shall arrange & augment all necessary resources from time to time on the instructions of BHEL.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - VII: Payment Terms

7.0 Terms of Payment: -

The progressive payment for supply on accepted price of contract value will be released as per the break up given hereinafter: -

Stages of progressive pro-rata payments

- ❖ 95% payment as per PO, Billing schedule/Price Bid, excluding GST shall be released within 30 days after receipt & acceptance of material at site and submission of following documents: -
 - a) GST Complaint Invoice (1 Original + 2 copies)
 - b) Copy of Intimation to Insurance Company
 - c) LR copy (consignee address shall be BHEL Khurja site)
 - d) Packing List
 - e) Copy of Material Dispatch Clearance Certificate issued by BHEL site.
 - f) Guarantee Certificate - Original
 - g) Material Receipt certificate by BHEL/site.
- ❖ Applicable GST shall be released upon compliance of following documents:
 - a) Vendor has declared such Invoice in their GSTR-1 & has paid the tax to the Government by filing GSTR-3B or any other return/form for payment of tax so that Vendor's invoice details appear in BHEL's GSTR-2A. Payment may not be released if above is not complied & invoice details do not appear in BHEL's GSTR-2A.
- ❖ Balance 5% payment as per PO, Billing schedule/Price Bid, excluding GST shall be released after completion of Trial operation or 18 Month from Last date of supply whichever is earlier. This shall be deemed as performance guarantee for the contract.
- ❖ Paying Authority shall be **Construction Manager, BHEL 2X660 MW, Khurja Site, Uttar Pradesh**

Chapter - VIII, IX and X – Not applicable for this contract.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - XI: Welding & Radiography

11.0 WELDING, RADIOGRAPHY AND OTHER NON-DESTRUCTIVE TESTING, POST WELD HEAT TREATMENT

11.1 WELDING:

11.1.1 INSTALLATION OF EQUIPMENT INVOLVES GOOD QUALITY WELDING, NDE CHECKS, POST WELD HEAT TREATMENT ETC. CONTRACTOR'S PERSONNEL ENGAGED SHOULD HAVE ADEQUATE QUALIFICATION ON THE ABOVE WORKS.

11.1.2 THE METHOD OF WELDING WILL BE INDICATED IN THE DETAILED DRAWING/DOCUMENTS. BHEL ENGINEER WILL HAVE THE OPTION OF CHANGING THE METHOD OF WELDING AS PER SITE/CUSTOMER REQUIREMENT.

11.1.3 BEFORE ANY WELDER IS ENGAGED ON WORK, HE SHALL BE TESTED AND QUALIFIED BY BHEL/ CUSTOMER, THOUGH THEY MAY POSSESS THE PREVIOUS CERTIFICATE. BHEL RESERVES THE RIGHT TO REJECT ANY WELDER WITHOUT ASSIGNING ANY REASON. ALL THE EXPENDITURE IN TESTING/QUALIFICATION OF THE CONTRACTOR'S WELDER SHALL BE BORNE BY CONTRACTOR.

11.1.4 UNSATISFACTORY AND CONTINUOUS POOR PERFORMANCE MAY RESULT IN DISCONTINUATION OF CONCERNED WELDER.

11.1.5 THE WELDED SURFACE SHALL BE CLEANED OF SLAG AND PAINTED WITH PRIMER PAINT TO PREVENT RUSTING, CORROSION. FOR THESE CONSUMABLES LIKE PAINT /PRIMER ETC WILL BE IN THE CONTRACTOR'S SCOPE.

11.1.6 WELDING ELECTRODES HAVE TO BE STORED IN ENCLOSURES HAVING TEMPERATURE AND HUMIDITY CONTROL ARRANGEMENTS. THIS ENCLOSURE SHALL MEET BHEL SPECIFICATIONS.

11.1.7 WELDING ELECTRODES, PRIOR TO THEIR USE, CALL FOR BAKING FOR SPECIFIED PERIOD AND WILL HAVE TO BE HELD AT SPECIFIED TEMPERATURE FOR SPECIFIED PERIOD. ALSO, DURING EXECUTION, THE WELDING ELECTRODES HAVE TO BE CARRIED IN PORTABLE OVENS.

11.2 NON DESTRUCTIVE EXAMINATION:

11.2.1 CONTRACTOR SHALL PROVIDE ALL RESOURCES AND MAKE ALL ARRANGEMENTS FOR THE RADIOGRAPHIC EXAMINATION OF WELDS FOR THIS WORK. FOR REASONS OF SAFETY, INVARIABLY THE RADIOGRAPHY WORK WILL BE CARRIED OUT AFTER THE NORMAL WORKING HOURS AND CLOSE OF OTHER SITE ACTIVITIES ONLY. IN THIS REGARD, THE CONTRACTOR HAS TO ADHERE TO THE SAFETY RULES / REGULATIONS LAID BY BARC AUTHORITIES FROM TIME TO TIME.

11.2.2 RADIOGRAPHY INSPECTION OF WELDS SHALL BE PERFORMED IN ACCORDANCE WITH REQUIREMENTS AND RECOMMENDATION OF BHEL ENGINEER. THE MINIMUM QUANTUM OF RADIOGRAPHIC INSPECTION SHALL BE AS PER PROVISION OF BHEL'S ERECTION

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - XI: Welding & Radiography

DOCUMENTS. THEY MAY, HOWEVER BE INCREASED DEPENDING UPON THE PERFORMANCE OF THE INDIVIDUAL WELDER AT THE DISCRETION OF BHEL ENGINEER/BOILER INSPECTING AUTHORITY. VENDOR SHALL ALSO ARRANGE THE UT EQUIPMENT WITH RECORDING FACILITY AT HIS OWN COST. UT SHALL BE DONE AS PER REQUIREMENT OF BHEL / CLIENT. RECORDS OF UT SHALL BE PRODUCED & SUBMITTED TO AS PER SITE REQUIREMENT.

- 11.2.3 ALL X-RAY / GAMMA RAY FILMS OF WELD JOINTS SHALL BE PRESERVED PROPERLY AND BE HANDED OVER TO BHEL.
- 11.2.4 THE FIELD WELDED JOINTS SHALL BE SUBJECT TO DYE-PENETRANT/MPT/RT/ OTHER NON- DESTRUCTIVE EXAMINATION AS SPECIFIED IN THE RESPECTIVE ENGINEERING DOCUMENTS/ AS INSTRUCTED BY BHEL.
- 11.2.5 WHERE REQUIRED, SURFACE PREPARATION, LIKE SMOOTH GRINDING OF WELDED AREA, PRIOR TO RADIOGRAPHY SHALL BE DONE. IT MAY ALSO BECOME NECESSARY TO ADOPT INTER-LAYER RADIOGRAPHY/MPT/UT DEPENDING UPON THE SITE/ TECHNICAL REQUIREMENT NECESSITATING INTERRUPTIONS IN CONTINUITY OF THE WORK AND MAKING NECESSARY ARRANGEMENTS FOR CARRYING OUT THE ABOVE WORK. THE CONTRACTOR SHALL TAKE ALL THIS INTO ACCOUNT IN HIS OFFER. THE REQUIRED NDT METHOD/PROCEDURE WILL BE DECIDED BY BHEL ENGINEER AT SITE.
- 11.2.6 FOR CARRYING OUT ULTRASONIC TESTING OF WELDING JOINTS OF LARGE SIZE, IT WILL BE NECESSARY TO PREPARE SURFACE BY GRINDING AND BUFFING A SMOOTH FINISH AND CONTOUR AS NECESSARY. THE CONTRACTOR'S SCOPE OF WORK INCLUDES SUCH PREPARATION AS INCIDENTAL TO WORK.
- 11.2.7 NO SEPARATE PAYMENT FOR ANY NDE ACTIVITIES IS ENVISAGED. ACCORDINGLY THE OFFERED RATE SHALL BE INCLUSIVE OF COST OF ALL NDE.

11.3 HEAT TREATMENT:

- 11.3.1 FOR THE PURPOSE OF TEMPERATURE RECORDING OF STRESS RELIEVING PROCESS, THERMOCOUPLES HAVE TO BE ATTACHED TO THE WELD JOINT. THE NUMBER OF TEMPERATURE MEASURING POINTS AND LOCATIONS SHALL BE AS PER THE STANDARDS OF BHEL. THERMOCOUPLES HAVE TO BE ATTACHED USING CAPACITOR DISCHARGE TYPE PORTABLE THERMOCOUPLE ATTACHMENT UNIT. CONTRACTOR SHALL ARRANGE SUFFICIENT NUMBER OF THERMOCOUPLE ATTACHMENT UNITS.
- 11.3.2 CONTRACTOR SHOULD PROVIDE TEMPERATURE INDICATOR / TEMPERATURE RECORDER FOR MEASURING TEMPERATURE DURING PRE-HEATING FOR WELDING OR FOR CONTROLLING TEMPERATURE OF METAL FOR HOT CORRECTION ETC. THE TEMPERATURE RECORDERS SHOULD BE PREFERABLY OF SOLID STATE TYPE.
- 11.3.3 HEAT TREATMENT MAY REQUIRE TO BE CARRIED OUT AT ANY TIME (DAY OR NIGHT) TO ENSURE THE CONTINUITY OF THE PROCESS. THE CONTRACTOR SHALL MAKE ALL

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - XI: Welding & Radiography

NECESSARY ARRANGEMENTS INCLUDING LABOURER REQUIRED FOR THE SAME AS PER DIRECTIONS OF BHEL.

- 11.3.4 IN CERTAIN CASES ONLY THE PRE-HEATING OF WELD JOINTS MAY BE CALLED FOR.
- 11.3.5 FOR WELD JOINTS OF HEAVY STRUCTURAL SECTIONS, IF HEAT TREATMENT IS REQUIRED, THE SAME SHALL BE CARRIED OUT AS PART OF THE WORK.
- 11.3.6 CHECKING EFFECTIVENESS OF STRESS RELIEVING BY HARDNESS TESTS (BY DIGITAL HARDNESS TESTER OR OTHER APPROVED TEST METHODS AS PER BHEL ENGINEER'S INSTRUCTION) INCLUDING NECESSARY TESTING EQUIPMENTS IS WITHIN THE SCOPE OF THE WORK / SPECIFICATION.
- 11.3.7 PREHEATING, INTER-PASS HEATING, POST WELD HEATING AND STRESS RELIEVING AFTER WELDING ARE PART OF ERECTION WORK AND SHALL BE PERFORMED BY THE CONTRACTOR IN ACCORDANCE WITH BHEL ENGINEER'S INSTRUCTIONS. WHERE THE ELECTRIC RESISTANCE HEATING METHOD IS ADOPTED CONTRACTOR SHALL MAKE ALL ARRANGEMENT INCLUDING HEATING EQUIPMENT WITH AUTOMATIC RECORDING DEVICES, ALL HEATING ELEMENTS, THERMOCOUPLES AND ATTACHMENT UNITS, GRAPH SHEETS, THERMAL CHALKS, & INSULATING MATERIALS LIKE MINERAL WOOL, ASBESTOS CLOTH, CERAMIC BEADS, ASBESTOS ROPES ETC, REQUIRED FOR ALL HEATING AND STRESS RELIEVING WORKS.
- 11.3.8 ALL THE RECORDED GRAPHS FOR HEAT TREATMENT SHALL BE HANDED OVER TO BHEL/ IBR AUTHORITIES AND DUE CLEARANCES OBTAINED.
- 11.3.9 RESULTS OF THESE PROCESSES SHALL BE VERIFIED/ VALIDATED AS PER REQUIREMENTS OF BHEL / CLIENT.

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Chapter - XII: Preservation & Protection of Components

12.0 Preservation & Protection of Components

At all stages of work, equipment's/materials in the custody of Vendor will have to be preserved as per the instructions of BHEL. Necessary preservation agents including the primer & paint, for the above work shall be provided by the Vendor.

- 12.1 The Vendor shall make suitable security arrangements including employment of security personnel and ensure protection of all materials/ equipment in their custody and installed equipment's from theft/fire/pilferage and any other damages and losses.

ANNEXURE - A

TENTATIVE REQUIREMENT FOR FACTORY FOR FABRICATION OF STEEL STRUTURES			
Sr. No	Characteristic		Check List
1	License	a	Availability of factory registration license ,GST Registration etc.
2	Quality management	a	Availability of work instruction/procedures for critical activities & its implementations.
3	Raw material control	a	Incoming raw material acceptance -MTC review records available
		b	Availability of material correlation/identification procedures & its implementations by hard punching/by record keeping/painting etc.
		c	Storage/stacking of raw material-in organized manner or elevated platform with proper identification.
4	Material handling	a	Availability of EOT crane/ Gantry Crane of required capacity to handle maximum Load required for movement.
		b	Availability of gantry cranes/Hydra/other handling equipment's capable to handle proposed heaviest component(if required other than EOT crane)
5	Handling of weld consumables	a	Availability of calibrated baking oven, holding oven & portable ovens(in sufficient quantities)
		b	Proper storage of weld consumables or racks & other controlled conditions
		c	Weld consumables handling: Issue/return of electrodes from store properly documented/recorded.
6	Welding qualification	a	Availability of qualified WPS & PQR
		b	Availability of sufficient no of qualified welders
		c	Availability of welder performance monitoring/defect rate monitoring systems
7	Machinery	a	Availability of sufficient no of SAW welding machines
		b	Availability of sufficient number of GTAW welding machines
		c	Availability of sufficient number of welding machinery-SMAW/GTAW/FCAE etc.
		d	Availability of CNC plasma/torchy cutting machines/profile cutting ,machines
		e	availability of PUG/Gas cutting machines
		f	Availability of radial drilling machine-capacity matching to proposed thickness & size of component

ANNEXURE - A

TENTATIVE REQUIREMENT FOR FACTORY FOR FABRICATION OF STEEL STRUCTURES			
Sr. No	Characteristic		Check List
		g	Availability of weld edge preparation/bevel end cutting machines
8	Spare/Inspection Area	a	Availability of said levelled floor for trail assembly adequate for proposed size of components with required material handling capacity
9	NDT/HEAT treatment/hydro/ leak test facility	a	Availability of sufficient size covered shed with concrete platform for fabrication activities
		b	Availability of beam straightening machine
		c	Availability of DPT/MPI facility-in house /outsourced to other agency
		d	availability of RT facility-in house/outsourced(as applicable)
		e	Availability of UT facility-in house/outsourced(however done inside vendors own works)
		f	Availability of RT film viewer/dark room, densitometer , reference photograph etc. if RT is done
10	Professional qualification/quality manpower	a	Availability of qualified & experience manpower for quality
		b	Availability of qualified welding inspectors
		c	Availability of DP/MPT Level II qualified personal
		d	Availability of RT level II qualified personal if applicable
		e	Availability of UT level II qualified personal if required
11	Testing facility	a	Availability of in house/outsourced testing facilities for chemical testing by spectro/PMI
		b	Availability of in house/outsourced testing facilities like UTS% elongation/ben/impact testing /hardens etc.
		c	Availability of calibrated tape/leaser beam instruments to measure long column length for proto /assembly/
		d	Availability of calibrated weld gauge, Vernier, micrometer & measuring instruments
12	Surface cleaning & painting	a	Availability of covered shot/grit blasting facility with air compressor, mechanism to segregate fine shot(sievers) shots/grits re-collection mechanism, surface compactor/surface roughness meter etc.

