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# TENDER NO. BHEL: NR:SCT:KOSTI:MEI:646

## T E N D E R  S P E C I F I C A T I O N S

## FOR

## TENDER FOR THE WORK OF "ERECTION, TESTING, COMMISSIONING AND TRIAL OPERATION OF 4 X 125 MW TG SETS, ELECTRICALS, C&I & BOP PACKAGES AT KOSTI TPP ( 4 X 125 MW UNITS), SUDAN".

## PART I – TECHNICAL BID

**Bharat Heavy Electricals Limited**
**(**A Govt. Of India Undertaking)
**Power Sector – Northern Region,**
**Plot No. 25 , Sector - 16A ,**
**Distt. Gautam Budh Nagar, NOIDA – 201 301 (INDIA)**

**ISO 9001-2000, ISO 14001 and OHSAS 18001 certified company**
**SubContract and Purchase Deptt.**

**Bharat Heavy Electricals Limited**
**(**A Govt. Of India Undertaking)
**Power Sector – Northern Region,**
**Plot No. 25 , Sector - 16A ,**
**Distt. Gautam Budh Nagar, NOIDA – 201 301 (INDIA)**
**Phone: 0091-0120-2515476 / 2515464 / 2515479**
**Fax 091-0120-2515464 / 2515467**
**Email: msd@bhelpsnr.co.in / sca@bhelpsnr.co.in**

# TENDER NO. BHEL: NR: SCT: KOSTI: MEI:646

## IMPORTANT NOTE

PURCHASER OF THIS TENDER DOCUMENT IS ADVISED TO CHECK AND ENSURE COMPLETION OF ALL PAGES OF TENDER DOCUMENT AND REPORT ANY DISCREPANCY TIMELY FOR CORRECTIVE ACTION, IF ANY, TO THE ISSUING AUTHORITY BEFORE THE BIDS ARE SUBMITTED. ORIGINAL COPY/ DOWNLOADED COPY OF TENDER DOCUMENT COMPLETE IN ALL RESPECTS MUST BE SUBMITTED BACK (DULY SIGNED AND STAMPED) AS PART OF THE BID WITHOUT WHICH THE SAME IS LIABLE TO BE REJECTED BY BHEL.

THIS TENDER SPECIFICATION ISSUED TO:

M/S----------

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# INDEX

ISO 9001-2000, ISO 14001 and OHSAS 18001 certified company
Sub-Contract and Purchase Deptt.

**Bharat Heavy Electricals Limited**
**(**A Govt. Of India Undertaking)
**Power Sector – Northern Region (SCP),**
**Room No. 104, Plot No. 25 , Sector - 16A ,**
**Distt. Gautam Budh Nagar, NOIDA – 201 301(INDIA)**
**Phone: 0091-0120-2515476 / 2515464 / 2515479**
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# TENDER NOTICE

Sealed tenders are invited from the contractors fulfilling qualifying requirements for the Work of "ERECTION, TESTING, COMMISSIONING AND TRIAL OPERATION OF 4 X 125 MW TG SETS, ELECTRICALS, C&I & BOP PACKAGES AT KOSTI TPP ( 4 X 125 MW UNITS), SUDAN"

## TENDER NO. BHEL: NR: SCT: KOSTI: MEI: 646

**QUALIFYING REQUIREMENTS:**

**1.0** **The tenderers who wish to participate should have, during preceding seven (7) years period ( reckoned as on the date of bid opening) :-**

**1.1 "Executed similar nature of work, covered in this tender, for atleast one STG Set of 67.5 MW Unit or higher rating units "**

**'OR'**

**"Should be executing works of similar nature, as covered in this tender, against BHEL's direct order for one STG set of 125 MW Unit or above rating."**

**'AND'**

**1.2 "Executed works of similar nature (against one or more contracts) consisting of 6.6 KV or higher rating indoor switch gear, 132 kV /150 MVA or higher rating Oil Filled Transformer, 11 KV Isolated Phase bus duct etc in Power Projects/ Industrial Projects."**

**'AND'**

**1.3 "Executed works of similar nature (against one or more contracts) consisting of Switch yard of 132 KV or higher rating in Power Projects/ Industrial Projects".**

**'AND'**

**1.4 "Executed works of similar nature in control panels and related field instrumentation of 67.5 MW or higher capacity unit in Power Projects/ Industrial Projects" .**

**NOTE: a). In case the tenderer with experience as per QR SL NO. 1.1, do not have experience as per QR at SL NO. 1.2, 1.3 and 1.4, they are allowed to have "Tie Up Arrangement" for these works as detailed at SL NO. 3.0 indicated below .**

**b) If the qualifying work is completed in the seven(7) year period specified above, even if it has been started earlier, the same will also be considered meeting the qualifying requirements.**

**c) The word "executed" means, tenderer should have achieved the progress specified above even if the total contract is not completed/closed.**

**2.0** **Party should also have an average annual turnover of minimum of Rs. 350 Millions (Rupees Three Hundred and fifty Millions Only) during preceding three years (2006-07, 2007-08 & 2008-09). Tenderer shall submit audited balance sheet in support of the same.**

**In case audited balance sheet and profit & loss account for last 3 years ending on 31-03-2009 is not finalised, bidder shall submit audited balance sheet for last 3 years, ending on 31-03-2008. In such a case, this QR shall be read as "Party should also have an average annual turnover of minimum of Rs. 350 Millions (Rupees Three Hundred and fifty Millions Only) during preceding three years (2005-06, 2006-07 & 2007-08). Tenderer shall submit audited balance sheet in support of the same"**

**3.0** **Tie-Up Arrangement: Tenderer having experience as per QR SL NO. 1.1 but not have experience as per QR SL NO. 1.2, 1.3 and 1.4, shall be allowed to have tie up arrangements with the parties who are having experience as per QR SL NO. 1.2, 1.3 and 1.4 given above. Tenderer having experience as per QR SL. No. 1.1 shall only be the Lead Partner. The composition of the Tie-up arrangement and role and responsibility of each constituent, including that of lead partner, for execution of work in their respective area must be well defined . The tenderer (Lead Partner) can have only one tie up partner for each QR indicated at Sl. No. 1.2, 1.3 and 1.4. The tenderer shall give an undertaking that the responsibility of execution of entire work shall lie with the Lead Partner and also that in case of dissolution of Tie up, the Lead partner shall be liable for completing the work as per the terms of contract without any additional cost to BHEL or without affecting project schedule. Also, in case of dissolution of any Tie up, the Lead partner will immediately arrange necessary alternate tie up with another party meeting the QR requirement of this NIT (Subject to BHEL's approval). In case the same is not arranged, BHEL will be free to get the work done through alternate sources at their (Contractor's) risk & cost. Legal documents of the tie up Agreement, signed by all the partners, shall be submitted as a part of technical bid.**

**3.1 For the purpose of qualifying requirements as given at SL no 2.0, the financial turnover of all the partners put together shall be considered. However, audited balance sheets of all the partners shall be submitted by the tenderer along with Part –I bid.**

**4.0** **Bidders are required to enter into an Integrity Pact (IP) with BHEL against this tender / contract as per Annexure XIII of this NIT by signing and stamping all the pages of IP by authorized representative. Bidder, who do not comply with this requirement shall not be considered against this tender.**

**NOTES**:

(i) The Tender Documents comprise of following;

(a) General Conditions of Contract
(b) Special Conditions of Contract, Tender Notice, Project Synopsis etc.
(c) Rate Schedule

(ii) Tender Documents with complete details are hosted in this web page. Bidder(s) intending to participate may download the tender document from the web site.

(iii) Bidder(s) can also purchase hard copy of tender documents from this office. Tender documents (non transferable) will be issued on all working days between 09.30 Hrs. to 12.30 Hrs within the sale period i.e ***up to 22*.09.2009** on payment of Rs.1,000/- (non-refundable) either in cash or by crossed demand draft in favor of BHEL, NOIDA. Request for issue of tender document should clearly indicate Tender No. and work.

(iv) Tenders must be submitted to the undersigned in Room No. 104 latest by 15:00 Hrs.(IST) on ***22*.09.2009**. Technical bids shall be opened at 15.30 Hrs. on ***22*.09.2009.**

(v) **Earnest Money Deposit (EMD)** : Refundable, Non-interest bearing **EMD of Rs. 2,00,000/- 'OR' USD (US Dollars) 5000/-** shall be deposited by Account Payee Pay Order 'OR' Demand Draft in favour of "Bharat Heavy Electricals Limited" payable at Delhi, INDIA. Those bidders who have already deposited ' One Time 'EMD' of Rs. 2,00,000/- with BHEL, PSNR, NOIDA need not submit EMD with the present tender.

(vi) Tenders not accompanied with Full Earnest Money Deposit, as indicated above, will not be considered.

(vii) **All corrigenda, addenda, amendments and clarifications to this Tender will be hosted in this web page and not in the newspaper. Bidders shall keep themselves updated with all such amendments.**

(viii) Bidders shall enter into an Integrity Pact (IP) with BHEL as per format given at Annexure – XIII of this NIT. The bidders are required to return this Integrity Pact (IP) alongwith Techno- Commercial bid (Part-I), duly signed and stamped by the authorized signatory who signs the bid. It may be noted that only those bidders who have entered into such an IP with BHEL would be competent to participate against this NIT i.e. entering into this pact is a preliminary qualification for the bidders. The Independent External Monitor against this NIT shall be Shri D. P . Bagchi, IAS (Retd), Y-165, Regency Park-II, Phase IV, DLF City, Gurgaon- 122009

(ix) BHEL reserves the right to accept or reject any or all tenders without assigning any reason whatsoever.

(x) BHEL takes no responsibility for any delay/loss of documents or correspondences sent by courier/post.

**(xi) BHEL reserves the right to go for a Reverse Auction instead of Opening the submitted sealed bid, which will be decided after technical evaluation. As such, the bidders should submit their best prices in the 'Sealed Price Bid'. However, bidders are required to confirm their acceptance of "General terms and conditions" governing RA specifically in their technical bid. The "General terms and conditions" governing RA are given in the SCC of the NIT. Bidders are also required to furnish following details in their techno-commercial bid, for this purpose (RA).**

Authorization of representative who will participate in the on line Reverse Auction Process;

1. Name and Designation of official
2. Postal Address (Complete)
3. Telephone Nos. (Land line & Mobile both)
4. FAX No.
5. E-mail address
6. Name of Place/State/Country, wherefrom he will participate in the RA

(xii) Purchase Preference will be given to CPSUs as per Indian Govt. Guidelines.

**Sr.DGM/SCP**

BHEL: NR: SCT: KOSTI:MEI:646

ISO 9001-2000, ISO 14001 and OHSAS 18001 certified company
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# TENDER NOTICE

**LAST DATE OF SALE : 22.09.2009**
**DUE DATE OF SUBMISSION : 22.09.2009 (15:00 Hrs.IST)**

| NIT NO. / NAME OF WORK |
|---|
| **TENDER NO. BHEL: NR: SCT: KOSTI: MEI: 646**<br><br>Sealed tenders are invited from the contractors fulfilling qualifying requirements given in tender document for the Work of "ERECTION, TESTING, COMMISSIONING AND TRIAL OPERATION OF 4 X 125 MW TG SETS, ELECTRICALS, C&I & BOP PACKAGES AT KOSTI TPP (4 X 125 MW UNITS) SUDAN" |

**NOTES:**

1. Purchase Preference will be given to CPSU as per Indian Govt. Guidelines.
2. The complete tender documents can be downloaded from BHEL Web Site, **www.bhel.com**.
3. All corrigenda, addenda, amendments and clarifications to this Tender will be hosted in this web page and not in the newspaper**.**

**Sr.DGM/SCP**

**Bharat Heavy Electricals Limited**
**(**A Govt. Of India Undertaking)
**Power Sector – Northern Region,**
**Plot No. 25 , Sector - 16A ,**
**Distt. Gautam Budh Nagar, NOIDA – 201 301 (INDIA)**

## PROCEDURE FOR SUBMISSION OF SEALED TENDERS:

**The tenderers must submit their tenders as required in two parts in separate sealed covers prominently superscribed as Part-I Technical bid and Part-II ,Price bid also indicating on each of the cover tender specification no., date and time as mentioned in tender notice.**

## TECHNICAL BID (COVER-I)

**Except Price bid Part-II, complete set of tender document consisting of General conditions of Contract, "Technical specifications & Special terms and conditions" (Part-I) issued by BHEL/ downloaded from BHEL website shall be enclosed in Part I Technical Bid only. All schedules, data sheets and details called for in the specification shall also be submitted along with technical bid. All details / Data / Schedules including offer letter duly signed and stamped are to be submitted in duplicate**.

## PRICE BID (COVER-II)

**Tenderers may please note that price bid is to be submitted only in original copy of Tender i.e. Price bid (Part-II) issued by BHEL/ downloaded from BHEL website.**

**These Two separate covers i.e. cover I & II shall together be enclosed in a third envelope (Cover-III) and this sealed cover shall be superscribed with tender specification No., due date, time and submitted to officer inviting tender as indicated in tender notice on or before due date as indicated.**

# PROJECT SYNOPSIS

Kosti Thermal Power Project to be constructed is a Greenfield project with 4x125 MW Thermal units having gas/oil fired boilers & aux., steam turbine generators & aux., BFPs, switchyard etc. to be executed on EPC basis by BHEL at Sudan. The owner of the Project is National Electricity Corporation(NEC), Sudan, which is a Govt. of Sudan entity. The plant will supply electricity to South & West Sudan.

Kosti lies south of Khartoum (Capital of sudan) on an Asphalt road with latitude 13.10 N and longitude 090.14E. The Kosti site is centrally located just 350 KM south of Khartoum. The river Nile is passing near by and the site has easy connectivity by road.

Distance of project site from Port of Sudan (only port in Sudan) is 1200 km and the project site is about 600 Mtrs. from Sinar Highway.