ANNEXURE-I
PRICE VARIATION COMPENSATION (PVC)

- 1) In order to take care of variation in cost of execution of work on either side, due to variation in the index of LABOUR, HIGH SPEED DIESEL OIL, WELDING ROD, CEMENT, STEEL, MATERIALS, Price Variation Formula as described herein shall be applicable. PVC is applicable from the Purchase Order date and during the extension period as well (if any), *subject to other conditions as described in this section.*
- 2) 85% component of Contract Value shall be considered for PVC calculations and remaining 15% shall be treated as fixed component. The basis for calculation of price variation in each category, their component, Base Index shall be as under:

SL NO.	CATEGORY	BASE INDEX	PERCENTAGE COMPONENT ('K')
			MECHANICAL / FABRICATION PACKAGES
i)	LABOUR (ALL CATEGORIES)	'MONTHLY ALL-INDIA AVERAGE CONSUMER PRICE INDEX NUMBER FOR INDUSTRIAL WORKERS' published by Labour Bureau, Ministry of Labour and Employment, Government of India. (Website: labourbureau.nic.in)	65
ii)	HIGH SPEED DIESEL OIL	Name of Commodity: HSD Commodity Code: 1202000005 (See Note E)	5
iii)	WELDING ROD	Name of Commodity: MANUFACTURE OF BASIC METALS Commodity Code: 1314000000 (See Note E)	15
iv)	CEMENT	Name of Commodity: ORDINARY PORTLAND CEMENT Commodity Code: 1313050003 (See Note E)	--
v)	STEEL (Structural and Reinforcement Steel)	Name of Commodity: MILD STEEL: LONG PRODUCTS Commodity Code: 1314040000 (See Note E)	--
vi)	All OTHER MATERIALS (Other than Cement & Steel)	Name of Commodity: ALL COMMODITIES Commodity Code: 1000000000 (See Note E)	--

Note: A) Cement & Steel: Free Issue (BHEL-Scope) - Not Applicable

B) Cement & Steel : In Contractor Scope - Not Applicable

C) Cement in Contractor Scope, and Steel is Free Issue (BHEL Scope) Not Applicable

D) For Composite packages (i.e. Civil+Mechanical+Electrical and/or CI or Civil+Mechanical or Mechanical+Electrical and/or CI), the COMPONENT ('K') for various categories shall be as per respective packages as above. Not Applicable

E) As per the 'MONTHLY WHOLE SALE PRICE INDEX' for the respective Commodity and Type, published by Office of Economic Adviser, Ministry of Commerce and Industry, Government of India. (Website: [http:// eaindstry.nic.in/ home.asp](http://eaindstry.nic.in/home.asp)). Revisions in the index or commodity will be re adjusted accordingly.

3) #

4) Payment/recovery due to variation in index shall be determined on the basis of the following notional formula in respect of the identified COMPONENT('K') viz LABOUR, HIGH SPEED DIESEL OIL, WELDING ROD, CEMENT, STEEL, MATERIALS

$$P = K \times R \times \frac{(X_N - X_0)}{X_0}$$

Where

P = Amount to be paid/recovered due to variation in the Index for LABOUR, HIGH SPEED DIESEL OIL, WELDING ROD, CEMENT, STEEL, MATERIALS

K = Percentage COMPONENT ('K') applicable for LABOUR, HIGH SPEED DIESEL OIL, WELDING ROD, CEMENT, STEEL, MATERIALS

R = Value of work done for the billing month (Excluding Taxes and Duties if payable extra)

X_N = Revised Index for Labour, High Speed Diesel Oil, Welding Rod, Cement, Steel and Materials for the billing month under consideration

X₀ = Index for Labour, High Speed Diesel Oil, Welding Rod, Cement, Steel and Materials as on the Base date

5) Base date shall be the calendar month of the Letter of Intent/award and/or Purchase Order date.

6) PVC shall not be payable for the ORC amount, Supplementary/Additional Items, Extra works. However, PVC will be payable for items executed under quantity variation of BOQ items under originally awarded contract.

7) The contractor shall furnish necessary monthly bulletins in support of the requisite indices from the relevant websites along with his Bills.

8) The contractor will be required to raise the bills for price variation payments on a monthly basis along with the running bills irrespective of the fact whether any increase/decrease in the index for relevant categories has taken place or not. In case there is delay in publication of bulletins (final figure), the provisional values as

published can be considered for payments and arrears shall be paid/recovered on getting the final values.

- 9) PVC shall be applicable only, during the extended period of contract (if any) after the scheduled completion period and for the portion of work delayed / backlog for the reasons not attributable to the Contractor.

However total quantum of Price Variation amount payable/recoverable shall be regulated as follows:

- i. For the portion of shortfall/ backlog not attributable to contractor, PVC shall be worked out on the basis of indices applicable for the respective month in which work is done. Base index shall be applicable as defined in clause 5 above.
- ii . In case of Force majeure, PVC shall be regulated as per (a) or (b) below:
 - a) Force majeure is invoked before “base date”/”revised base date”(as explained below)OR immediately after “base date”/”revised base date” in continuation (i.e. during the period when PVC is not applicable):
 1. Base date shall be revised: Revised base date =Previous base date + duration of Force majeure.
No PVC will be applicable for the work done till revised base date.
 2. PVC will be applicable for the work done after “base date”/”revised base date” as the case may be (during extended period when delay is not attributable to contractor). PVC shall be worked out on the basis of indices applicable for the respective month in which work is done with base index as on “base date”/”revised base date” as the case may be.
 - b) Force majeure is invoked after “base date”/”revised base date “as the case may be (during extended period when delay is not attributable to contractor) -
 1. PVC shall be applicable for the work done after revocation of force majeure.
 2. PVC for the work done after revocation of force majeure shall be worked out on the basis of indices applicable for the respective month in which work is done excluding the effect of change in indices during total period of Force majeure(s) invoked after “base date”/”revised base date “ as the case may be.
Base index shall be taken as on “base date”/”revised base date “as the case may be.
- iii. The total amount of PVC shall not exceed **15%** of the cumulatively executed contract value. Executed contract value for this purpose is exclusive of PVC, ORC, Supplementary/Additional Items and Extra works except extra items due to quantity variation.

ANNEXURE-II – BANK GUARANTEE

2.0 BANK GUARANTEE (BG) FOR FREE ISSUE OF BHEL'S MATERIAL

BG shall be provided by successful bidder/Fabricator for 50% raw steel material value identified to be issued to the Fabricator against Purchase Order (PO). The value of raw steel materials shall be as per BHEL calculation. BHEL shall supply raw steel material that shall not exceed more than 2000 MT at Fabricator's shop at any single point of time; absolute value of material may be equivalent to 1000MT and BG shall be furnished in two stages as recited below, i.e. in BG value to the value of Free Issue Material shall be in 1:2 ratios. If there is any additional requirement of steel for fabrication work which is exceeding the rolling plan limit, BHEL will provide the raw steel on submission of additional BG of 50% raw steel material value. Rolling plan limit for supply of Raw Steel is 2000 MT each for both the package.

The BG required for execution of the Purchase Order (PO) should be submitted in following Stages: -

Stage 1 BG:

- a) First BG equivalent to the 50% Raw steel material value of 1,000 MT approx. for execution of the Purchase Order (PO) should be submitted within a period of '15 days from the date of Purchase Order' or '15 days from the intimation date for submission of (Stage 1 BG) BG by BHEL to Fabricator regarding submission of required BG whichever is later. This BG must be kept valid till completion of supply of all finished goods as per contract or termination of contract whichever is later.

Stage 2 BG:

- b) Second BG equivalent to the 50% Raw steel material value of 1,000 MT approx. for execution of the Purchase Order (PO) should be submitted within a period of '30 days from the date of Purchase Order' or '15 days from the intimation date for submission of (Stage 2 BG) BG by BHEL to Fabricator regarding submission of required BG whichever is later. This BG must be kept valid till completion of supply of all finished goods as per contract or termination of contract whichever is later.

Stage 3 BG: (If Applicable)

Supply of additional Raw steel material that is exceeding the rolling plan limit of 2000 MT, will provided by BHEL on submission of additional BG equivalent to 50% of Raw steel material value. Fabricator may also request BHEL to deduct amount equivalent to the value of additional Raw Steel from the RA bills in lieu of BG.

Important Note:

1. BHEL will supply raw steel material after receipt of BG from fabricator. Supply of Raw Steel Material will start after receipt of Stage-1 BG. At any point of time, BHEL shall not supply Raw Steel without any Bank Guarantee equivalent to value of 50% Raw steel material.
 2. If the successful fabricator decides to provide the BG cited in Stage 1, 2 & 3 as a single BG or combination of 2 BGs, they may do so without affecting other aspects of the contract/PO.
 3. BG shall have a claim period of 3 months in addition to the contract or termination of contract whichever is later.
 4. If the Free Issue Material Value is not available while Purchase Order placement, then BHEL PSNR shall have the right to obtain BG value of **Rs. 5 Cr** in two equal parts (Rs. 2.5 Cr each) in lieu of BGs stages cited in 1 and 2. All terms and conditions of BGs stages cited in 1 and 2 shall be applicable. Stage -3 BG shall be obtained as cited above.
-
- 2.1** On intimation to the Fabricator regarding submission of required BGs (which includes Stage – 1, 2 and 3) and if the Fabricator does not submit the required BG within timeline stipulated in above clauses, then action shall be taken as per the extant **Suspension of Business dealings with Suppliers / Contractors.**
 - 2.2** Bank Guarantee to the specified value for the safe custody of the materials issued by BHEL, PSNR Noida is to be executed by any one of the banks in the List of Consortium of Banks or Nationalized banks on behalf of the Fabricator. Also, the above bank guarantee shall be executed on a non-judicial stamp paper of value Rs.100/- as per BHEL's bank guarantee format attached in Annexure Bank Guarantee.
 - 2.3** The bank guarantee should cover the recoveries to be made by BHEL towards material / faulty workmanship etc. for which proper accountal is not made within the stipulated time. If the recovery amount is more than the pending bills, the difference amount should be settled immediately by submitting Demand Draft(s)/Cheque in favor of BHEL/ PSNR Noida.
 - 2.4** Successful bidders may furnish Fixed Deposit Receipt (FDR) in lieu of Bank Guarantee (BG) if they wish to do so. Prior intimation may be provided to the Competent Authority
 - 2.5** Necessary Bank Guarantee (BG) / Fixed Deposit Receipt (FDR) should be furnished and renewed in time.

- 2.6 Diversion/Cancellation of P.O.:** In case of delay in delivery beyond PO delivery / mutually agreed delivery, or Fabricator fails /refuses to complete the PO as per terms, or insufficient facilities at Fabricator's works to execute a PO, BHEL has the right to get the items ordered elsewhere at the risk and cost of the Fabricator with notice to the Fabricator; and the additional expenditure / difference in cost, if any, including consequential cost shall be recovered from the defaulted Fabricator. Also, in such case of withdrawal of orders, Fabricator shall return full material in condition as issued to them by BHEL for executing the job; otherwise, BHEL shall recover full material cost and conversion cost (in case of part processed items) from Fabricator by adjusting against amount due to Fabricator and/or by invoking the BG and/or by any other suitable means as decided by BHEL. In addition, BHEL may recover from the default Fabricator any loss to BHEL arising due to withdrawal of orders in such case, and action shall be taken as per latest revision of BHEL Guidelines for Suspension of Business dealings with Suppliers / Contractors. Fabricators are requested to visit http://www.bhel.com/vender_registration/pdf/Suspension_guidelines_adbridged.pdf for details of BHEL Guidelines for Suspension of Business dealings with Suppliers / Contractors.
- 2.7 All the materials of BHEL PSNR shall under no circumstance be sold/hypothecated to any bank or to any lending institution or to any party whomsoever.** Such materials should not be shown as the Subcontractor's assets in any of the statements of the Fabricator to any party.
- 2.8** The default Fabricator shall be liable for any loss, which BHEL may sustain by reason of such risk purchases in addition to liquidated damages as mentioned above.
- 2.9** No compensation shall be given to the Fabricator, in case of cancellation/diversion of PO(s) even if the jobs have been processed partly.

**BANK GUARANTEE FOR SUPPLY FREE
ISSUE MATERIAL**

Bank
Guarantee No:
Date:

To
NAME & ADDRESSES OF THE BENEFICIARY:

Dear Sirs,

In consideration of Bharat Heavy Electricals Limited¹ (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at

_____ ¹ through its Unit at _____ (Name of the Unit) having
_____ awarded to _____

_____ ² (~~Name of the Vendor / Contractor~~ / Supplier), with its registered
_____ office at _____ ²

(hereinafter called "the Vendor/Contractor/Supplier" which expression shall include its successors and

permitted _____ assigns) a contract date _____ ³ valued at Rs.
Ref No. _____ d _____

(Rupees _____)/ FC _____ (in words _____) _____ ⁴ (hereinafter
for the 'Contract') _____ called

AND WHEREAS the Employer having agreed as per the terms and conditions of the Contract to supply

free issue material costing Rs.____for the manufacture/fabrication of the equipment at the 'Contractor/Supplier/Fabricator's' site on furnishing of a Bank Guarantee for Rs./FC_____(Rupees/FC____)5 in the manner hereinafter specified for the due safeguard of the free issue material,

we,_____(hereinafter referred to as the Bank), having registered/Head office at_____and inter alia a branch at____being the Guarantor under this Guarantee, hereby irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer any sum or sums upto a maximum amount but not exceeding Rs./FC_____(Rupees/FC____) without any demur, merely on a demand from the Employer and without any reservation, protest and recourse and without the Employer needing to prove or demonstrate reasons for its such demand.

Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs._____.

We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the 'Contractor/Supplier/Fabricator in any suit or proceeding pending before any Court or Tribunal or Arbitrator or any other authority, our liability under this present being absolute and unequivocal.

The payment so made by us under this Guarantee shall be a valid discharge of our liability for payment hereunder and the 'Contractor/Supplier/Fabricator' shall have no claim against us for making such payment.

We the_____Bank further agree that the guarantee herein contained shall remain in full force

and effect during the period that would be taken for the performance of the said Contract and till the

reconciliation of the free issue material has been carried out and that it shall continue to be enforceable till all the dues of the Employer under or by virtue of the said Contract have been fully paid and its claims satisfied or discharged.

We_____Bank further agree that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Contract or to extend time of performance by the said

'Contractor/Supplier/Fabricator' from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said Contractor/Supplier/Fabricator and to forbear or enforce any of the terms and conditions relating to the said Contract and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said

'Contractor/Supplier/Fabricator' or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said 'Contractor/Supplier/Fabricator' or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor/Supplier/ Fabricator and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's/Supplier's/ Fabricator's liabilities.

This Guarantee shall remain in force upto and _____⁶ and shall be extended including time to time for such period as may _____ from be desired by Employer.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Contractor/ Supplier/ Fabricator but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms thereof.

Unless a demand or claim under this guarantee is made on us in writing on or before the

7

we shall be discharged from all liabilities under this guarantee thereafter.

We, _____ BANK lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Any claim or dispute arising under the terms of this Guarantee shall be subject to the exclusive jurisdiction of the court at NEW DELHI only.

Notwithstanding anything to the contrary contained hereinabove:

a) The liability of the Bank under this Guarantee shall not exceed _____ 5

b) _____ This Guarantee shall be valid up to 6

c) Unless the Bank is served a written claim or demand on or before _ 7
all rights under this

guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank.

We, _____ Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

For and on behalf of
(Name of the Bank)

Dated _____

Place of Issue _____

- 1 NAME AND ADDRESS OF THE EMPLOER. i.e. Bharat Heavy Electricals Limited
- 2 NAME AND ADDRESS OF THE CONTRACTOR / SUPPLIER/ FABRICATOR.
- 3 DETAILS ABOUT THE NOTICE OF AWARD/CONTRACT REFERENCE
- 4 PROJECT/SUPPLY DETAILS AND CONTRACT VALUE
- 5 BG AMOUNT IN FIGURES AND WORDS
- 6 VALIDITY DATE
- 7 DATE OF EXPIRY OF CLAIM PERIOD

2x660 MW KHURJA STPP

VOLUME – II B CIVIL, STRUCTURAL & ARCHITECTURAL WORKS

SPECIFICATION NO. PE-TS-475-600-C001

SECTION - D GENERAL TECHNICAL SPECIFICATION

Customer



THDC INDIA LIMITED

Consultant



NTPC LIMITED



BHARAT HEAVY ELECTRICALS LIMITED

NEW DELHI

SECTION – D comprises of sub-sections as mentioned below:

Sub-section D1: Earthwork in excavation and backfilling

Sub-section D2: Cement concrete (Plain and reinforced) and formwork

Sub-section D3: Carpentry and joinery

Sub-section D4: Roof and underground structures water proofing, insulation & allied works

Sub-section D5: Metal doors, windows, ventilators, louvers etc.