**Temperature Data:**

(a) Maximum ambient tempurature : 45 Deg C
(b) Minimum ambient tempurature : 16 Deg C

**Mean(Design) annual humidity:**

(a) Maximum 71% in August
(b) Minimum 26% in April

**Wind Data:**

(a) Maximum speed of wind 11 Km/h
(b) Wind direction is Southern ( May to September) and Northern in the rest of the year.

## SECTION - III `A'

## SPECIAL CONDITIONS OF CONTRACT

## INDEX

## SECTION - III `A'

## SPECIAL CONDITIONS OF CONTRACT

### 34.0 GENERAL

**34.1** The intent of this specification is to provide services for execution of the project according to most modern and proven techniques and codes. The omission of specific reference to any method, equipment or material necessary for the proper and efficient services towards installation of the plant shall not relieve the contractor of the responsibility of providing such services / facilities to complete the work or portion of work awarded to him. The quoted / accepted rates / lumpsum price shall deem to be inclusive of all such contingencies.

**34.2** The contractor shall carry out the work in accordance with standard practices / codes / instructions / drawings / documents / specification supplied by BHEL from time to time.

**34.3** The work shall conform to dimensions and tolerances given in various drawings and documents that will be provided during erection. If any portion of work is found to be defective in workmanship, not conforming to drawings or other stipulations, the contractor shall dismantle and redo the work duly replacing the defective materials at his cost, failing which the job will be carried out by BHEL by engaging other agencies/ departmentally and recoveries will be affected from contractor's bills towards expenditure incurred including BHEL's usual overhead charges.

**34.4 Following shall be the responsibility of contractor and have to be provided within finally accepted rates / prices:**

**a** Provision, as required, of all types of labour, supervisors, engineers, watch and ward, tools & tackles, calibrated inspection, measuring and testing equipment as specified and otherwise required for the work, consumables for erection, testing and commissioning including material handling.

**b** Proper out-turn as per BHEL plan and commitment.

**c** Completion of work as per BHEL Schedule.

**d** Good quality and accurate workmanship for proper performance of the equipment.

**e** Repair and rectification.

**f** Preservation / Re-conservation of all components during storage / erection / commissioning till handing over.

**34.5 BHEL-Power Sector (NR) is an ISO 9001-2000, ISO 14001-1996 and OHSAS 18001-1999 certified company. Quality of work, to customer's satisfaction and system requirements is the essence of these certifications. The contractor in all respects will organize his work, systems, environment, process control documentation, tools, plant, inspection, measuring and testing equipments etc. as per instructions of BHEL engineer**.

**The contractor shall also comply with applicable legislation and regulations with regards to Health, Safety and Environmental aspects for minimizing risk arising from occupational health & safety hazards, controlling pollution and wastage. The Contractor will be responsible for Health, Safety & Environment management (HSE) at site for the construction activities to be carried out by them in accordance with requirements given under section I (a) of GCC and elsewhere in this tender document. The contractor, who is awarded the work, shall have to sign an MOU w.r.t implementation of HSE conditions with BHEL (Safe Work Practices).**

## 35.0 PRELIMINARY WORKS

**35.1** The contractor shall, as a first field activity check the foundations for turbine, generator and all auxiliaries for the correctness of the same as per the drawings and satisfy himself in all aspects. He should ensure location of foundations, their consolidation, absence of voids, levels, correctness of bolt holes, pockets levels and centerlines etc. All measurements should be recorded and submitted to Engineer for approval before erection.

**35.2** Before starting erection job, contractor shall ensure that TG area is sufficiently enclosed against ingress of dust and water, and all debris have been cleared off from the floor to a designated area as per instruction of Engineer. The contractor shall arrange to get the working area and surroundings cleaned daily to ensure a dust free atmosphere for working.

Contractor shall first cover all openings on operating floor and put temporary hand railings on all sides of the floor to avoid any accident to the personal working. Material for above work, if available can be issued by BHEL on returnable basis.

**35.3** The contractor shall provide his tool stores for special tools and instruments at a convenient location near to the place of working in TG hall. Necessary area shall be provided to contractor by BHEL. This is to be cleared after completion of the work. If so required, he will have to shift the same if required to give fronts to other agencies engaged at site.

**35.4** The contractor shall set up longitudinal and transverse axes and two or more level bench marks accurately on TG floor. BHEL Engineer shall certify these. The certified TG-Center lines and datum level shall be the reference for TG and all auxiliaries' erection and alignment work. The contractor shall transfer these axes to all the floors to facilitate further execution.

**35.5** All matching surfaces of components shall be well cleaned with cleaning agent and burrs shall be removed by filing and blue matched wherever required. Wherever necessary sealing / lubricating / anti-seize compounds shall be applied as per recommendation of Engineer. Machining / grinding required for fitting of keys, pins, packers & dowels etc. shall be carried out by contractor at his cost. The contractor is expected to have his own arrangements for machining activities.

**35.6** The accuracy of all equipment / instruments and their functioning shall be established before they are permitted for use on the job. If the Engineer doubts the accuracy of the precision tools, any time during erection, the contractor shall arrange the checking / calibration of tools / equipment/ instruments at his cost.

## 36.0 CIVIL WORKS, FOUNDATIONS AND GROUTING.

**36.1** BHEL shall provide all equipment foundations. For the correctness of these foundations as per drawings, the contractor shall check the dimensions & locations of the foundations, pockets, anchor-bolt pitch. Further, top elevation of foundations shall be checked with respect to benchmark. All minor adjustments of foundation level, dressing and chipping of foundation surfaces up to 50 mm, enlarging the pockets in foundations etc., as may be required for the erection of equipment / plants shall be carried out by the contractor.

**36.2** While on the job, care is essential to avoid too much chipping and resultant lowering of level. In case of excess chipping, contractor has to arrange additional

packing plates as per requirements provided BHEL Engineer allows it. When required by manufacturers, the embedded sub-sole plates shall be scraped and checked with prussian blue to get the required contact with frames.

**36.3** The grouting of all the equipments except TG and BFP will be carried out by the Civil Agency . In both the cases, the the contractor has to ensure that all the matching joints which are not to be grouted shall be kept free from the grouting mixture by applying tape or any other alternative method approved by Engineer. All assistance required has to be provided by the contractor.

**36.4** The Grouting of BFP and TG will have to be carried out by the Contractor . The contractor has to arrange for all materials required for carrying out the grouting including supply of the Special Grout as indicated in the drawings and as approved by the Engineer. **Although supply and application of approximately 20 MT of approved Non- Shrink Grout per unit has been envisaged, the contractor will be required to supply and apply actual quantity as per the site requirement without any extra cost.**

**36.5** BHEL shall provide foundations for all the equipments and columns including their grouting and necessary other civil work. The contractor for their scope shall check the dimensions of the foundations, locations of pockets, pitch of anchor bolts and other inserts as per drawings. Further, top elevation of foundations shall be checked with respect to benchmark etc. All minor adjustments of foundation level, dressing and chipping of foundation surfaces up to 50 mm, enlarging the pockets in foundations etc., as may be required for the erection of equipment / plants shall be carried out by the contractor.