Sub-section D6: Glass and Glazing

Sub-section D7: Rolling Steel Shutter and Grills

Sub-section D8: Miscellaneous Metal

Sub-section D9: Masonry and allied works

Sub-section D10: Finish to masonry and concrete

Sub-section D11: Painting, Whitewashing, polishing

Sub-section D12: Floor finish and allied works

Sub-section D13: Sheet work in roof and siding

Sub-section D14: Suspended ceiling

Sub-section D15: Water supply, drainage & sanitation

Sub-section D16: Road & drainage

Sub-section D17: Fabrication of structural steelwork

Sub-section D18: Erection of structural steelwork

Sub-section D19: Roof decking

Sub-section D20: False flooring

Sub-section D21: Bored cast-in-situ RCC piles

Sub-section D22: Site levelling & grading works

Sub-section D23: Anti-termite treatment

Sub-section D31: Landscaping



TITLE:

**TECHNICAL SPECIFICATION FOR
FABRICATION OF STRUCTURAL
STEEL WORK**

SPECIFICATION NO. PE-TS-999-600-C017

VOLUME - II B

SECTION - D

SUBSECTION -D17

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VOLUME: II B

SECTION - D (PART I)

SUB-SECTION – D 17

FABRICATION OF STRUCTURAL STEEL WORK



Bharat Heavy Electricals Limited
Project Engineering Management
PPEI Building, Power Sector,
Plot No. 25, Sector 16A,
Noida (U.P.)-201301



TITLE:

**TECHNICAL SPECIFICATION FOR
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C O N T E N T

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2.00.00	GENERAL	3
3.00.00	WORKMANSHIP	19
4.00.00	INSPECTION, TESTING, ACCEPTANCE CRITERIA AND DELIVERY	29
5.00.00	INFORMATION TO BE SUBMITTED	33
6.00.00	RATES AND MEASUREMENTS	34

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SUB-SECTION – D XVII					
FABRICATION OF STRUCTURAL STEEL WORK					
1.00.00	SCOPE				
This specification covers supply, fabrication, testing, painting and delivery to site of structural steelwork including supply of all consumable stores and rivets, bolts, nuts, washers, electrodes and other materials required for fabrication and field connections of all structural steelwork covered under the scope of the contract.					
2.00.00	GENERAL				
2.01.00	Work to be provided for by the Contractor				
The work to be provided for by the Contractor, unless otherwise specified elsewhere in the contract, shall include, but not be limited to the following					
a) Preparation of complete detailed fabrication drawings and erection marking drawings required for all the structures covered under the scope of the contract based on the approved design drawings. As decided by the Engineer, some or all of these detailed drawings will have to be submitted for approval.					
b) To submit revised design with calculations and detailed fabrication drawings in case any substitution of the designed sections are to be made.					
c) To submit design calculations for joints and connections developed by the contractor along with detailed fabrication drawings.					
d) Furnish all materials, labour, tools and plant and all consumables required for fabrication and supply, all necessary rivets, bolts, nuts, washers, tie rods and welding electrodes for field connections,					
e) Furnish shop painting of all fabricated steelwork as per requirements of this Specification.					
f) Suitably mark, bundle, and pack for transport all fabricated materials.					
g) Prepare and furnish detailed Bill of Materials, Drawing Office Dispatch lists, Rivet and Bolt List and any other list of bought out items required in connection with the fabrication and erection of the structural steelwork.					
h) Insure, load and transport all fabricated steelwork field connection materials to site.					
i) Maintain a fully equipped workshop at site for fabrication, modification					

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and repairs of steelwork at site as may be required to complete the works in accordance with the Contract.					
2.02.00	Work by others				
No work under this specification will be provided for by any agency other than the contractor, unless specifically mentioned otherwise elsewhere in the contract.					
2.03.00	Codes and standards				
All work under this specification shall, unless otherwise specified in the contract, conform to the requirements of the latest revision and/or replacements of the following or any other relevant Indian Standard specifications and codes of practice. In case any particular aspect of the work is not specifically covered by any Indian Standard specification, any other standard practice, as may be specified by the Engineer shall be followed:					
IS : 226 - Structural steel (Standard Quality)					
IS : 800 - Code of Practice for general construction in steel.					
IS : 806 - Code of practice for use of steel tubes in general building construction.					
IS : 808 - Rolled steel beams, channels, and angle sections					
IS : 813 - Scheme of symbols for welding					
IS : 814 - Covered electrodes for metal arc welding of structural steel					
IS : 815 - Classification and coding of covered electrodes for metal arc welding of structural steels.					
IS : 816 - Code of practice for use of metal arc welding for general construction in mild steel					
IS : 817 - Code of practice for training and testing metal arc welders					
IS : 818 - Code of practice for safety and health requirements in electric and gas welding and cutting operations					
IS : 822 - Code of practice for inspection of welds					
IS : 919 - Recommendations for limits and fits for Engineering					
IS : 961 - Structural Steel (High Tensile)					

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-999-600-C017			
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IS : 1148 - Rivet bars for structural purposes IS : 1149 - High tensile rivet bars for structural purposes IS : 1161 - Steel Tubes for structural purposes IS : 1200 - Method of measurement of steelwork and ironwork (Part 8) IS : 1239 - Mild Steel Tubes IS : 1363 - Black hexagon bolts, nuts and lock nuts (dia. 6 to 30 mm) and black hexagon screws (dia 6 to 24 mm) IS : 1364 - Precision and semi-precision hexagon bolts, screws, nuts and 1 locknuts (dia, range 6 to 39 mm) IS : 1367 - Technical supply conditions for threaded fasteners IS : 1442 - Covered electrodes for the metal are welding of high tensile structural steel IS : 1608 - Method for tensile testing of steel products other than sheet strip, wire and tube IS : 1730 - Dimensions for steel plate, sheet, and strip for structural and general engineering purposes. IS : 1731 - Dimensions for steel flats for structural and general engineering purposes IS : 1852 - Rolling and cutting tolerances for hot-rolled steel products IS : 1977 - Structural steel (ordinary quality) St-42-0 IS : 2062 - Steel for General Structural Purposes IS : 2074 - Ready mixed paint, red oxide Zinc chromate priming IS : 2595 - Code of Practice for Radiographic Testing IS : 2629 - Recommended practice for Hot-Dip Galvanizing of Iron and Steel IS : 2633 - Method for testing uniformity of coating on Zinc Coated Articles IS : 3757 - High strength structural bolts					

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	IS : 4759 - Specifications for Hot-Dip Zinc Coatings on Structural Steel and other allied products IS : 7205 - Safety Code for Erection of Structural Steelwork IS : 7215 - Tolerances for fabrication of steel structures IS : 7280 - Bare wire electrodes for submerged arc welding of structural steels. IS : 9595 - Recommendations for metal arc welding of carbon and carbon manganese steels.		
2.04.00	Conformity with Designs The contractor shall design all connections, supply and fabricate all steelwork and furnish all connection materials in accordance with the approved drawings and/or as instructed by the Engineer keeping in view the maximum Utilization of the available sizes and sections of steel materials. The methods of painting, marking, packing and delivery of all fabricated materials shall be in accordance with the provisions of the contract and/or as approved by the Engineer. Provision of all relevant Indian Standard Specifications and Codes of Practice shall be followed unless otherwise specified in the contract.		
2.05.00	Materials to be used		
2.05.01	General All steel materials required for the work will be supplied by the contractor unless otherwise specified elsewhere in the contract. The materials shall be free from all imperfections, mill scales, slag intrusions, laminations, fittings, rusts etc. that may impair their strength, durability, and appearance. All materials shall be of tested quality only unless otherwise permitted by the Engineer and/or Consultant. If desired by the Engineer, Test Certificates in respect of each consignment shall be submitted in triplicate. Whenever the materials are required to be used from unidentified stocks, if permitted by the Engineer, a random sample shall be tested at an approved laboratory from each lot of 50 tones or less of any particular section. The arc welding electrodes shall be of approved reputed manufacture and conforming to the relevant Indian Standard Codes of Practice and Specifications and shall be of heavily coated type and the thickness of the coating shall be uniform and concentric. With each container of electrodes, the manufacturer shall furnish instructions giving recommended voltage and amperage (Polarity in case of D.C. supply) for which the electrodes are suitable.		

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2.05.02

Steel

All steel materials to be used in construction within the purview of this specification shall comply with any of the following Indian Standard Specifications as may be applicable:

a)

IS : 2062

-

Steel for general structural purposes

b)

IS : 961

-

Structural steel High Tensile

c)

IS : 1977

-

Structural steel (Ordinary quality) St-42-0

In case of imported steel materials being used, these shall conform to specifications equivalent to any of the above as may be applicable.

2.05.03

Rivet Steel

All rivet steel used in construction within the purview of this Specification shall comply with one of the following Indian Standard Specifications as may be applicable:

a)

IS : 1148

- Rivet Bars for structural purpose

b)

IS : 1149

- High tensile rivet bars for structural purposes. Where high tensile steel is specified for rivets, steps shall be taken to ensure that the rivets are so manufactured that they can be driven and heads formed satisfactorily without the physical properties of steel being impaired.

2.05.04

Electrodes

All electrodes to be used under the Contract shall be of approved reputed manufacture, low hydrogen electrode and shall comply with any of the following Indian Standard Specifications as may be applicable

a)

IS : 814

-

Covered electrodes for metal arc welding of structural steel

b)

IS : 815

-

Classification and coding of covered electrodes for metal arc welding of mild steel and low alloy high tensile steel

c)

IS : 1442

-

Covered electrodes for the metal arc welding of high tensile structural steel

d)

IS : 7280

-

Bare wire electrodes for submerged arc welding of

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		structural steels			
2.05.05 Bolts and Nuts		All bolts and nuts shall conform to the requirements of Indian Standard Specification IS: 1367 - Technical Supply Conditions for Threaded Fasteners. Materials for Bolts and nuts under the purview of this contract shall comply with any of the following Indian Standard Specifications as may be applicable. a) Mild Steel All mild steel for bolts and nuts when tested in accordance with the following Indian Standard Specification shall have a tensile strength of not less than 44 Kg/mm² and a minimum elongation of 23 per cent on a gauge length of 5.6 $\frac{A}{A}$, where "A" is the cross sectional area of the test specimen i) IS: 1367: Technical supply conditions for threaded fasteners ii) IS: 1608: Method for tensile testing of steel products other than sheet, strip, wire and tube b) High Tensile Steel The material used for the manufacture of high tensile steel bolts and nuts shall have the mechanical properties appropriate to the particular class of steel as set out in IS: 1367 or as approved by the Engineer.			
2.05.06 Washers		Washers shall be made of steel conforming to any of the following Indian Standard Specifications as may be applicable under the provisions of the Contract: a) IS : 2062 - Steel for general structural purposes b) IS : 961 - Structural Steel (High Tensile Quality) c) IS : 1977 - Structural steel (Ordinary Quality) St-42-0 d) IS : 6649 - Hardened washers			
2.05.07 Paints		Paints to be used for shop coat of fabricated steel under the purview of this			

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		contract shall conform to the Indian Standard Specification IS: 2074 - Ready mixed Paint, Red oxide Zinc Chromate Priming.	
2.06.00	Coal Bin		
2.06.01	Shape of bins shall be circular, polygonal, square, or rectangular in plan. Bottom hopper portion may have be conical-cum-hyperbolic or any other profile shape as shown in the drawing. Bin shall be termed as bunkers or silos according to their shape and plane of rupture of coal.		
2.06.02	For general requirements, fabrication and construction details IS: 9178 (Pt.1 & 11) shall be followed as general guidance. The bins shall be fabricated and erected in segments.		
2.06.03	The Coal bins shall be made of mild steel plates joined together with full strength butt weld and provided with stiffeners at regular interval. Stiffeners shall be provided on the external face and it may be welded with external face.		
2.06.04	Bending of plates and rolled sections to the required shape for fabrication shall be done by plate bending machine or cold bending process Without resorting to heating, hammering, angle smithy and black smithy process.		
2.06.05	Poking hole (manual or pneumatic) and striking plate shall be provided to facilitate coal flow. Poking holes shall have circular MS pipe and cover cap as detailed in the drawing.		
2.07.00	New Erection Marks		
2.07.01	Additional structures involving new erection marks may be required to be added at any stage of work.		
2.07.02	All such new erection marks shall be detailed and included in marking schemes and fabrication carded out thereafter.		
2.07.03	All such new erection marks shall be considered under item of original fabrication work. As a result of additional structures becoming necessary if the work is delayed beyond the time schedule stipulated, the Engineer shall give suitable extension of time provided he is satisfied about the reasonableness of the delay involved. However, no claim for extra payments or revision of rates due to delay shall be entertained.		

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2.08.00	ELECTRO FORGED STEEL GRATINGS		
2.08.01	Factory made fabricated electro forged gratings unit with steel conforming to IS: 2062 shall be supplied, fabricated, transported, erected and aligned in floorings, platforms, drain and trench covers, walkways, passages, staircases with edge binding strips and anti skid nosing in treads etc.		
2.08.02	All grating units shall be rectangular in pattern and electro forged. The size and the spacing of the bearing bars and cross bars shall be as detailed in fabrication drawings. The contractor shall submit the grating design for different spans and load intensities along with fabrication drawings. The depth of the grating unit shall be 40 mm, unless specified otherwise.		
2.08.03	The gratings shall be made up in panel units designed to coincide with the span of the structural steel framing or openings as indicated in the design/scope drawings. Maximum possible standardization of the grating panel sizes shall be tried and designed.		
2.08.04	The grating unit shall be accurately fabricated and finished, free from wraps, twists, or any defects that would impair their strength, serviceability, and appearance.		
2.08.05	Grating work shall include cut outs and clearance opening for all columns, pipes, ducts, conduits or any other installation penetrating through the grating work. Such cut outs and clearances shall be treated as specified in subsequent clauses.		
2.08.06	The gratings shall be notched, trimmed and neatly finished around flanges and webs of the columns, moment connections, cap plates, and such other components of the steel structures encountered during the placement of the gratings. In all such cases, the trimming shall be done to follow the profile of the components encountered. After trimming, the binding strip shall be provided on the grating to suit the profile so obtained.		
2.08.07	Opening in gratings for pipes or ducts that are 150mm in size or diameter or larger shall be provided with steel bar toe plates of not less than 5mm thickness and appropriate width, set flush with the bottom of the bearing bars.		
2.08.08	Penetrations in gratings that are more than 50mm but less than 150mm in size or diameter shall be welded with plates of size shown in the detailed drawings set flush with the bottom of the grating panel.		
2.08.09	Unless otherwise indicated on the drawings, grating units at all penetrations shall be made up in split section, accurately fitted and neatly finished to provide for proper assembly and erection at the job site.		

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these defects noticed on visual or microscopic inspection shall render the material liable to rejection.					
2.09.05		There shall be no flaking or loosening when struck squarely with a chisel faced hammer. The galvanized steel member shall withstand minimum four one minute dips in copper sulphate solution as per IS: 2633.			
2.09.06		When the steel section is removed from the galvanizing kettle, excess spelter shall be removed by 'bumping'. The processes known as 'wiping' or 'scrapping' shall not be used for this purpose.			
2.09.07		Defects in certain members indicating presence of impurities in the galvanizing bath in quantities larger than that permitted by the specifications or lack of quality control in any manner in the galvanizing plant, shall render the entire, production in the relevant shift liable to rejection.			
2.09.08		All structural steel shall be treated with sodium dichromate or an approved equivalent solution after galvanizing; so as to prevent white storage stains.			
2.09.09		If the galvanizing of any member is damaged, the Engineer shall be shown of the extent of damage, if so directed the galvanizing may have to the redone in the similar manner as stated above at no extra cost to the Owner.			
2.10.00		STAINLESS STEEL HOPPERS (As per BOQ item)			
2.10.01		Material			
In case SS Hopper is to be fabricated & erected as per BOQ item with SS415M, following specification shall be followed. Stainless steel hopper of grade SS 415M as manufactured by SAIL or equivalent shall be provided in the lower portion of bunker hopper. SS 4 15M having the following chemical composition shall be used.					
Material		%		Remarks	
Carbon		10.03%		Max.	
Silicon		1.60%		Max.	
Manganese		0.80% to 1.50%			
Phosphorous		0.03%		Max.	
Sulpher		0.03%		Max.	
Chromium		10.80% to 12.50%			

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Nickel		1.50%	Max.	
Titanium		0.75%	Max.	
Nitrogen		0.03%	Max.	
The mechanical properties shall be as follows:				
Description		Value	Remarks	
Hardness Rock Well B Scale		90	Max.	
Tensile Strength		450 MPa	Min.	
Yield Strength		300 MPa	Min.	
Elongation		25%	Min.	
2.10.02	Fabrication			
The fabrication, erection, alignment and welding shall be carried out as per the accepted practice and in accordance with relevant I.S. and international specification as well as stipulations contained herein. Fabrication drawings shall be prepared by the contractor on the basis of the design / scope drawings furnished by Engineer. The fabrication and erection works shall be done as per the approved fabrication drawings.				
2.10.03	Fabrication Drawings			
a) Fabrication drawing shall give the cutting plan for each hopper plate. Such, cutting plan shall be based on the size of the Stainless Steel plate available at store. In order to reduce the wastage and ensure the maximum utilization of stainless steel plate, the cutting plan shall take in the consideration of the reverse curvature and place the various elements of hopper plate in opposite fashion to reduce the end wastage. Similarly the hopper plate element having different radii shall be placed one inside the other, to optimize the stainless steel plate use. Such optimization may also required adjustment in the size of the each element of hopper plate and also additional weld joints.				
b) The bill of material of hopper plate shall indicate the inner surface area of the hopper, weight of the hopper based on the inner surface area, weight of each of the cut plate of hopper fabrication, weight of cut and scrap pieces generated. Contractor shall return to the Owner’s store all unutilized (surplus) stainless steel plates and all waste and cut pieces generated. Non return of any part of the surplus/waste steel pieces to the Owner’s store will call for the penal recovery at three (03) times the maximum				

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procurement rate for the weight of stainless steel pieces not returned to the store. c) In case the contractor does the cutting of the stainless steel without approved cutting plan then all the wastage (i.e. the difference between the weight of stainless steel plate cuts and the actual finished weight considered for the measurement for payment) shall be subjected to the penal recovery at the rate mentioned above.							
2.10.04		Cuffing					
Cutting may be affected by shearing, or by using plasma. The cut edges of all plates shall be perfectly straight and uniform through out. Cutting shall be done as per the cutting plan shown in the fabrication drawing. Should the Engineer find it necessary, the edges shall be ground smooth afterwards by contractor within the unit rates quoted by him. All the edge s shall be ground smooth before they are welded.							
2.10.05		Jointing					
Welding shall join stainless steel. All weld joints (along the inclined plane) shall be staggered. Any common welding process can weld stainless steel viz. MIG, metal arc or plasma using the covered compatible electrodes as per IS: 5206 or by inert gas arc welding as per IS: 2811. Shielding gas shall be Argon + Hydrogen mixture or Argon + Oxygen mixture. However, Argon + Oxygen mixture shall be preferred. Carbon-di-oxide mixture shall be avoided. 308L and 315L electrodes/fillers shall be used for the welding of Stainless Steel to Stainless Steel and Stainless Steel to Mild Steel respectively. However, the welding process and the type of the electrodes to be used for welding shall be as per welding procedure, as approved by the Engineer. On the basis of the welding procedure, the Contractor shall conduct qualification test.							
2.10.06		Bending					
The stainless steel plates shall be subjected to cold forming and bending in order to get the desired shape and profile.							
2.10.07		Welding sequence					
The type of electrodes, welding sequence, preheat and interpass temperature and post weld heat treatment shall be as approved by the Engineer.							
2.10.08		Acceptance Criteria of Fabricated Structures					
The acceptance of the fabricated structure work shall depend upon correct dimensions and alignment, absence of distortion in the structure, satisfactory results from the inspection and testing of the welded structure joints and the							

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test specimens, general workmanship being good meeting the tolerance requirements given in IS: 7215.					
2.11.00		BEARINGS			
2.11.01		PTFE (Poly tetra fluorethylene) slide bearing			
a) General					
The bearings shall consist of upper and lower units. The upper unit shall include a sole plate with mirror finish stainless steel facing bonded to the bottom surface of the sole plate. The lower unit shall consist of a relevant laminated elastomers pad surfaced with PTFE. A rigid confining medium substructure bonds the PTFE to the pad. When the upper and lower units are mated the stainless steel slides on the PTFE surface with an extremely low coefficient of friction. These bearings shall be designed as per the performance requirements. The bearing shall be of reputed make and manufacturer as approved by Engineer, for required vertical loads, as per the construction drawings and for a maximum displacement of ± 50 mm.					
b) Material					
PTFE bearing shall be sliding against highly polished stainless steel and the coefficient of friction between them shall be less than 0.06 at 55 kg/cm². In order to prevent cold flow in the PTFE surface it shall be rigidly bonded by a special high temperature resistant adhesive to the stainless steel sub-strata. The stainless steel surface, which slides against the PTFE, is mirror polished. The stainless steel shall be bonded to the top plate by special high strength adhesive. The thickness of the stainless steel shall be between 1.0 to 1.5mm.					
The resilient bearing pad shall consist of multiple layers of lightweight fabric impregnated with a high quality elastomer compound vulcanized into slabs of uniform standard thickness as per the requirement. This shall withstand vertical (compressive) load not less than 500 kg/cm² and shear loads upto 40 kg/cm².					
c) Installation					
The seating area for PTFE bearing shall be prepared accurately level and furnished with a thin layer of epoxy resin mortar. The bearing will be placed on this layer while it is still workable and the bearing is levelled. The bearing should not be displaced as the beam is lowered into position. When the mortar and adhesive are fully set and the beam slightly above the top of the bearing. The upper surface of the bearing shall then be coated with sufficient thickness of epoxy resin mortar so that when the beam is lowered on to the temporary supports it comes into full contact					

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with the mortar and some is squeezed out. The surplus shall be troweled off and after the mortar is fully set the temporary supports removed.			
2.12.00	Storage of material		
2.12.01	General		
All materials shall be so stored as to prevent deterioration and to ensure the preservation of their quality and fitness for the work. Any material, which has deteriorated or has been damaged, shall be removed from the contractor's yard immediately, failing which, the Engineer shall be at liberty to get the material removed and the cost incurred thereof shall be realised from the Contractor. The Contractor shall maintain upto date accounts in respect of receipt, use, and balance of all sizes and sections of steel and other materials. In case the fabrication is carried out in contractor's fabrication shop outside the plant site where other fabrication works are also carried out, all materials meant for use in this contract shall be stacked separately with easily identifiable marks.			
2.12.02	Steel		
The steel to be used in fabrication and the resulting cut-pieces shall be stored in separate stacks off the ground section wise and lengthwise so that they can be easily inspected, measured, and accounted for at any time. If required by the Engineer, the materials may have to be stored under cover and suitably painted for protection against weather.			
2.12.03	Electrodes		
The electrodes for electric arc welding shall be stored in properly designed racks, separating different types of electrodes in distinctly marked compartments. The electrodes shall be kept in a dry and warm condition if necessary by resorting to heating.			
2.12.04	Bolts, Nuts and Washers		
Bolts, nuts and washers and other fastening materials shall be stored on racks off the ground with a coating of suitable protective oil. These shall be stored in separate gunny bags or compartments according to diameter, length, and quality.			
2.12.05	Paints		
Paints shall be stored under cover in air tight containers. Paints supplied in sealed containers shall be used up as soon as possible once the container is opened.			

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2.13.00	Quality Control
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The Contractor shall establish and maintain quality control procedures for different items of work and materials to the extent he deems necessary to ensure that all work is performed in accordance with this specification. In addition to the Contractor's quality control procedures, materials and workmanship at all times shall be subjected to inspection by the Engineer or Engineer's representative. As far as possible, all inspection by the Engineer or Engineer's representative shall be made at the Contractor's fabrication shop whether located at Site or elsewhere. The Contractor shall co-operate with the Engineer or Engineer's representative in permitting access for inspection to all places where work is being done and in providing free of cost all necessary help in respect of tools and plants, instrument, labour and materials required to carry out the inspection. The inspection shall be so scheduled as to provide the minimum interruption to the work of the Contractor.

Materials or workmanship not in reasonable conformance with the provisions of this Specification may be rejected at any time during the progress of the work.

The quality control procedure shall cover but not be limited to the following items of work

a) Steel: Quality manufacturer's test certificates, test reports of representative samples of materials from unidentified stocks if permitted to be used.

b) Rivets, Bolts, Nuts & Washers

:

Manufacturer's certificate, dimension checks, material testing.

c) Electrodes

:

Manufacturer's certificate, thickness and quality of flux coating.

d) Welders

:

Qualifying Tests

e) Welding sets

:

Performance Tests

f) Welds

:

Inspection, X-ray, Ultrasonic tests

g) Paints

:

Manufacturer's certificate, physical inspection reports

h) Galvanizing

:

Tests in accordance with IS 2633 - Method for testing uniformity of coating on Zinc Coated Articles and IS : 4759 - Specification for Hot-Dip Zinc coatings on Structural Steel and other allied products.

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2.14.00

Standard dimensions, forms and weights

The dimensions, forms, weights and tolerances of all rolled shapes rivets, bolts, nuts, studs, washers etc. and other members used in the fabrication of any structure shall, wherever applicable, conform to the requirements of the latest relevant Indian Standards, wherever they exist, or, in the absence of Indian Standards, to other equivalent standards.

2.15.00

Fabrication Drawings

The contractor shall within thirty (30) days after the award of the Contract submit to the Engineer the Schedule of Fabrication and erection of structural Steelworks, for approval. Within one week after receipt of approval on design of any steel structure (part or full) based on the approved design. As decided by the Engineer, six (6) copies each of some or all of the detailed fabrication drawings will have to be submitted for approval.

The sequence of preparation of fabrication drawings shall match with the approved fabrication and erection schedule. The above-mentioned approval for fabrication drawings will be accorded only towards the general conformity with the design requirements as well as specifications. The approval of drawing however shall not relieve the contractor of his sole responsibility in carrying out the work correctly and fulfilling the complete requirements of contract documents.

The fabrication drawings shall include but not limited to the following:

a)

Assembly drawings giving exact sizes of the sections to be used and identification marks of the various sections.

b)

Dimensional drawings of base plates, foundation bolts location etc.

c)

Comparison sheets to show that the proposed alternative section, if any, is as strong as the original sections shown on the Design Drawings.

d)

Complete Bill of Materials and detailed drawings of all sections as also their billing weights.

e)

Any other drawings or calculations that may be required for the clarification of the works or substituted parts thereof.

These drawings shall give all the necessary information for the fabrication, erection, and painting of the steelwork in accordance with the provisions of this Specification. Fabrication drawings shall be made in accordance with the best modern practice and with due regard to sequence, speed and economy in fabrication and erection. Fabrication drawings shall give complete information necessary for fabrication of the various components of the steelwork,

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including the location, type, size, and extent of welds. These shall also clearly distinguish between shop and field rivets, bolts, and welds and specify the class of bolts and nuts. The drawings shall be drawn to a scale large enough to convey all the necessary information adequately. Notes on the fabrication drawings shall indicate those joints or groups of joints in which it is particularly important that the welding sequence and technique of welding shall be carefully controlled to minimize the locked up stresses and distortion. Welding symbols used shall be in accordance with the requirements of the Indian Standard Specification. IS: 813 - Scheme of symbols for Welding, and shall be consistent throughout. Weld lengths called for on the drawings shall mean the net effective length. The Contractor shall be responsible for and shall carry out at his cost any alterations of the work due to any discrepancies, errors or omissions on the drawings or other particulars supplied by him, whether such drawings or other particulars have been duly approved or not in accordance with the Contract. 3.00.00 WORKMANSHIP 3.01.00 Fabrication 3.01.01 General All workmanship shall be equal to the best practice in modern structural shops, and shall conform to the provisions of the Indian Standard IS: 800 - Code of Practice for general construction in steel and other relevant Indian Standards or equivalent. 3.01.02 Straightening Material Rolled materials before being laid off or worked, must be clean, free from sharp kinks, bends or twists and straight within the tolerances allowed by the Indian Standard Specification on IS: 1552 - Specification for rolling and cutting tolerance for hot-rolled steel products. If straightening is necessary, it may be done by mechanical means or by the application of a limited amount of localized heat. The temperature of heated areas, as measured by approved methods, shall not exceed 600°C. 3.01.03 Cutting Shearing, cropping, or sawing shall affect cutting. Use of a mechanically controlled gas-cutting torch may be permitted for mild steel only. Gas cutting of high tensile steel may also be permitted provided special care is taken to leave sufficient metal to be removed by machining, so that all metal that has been hardened by flame is removed. Gas cutting without a mechanically controlled torch may be permitted if special care is taken and done under expert hand, subject to the approval of the Engineer.			

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To determine the effective size of members cut by gas, 3 mm shall be deducted from each cut edge. Gas cut edges, which will be subjected to substantial stress or which are to have weld metal deposited on them, shall be reasonably free from gouges, occasional notches or gouges not more than 4 mm deep will be permitted. Gouges greater than 4 mm that remain from cutting shall be removed by grinding. All re-entrant corners shall be shaped notch free to a radius of at least 12 mm. Shearing, cropping and gas cutting shall be clean, reasonably square and free from any distortion.

3.01.04 Planning of edges

Planning or finishing of sheared or cropped edges of plates or shapes or of edges gas-cut with a mechanically controlled torch shall not be required, unless specifically required by design and called for on the drawings, included in a stipulation for edge preparation for welding or as may be required after the inspection of the cut surface. Surface cut with hand-flame shall generally be ground, unless specifically instructed otherwise by the Engineer.

3.01.05 Clearances

The erection clearance for cleated ends of members connecting steel to steel shall preferably be not greater than 2 mm at each end. The erection clearance at ends of beams web shall be not more than 3 mm at each end, but where for practical reasons greater clearance is necessary, suitably designed cheatings shall be provided.

3.02.00 Riveted and bolted construction

3.02.01 Holes

Holes through more than one thickness of material for members, such as compound stanchions and girder flanges, shall be drilled after the members are assembled and tightly clamped or bolted together. Punching may be permitted before assembly, if the thickness of the material is not greater than the nominal diameter of rivet or bolt plus 3 mm subject to a maximum thickness of 16 mm provided that the holes are punched 3 mm less in diameter than the required size and reamed after assembly to the full diameter.

Holes for rivets or black bolts shall be not more than 1.5 mm or 2.0 mm (depending on whether the diameter of the rivet or bolt is less or more than or equal to 25 mm) larger in diameter than the nominal diameter of the rivet or black bolt passing through them.

Holes for turned and fitted bolts shall be drilled to a diameter equal to the nominal diameter of the shank or barrel subject to a tolerance grade of BS as specified in IS: 919. Parts to be connected shall be firmly held together by

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tacking welds or clamps and the holes drilled through all the thicknesses in one operation and subsequently reamed to size. Holes not drilled through all thickness in one operation shall be drilled to a smaller size and reamed out after assembly.

Holes for rivets or bolts shall not be formed by gas cutting process.

3.02.02

Assembly

All parts of riveted members shall be well pinned or bolted and rigidly held together while riveting. Drifting to enlarge unmatching holes shall not generally be permitted. In case drifting is permitted to a slight extent during assembly, it shall not distort the metal or enlarge the holes. Holes that must be enlarged to admit the rivets or bolts shall be reamed. Poor matching of holes shall be cause for rejection .The component parts shall be so assembled that they are neither twisted not otherwise damaged, and shall be so prepared that the specified cambers, if any, are maintained.

Rivets shall ordinarily be hot driven, in which case their finished heads shall be approximately hemispherical in shape and shall be of uniform size throughout the work for rivets of the same size full, neatly finished and concentric with he holes. Rivets shall be heated uniformly to a temperature not exceeding 1 125°C they shall not be driven after their temperature has fallen below 540°C.

Rivets shall be driven by power riveters, of either compression or manually operated type, employing pneumatic, hydraulic or electric power. Hand driven rivets shall not be allowed unless in exceptional cases specifically approved by the Engineer. After driving, rivets shall be tight, shall completely fill the holes and their heads shall be in full contact with the surface. In case of countersunk rivets, the countersinking shall be fully filled by the rivet, any proudness of the countersunk head being dressed off flush, if required.

Riveted members shall have all parts firmly drawn and held together before and during riveting and special care shall be taken in this respect for all single riveted connections. For multiple riveted connections, a service bolt shall be provided in every third or fourth hole.

All loose, burnt, or otherwise defective rivets shall be cut out and replaced and special care shall be taken to inspect all single riveted connections. Special care shall also be taken in heating and driving long rivets. The Contractor shall prove the quality of riveting by cutting some rivets chosen at random by the Engineer. No extra payment will be made to the Contractor for such cutting and replacing. Riveting work, for any particular section or group, will be considered satisfactory when at least 90% of the corresponding cut rivets is found to be sound. If the ratio is below 75%, all the rivets in the particular section or group shall be cut, removed and replaced and tested again at the

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Contractor's expense. For cases between 75% and 90% the engineer shall have the option to instruct cutting and replacing any number of further rivets at the Contractor's cost as he deems necessary. Bolted construction shall be permitted only in case of field connections if called for on the Drawings and is subjected to the limitation of particular connections as may be specified. In special cases, however, shop bolt connections may be allowed if shown on drawing or directed by the Engineer. Washers shall be tapered or otherwise suitably shaped, where necessary, to give the heads and nuts of bolts a satisfactory bearing. The threaded portion of each bolt shall project through the nut at least one thread. In all cases the bolt shall be provided with a washer of sufficient thickness under the nut to avoid any threaded portion of the bolt being within the thickness of the parts bolted together. In addition to the normal washer one spring washer or lock nut shall be provided for each bolt for connections subjected to vibrating forces or otherwise as may be specified on the Drawings. 3.03.00 Welded Construction 3.03.01 General Welding shall be in accordance with relevant Indian Standards and as supplemented in the Specification. Welding shall be done by experienced and good welders who have been qualified by tests in accordance with IS: 817. 3.03.02 Preparation of material Surface to be welded shall be free from loose scale, slag, rust, grease, paint, and any other foreign material except that mill scale, which withstands vigorous wire brushing, may remain. Joint surfaces shall be free from fins and tears. Preparation of edges by gas cutting shall, wherever practicable, be done by a mechanically guided torch. 3.03.03 Assembling Parts to be fillet welded shall be brought in, as close contact as practicable and in no event shall be separated by more than 4 mm. If the separation is 1.5 mm or greater, the size of the fillet welds shall be increased by the amount of the separation. The fit of joints at contact surfaces, which are not completely sealed by, welds, shall be close enough to exclude water after painting. Abutting parts to be butt-welded shall be carefully aligned. Misalignments greater than 3 mm shall be corrected and in making the correction the parts shall not be drawn into a sharper slope than two degrees (2°). The work shall be positioned for flat welding whenever practicable.					