**36.6** The contractor shall ensure perfect matching of packer plates including machining, scraping and blue matching with foundation by dressing the foundation, as well as perfect matching between the packer plates and the base plate of equipment to the satisfaction of BHEL Engineer. If required the packer plates may have to aligned and fixed on the foundations using special high strength, non-shrinking and quick-setting grouts. The minimum thickness below the packer plate should be 20 mm.

**Use of high-strength, non-shrinking and quick-setting grouts is an option to facilitate fixing of packer plates and as such is in bidders' scope. Packer plates will be supplied by BHEL. Grouting for filling grout gaps between foundations top and base of equipments is in BHEL civil contractor's scope as per clause 36.1 of NIT.**

**36.7** Entire secondary grouting work of foundation bolt grouting, base plate grouting etc. including materials will be carried out by another agency carrying out Civil work for BHEL. Contractor for subject work has to offer neat & clean foundations to the Civil Contractor to ensure perfect grouting. While grouting will be carried out by other agency, the contractor has to ensure that all the matching joints which are not to be grouted shall be kept free from the grouting mixture by applying tape or any other alternative method approved by Engineer. All assistance required has to be provided by the contractor.

**36.8** The contractor shall check and verify the alignment of equipment, alignment of shafts of rotating machinery, the slopes of all bearing pedestals, centering of rotors with respect to their sealing bores, couplings etc. as applicable and the like items to ensure that no displacement had taken place during grouting. The values recorded prior to grouting shall be used during post grouting check up and verifications. Such pre and post grout records of alignment details shall be maintained by the contractor in a manner acceptable to the Engineer.

**36.9** Besides grouting as above, any civil works required for safe and efficient operation of tools and tackles like grouting / excavation/ casting of foundation / anchor points for derricks,

winches, guy ropes fastening, etc / foundations required for chemical cleaning pumps, tanks and any other temporary supports shall also be the contractor's responsibility. For these civil works all materials including cement and required facilities will have to be arranged by contractor at his own cost.

**36.10** Any civil works required for safe and efficient operation of tools and tackles like grouting / excavation/ casting of foundation / anchor points for derricks, winches, guy ropes fastening, etc / foundations required for chemical cleaning pumps, tanks and any other temporary supports shall also be the contractor's responsibility. For these civil works all materials including cement and required facilities will have to be arranged by contractor at his own cost.

**37.0 CONSUMABLES**

**37.1** The contractor shall provide within finally accepted price / rates, all consumables like all welding electrodes (including alloy steel and stainless steel), filler wires, TIG filler wires (over & above as supplied by the unit along with the plant materials, which will be given free of cost to bidder, all gases (inert, welding, cutting), soldering material, dye penetrants, radiography films. Other erection consumables such as tapes, jointing compound, grease, mobile oil, M-seal, Araldite, petrol, CTC / other cleaning agents, grinding and cutting wheels are to be provided by the contractor. Steel, H&S, packers, shims, wooden planks, scaffolding materials hardware items etc required for temporary works such as supports, scaffoldings are to be arranged by him. Sealing compounds, gaskets, gland packing, wooden sleepers, for temporary work, required for completion of work except those which are specifically supplied by manufacturing unit are also to be arranged by him. Required quantity as arrived at by calculation / standards will only be supplied. It would be the contractors' responsibility to account for the consumption of these filler wires. Additional requirement beyond standard / calculated quantity will be at cost recovery basis only unless and otherwise accounted for. Surplus quantity of TIG filler wire, if any, shall be properly stored and returned to BHEL stores.

**37.2** All the shims, gaskets and packing, which go finally as part of equipment, shall be supplied by BHEL free of cost.

**37.3** It shall be the responsibility of the contractor to plan the activities and store sufficient quantity of consumables. Non-availability of any consumable materials or equivalent suggested by BHEL cannot be considered as reason for not attaining the required progress or for additional claim.

**37.4** It shall be the responsibility of the contractor to obtain prior approval of BHEL, regarding suppliers, type of electrodes etc before procurement of welding electrodes. On receipt of electrodes at site these shall be subjected to inspection and approval by BHEL. The contractor shall inform BHEL details regarding type of electrodes, batch number, date of expiry etc and produce test certificate for each lot / batch with correlation of batch / lot number with respective test certificate. No electrode without a valid test certificate will to be used.

**37.5** BHEL reserves the right to reject the use of any consumable including electrodes, gases, lubricants / special consumables if it is not found to be of the required standard / make / purity or when shelf life has expired. Contractor shall ensure display of shelf life on consumable wherever required and records maintained.

**37.6** Storage of all consumables including welding electrodes shall be done as per requirement / instruction of the Engineer by the contractor at his cost.

**37.7** In case of improper arrangement for procurement of any consumable, BHEL reserves the right to procure the same from any source and recover the cost from the Contractor's first

subsequent bill at market value plus the departmental charges of BHEL from time to time (30% at present). Postponement of such recovery is normally not permitted. The decision of Engineer in this regard shall be final and binding on the Contractor.

**37.8** All lubricants and chemicals required for cleaning, pre-commissioning, commissioning, testing, preservation and lubricants for trial runs of the equipment shall be supplied by BHEL / BHEL's client. All services including labour and T&P will be provided by the contractor for handling, filling, emptying, refilling etc. the consumption of lubricants / chemicals shall be properly accounted for. Surplus material if any shall be properly stacked and returned to BHEL/ CUSTOMER stores at no extra cost to BHEL. BHEL reserves the right to recover costs for wastage by the contractor.

**37.9** Special consumables that are required for final box up like anti-seize compounds, jointing compound and sealing compound shall be provided by BHEL However the contractor shall use them to the satisfaction of BHEL Engineer.

**37.10** Transportation of Oil Drums from stores , centrifuging and first filling of Oil , subsequent topping / makeup till the unit is commissioned and handed over to the customer is included in the scope of this contract . The contractor shall have to return all the empty drums to BHEL / BHEL client's store at no extra cost . Any damage / loss of above drums shall be to the contractor's account .

**37.11** **All charges on account of Octroi, terminal or sales tax and other duties on materials obtained for the works from any source shall be borne by the contractor.**

**38.0 TOOLS AND PLANTS / IMTE's**

**38.1** All T&Ps and IMTEs which are required for successful and timely execution of the work covered within the scope of this tender, shall be arranged and provided by the contractor at his own cost in working condition. **BHEL shall not provide any T&P including cranes.**

**38.2** **Modern construction equipments & IMTEs** are required to be used as per international practices. Indicative lists of T&Ps and IMTEs to be arranged by the contractor are given **as per Annexures-IV, V, VI & VII.** He should ensure that these are in good working condition. In the event of the failure of contractor to bring necessary and sufficient T&Ps and IMTEs, BHEL will be at liberty to arrange the same and hire charges or total cost as applicable along with overheads shall be deducted from contractor's bill. Decision of BHEL in this regard shall be final and binding on contractor.

**38.3** EOT crane(s) as available in the TG hall shall be provided to the contractor. The crane may be provided with a trailing cable that has to be handled by the contractor till the charging of the down shop leads. **The contractor shall have to deploy his own operator for operating the crane under supervision of BHEL**. The running / capital maintenance of the EOT cranes is excluded from the contractor's scope. Routine maintenance like cleaning and oil topping (oil will be provided by BHEL) will be carried out by the contractor.