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3.03.04

Welding Sequence

In assembling and joining parts of a structure or of built-up members, the procedure and sequence of welding shall be such as will avoid needless distortion and minimize shrinkage stresses in the closing welds of a rigid assembly, such closing welds shall be made in compression elements.

In the fabrication of cover-plated beams and built-up members, all shop splices in each component part shall be made before such component part is welded to other parts of the member. Long girders or girder sections may be made by shod splicing not more than three sub-sections, each made in accordance with this paragraph.

When required by the Engineer, welded assemblies shall be stress relieved by heat-treating in accordance with the provisions of the relevant Indian Standard or any other Standard approved by the Engineer.

3.03.05

Welding technique

All complete penetration groove welds made by manual welding, except when produced with the aid of backing material not more than 8 mm thick with root opening not less than one-half the thickness of the thinner part joined, shall have the root of the initial layer gouged out on the back side before welding is started from that side, and shall be so welded as to secure sound metal and complete fusion throughout the entire cross-section. Groove welds made with the use of the backing of the same material, as the base metal shall have the weld metal thoroughly fused with the backing material. Backing strips need not be removed. If required, they may be removed by gouging or gas cutting after welding is completed, provided no injury is done to the base metal and weld metal and the weld metal surface is left flush or slightly convex with full throat thickness.

Groove welds shall be terminated at the ends of a joint in a manner that will ensure their soundness. Where possible, this should be done by use of extension bars or run-off plates. Extension bars or run-off plates need not be removed upon completion of the weld unless otherwise specified elsewhere in the contract.

To get the best and consistent quality of welding, automatic submerged arc process shall be preferred. The technique of welding employed, the appearance and quality of welds made, and the methods of correcting defective work shall all conform to the relevant Indian Standards.

3.03.12

Temperature

No welding shall normally be done on parent material at a temperature below (-) 5°C. However, if welding is to undertaken at low temperature, adequate precautions as recommended in relevant Indian Standard shall be taken. When

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the parent material is less than 40 mm thick and the temperature is between (-) 5°C and 0°C, the surface around the joint to a distance of 100 mm or 4 times the thickness of the material, whichever is greater, shall be preheated till it is hand warm. When the parent material is more than 40 mm thick, the temperature of the area mentioned above shall be in no case be less than 20°C. All requirements regarding preheating of the parent material shall be in accordance with the relevant Indian Standard.					
3.03. 13		Peening Where required, intermediate layers of multiple-layer welds may be peened with light blows from a power hammer, using a round-nose tool, peening shall be done after the weld has cooled to a temperature warm to the hand. Care shall be exercised to prevent scaling or flaking of weld and base metal from over peening.			
3.03. 14		Equipment These shall be capable of producing proper current so that the operator may produce satisfactory welds. The welding machine shall be of a type and capacity as recommended by the manufacturers of electrodes or as may be approved by the engineer.			
3.04.00		Finish Column splices and butt joints of compression members depending on contact for stress transmission shall be accurately machined and close-butt over the whole section with a clearance not exceeding 0.1 mm locally at any place. In column caps and bases, the ends of shafts together with the attached gussets, angles, channels etc; after welding/riveting together, should be accurately machined so that the parts connected butt over the entire surfaces of contact. Care should be taken that those connecting angles of channels are fixed with such accuracy that they are not reduced in thickness by machining by more than 1.0 mm.			
3.05.00		Slab bases and caps Bases and caps fabricated out of steel slabs, except when cut material with true surface, shall be accurately machined over the bearing surface and shall be in effective contact with the end of the stanchion. A bearing face, which is to be grouted direct to a foundation, need not be machined if such face is true and parallel to the upper face. To facilitate grouting, holes shall be provided, where necessary, in stanchion bases for the escape of air.			

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3.12.00	Lacing bars The ends of lacing bars shall be neat and free from burns.		
3.13.00	Separators Rolled section or built-up steel separators or diaphragms shall be required for all double beams except where encased in concrete, in which case, pipe separators shall be used.		
3.14.00	Bearing Plates Provision shall be made for all necessary steel bearing plates to take up reaction of beams and columns and the required stiffeners and gussets whether or not specified in Drawings.		
3.15.00	Floor Grating All grating units shall be rectangular in pattern and of pressure locked assembly. The size and spacing of bearing bars and cross bars shall be as approved in detailed drawings. Alternatively diamond pattern grating if approved may be used. The grating shall be made in panel units designed to span as indicated in structural steel framing drawing or as directed by the Engineer. The grating units shall be finished free from warps, twists, or any other defects. Grating work shall include cutouts and clearance openings for all columns, pipes, ducts, conduits etc. The gratings shall be notched, trimmed, and neatly finished around components of the steel structures encountered. Binding strip shall be provided on the grating to suit the profile. Openings in gratings shall be provided with steel bar toe plates of not less than 5 mm thickness and 100 mm width. Unless otherwise indicated on drawings, all penetrations of grating units shall be made up in split section, accurately fitted, and neatly finished. Grating units shall be provided with all necessary clips, bolts, lock washers etc. for proper assembly and installation on supporting steel members. Maximum deviation in linear dimension shall not exceed 12 mm.		
3.10.00	Chequered Plates Minimum thickness of chequered plate floorings, covers etc. shall be 6 mm O/P. Chequered plate shall be accurately cut to the required sizes and shapes and the cut edges properly ground. Stiffeners shall be provided wherever required from design consideration.		

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3.11.00	Architectural Clearances Bearing plates and stiffener connections shall not be permitted to encroach on the designed architectural clearances.		
3.11.00	Shop connections a) All shop connections shall be otherwise riveted or welded as specified on the Drawings. b) Heads of rivets on surfaces carrying brick walls shall be flattened to 10 mm thick projection. c) Certain connections, specified to be shop connections, may be changed to field connections if desired by the Engineer for convenience of erection and the contractor will have to make the desired changes at no extra cost to the exchequer.		
3.13.00	Castings Steel castings shall be annealed.		
3.14.00	Shop erection The steelwork shall be temporarily shop-erected complete or as directed by the Engineer so that accuracy of fit may be checked before dispatch. The parts shall be shop-erected with a sufficient number of parallel drifts to bring and keep the parts in place. In case of parts drilled or punched using steel jigs to make all similar parts interchangeable, the steelwork shall be shop erected in such a way as will facilitate the check of interchange ability.		

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3.15.00	Shop painting				
3.15.01	General Unless otherwise specified, steelwork, which will be concealed by interior building finish, need not be painted; steelwork to be encased in concrete shall not be painted. Unless specifically exempted, all other steelwork shall be given one coat of shop paint, applied thoroughly and evenly to dry surfaces which have been cleaned, in accordance with the following paragraph, by brush, spray, roller coating, flow-coating or dipping as may be approved by the Engineer. After inspection and approval and before leaving the shop, all steelwork specified to be painted shall be cleaned by hand-wire brushing or by other methods of loose mill scale, loose rust, weld slag or flux deposit, dirt and other foreign matter. Oil and grease deposits shall be removed by the solvent. Steelwork specified to have no shop paint shall, after fabrication, be cleaned of oil or grease by solvent cleaners and be cleaned of dirt and other foreign material by trough sweeping with a fibre brush.				
3.15.02	Inaccessible parts Surfaces not in contact, but inaccessible after assembly, shall receive two coats of shop paint, Positively of different colours to prove application of two coats before assembly. This does not apply to the interior of sealed hollow sections.				
3.15.03	Contact surfaces Contact surface shall be cleaned in accordance with sub-clause 3.13.1 before assembly.				
3.15.04	Finished surfaces Machine finished surfaces shall be protected against corrosion by a rust inhibiting coating that can be easily removed prior to erection or which has characteristics that make removal unnecessary prior to erection.				
3.15.05	Surfaces adjacent to field welds Unless otherwise provided for, surfaces within 50 of any field weld location shall be free of materials that would prevent proper welding or produce objectionable fumes while welding is being done.				

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3.16.00	Galvanizing				
3.16.01	General				
	Structural steelwork for switchyard or other structures as may be specified in the contract shall be hot dip galvanized in accordance with the American Society for Testing and Materials Specification ASTM-A 123 or IS: 2629 - Recommended practice for Hot-Dip Galvanizing of Iron and steel. Where the steel structures are required to be galvanized the field connection materials like bolts, nuts and washers shall also be galvanized.				
3.16.02	Surface Preparation				
	All members to be galvanized shall be cleaned, by the process of pickling of rust, loose scale, oil, grease, slag and spatter of welded areas and other foreign substances prior to galvanizing. Pickling shall be carried out by immersing the steel in an acid bath containing either sulphuric or hydrochloric acid at a suitable concentration and temperature. The concentration of the acid and the temperature of the bath can be varied, provided that the pickling time is adjusted accordingly. The pickling process shall be completed by thoroughly rinsing with water, which should preferably be warm, so as to remove the residual acid.				
3.16.03	Procedure				
	Galvanizing shall be carried out by hot dip process in a proper and uniformly heated bath. It shall meet all the requirements when tested in accordance with IS: 2633 - Method for testing uniformity of coating on Zinc Coated Articles and IS: 4759 - Specification for Hot-dip zinc coatings on Structural Steel & other allied products. After finishing the threads of bolts, galvanizing shall be applied over the entire surface uniformly. The threads of bolts shall not be machined after galvanizing and shall not be clogged with zinc. The threads of nuts may be tapped after galvanizing but care shall be taken to use oil in the threads of nuts during erection. The surface preparation for galvanizing and the process of galvanizing itself, shall not adversely affect the mechanical properties of the materials to be galvanized. Where members are of such lengths as to prevent complete dipping in one operation, great care shall be taken to prevent warping. Materials on which galvanizing has been damaged shall be acid stripped and re-galvanized unless otherwise directed, but if any member becomes damaged after leaving been dipped twice, it shall be rejected. Special care shall be taken not to injure the skin on galvanized surfaces during transport, handling, and				

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erection. Damages, if occur, shall be made good in accordance or as directed by the Engineer.					
4.00.00 INSPECTION, TESTING, ACCEPTANCE CRITERIA AND DELIVERY					
4.01.00 Inspection Unless specified otherwise, inspection to all, work shall be made by the or Engineer's representative at the place of manufacture prior to delivery. The Engineer or his representative shall have free access at all reasonable times to those parts of the manufacturer's works which are concerned with the fabrication of the steelwork under this Contract and he shall be afforded all reasonable facilities for satisfying himself that the fabrication is being done in accordance with the provisions of this Specification. The Contractor shall provide free of charge, such labour, materials, electricity, fuel, water, stores, tools and plant, apparatus and instruments as may be required by the Engineer to carry out inspection and/or tests in accordance with the Contract. The Contractor shall guarantee compliance with the provisions of this Specification.					
4.02.00 Testing and Acceptance Criteria					
4.02.01 General The Contractor shall carry out sampling and testing in accordance with the relevant Indian Standards and as supplemented herein for the following items at his own Cost. The Contractor shall get the specimens tested in a laboratory approved by the Engineer and submit to the Engineer the test results in triplicate within 3 (three) days after completion of the test.					
4.02.02 Steel All steel supplied by, the Contractor shall conform, to the relevant Indian Standards. Except otherwise mentioned in the contract, only tested quality steel having mill test reports shall be used. In case unidentified steel materials are permitted to be used by the Engineer, random samples of materials will be taken from each unidentified lot of 50 M.T or less of any particular section for tests to conform to relevant Indian Standards. Cost of all tests shall be born by the contractor. All material shall be free from all imperfections, mill scales, slag intrusions, laminations, fittings, rusts etc. that may impair their strength, durability, and appearance.					

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4.02.02	Welding a) The weld surface shall be cleaned with steel wire brush to remove spatter metal, slag etc. and 100% of welds shall be inspected visually for size, length of weldment and external defects. Weld gauges shall be used for checking weld sizes. The surface shall be clean with regular beads and free from slags, cracks, blow-holes etc. b) Non-destructive examination shall be carried out to determine soundness of weldments as follows: i) 10% at random on fillet-joints. ii) 100% on all butt-joints. c) Should the ND tests indicate defects like improper root penetration, extensive blowholes, slag intrusion etc., such welds shall be back gauged, joints prepared again and rewelded. All defects shall be rectified by the Contractor at no extra costs. d) All electrodes shall be procured from approved reputed manufacturers with test certificates. The correct grade and size of electrode, which has not deteriorated in storage, shall be used. The inspection and testing of welding shall be performed in accordance with the provisions of the relevant Indian Standards or other equivalents. For every 50 tones of welded fabrication, the Engineer may ask for 1(one) test-destructive or non-destructive including X -ray, ultrasonic test or similar, the cost of which shall be borne by the Contractor.		
4.02.04	Rivets, bolts, nuts and washers All rivets, bolts, nuts, and washers shall be procured from M/s. Guest Keen William Ltd. or equivalent and shall confirm to the relevant Indian Standards. If desired by the Engineer, representative samples of these materials may have to be tested in an approved laboratory and in accordance with the procedures described in relevant Indian Standards. Cost of all such testing shall have to be borne by the Contractor. In addition to testing the rivets by hammer, 2% (two per cent) of the rivets done shall have to be cut off by chisels to ascertain the fit, quality of material and workmanship. The removal of the cut rivets and re-installing new rivets shall be done by the Contractor at his own cost.		
4.02.05	Shop painting All paints and primers shall be of standard quality and procured from approved manufacturers and shall conform to the provisions of the relevant Indian Standards.		

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4.02. 12	Galvanizing All galvanizing shall be uniform and of standard quality when tested in accordance with IS: 2633 - Method for testing uniformity of coating on Zinc Coated Articles and 15: 4759 - specification for Hot-Dip Zinc Coatings on Structural Steel & other allied products.	
4.03.00	Tolerance The tolerances on the dimensions of individual rolled steel components shall be as specified in IS: 1852 - specification for rolling and Cutting Tolerances for Hot-rolled Steel Products. The tolerances on straightness, length etc. of various fabricated components (such as beams and girders, columns, crane gantry girder etc.) of the steel structures shall be as specified in IS: 721 - Tolerances for Fabrication of Steel Structures.	
4.04.00	Acceptance Should any structure or part of a structure be found not to comply with any of the provisions of this specification, the same shall be liable to rejection. No Structure or part of the structure once rejected, shall be offered again for test, except in cases where the Engineer considers the defects rectifiable. The Engineer may, at his discretion, check some of the tests at an appropriate laboratory at the contractors cost. When all tests to be performed in the Contractor's shop under the terms of this contract have been successfully carried out, the steelwork will be accepted forthwith and the Engineer will issue acceptance certificate, upon receipt of which, the items will be shop painted, packed and dispatched. No item to be delivered unless an acceptance certificate for the same has been issued. The satisfactory completion of these tests or the issue of the certificates shall not bind the Owner to accept the work, should it, on further tests before or after erection, be found not in compliance with the Contract.	
4.05.00	Delivery of materials	
4.05.01	General The Contractor will deliver the fabricated structural steel materials to site with all necessary field connection materials in such sequence as will permit the most efficient and economical performance of the erection work. The Owner may prescribe or control the sequence of delivery of materials, at his own discretion.	

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4.05.02

Marking

Each separate piece of fabricated steelwork shall be distinctly marked on all surfaces before delivery in accordance with the markings shown on approved erection drawings and shall bear such other marks as will further facilitate identification and erection.

4.05.03

Shipping

Shipping shall be strictly in accordance with the sequence stipulated in the agreed Programme. Contractor shall dispatch the materials to the e worksite securely protecting and packing the materials to avoid loss or damage during transport by rail, road or water. All parts shall be adequately braced to prevent damage in transit.

Each bundle, bale or package delivered under this contract shall be marked on as many sides as possible and such distinct marking (all previous irrelevant markings being carefully obliterated) shall show the following:

a)

Name and address of the consignee

b)

Name and address of the consignor

c)

Gross weight of the package in tonnes and its dimensions

d)

Identification marks and/or number of the package

e)

Custom registration number, if required

All markings shall be carried out with such materials as would ensure quick drying and indelibility.

Each component or part or piece of material when shipped, shall be indelibly marked and/or tagged with reference to assembly drawings and corresponding piece numbers.

Each packing case shall contain in duplicate in English a packing list pasted on to the inside of the cover in a water-proof envelope, quoting especially -

a)

Name of the Contractor

b)

Number and date of the Contract

c)

Name of the office placing the contract

d)

Nomenclature of stores

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e) A schedule of parts or pieces, giving the parts or piece number with reference to assembly drawings and the quantity of each. The shipping dimensions of each packing shall not exceed the maximum dimensions permissible for transport over the Indian Railways/Roads. After delivery of the materials at site, all packing materials shall automatically become the property of the Owner. Notwithstanding anything stated hereinbefore, any loss or damage resulting from inadequate packing shall be made good by the Contractor at no additional cost to the Owner. When facilities exist, all shipments shall be covered by approved Insurance Policy for transit at the cost of the Contractor. The contractor shall ship the complete materials or part on board a vessel belonging to an agency approved by the Owner or on rail and/or road transport as directed. The Contractor shall take all reasonable steps to ensure correct appraisal of freight rates, weights and volumes and in no case will the Owner be liable to pay any warehouse, wharfage, demurrage and other charges. If, however, the Owner has to make payment of any of the above-mentioned charges, the amount paid will be deducted from the bills of the Contractor. Necessary advise regarding the shipment with relevant details shall reach the Engineer at least a week in advance. 5.00.00 INFORMATION TO BE SUBMITTED 5.01.00 With Tender The following information is required to be submitted with the Tender: a) Progress Schedule The Contractor shall quote in his Tender a detailed schedule of progress of work and total time of completion, itemizing the time required for each of the following aspects of work. i) Preparation and approval of fabrication drawing ii) Procurement of Materials iii) Fabrication and shipping of all anchor bolts iv) Fabrication and shipping of main steelwork. v) Fabrication and shipping of steelwork for bunkers, tanks and/or silos		

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	as applicable. vi) Fabrication and shipping of all other remaining steelwork including miscellaneous steelwork. vii) Final date of completion of all shipments. b) Shop Location of the Tenderer's fabrication workshop giving details of equipment, manpower, the total capacity, and the capacity that will be available exclusively for this contract shall be submitted. 5.02.00 After Award After award of the Contract the successful Tenderer is to submit the following: a) Complete fabrication drawings, material lists, cutting lists, rive and bolt lists, field welding schedules based on the approved design drawings prepared by him in accordance with the approved schedule. b) Monthly Progress Report with necessary photographs in six (6) copies to reach the Engineer on or before the 7th day o. each month, giving the up-to-date status of preparation of detailed shop drawings, bill of materials, procurement of materials, actual fabrication done, shipping and all other relevant information. c) Detailed monthly material reconciliation statements relevant to the Work done and reported in the Progress Report, giving the stock at hand of raw steel, work in progress, finished materials. d) Results of any test as and when conducted and as require by the engineer. e) Manufacturer's mill test report in respect of steel materials, rivets, bolts, nuts, and electrodes as may be applicable. 6.00.00 RATES AND MEASUREMENT 6.01.00 Rates 6.01.01 The items of work in the Schedule of items describe the work in brief. The various items of the Schedule of items shall be read in conjunction with these specifications including amendments and additions, general conditions of contract, special conditions of contracts, and other tender documents, if any. For each item of Schedule of Items, the bidder's rates shall include the activities covered in the description of the item as well as all necessary	

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operations described in the Specifications.

6.01.02 The bidder's rates shall include cost of all minor details which are obviously and fairly intended and which may not have been included in the description in these documents but are essential for the satisfactory completion of the work. Rates shall also include for taking all safety measures.

6.01.03 The bidder's -rates for all items of schedule of items shall include complete cost towards plant, equipment, erection and dismantling of scaffolding, men, materials and consumables, skilled and unskilled labour, levies, taxes, royalties, duties, transport, storage, repair/rectification/maintenance until handing over, contingencies, overhead and all incidental items not specifically mentioned but reasonably implied and necessary to complete the work.

6.01.04 No claims shall be entertained, if the details shown on the 'Released for Construction' drawings differ from those shown on the bid/tender drawings.

6.01.05 Rates shall be inclusive of all leads and lifts/elevation.

6.01.06 The bidder's rates for Structural Steel shall include for fabrication and erection, transportation to site, preparation checking collecting and distributing of the fabrication drawings and design calculations, erection scheme, alignment, welding, including preheating and post heating, testing of welders, inspection of welds, visual inspection, non destructive and special testing, rectification and correction of defective welding works, production test plate, inspection and testing, erection scheme, protection against damage in transit, stability of structures, etc. The rates shall also be inclusive of providing and installing temporary structures, transport of Owner issue material from store, return of surplus/waste steel materials including cut pieces/waste steel, provision of additional butt/weld joint to reduce the wastage and all other general, special, such requirements as may be required, for the successful completion of the work.

The rates for fabrication are inclusive of all tests on welds and material and no extra shall be payable for quality tests specified for fabrication of structure in shop or at site.

Separate BOQ items for test on welds like radiography or Ultrasonic, DPT, magnetic particle tests are kept for tests on material/fabrication not covered under regular fabrication item of BOQ.

6.01.07 The bidder's rates for foundation bolts assembly shall include fabrication, threading, heat treatment, erection, installation, and alignment of complete bolt assembly with nuts, locknuts, anchor plates, stiffener plates, protective tape, etc. This shall also include the cost of all materials not issued by the Owner. Material issued by Owner will be specified in GCC.

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foundation bolt shall be calculated in the same way as that done for the item of fabrication, erection, alignment of structural steel. The weight of the nut / locknut shall be taken as per actual weight supplied by the contractor and accepted by the Engineer.					
6.02.02	The measurement for the item of fabrication, erection, alignment, welding, etc. of structural steel work shall be based on the approved weight of steel nearest to a Kg, by applying the unit weight as adopted at the time of issue of structural steel on the measurements worked out as given below.				
6.02.03	For ISMB, ISMC, ISA, flats, round bars, square bars and pipes, length shall be taken as per distance between planes normal to the axis of the member passing through the extreme points of the section.				
6.02.04	Gussets plates in trusses, and bracings, brackets plates, stiffeners, and skew cuts if any in plates for butt welds, the area shall be assumed as the minimum circumscribed rectangle. However deduction for any notch/skew cut shall be made as mentioned in clause no-6.02.06.				
6.02.05	For bunker wall plates, the minimum-circumscribing rectangle of the individual plate/pieces out of which these wall plates are assembled by butt-welding, shall be measured. Care shall be taken to ensure maximum utilization of cut-pieces generated by providing extra butt joints (for which no extra payment shall be made).				
6.02.06	For all other plates, where the area of any notch/skew cut in the plate is less than 0.05 sq.m. the area of the plate shall be assumed as that of the minimum circumscribing rectangle for the purpose of measurement and calculation of area for the purpose of payment. However, if the area of any notch/skew cuts in a plate is more than 0.05 sq.m, the area of notch/skew cut shall be deducted from assumed minimum circumscribing rectangular area for the purpose of payment.				
6.02.07	No deduction shall be made for the hole in the members, if the area of individual hole is less than 0.05 sq.m. The weight shall be calculated by deducting the area of holes, if area of individual hole is more than 0.05 sq.m.				
6.02.08	All cut-pieces and scrap generated due to cutting of holes, skew-cuts of plates, gussets, brackets, stiffeners, etc. shall be stacked separately and handed over to the project stores without being considered for material accounting as the circumscribing rectangle has been considered for payment.				
6.02.09	The splice plate shown in the fabrication drawing or approved by the Engineer shall only be measured for payment.				
6.02.10	The weight of permanent bolts, washers and nuts and welds shall not be included in the weights of the members. No extra payment shall be made for				

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welding/bolting.					
6.02.11	The bolts and nuts required for erection purpose shall not be paid for and may be taken away by the Contractor after final welding for members. Erection boltholes left after removal of erection bolts shall be suitably plugged with welds.				
6.02.12	The measurement for the item of application of inorganic primer including blast cleaning of steel surfaces shall be based on the weight on which the zinc silicate primer is applied, after blast cleaning in Metric Tonne, corrected to third place of decimal. The weight shall be the weight as approved, for erection mark/element of the mark painted, for payment of the item of fabrication and erection of structural steel works.				
6.02.13	The measurement for the item of application of finish primer system shall be based on the weight on which the epoxy based finish primer is applied in Metric Tonne, corrected to third place of decimal. The weight shall be the weight as approved, for erection mark/element of the mark painted, for payment of the item of fabrication and erection of structural steel works.				
6.02.14	The measurement for the item of gratings shall be based on the actual weight in Kgs, corrected to second place of decimal, as supplied by the Contractor, and accepted by the Engineer. Nothing extra shall be payable for making cutouts, notches, openings of any profile, trimming profiles etc. in the grating units.				
6.02.15	The measurement for the item of hot dipped galvanization of gratings shall be based on the actual weight in Kgs, corrected to second place of decimal of gratings galvanized by the Contractor and accepted by the Engineer.				
6.02.16	The measurement for the item of permanent bolts with nuts and washers shall be based on the actual weight in Kgs, corrected to second place of decimal, as supplied by the Contractor and accepted by the Engineer, and as per the approved bolts and nuts schedules.				
6.02.17	The measurement for the item of High Strength Structural bolts with nuts and washers shall be based on the actual weight in Kgs, corrected to second place of decimal, as supplied by the Contractor and accepted by the Engineer, and as per the approved bolts and nuts schedules.				
6.02.18	The measurement for the item of the work of dismantling, additions, alterations, reerection etc. shall be as given below				
6.02.19	For dismantling, the unmodified weight of the actually dismantled erection marks shall only be measured.				
6.02.20	For the work of addition to, alteration in and / or modification of 'erection				

	TITLE: TECHNICAL SPECIFICATION FOR FABRICATION OF STRUCTURAL STEEL WORK	SPECIFICATION NO. PE-TS-999-600-C017 VOLUME - II B SECTION - D SUBSECTION -D17 REV.NO. 0 DATE 01/01/2020 SHEET 40 OF 40
	marks' either in erected position or in the fabrication yard, measurement of weight for payment purpose shall be calculated as the arithmetic sum of weight of steel cut and removed from the erection mark, weight of steel reutilised out of such cut and removed pieces and weight of additional new steel pieces added to the erection mark. 6.02.21 For re-erection the weight of the modified erection mark shall only be measured. 6.02.22 The weight shall be measured nearest to kg. and shall be arrived in a manner similar to the measurement for the item of fabrication, erection, alignment and welding of structural steel. 6.02.23 The measurement for the item of PTFE bearings shall be based on the load carrying capacity of PTFE in MT, corrected to third place of decimal, supplied by the contractor and as accepted by the Engineer and as per the approved bearing schedule, for the total vertical load carrying capacity, for all bearings. 6.02.24 The measurement for the item of stainless steel hopper shall be based on the actual finished weight of hopper weight in Kgs, corrected to second place of decimal. The hopper weight shall be arrived by multiplying of the inner surface area of the hopper with the unit weight of the hopper plate. 6.02.25 The measurement for the item of flexible open-ended bellows straps of neoprene shall be based in running meter, corrected to second place of decimal. Bellow Straps shall be supplied as per the requirement of the approved drawings. The measurement shall be done for the inner circumference of the bunker on which neoprene has been fixed and for the length supplied by the Contractor 'and as accepted by the Engineer. 6.02.26 The measurement for the item of Stainless Steel Hand Railing shall be based on finished weight of handrail in Kgs corrected to second place of decimal. The weight shall also include the weight of Stainless Steel fasteners, Stainless Steel beading, Stainless Steel cleats etc. The weight shall be the finished weight of Hand Rail, as accepted by the Engineer.	

SUB-SECTION – E-47

QA – CIVIL WORKS

CLAUSE NO.	 Quality Assurance for Civil Works 																																																									
	<table><tr><th colspan="4">TOLERANCES</th></tr><tr><th colspan="3">Description of Item/ Structural Element</th><th>Max (mm)</th><th>Min (mm)</th></tr><tr><td colspan="3">Pre- Cast Concrete</td><td></td><td></td></tr><tr><td>15.</td><td>Length:</td><td>+/- 0.1 percent</td><td>+/- 5</td><td>+ 10</td></tr><tr><td>16.</td><td>Straightness or Bow</td><td>1/750 of the length</td><td>+/- 5</td><td>+/- 10</td></tr><tr><td>17.</td><td>Cross-sectional dimensions</td><td colspan="3">+/- 3 mm or +/- 0.1 percent whichever is greater</td></tr><tr><td>18.</td><td>Squareness:</td><td colspan="3">When considering the squareness of the corner the length of the two adjacent sides being checked shall be taken as the base line. The shorter side shall not vary in length from the perpendicular by more than 5 mm.</td></tr><tr><td>19.</td><td>Flatness:</td><td colspan="3">The maximum deviation from a 1.5m straight edge placed in any position on a nominal plant surface shall not exceed 5 mm.</td></tr><tr><td colspan="3">Placing of reinforcement and for cover (Cover blocks shall be of same grade of concrete in which these would be embedded)</td><td colspan="2">Clause 12.3.1 and 12.3.2 of IS 456</td></tr><tr><td colspan="3">Formwork</td><td colspan="2">Clause 9.6 of IS 14687 and 11.1 of IS 456</td></tr><tr><td colspan="3">Batching</td><td colspan="2">Clause 10.2.2 of IS 456</td></tr></table>				TOLERANCES				Description of Item/ Structural Element			Max (mm)	Min (mm)	Pre- Cast Concrete					15.	Length:	+/- 0.1 percent	+/- 5	+ 10	16.	Straightness or Bow	1/750 of the length	+/- 5	+/- 10	17.	Cross-sectional dimensions	+/- 3 mm or +/- 0.1 percent whichever is greater			18.	Squareness:	When considering the squareness of the corner the length of the two adjacent sides being checked shall be taken as the base line. The shorter side shall not vary in length from the perpendicular by more than 5 mm.			19.	Flatness:	The maximum deviation from a 1.5m straight edge placed in any position on a nominal plant surface shall not exceed 5 mm.			Placing of reinforcement and for cover (Cover blocks shall be of same grade of concrete in which these would be embedded)			Clause 12.3.1 and 12.3.2 of IS 456		Formwork			Clause 9.6 of IS 14687 and 11.1 of IS 456		Batching			Clause 10.2.2 of IS 456	
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11.1.5	STRUCTURAL STEEL WORK																																																									
11.1.5.1	For structural steel works provisions of technical specifications and IS: 800 shall apply. A detailed methodology for structural steel works shall be submitted by the contractor to OWNER for approval. The methodology may require change / modification based on the site conditions, for which suitable revisions shall be submitted.																																																									
11.1.5.2	The contractor shall submit the welding procedures specification (WPS), heat treatment procedures, NDT procedures etc. at least ninety days before scheduled start of erection work at site. All welding and brazing shall be submitted to the OWNER and carried out as per procedure drawn and qualified in accordance with requirements of ASME Section IX/BS-4870 or other International equivalent standard acceptable to the OWNER.																																																									
11.1.5.3	All brazers, welders and welding operators employed on any part of the contract either in the contractor's / sub-contractor's works or at site or elsewhere shall be qualified as per AWS D1.1/ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the OWNER.																																																									
11.1.5.4	The records of welding procedure qualification and welder qualification test results shall be furnished to the OWNER for approval. However, where required by the OWNER, the tests shall be conducted in presence of OWNER / authorized representative.																																																									
11.1.5.5	No welding shall be carried out on cast iron components for repair. All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.																																																									
11.1.5.6	All Non-destructive examination shall be performed in accordance with written procedures as per International Standards and as mentioned elsewhere in the technical																																																									
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION-E-47 STEAM TURBINE GENERATOR	PAGE 13 OF 23																																																					