**38.4** All distribution boards, connecting cables, wire ropes, hoses, pipes etc, including temporary air / water / electrical connections etc shall have to be arranged by the contractor at his own cost.

**38.5** Consolidation of ground and arrangement of sleepers / sand bag filling etc. for safe operation / movement of equipment including cranes / trailers etc. shall be the responsibility of the contractor at his cost.

**38.6** Contractor shall ensure deployment of serviced and healthy T&Ps including cranes, lifting tackles, wire ropes, manila ropes, winches and slings etc. History card and maintenance

records for major T&Ps will be maintained by the contractor and will be made available to BHEL Engineer for inspection as and when required. Fitness certificate / Test Certificates of T&Ps shall have to be submitted before it is put in use. Identification for such T&Ps will be done as per BHEL Engineer's advice.

**38.7** Contractor shall ensure deployment of reliable and calibrated IMTEs (Inspection, measuring and testing equipments). The IMTEs shall have test / calibration certificates from authorized / Government approved / accredited agencies traceable to National / International standards. Each IMTE shall have a label indicating calibration status i.e. date of calibration, calibration agency and due date for calibration. A list of such instruments deployed by contractor at site with its calibration status is to be submitted to BHEL Engineer for control.

**38.8** Re-testing / re-calibration shall also be arranged at regular intervals during the period of use as advised by BHEL Engineer within the contract price. The contractor will also have alternate arrangements for such IMTE so that work does not suffer when the particular instrument is sent for calibration. If any IMTEs not found fit for use, BHEL shall have the right to stop the use of such item. It will be necessary for the contractor to deploy proper item. Any readings taken by the defective instrument will be recalled and repeat the readings taken by that instrument with a proper one. In case he fails to do so, BHEL may deploy IMTEs and retake the readings at contractor's cost.

**38.9** BHEL shall have lien on all T&P, IMTEs and other equipment of the contractor brought to the site for the purpose of erection, testing and commissioning. BHEL shall continue to hold the lien on all such items throughout the period of contract / extended period. The contractor and / or his sub-contractors, without the prior written approval of the Engineer, shall remove no material brought to the site.

**38.10** The month wise T&P deployment plan to be submitted as per format **(at Annexure-D to General Conditions of Contract)** is only to assess the capability as well as understanding of the contractor to execute the work. It shall be the contractor's responsibility to deploy the required T&P, for timely and successful completion of the job, to any extent over and above those indicated in the above deployment plan (including those which are not covered in the plan submitted) without any compensation on this account.

**39.0 SUPERVISORY STAFF AND WORKMEN**

**39.1** The contractor shall deploy all the skilled workmen like millwright fitters, welders, crane operators, drivers, gas cutters, riggers, sarangs, masons, carpenters, electricians, helpers and instrument technicians to carry out the works as per specifications. In addition to skilled, semi-skilled and unskilled workmen required for all the works, suitable workmen required for handling and transporting of equipment from site storage to erection site, erection, testing and commissioning as contemplated under this specification shall be deployed. Only fully trained and competent men with previous experience on the job shall be employed. They shall hold valid certificates wherever necessary.

BHEL reserves the right to decide on the suitability of the workers and other personnel who will be deployed by the contractor. BHEL reserves the right to insist on removal of any employee of the contractor at any time, if they find him unsuitable and the contractor shall forthwith remove him. **Such person shall not again be employed for the purpose of or in connection with the Contract without the written permission of BHEL and/or its Customer(M/s NEC). Any person so removed shall be replaced as soon as possible by a competent substitute with information to BHEL and/or its Customer(M/s NEC)**

**39.2** The supervisory staff including qualified Engineers deployed by the contractor shall ensure proper out-turn of work and discipline on the part of the labour put on the job by the

contractor. They should in general see and ensure that the works are carried out in a safe and proper manner and in coordination with other labour and staff deployed directly by BHEL or other contractors of BHEL or BHEL's client / other agency.

**39.3** The work shall be executed under the usual conditions affecting major power plant construction and in conjunction with numerous other operations / activities at site. The contractor and his personnel shall cooperate with other personnel / contractors, coordinating his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.

**39.4** The contractor's supervisory staff shall execute the work in the most substantial and workman like manner in the stipulated time. Accuracy of work and aesthetic finish are essential part of this contract. The contractor shall be responsible to ensure that assembly and workmanship conforms to the dimensions and tolerances given in the drawings / documents / instructions given by BHEL Engineer from time to time.

**39.5** The contractor shall deploy the necessary number of qualified and approved full time electricians at his cost to maintain his temporary electrical installation till the completion of work.

**39.6** It is the responsibility of the contractor to engage his workmen in shifts or on overtime basis for achieving the targets set by BHEL and also during the period of commissioning and testing of unit. The contractor's finally accepted rates / prices shall include all these contingencies.

**39.7** During the course of erection,

- If the progress is found unsatisfactory,
- If the target dates fixed from time to time for every mile stones are to be advanced / not being met,
- if it is found that the skilled workmen like fitters, operators, technicians etc deployed are not sufficient,

BHEL after giving reasonable opportunity to the contractor will induct on the work the required workmen in addition to contractor's workmen to improve the progress. The expenses so incurred will be recovered from the contractor's bills with overheads.

**39.8** If the contractor or his workmen or employees shall break, deface, injure or destroy any part of a building, road kerb, fence, enclosure, water pipes, cables, drains, electric / telephone poles, wire, trees or any other property or to any part of erected components, the contractor shall make the same good at his own expense. In default, BHEL may cause the same to be made good by other workmen or by other means and deduct the expenses from any money due to the contractor. BHEL's decision will be final and binding.

**39.9** Though every endeavor shall be made to ensure that all plant materials are supplied as per schedule. However in a job of this kind it is possible that some materials may be delayed. In order to achieve the ultimate targets, the contractor may have to augment his manpower and resources. No compensation on this account shall be admissible.

**39.10** The month wise manpower deployment plan to be submitted as per format **(at Annexure-C to General Conditions of Contract)** is only to assess the capability as well as understanding of the contractor to execute the work. It shall be the contractor's responsibility to deploy the required manpower, for timely and successful completion of the job, to any extent over and above those indicated in the above deployment plan (including those which are not covered in the plan submitted) without any compensation on this account. The contractor shall identify separate persons at site for quality control and safety. These are expected to be well versed and qualified in their respective functions. **Manpower deployment plan for execution of BOP, Electrical & C&I packages shall be submitted separately**. **Specialized manpower shall be deployed by the contractor for execution of Electrical , C&I , BOP Packages.**

**39.11** The Contractor shall appoint a Project Manager in India for the project, being the responsible representative of the Contractor in charge of managing the Works and liaison with BHEL.

From the commencement of construction activities at site, Contractor shall appoint a suitable person as the Incharge (hereinafter referred to as "Site Incharge". The Site Incharge shall be present at the site throughout normal working hours except when on leave, sick or absent for reasons connected with proper performance of the contract. Whenever the Site Incharge is absent from the site, a suitable person shall be appointed to act as his or her deputy.