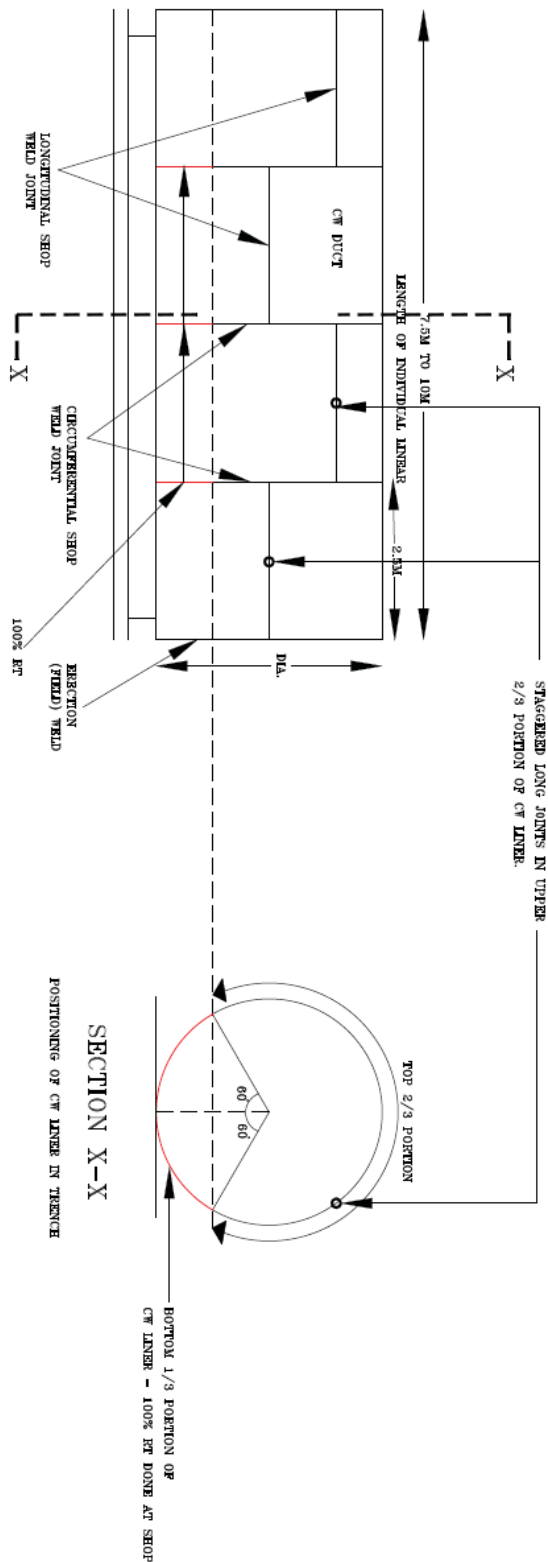
CLAUSE NO.	 Quality Assurance for Civil Works 																																
	specification. The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report, which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job. The records of RT (Films) and UT (inspection records or printed reports if possible) shall be documented and produced to OWNER.																																
11.1.5.7	Low hydrogen electrode (AWS E-7018) for welding of High/Medium tensile steel, for M.S (IS 2062) sections thickness above 20mm shall be used. Preheating and Post weld heat treatment requirements shall be complied as specified in the technical specification / approved WPS.																																
11.1.5.8	The requirements of pre-heating shall be <table><tr><td>Thickness of thickest part at the area of welding / heat affected zone</td><td>Welding using other than low hydrogen welding electrodes IS 2062</td><td>Welding using low hydrogen welding electrodes or submerged arc welding IS 2062</td></tr><tr><td>Upto 20 mm (including)</td><td>None</td><td>None</td></tr><tr><td>Over 20 mm to 40 mm (including)</td><td>Not allowed</td><td>20⁰ C</td></tr><tr><td>Over 40 mm to 63 mm (including)</td><td>Not allowed</td><td>66⁰ C</td></tr><tr><td>Over 63 mm</td><td>Not allowed</td><td>110⁰ C</td></tr></table>			Thickness of thickest part at the area of welding / heat affected zone	Welding using other than low hydrogen welding electrodes IS 2062	Welding using low hydrogen welding electrodes or submerged arc welding IS 2062	Upto 20 mm (including)	None	None	Over 20 mm to 40 mm (including)	Not allowed	20 ⁰ C	Over 40 mm to 63 mm (including)	Not allowed	66 ⁰ C	Over 63 mm	Not allowed	110 ⁰ C															
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11.1.5.9	The following tests / checks shall be carried out for structural steel works <table><tr><td>SL. NO.</td><td>TESTS / CHECKS</td><td>QUANTUM / STANDARD</td></tr><tr><td>1.</td><td>Physical and chemical properties of material if supply in the scope of contractor</td><td>As per relevant codes, review of correlated mill test certificates or check testing in absence of MTC</td></tr><tr><td>2.</td><td>Ultrasonic test on plates above 40mm</td><td>As per ASTM A435</td></tr><tr><td>3.</td><td>Welding procedure & welders qualification test</td><td>AWSD1.1/ASME Section-IX or BS-4871 or other equivalent International Standards</td></tr><tr><td colspan="2">Fillet Weld</td><td></td></tr><tr><td>4.</td><td>Macro-etch examination on production test coupons for main fillet welds</td><td>Minimum one joint per built up beams, columns and crane girder etc.</td></tr><tr><td>5.</td><td>Tension member of crane girder</td><td>Dye penetration test on 25% weld length</td></tr><tr><td>6.</td><td>All other fillet welds</td><td>DPT on 5% of weld length with minimum 300mm at each location</td></tr><tr><td colspan="2">Butt Weld</td><td></td></tr><tr><td>7.</td><td>DPT</td><td>100% after back gouging on all</td></tr></table>			SL. NO.	TESTS / CHECKS	QUANTUM / STANDARD	1.	Physical and chemical properties of material if supply in the scope of contractor	As per relevant codes, review of correlated mill test certificates or check testing in absence of MTC	2.	Ultrasonic test on plates above 40mm	As per ASTM A435	3.	Welding procedure & welders qualification test	AWSD1.1/ASME Section-IX or BS-4871 or other equivalent International Standards	Fillet Weld			4.	Macro-etch examination on production test coupons for main fillet welds	Minimum one joint per built up beams, columns and crane girder etc.	5.	Tension member of crane girder	Dye penetration test on 25% weld length	6.	All other fillet welds	DPT on 5% of weld length with minimum 300mm at each location	Butt Weld			7.	DPT	100% after back gouging on all
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KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-E-47 STEAM TURBINE GENERATOR																														
			PAGE 14 OF 23																														

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11.1.6	<table><tr><th>SL. NO.</th><th>TESTS / CHECKS</th><th>QUANTUM / STANDARD</th></tr><tr><td></td><td></td><td>butt welds except for coal bunker bins 10% after back gouging-For coal bunker bins</td></tr><tr><td>8.</td><td>Mechanical testing of production test coupons</td><td>Minimum one joint per built up beam, column and crane girder.</td></tr><tr><td>9.</td><td>Radiography test on butt welds (In case of failure of any welds in SPOT/RT or UT the % of retesting shall be doubled at that particular location. Acceptance criteria of NDT on welds shall be as per AWS D1.1. Wherever RT is not feasible UT to be carried out with the approval of the engineer)</td><td>100% RT on butt welds of tension flange (bottom flange) of crane girders 10% RT weld length of each welder on butt welds, except for crane girders and coal bunker 5% spot RT on butt welds / at inaccessible locations UT on butt welds- For coal bunker bins</td></tr><tr><td>10.</td><td>Ultrasonic testing on full penetration welds (other than butt welds)</td><td>100% UT on the web to flange joint of crane girder 10% UT on other full penetration joints</td></tr><tr><td>11.</td><td>Control assembly check in shop before erection</td><td>1st and further every 10th set of identical structure</td></tr><tr><td>12.</td><td>Dimensional tolerances during fabrication and erection</td><td>as per IS-7215 and IS-12843</td></tr><tr><td>13.</td><td>Surface Preparation and Paint thickness</td><td>SA 2 1/2 , By elcometer random after each coat, each member</td></tr></table>	SL. NO.	TESTS / CHECKS	QUANTUM / STANDARD			butt welds except for coal bunker bins 10% after back gouging-For coal bunker bins	8.	Mechanical testing of production test coupons	Minimum one joint per built up beam, column and crane girder.	9.	Radiography test on butt welds (In case of failure of any welds in SPOT/RT or UT the % of retesting shall be doubled at that particular location. Acceptance criteria of NDT on welds shall be as per AWS D1.1. Wherever RT is not feasible UT to be carried out with the approval of the engineer)	100% RT on butt welds of tension flange (bottom flange) of crane girders 10% RT weld length of each welder on butt welds, except for crane girders and coal bunker 5% spot RT on butt welds / at inaccessible locations UT on butt welds- For coal bunker bins	10.	Ultrasonic testing on full penetration welds (other than butt welds)	100% UT on the web to flange joint of crane girder 10% UT on other full penetration joints	11.	Control assembly check in shop before erection	1 st and further every 10 th set of identical structure	12.	Dimensional tolerances during fabrication and erection	as per IS-7215 and IS-12843	13.	Surface Preparation and Paint thickness	SA 2 1/2 , By elcometer random after each coat, each member		
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	CW LINER/DUCT																										
	The following tests / checks shall be carried out for CW Liner works:																										
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	SL. NO.	TESTS / CHECKS	QUANTUM / STANDARD																								
	CW Liner Fabricated at Site (Field Shop) and Factory Fabricated CW Liner using Steel Plates with Longitudinal & Circumferential Weld Joints																										
	Option-1																										
<table><tr><td>1.</td><td>WPS,PQR& welder's Qualification</td><td>100%</td></tr><tr><td>2.</td><td>DPT on root run</td><td>100% for pipes upto 1200mm diameter</td></tr><tr><td>3.</td><td>DPT after back gouging</td><td>100% for pipes above 1200mm diameter</td></tr><tr><td>4.</td><td>UT</td><td>Not recommended.</td></tr></table>	1.	WPS,PQR& welder's Qualification	100%	2.	DPT on root run	100% for pipes upto 1200mm diameter	3.	DPT after back gouging	100% for pipes above 1200mm diameter	4.	UT	Not recommended.															
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KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-E-47 STEAM TURBINE GENERATOR	PAGE 15 OF 23
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	SL. NO.	TESTS / CHECKS	QUANTUM / STANDARD
	5.	RT	5%
	6.	DPT on finished butt welds	10%
	7.	Hydro test	1.5 times the design pressure or 2 times the working pressure whichever is higher.
	Option-2		
	1.	WPS,PQR& welder's Qualification	100%
	2.	DPT on root run	100% for pipes upto 1200mm diameter
	3.	DPT after back gouging	100% for pipes above 1200mm diameter
	4.	UT	Not recommended
	5.	RT	- 100 % RT on circumferential joints in the bottom 1/3 portion of CW liner for weld length as per Fig 1 - 5% RT on top 2/3 portion of circumferential joints and - 5% RT on longitudinal joints
	6.	DPT on finished butt welds	10%
	7.	Hydro test	No Hydro test
	Factory fabricated CW liner using H.R. coils with spiral weld joints		
	1.	WPS,PQR& welder's Qualification	100%
	2.	DPT on root run	100% DPT for pipes upto 1200mm diameter
	3.	DPT after back gouging	100% DPT for pipes above 1200mm diameter
	4.	UT	Not recommended.
	5.	RT	5% RT
	6.	DPT on finished butt welds	10% DPT
	7.	Hydro test	Hydro test at 1.5 times the design pressure or 2 times the working pressure whichever is higher.
	CW Liners erection site test		
	1.	WPS,PQR& welder's Qualification	100%
	2.	DPT on root run	100% for pipes upto 1200mm diameter
	3.	DPT after back gouging	100% for pipes above 1200mm diameter
	4.	UT	Not recommended.
	5.	RT	5%
	6.	DPT on finished butt welds	10%
	7.	Hydro test	1.5 times the design pressure or 2 times the working pressure whichever is higher. In exceptional cases where hydraulic test is not possible the same may be substituted with 100%RT
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-E-47 STEAM TURBINE GENERATOR
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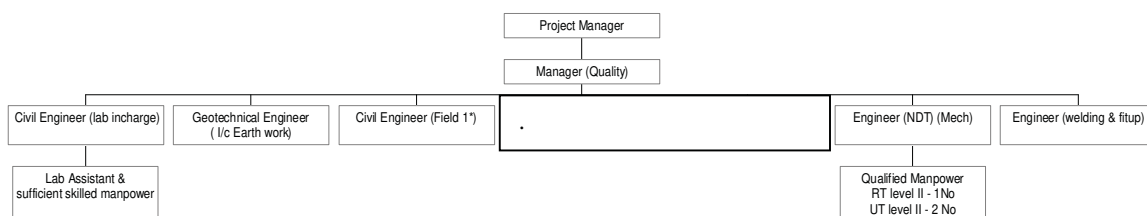
CLAUSE NO.	 Quality Assurance for Civil Works 		
11.1.7.	SHOP TEST EOT Cranes, Other cranes & Hoist 1.0 HOOKS 1.01 ALL TESTS INCLUDING PROOF LOAD TEST AS PER RELEVANT IS/BS/DIN SHALL BE CARRIED OUT. 1.02 MPI/DPT SHALL BE CARRIED OUT AFTER PROOF LOAD TEST. 2.0 STEEL CASTING 2.01 DPT ON MACHINED SURFACE SHALL BE CARRIED OUT. 3.0 GIRDERS, END CARRIAGE, CRAB, GEAR BOX AND ROPE DRUM 3.01 THE PLATES OF THICKNESS 25MM AND ABOVE SHALL BE ULTRASONICALLY TESTED. 3.02 NDT REQUIREMENTS ON WELDMENTS SHALL BE AS FOLLOWS: a) BUTT WELDS IN TENSION:- 100% RT AND 100% DPT b) BUTT WELDS IN COMPRESSION:- 10% RT AND 100% DPT c) BUTT WELDS IN ROPE DRUM:- 100% RT AND 100% DPT d) FILLET WELDS:- RANDOM 10% DPT 4.0 FORGING (WHEEL, GEARS, PINIONS, AXLE, HOOKS & HOOK TRUNION) 4.01 ALL FORGINGS GREATER THAN OR EQUAL TO 50 MM DIAMETER OR THICKNESS SHALL BE SUBJECTED TO ULTRASONIC TESTING. 4.02 DPT/MPI SHALL BE DONE AFTER HARDFACING AND MACHINING. 5.0 WIRE ROPE SHALL BE TESTED AS PER RELEVANT STANDARD. 6.0 REDUCTION GEARS SHALL BE TESTED FOR REDUCTION RATIO, BACKLASH & CONTACT PATTERN. GEAR BOX SHALL BE SUBJECTED TO NO-LOAD RUN TEST TO CHECK FOR OIL LEAKAGE, TEMPERATURE RISE, NOISE AND VIBRATION. 7.0 THE CRANES SHALL BE COMPLETELY ASSEMBLED AT SHOP FOR FINAL TESTING. ALL TESTS FOR DIMENSION, DEFLECTION, LOAD, OVERLOAD, HOISTING MOTION, CROSS TRAVEL ETC. AS PER IS-3177 SHALL BE CARRIED OUT AT SHOP. 8.0 ALL ELECTRIC HOISTS SHALL BE TESTED AS PER IS-3938 AND CHAIN PULLEY BLOCKS SHALL BE TESTED AS PER IS-3832.		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-E-47 STEAM TURBINE GENERATOR	PAGE 17 OF 23

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	FIG.1 INDIVIDUAL PIECE OF CW LINER - RADIOGRAPHY TEST NOTE : RADIOGRAPHED PORTIONS OF THE JOINTS TO BE SUITABLY COLORED FOR IDENTIFICATION DURING LAYING. 		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-371	SUB-SECTION-E-47 STEAM TURBINE GENERATOR	PAGE 18 OF 23