The BHEL Engineer shall have full powers to instruct the Contractor to arrange for immediate termination of services, in connection with this contract, of any Agent, servant or employee whose continued employment is, in his opinion, undesirable, without assigning any reason.

**39.12 It shall be the responsibility of the Contractor to pay salaries and other benefits to its employees/personnel engaged by it as per the agreement with them, and in keeping in line with the local laws in Sudan. The Contractor shall submit to Construction Manager, BHEL Site, Kosti, Sudan regularly, the details/statement of wages paid to its workers in India/back home, besides wages paid in Sudan.**

**39.13 All traveling and transportation expenses including air fares etc shall be borne by the Contractor for all his employees. The Contractor shall also bear air fare and other expenses for those employees sent back to their place on account of misconduct, disobedience, improper behavior, sickness, unsatisfactory work or any other reason whatsoever.**

**39.14 Contractor shall arrange passports for all his staff and labour. BHEL will assist Contractor for issue of visas including multi-entry visas and other permits as per requirement for the job. However, the Contractor shall arrange for attestation of certificates and other documents required for travel arrangements, medical tests as applicable and comply with other formalities. All expenses for all these activities will be borne by the Contractor.**

**39.15 The delay in obtaining the passports and other travel documents or compliance with the various formalities for the deputation of the contractor's personnel shall not absolve the contractor from his obligations under the Contract including completion of the work strictly in accordance with the time schedule.**

**39.16 The Contractor shall in all dealings with persons in his employment have due regard to all recognised festivals, days of rest/weekly off, and religious or other customs in Sudan and shall make special arrangements whenever the exigencies of the construction program demand that work shall proceed during such festivals and days of rest**

**39.17** **The Contractor shall plan and schedule the activities on Site such that they happen strictly during the specified working hours.**

**The Contractor shall not otherwise than in accordance with Sudanese State Laws import, sell, give, barter, or otherwise dispose of any alcoholic liquor or drugs or any arms or ammunition to any person or persons whatsoever, nor permit or suffer any such importation, sale, gift, barter, or other disposal by his employees. The Contractor shall submit a request to BHEL for issue of an identity card to each and every person employed at the Site by him along with passport size photographs and other documents as may be required for the purpose. No person will be allowed to enter the project premises without an identity card. All identity cards will be surrendered by the Contractor to BHEL in respect of each person on completion of assignment of such person.**

**39.18** **The Contractor shall deliver to BHEL before 10:00 hrs on each first working day of the week; a report in detail, in such form as BHEL or its Customer (M/s NEC) may prescribe, showing the supervisory staff and the numbers of the several classes of labour, from time to time employed by the Contractor on the Site. The Contractor shall at all times take all requisite precautions and use his best endeavors to prevent any riotous or unlawful behavior by or amongst the labourers and others employed by him for the purpose of or in connection with the Contract and for the preservation of the peace and the protection of the inhabitants and the security of property on or in the neighborhood of the Site.**

**39.19** **The Contractor shall in collaboration with, and to the requirements of, any duly constituted medical or sanitary authority, ensure that suitable arrangements are made on the Site for the maintenance of health, the prevention and overcoming of epidemics, and for adequate first-aid, welfare, and hygiene services. The Contractor, his partners, foreign workers and employees and their families shall not be involved by any manner in any political activity during their residence in the Employer's country.**

## 40.0 MATERIAL HANDLING AND STORAGE

**40.1** All the equipments/materials furnished under this contract shall be received from the project stores, sheds / storage yards and transported to pre assembly area / erection site and stored in the storage spaces in a manner so that they are easily retrievable till the contractor erects them. **While drawing / lifting material from BHEL / customer stores, the contractor shall ensure that the balance / other materials are stacked back immediately. No claim is admissible on this account**

**40.2** While BHEL will endeavor to store / stack / identify materials properly in their open / close / semi closed / tarpaulins covered storage yard / shed, it shall be contractor's responsibility to assist BHEL in identifying materials well in time for erection. They should take the delivery of the same, following the procedure indicated by BHEL, and transport the material safely to pre-assembly yard / erection site in time, according to program.

**40.3** The contractor shall take delivery of components, equipment / consumables from storage area after getting the approval of BHEL Engineer on standard indent forms.

**40.4** The contractor shall identify and deploy necessary Engineers / supervisors / workmen for the above work in sufficient number as may be needed by BHEL, for areas covering their scope.

**40.5** All the equipment shall be handled very carefully to prevent any damage or loss. No untested wire ropes / slings etc. shall be used for unloading / handling. The equipment shall be properly protected to prevent damage either to the equipment or to the floor where they are stored. The equipment from the stores shall be moved to the actual location at the appropriate time so as to avoid damage of such equipment at site.

**40.6** Contractor shall ensure that while lifting slings shall be put over the points indicated on the equipment or as indicated in the manufacturer's drawings. Slings / shackles of proper size shall be used for all lifting and rigging purposes. All care shall be taken to safe guard the

equipment against any damage. Dragging of piping / valves should be avoided. In case of any damage the cost shall be covered from the contractor.

**40.7** Approach road conditions from the stores / yards to the erection site may not be equipped and ideal for smooth transportation of the equipment. Contractor may have to be adequately prepared to transport the materials under the above circumstances without any extra cost. . The contractor may familiar himself with soil conditions at site.

**40.8** Contractor shall be responsible for examining all the plant and materials issued to him and notify the Engineer immediately of any damage, shortage, discrepancy etc before they are moved out of the stores / storage area. The contractor shall be solely responsible for any shortages or damages in transit, handling, storage and erection of the equipment once received by him. As the erection work will be spread in different areas / locations of the project, contractor has to arrange sufficient number of watch / ward personal to avoid any pilferage of material. As per General Conditions of contract under provisions of clause No 29, BHEL will reserve the right to recover the cost of repair / replacement, if any, to bring back the equipment in original order, in case the equipment / material is lost / damaged while in the custody of the contractor. BHEL's decision in this regard shall be final and binding on the contractor.

**40.9** The contractor shall maintain an accurate and exhaustive record-detailing out the list of all equipment received by him for the purpose of erection and keep such record open for the inspection of the engineer at any time.

**40.10** All the material in the custody of contractor and stored in the open or dusty locations must be covered with suitable weather proof / fire retardant covering material wherever applicable and shall be blocked up on raised level above ground. All covering materials including blocks and sleeper shall be arranged by the contractor at his cost.

**40.11** If the material belonging to the contractor are stored in area other than those earmarked for his operation the engineer will have the right to get it moved to the area earmarked for the contractor at the contractors risk and cost.

**40.12** The contractor shall be responsible for making suitable indoor storage facilities to store all equipment (drawn by the contractor from BHEL / customer stores), which require indoor storage till the time of their installation. The Engineer will direct the contractor in this regard, which item in his opinion will require indoor storage, and the contractor shall comply with Engineer's decision.

**40.13** The contractor shall ensure that all surplus / damaged / scrap / unused material, packing wood / containers/ special transporting frames etc are returned to BHEL at a place in project area identified by the Engineer. The contractor will maintain an account for all items received and returned to BHEL. Any shortage in returning such items shall be chargeable to the contractor except for a 5% allowable against wastage for packing wood only.