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11.1.8	PAINTING WORKS Painting works shall be carried out as per the provisions of technical specifications. A detailed methodology for painting works shall be submitted by the contractor to OWNER for approval. The methodology may require change / modification based on the site conditions, for which suitable revisions shall be submitted. The methodology for painting works shall broadly contain the source of approved brand of paints, blast cleaning as specified, minimum acceptable size of shot used for blasting, application of primer, intermediate coat and final coat, experience of applicator, etc. testing of painting work and acceptance checks for final clearance. For PU coating works if specified, material shall be procured from OWNER approved source and the application of the PU coating shall be carried out by an experienced authorized applicator of the material supplier approved by OWNER. A separate quality plan and methodology for PU coating works shall be submitted by the contractor for approval of OWNER. Based on the approved quality plan, the tests on material and works shall be got conducted at specialist laboratories like IICT Hyderabad, CECRI Karaikudi.			
11.1.9	SHEETING WORKS All bought out items shall be procured from the approved manufacturers and tested as per relevant Codes/ Specification. Raw material of colour coated sheets shall meet the chemical & physical properties as per relevant standards / codes referred in the approved data sheet. It shall be tested for colour match, bare metal thickness, weight of Z/AZ coating, thickness of painting system, reverse impact, T-Bend adhesion, scratch resistance, salt spray test for 1000 Hrs and any other test / properties as specified in the technical specifications. Colour coated sheets shall be marked with video jet printing at the interval not more than 2m bearing manufacturer's name, date & time of manufacturing. Fasteners shall also be tested for 1000 hrs salt spray test as per the requirement of technical specifications. Bonded Mineral Wool Insulation shall meet the requirements of thickness, density, thermal Conductivity, all other tests as per the technical specifications and IS-8183. For sheet installation no gas cut opening shall be allowed at the site, whenever opening is specified these shall be properly cut in the factory and shall be filled with lipping / flashing for true shape / dimension etc. The sheets/ packets shall be stacked neatly clear off the ground at an angle to the ground, over a base pallet to provide drainage. Water / moisture should not be allowed to stagnate on surface, or in between layers. This can damage the coating, and cause corrosion.			
11.1.10	TILE WORKS The contractor shall submit the work methodology which shall include the type, grade and make of materials along with their technical data sheets, details, etc, clearance from E-I-C regarding leak proofness and damp proofness of parent concrete surface, surface preparation, the procedure of application, curing, testing and acceptance. The agencies having adequate experience to execute the acid / alkali resistant lining works shall be engaged for executing the acid / alkali resistant lining works after obtaining the approval from the E-I-C. The execution, finishing, testing and acceptance of tile works shall be as per the provisions of technical specifications. The material for tile works shall be procured from			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-371	SUB-SECTION-E-47 STEAM TURBINE GENERATOR	PAGE 19 OF 23

ANNEXURE-I

QA&QC ORGANISATION SETUP

**NOTE:**

1. The above organization setup is minimum however their deployment shall be as per the agreed deployment schedule. The contractor shall prepare a manpower deployment schedule in line with the finalized work plan and the same shall be submitted to the engineer-in charge for acceptance/ approval.
2. The contractor shall mobilize the QA& QC manpower in line with the finalized manpower deployment schedule and shall ensure their availability well in advance (15 days approx.) of the beginning of the concerned activity/ work.
3. The contractor shall further mobilize required number of skilled & supporting staff and additional resources, if any to meet the work schedule.
4. * For concrete work 2 Nos (one for foundation work & one for superstructure)
5. ** For lines and levels - 1 No.
6. *** For Finishes and cladding work - 1 No

INDICATIVE FIELD QUALITY PLAN													ANNEXURE-V B		
SUPPLIERS NAME AND ADDRESS:		ITEM : STRUCTURAL STEEL WORK		Q.P. NO. : 2		PROJECT: Khurja TPP (2 X 660 MW)		Steam Turbine Generator Island Package							
		SUB-SYSTEM : FABRICATION & ERECTION		REV. NO. :		CONTRACT NO.									
		DATE :		PAGE :		MAIN CONTRACTOR									
Sl. No	Activity and operation	Characteristics / Instruments	Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record		Remarks					
1.00	2	3	4	5	6	7	8	9	D*	10					
i	MATERIALS	Structural steel procured from OWNER approved sources- Mechanical (YS, UTS, Elg, UT if specified), and Chemical properties (CF as per IS)	A	Review	For each batch of each section delivered at site	Technical Specification and Construction Drawings, IS 2062		SR	✓	Correlated MTC shall be verified. In the event of non submission of MTC, sample shall be selected by FOA for testing as per specification.					
2.00	FIT-UP														
i		Marking and Cutting	B	Visual & Measurement	Each plate/ Section	Tech Specs and Const. Drawings/ Approved cutting plan		SR							
ii		Match markings for trial assembled components	B	Physical	Each fit-up	Tech Specs and Const. Drawings		SR							
iii		Weld Fit Up	B	Physical	Each fit-up	Tech Specs and Const. Drawings		SR	✓	Edge Preparation/ Gap/ Alignment					
3.00	PRE HEATING (wherever applicable)														
i		Pre-Heating Temperature	B	Measurement	Each pre-heating	Tech Specs and Const. Drawings, Approved WPS		SR	✓						
ii		Post Weld Heat Treatment (PWHT), if required	A	Time & Temperature	Each PWHT	Tech Specs and Const. Drawings, Approved WPS		SR	✓						
4.00	WELDING REQUIREMENTS														
i		PQR and Welder's Qualification	A	Physical	Each welder	Approved WPS/ PQR, AWS-D1, /ASME-IX, Tech Specs and Const. Drawings		Test Report	✓						
ii		Welding consumables	B	Physical	Random in each shift	Approved WPS/ Owner Rationalized list of Electrodes		SR	✓						
iii		Sequence of welding	B	Physical	Random in each shift	Tech Specs and Const. Drawings		SR							
iv		Removal/ grinding of temporary attachments	B	Measurement	All cleats/ attachments	Tech Specs and Const. Drawings, IS-7215		SR							
v		Completeness after welding- Dimensions/ distortion	B	Visual	Each structure component	Tech Specs and Const. Drawings		SR							
5.00	NON DESTRUCTIVE AND DESTRUCTIVE TESTING														
5.01	Fillet Welds														
i		Visual	B	Visual/ Measurement	Each welded joint	As per technical specifications and construction drawings		SR		As per requirement of Owner Engineer					
ii		Macro-Etch Examination	B	Physical	Main fillet weld with min one joint per built up beam, columns and crane girders	As per technical specifications and construction drawings		SR	✓						
iii		Dye Penetration Test (DPT)	B	Physical	25% weld length of tension member of crane girder- For crane girder 5% of Weld length with min. 300mm at each location - Except Crane Girder, for all other Fillet Welds	As per technical specifications and construction drawings		SR	✓						
5.02	Butt Welds														

INDICATIVE FIELD QUALITY PLAN										ANNEXURE- V B				
SUPPLIERS NAME AND ADDRESS:		ITEM : STRUCTURAL STEEL WORK				QP NO. : 2		PROJECT:		Khurja TPP (2 X 660 MW)				
		SUB-SYSTEM : FABRICATION & ERECTION				REV. NO. :		CONTRACT NO.		Steam Turbine Generator Island Package				
		PAGE :				DATE :		MAIN CONTRACTOR						
Sl. No	Activity and operation	3		Class of check	4	Type of Check	5	6	Quantum Of check	Reference Document	Acceptance Norms	Format of Record		Remarks
		Visual	As required/ agreed									8	9	
i				R		Visual		Random in each shift	As per technical specifications and construction drawings					
ii		Dye Penetration Test	As required/ agreed	B		Physical		100% DPT after back gouging on all butt welds except for coal bunker bins	As per technical specifications and construction drawings	SR				All butt welds to be back gouged before DPT
iii		Mechanical testing on production test coupons	As required/ agreed	A		Physical		Min. one joint per built up beams, columns and crane girder.	As per technical specifications and construction drawings	SR		✓		Test on production test coupons
iv		Radiography Test (RT)	As required/ agreed	A		Physical		100% RT on butt welds of tension flange (bottom flange) of crane girders 5% spot RT on butt welds / at inaccessible locations UT on butt welds for coal bunker bins 10% RT weld length of each welder on butt welds except for crane girders and coal bunk	As per technical specifications and construction drawings	SR		✓		In case of failure of any welds in SPOT/RT or UT the % of retesting shall be doubled at that particular location. Acceptance criteria of NDT on welds shall be as per AWS D1.1. Wherever RT is not feasible UT to be carried out with the approval of the Engineer
5.03	Full Penetration Welds (Other than butt welds)							100% UT on the web to flange joint of crane girder 10% UT on other full penetration joints	As per technical specifications and construction drawings	IR		✓		In case of failure of any welds in SPOT/RT or UT the % of retesting shall be doubled at that particular location. Acceptance criteria of NDT on welds shall be as per AWS D1.1.
5.04	NON DESTRUCTIVE AND DESTRUCTIVE TESTING FOR CHIMNEY STEEL LINER													
i		Visual examination	As required/ agreed	B		Visual		100%		As per technical specifications and construction drawings, IS 822, AWS D 1.1	SR		✓	As per requirement of OWMNER Engineer
ii		DPT	As required/ agreed	B		Physical		100%		As per technical specifications and construction drawings, IS 822, AWS D 1.1	IR		✓	
iii		RT	As required/ agreed	A		Physical		10% FOR SHOP BUTT WELD AND 15% FOR SITE BUTT WELDS	As per technical specifications and construction drawings, IS 822, AWS D 1.1					
6.00	FOUNDATION CHECKS													

INDICATIVE FIELD QUALITY PLAN										ANNEXURE- V B			
SUPPLIERS NAME AND ADDRESS:		ITEM : STRUCTURAL STEEL WORK			QP NO. : 2		PROJECT:		Khurja TPP (2 X 660 MW)				
		SUB-SYSTEM : FABRICATION & ERECTION			REV. NO. :				Steam Turbine Generator Island Package				
		DATE :			PAGE :		CONTRACT NO.						
							MAIN CONTRACTOR						
Sl. No	Activity and operation	Characteristics / Instruments			Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record		Remarks	
	2	3	4	5	6	7	8	9	10				
i		Dimensions and levels	As agreed / required	B	Physical/ Measurement	Each Foundation	Tech Specs and Const. Drawings	SR	✓	Shape, lines (including diagonal checks)			
ii		Foundation Bolts (materials)	As agreed / required	A	Physical and MTC Review	Once for each lot of delivery	Tech Specs and Const. Drawings	SR/MTC	✓	Foundation bolts shall conform to IS:5624 and property class shall be 4.6 as per IS:1367 (Part-3).			
ii		Foundation Bolts and Embedment's	As agreed / required	B	Physical/ Measurement	Each Foundation	Tech Specs and Const. Drawings	SR	✓	Measurement of Verticality, Levels, pitch distance			
7.0	Receipt of shop fabricated steel structure at site	Material	As agreed / required	A	Physical & Review of CHP	Each structural member	Tech Specs and Const. Drawings	SR	✓	Checks for visual defects and completeness of painting as per CHP			
8.0	Submission of Erection sequence/ methodology of erection for all structures	-	A	Approval	Once prior to erection of each structure		Approved drawings and Technical Specifications	SR	✓				
PRE-ASSEMBLY CHECKS													
i		Punch Erection marks and match marks on members	As agreed / required	B	Visual/ Physical	Each structural member	Tech Specs and Const. Drawings			Markings for - Assembly designation, Part number, Weight, Any other important identifications.			
ii		Pre-assembly as per match mark	As agreed / required	B	Visual/ Physical	Each structural member	Tech Specs and Const. Drawings						
iii		Camber, sweep and total length after trial assembly of structure.	As agreed / required	B	Visual/ Physical	Each structural member	Tech Specs and Const. Drawings	SR	✓				
iv		Control assembly check at shop	As agreed / required	B	Visual/ Physical	Every first and tenth set of identical structure	Tech Specs and Const. Drawings						
ERECTION CHECKS													
i		Alignment, slopes, level, tolerances of erected member	As agreed / required	B	Measurement	Each structural member	Tech Specs and Const. Drawings	SR	✓				
ii		Tightening of bolts including foundation bolts with lock nuts	As agreed / required	B	Visual/ Physical	Each structural member	Tech Specs and Const. Drawings	SR	✓				
iii		Acceptance of erected structure	As agreed / required	A	Visual/ Physical	Each erected structure	Tech Specs and Const. Drawings, IS 7715 and IS 17843	SR	✓	To be verified w.r.t. approved methodology for erection / erection sequence			
PAINTING SYSTEM													
i		Painting Materials and accessories	As agreed / required	A	Review of MTC	Each batch of delivery	Tech Specs and Const. Drawings	SR/MTC	✓	Material to be procured from OWNER approved sources.			
ii		Surface preparation	As agreed / required	B	Physical / Visual	Random in each shift	Tech Specs and Const. Drawings, Relevant code/ standards	SR	✓				
iii		DFT of paint - Over steel surface	As agreed / required	A	Physical	Each surface at random	Tech Specs and Const. Drawings	SR	✓				

 SUPPLIERS NAME AND ADDRESS:		INDICATIVE FIELD QUALITY PLAN						ANNEXURE- V B			
		ITEM : STRUCTURAL STEEL WORK		QP NO. : 2		PROJECT: Khuria TPP (2 X 660 MW)		Steam Turbine Generator Island Package			
		SUB-SYSTEM : FABRICATION & ERECTION		REV. NO. :		CONTRACT NO.					
				DATE :		MAIN CONTRACTOR					
		PAGE :									
Sl. No	Activity and operation	Characteristics / Instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record		Remarks
1	2	3	4	5	6	7	8	9	10		
iv		Acceptance of painted surfaces	As agreed / required	3	Physical	Each surface at random	Tech Specs and Const. Drawings		SR		
12.00	PERMANENT BOLTS AND NUTS AND WASHERS										
i		Material	As agreed / required	A	Physical and MTC Review	Once for each lot of delivery	Tech Specs and Const. Drawings		SR/MTC	✓	All bolts, nuts and washers for connections shall be conforming to relevant IS as given in the Tech. Spec./Construction Drawing
ii		Contact surfaces before bolting	As agreed / required	B	Physical	Random before assembly for bolting	Tech Specs and Const. Drawings, IS 4000		SR		
iii		Inspection of the assembled bolts	As agreed / required	B	Physical	Randomly in each shift for assembled bolts	Tech Specs and Const. Drawings, IS 4000		SR		
iv		Tensioning	As agreed / required	B	Physical	Randomly during snug tight test and after full tensioning	Tech Specs and Const. Drawings, IS 4000		SR	✓	
v		Acceptance of installed bolts	As agreed / required	B	Physical	Each bolt	Tech Specs and Const. Drawings		SR		
13.00	ELECTROFORGED GRATINGS										
i		Material from approved source	As agreed / required	A	Physical and CHP Review	Once for each lot of delivery	Tech Specs and Const. Drawings		SR/MTC	✓	Also refer the approved MQP
ii		Acceptance of Erection, alignment and each Installation	As agreed / required	B	Physical	100%	Tech Specs and Const. Drawings		SR		
14.00	STAINLESS STEEL HAND RAILS										
i		Material	As agreed / required	A	Physical/MTC Review(In case procured by contractor)	Once for each lot of delivery	Tech Specs and Const. Drawings		SR/MTC	✓	Also check grade of steel
ii		DPT for welding	As agreed / required	A	Physical	Random for each fabrication	AWS D1.1 / Tech Specs and Const. Drawings		SR/ R	✓	WPS shall be submitted for Owner approval, electrodes used shall be as specified in WPS
iii		Acceptance of stainless steel hand rails	As agreed / required	B	Physical	Each installation	Tech Specs and Const. Drawings		SR		

SUPPLIERS NAME AND ADDRESS:		INDICATIVE FIELD QUALITY PLAN				ANNEXURE- V B			
		ITEM : STRUCTURAL STEEL WORK		QP NO. : 2	PROJECT: Khuria TPP (2 X 660 MW)				
		SUB-SYSTEM : FABRICATION & ERECTION		REV. NO. :	CONTRACT NO.				
				DATE :	MAIN CONTRACTOR				
				PAGE :					
Sl. No	Activity and operation	Characteristics / Instruments	Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record	Remarks
1	2	3	4	5	6	7	8	9	10
15.00	PTFE SLIDING BEARINGS AND ELASTOMERIC BEARINGS								
i	Material from approved source	As agreed / required	A	Physical and MTC Review	Once for each lot of delivery	Tech Specs and Const. Drawings		SR/MTC	✓
ii	Acceptance of installation of bearings	As agreed / required	B	Physical	Each installation	Tech Specs and Const. Drawings		SR	
			LEGEND: D = Records, identified with "Tick" (✓) shall be essentially included by supplier in QA documentation						
			Legend to be used: Class # : A = Critical, B=Major, C=Minor, SR, TR, MTC, LB						
Manufactur			Categorization Witnessing & Accepting (As per Owner QA&I System)						
er Sub-			Category 'A' FQA Engineer in association with Executing Engineer, Category 'B' Executing Engineer, Category 'C' Executing Engineer; SR = Site Register, TR= Test Report, MTR TC = Manufacturer's Test Certificate						
supplier			For Owner USE						
Signature			This document shall be read in conjunction with Owner Tech. Specifications, BOQ, Drawings						
			REVIEWED BY						
			APPROVED BY						
			APPROVAL SEAL						