**40.14** The contractor shall hand over all parts / materials remaining extra over the normal requirement with proper identification tags to the stores as directed by the concerned BHEL engineer.

**40.15** The contractor shall ensure that all the packing materials and protective devices installed on equipment during transit and storage are removed before installation.

**40.16** It shall be the responsibility of the contractor to keep the work / storage areas in neat, tidy and working conditions. All surplus/unusable packing and other materials shall be removed and deposited at location(s) specified by BHEL within the project premises. If required weighing of the same within the project premises will have to be carried out.

**40.17** All electrical panels, control gear, motors and such other devices shall be properly dried by heating before they are installed and energized. Exposed parts those required special protection such as bearings, slip rings, commutators shall be protected against moisture ingress and corrosion during storage and are periodically inspected. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion due to prolonged storage

**40.18** Power Transformer tanks shall be dispatched from BHEL / Suppliers manufacturing units directly to site by road on trailers. It shall be unloaded near foundations by other agency (with in a distance of 100 M ). The contractor may be required to place these on foundation by dragging , jacking, rigging or lifting by crane on the foundation .

**40.19** While Transformer main tanks will be delivered near the foundation, the accessories and oil will be issued to the contractor from BHEL stores / place of stacking for installation. All arrangements for receiving, transporting & handling of such accessories, transformer oil drums etc. are to be made by the contractor except those spelt out else where in the contract

**40.20** Till the start of erection of respective transformers, supplied oil / Gas filled, it will be contractor's responsibility to maintain the gas pressure and replace/ reactivate silica gel. Silica gel will be arranged by contractor within the accepted rates. However the N2 gas if required will be provided by BHEL free of cost & filling etc. will be arranged by the contractor with in the accepted rates for transformer erection & commissioning.

**41.0 PRESERVATION OF COMPONENTS**

**41.1** After taking delivery from BHEL / customer's stores, plant materials storage shall be subjected to the following protection besides other provisions indicated in these specifications elsewhere.

**a)** Items stored outdoors shall be blocked up at least six inches (6") off the ground . He should have sufficient numbers of wooden / concrete / steel sleepers for the job.

**b)** Motors, valves, electrical equipment, control equipment and instruments etc shall be stored indoors in a warehouse provided by contractor. Motor windings shall be kept dry by use of external heat or space heaters.

**c)** Bearings and other wearing surfaces of plant materials shall be protected against corrosion and kept clean.

**d)** Insulation materials shall be stored indoors or otherwise protected against getting wet/ damaged.

**41.2** It shall be the responsibility of the contractor to apply preservatives / touch up paints (primer) on equipment handled and erected by him till such time of final painting. It shall be contractor's responsibility to arrange for required paints (primer), thinners, labour, scaffolding materials, cleaning materials like wire brush, emery sheets, etc, cleaning of surface and provide one coat of preservatives / paints (primer) from time to time as decided by BHEL engineer. The accepted rate shall include this work also. It is to be noted that such painting may have to be done as and when required till such time the final painting is carried out.

**41.3** The contractor shall effectively protect the finished work from action of weather and from damage or defacement and shall cover the finished parts then and there for their protection.

**41.4** Any failure on the part of contractor to carry out works according to above clauses will entail BHEL to carry out the job from any other party and recover the cost from contractor.

**41.5** The contractor shall thoroughly clean all the components before installation. The components whose surfaces are coated with protective coating and sent to site are to be

thoroughly cleaned by suitable mechanical / chemical means as per the approved procedures.

**41.6** The contractor shall clean inside of all pipes and fittings from dirt, sand and loose scales, mechanically and by air blowing before being erected. All pipelines shall be thoroughly blown and / or flushed. Method of cleaning shall be in accordance with the relevant Field Quality Plan or as instructed by BHEL engineer. Cleaning of pipelines may call for repeated disconnection and restoration of the terminal joints with other equipments. Cleaning may have to be done in parts or loops as specified by BHEL engineer. After cleaning, the piping systems shall have to be restored to their final position complete with all pipeline, equipments, hangers and supports

## 42.0 ERECTION

**42.1** All normal erection and assembly techniques necessary for completion of works under this specification and magnitude have to be carried out. It is not possible to specifically list out all of them. Absence of any specific reference will not absolve the contractor of his responsibility for the particular operation. These would include,

- Scaffolding and rigging operations,
- Machine / flame / electric cutting, grinding, welding, radiography and stress relieving
- Fitting, fettling, filing, straightening, chamfering chipping, scrapping, reaming, as cleaning, checking, leveling, blue matching, aligning and assembly.
- Machining, surface grinding, drilling, doweling, shaping
- Temporary erections for alignment, dismantling of certain equipment for checking, cleaning, servicing and site fabrication.

**42.2** Any fixtures, scaffolding materials, approach ladder, concrete block supports, steel structures required for temporary supporting, pre-assembly or checking, welding, lifting and handling during pre-assembly and erection shall be arranged by contractor at his cost.

**42.3** No members of any ladder / structure / platform should be cut without specific approval of BHEL. In case it is necessary to cut, the contractor shall rectify / repair in a manner acceptable to BHEL / customer without any additional cost.

**42.4** The contractor shall erect scaffolding / temporary platforms for erection. These should be of adequate capacity and shall never be over loaded. These should be replaced when not found suitable during erection work and dismantled on work completion and removed from work site.

**42.5** Corrections like adjustment / removal of ovulates in pipes and opening or closing the fabricated bends of piping to suit the layout shall be considered part of the work and the contractor is required to carry out such work within finally accepted price / rate as per instructions of Engineer.

**42.6** The contractor shall carry out the condenser tube insertion and expansion at site after the installation of condenser on its foundation. Condenser tubes shall be handled strictly as per instructions of BHEL Engineer. Before installation of tubes, the contractor shall check for any dents, mechanical damages or any other defects of tubes caused during storage. These should be thoroughly internally and externally cleaned for all extraneous matter as per the directions of the engineer.

Before insertion of tubes, the contractor shall clean the surface of the holes in the main tube plates and tube support plates for paint, corrosion spots oxide scale etc. as per the instructions of the engineer. Even reaming of support plates if required for smooth insertion of tubes is to be carried out by contractor at his cost and reaming and its

arrangement is to be arranged by contractor.

The contractor shall carry out the tube insertion & expansion of the condenser strictly in accordance with the instructions issued by the engineer. Tubes may require adjustment of length on both ends. The contractor shall ensure to provide covering above the top row of tubes to avoid any damage to the tubes prior to tube insertion as per instruction of BHEL Engineer at his cost.

The contractor shall carry out the condenser neck welding with casing only after final installation of casing. However the contractor shall adjust the gap between condenser neck and LP exhaust hood uniformly by suitably lifting the condenser as directed by engineer. Also the makeup pieces required for this purpose shall be fabricated and welded to the dome walls by the contractor.

**It may be noted that simultaneously with the regular erection works, the contractor will check availability of all required materials, servicing and testing of the components to make them ready prior to their actual requirement in assembly. For this purpose, if required, contractor shall make a shed of size approx. 400 sqm. with material lifting/handling facilities within their quoted prices & without any extra cost to BHEL.**

**42.7** Some of the rotating equipment and electrical motors are provided with protective greases only. Contractor shall arrange for cleaning of the same with petrol or some other reagent. If necessary, dismantling some of the parts of the equipment would be necessary. He shall arrange for re-greasing / lubricating them with recommended lubricants and for assembling back the dismantled parts, at quoted rate. Lubricants will, however, be supplied free of cost by BHEL.

All rotating machines and equipment shall be cleaned, lubricated, checked for their smooth rotation, if necessary by dismantling and refitting before erection. If, in the opinion of Engineer, the equipment is to be checked for clearance, tolerance at any stage of work or during commissioning period, all such works are to be carried out by contractor at his cost.

All the shafts of rotating equipment shall be properly aligned to those of the matching equipment to as perfect and as accurately as practicable. All bearings, shafts and other rotating parts shall be thoroughly cleaned and suitably lubricated before starting.

All the motors and equipment shall be suitably doweled after alignment of shafts with tapered/parallel machined dowels. The contractor at his own cost shall arrange for the machining of dowel pins required for the same. However the materials for dowel pins shall be issued by BHEL free of cost.

The bearings shells will be blue matched at site and checked for bearing clearances. The contractor shall carry out scraping of bearing housing, if required to any extent. No extra claim for blue matching of any two surfaces up to 1mm initial gap will be entertained. The contractor shall also check air gap and adjustment of stator/ rotor to magnetic center shall be carried out as part of erection.

**42.8** The contractor shall fabricate and weld pipes, special bends, as required for installing lube oil systems. The contractor shall also service the lube oil system, carry out the hydraulic test of oil coolers and piping systems as required.

**42.9** The contractor as part of the scope of work if required or if directed by BHEL shall carry out the servicing and realignment of skid-mounted equipment.

**42.10** All electrical panels, control gears, motors and such other devices shall be properly dried by heating to improve IR value, before they are installed and energized. Bearings, slip rings commutators and other exposed parts shall be protected against ingress of moisture and corrosion during storage and periodically inspected.

**42.11** Whenever required the contractor shall arrange for pre-qualification of process task performers.

**42.12** The contractor shall completely erect and test all the piping systems including their hangers, supports, valves, insulation, and accessories including sampling lines and coolers as per specifications and drawings. The services will include welding, pre-heating, stress relieving, bolting, testing, cleaning insulation and painting. System shall be demonstrated in condition to operate continuously in a manner acceptable to the Engineer. Welding shall be used throughout for joining pipes except where flanged screwed or other type joints are specified or shown on the drawings. All piping shall be erected true to the lines and elevation as indicated in the drawings.

**42.13** Pipes sent in running lengths shall be cut to suit the site conditions and the layouts. Tubes or pipes wherever deemed to be convenient will be sent in running lengths with sufficient bends. Bends up to 80 mm NB will have to be fabricated and tested at site within the finally accepted rates.

**42.14** Certain adjustments in length may be necessary while erecting high-pressure pipelines. The contractor should remove the extra lengths/ add extra lengths to suit the final layout after preparing edges a fresh by adopting specified heat treatment procedures, at no extra cost. The contractor shall ensure lowering of pipes in position with adequate precautions as to avoid any damage to either material or men. Only the anchoring points earmarked for the purpose of lowering the pipes are to be used.

**42.15** It is possible that a few flanges may not be matching. The contractor shall be required to cut and re-weld the same as and when required without any additional cost. The contractor shall be responsible for any modifications of shop fabricated pipes prior to installation to accommodate minor site alteration in pipe routing at no extra cost

**42.16** Wherever piping erected by the contractor is connected to equipment / piping erected by the other agencies the joint at the connecting point shall be the responsibility of the contractor who is erecting the piping under this specifications.

**42.17** Normally the high-pressure valves will have prepared edges for welding. But, if it becomes necessary, the contractor will prepare new edges or recondition the edges by grinding or chamfering to match the corresponding tubes and pipes within the scope of the work.

**42.18** All fittings like `T'-pieces, weld neck flanges, reducers etc., shall be suitably matched with pipes for welding. The valves will have to be checked, cleaned or overhauled in full or in part before erection after chemical cleaning and during commissioning.

**42.19** The contractor shall be responsible for correct orientation of all valves so that seats, stems and hand wheels will be in desired location. It is the responsibility of the contractor to obtain the information regarding orientation of valves not fully located on drawings before the same are installed.

**42.20** Suspension for piping, etc., will be supplied in running lengths, which shall be cut to suitable sizes and adjusted as required.

**42.21** The adjustment of all hangers & supports for maintaining the proper slopes towards the drain pots and application of cold pull in the piping wherever required is also included in the scope of the contractor.

**42.22** No temporary supports should be welded on the pressure parts and piping. In case of absolute necessity prior approval should be taken from BHEL Engineer. In such cases the contractor, if required, shall carry out heat treatment.

**42.23** Spring suspensions / constant load hangers have to be pre-assembled for required load and erection carried out as per instructions of BHEL. Any adjustments, removal of

temporary arrests / locks etc., have to be carried out as and when required.

**42.24** Contractor shall install piping in such a way that no excessive or destructive expansion forces exists in either the cold condition or under conditions of maximum temperature and pressure. All bends, expansion joints and any other special fittings necessary to take care of proper expansion shall be incorporated as per the advice of Engineer. During installation of expansion joints, anchors, care must be taken to see that full design movement is available at all times from maximum and minimum temperature.

**42.25** The hanger assemblies shall not be used for attachment of rigging to hoist the pipes into position. Other means shall be used to securely hold the pipe in position till pipe supports are completely assembled and attached to the pipe and building structure.

**42.26** Layout of small-bore piping wherever required shall be done as per site requirement. Necessary sketch for routing these lines should be got approved from BHEL by the contractor. There is a possibility of slight change in routing the above pipelines even after completion of erection or from aesthetic point of view. Contractor at no extra cost should carry this out. As built drawing is to be submitted by the contractor after erection completion.

**42.27** All the valves, including motorized valves, flap valves, dampers, actuators, etc. shall be serviced and lubricated to the satisfaction of Engineer before erecting the same and during pre-commissioning also. Welding or jointing of extension spindle for valves to suit the site conditions and operational facility shall be part of erection work within the quoted rates.

**42.28** Erection and welding of necessary instrumentation tapping points, thermocouple pads, thermo-wells, valves, battery of first root valves, condensing vessels, flow nozzles and control valves to be provided on, auxiliaries and pipe lines are covered within the scope of this specification. This will be the responsibility of the contractor and will be done as per the instructions of BHEL Engineer.

**42.29** The contractor shall carry out the tightening of the field bolts on the equipment and piping covered under this specification by using either the calibrated torque wrench method or the turn of part method. The methods used the tools and the equipment deployed shall be subject to the approval of Engineer. The competent technicians shall carry out the bolting work.

**42.30** The contractor shall assist BHEL in preparation of as built piping drawing.

**42.31** The Erection, testing and commissioning of all electrically operated valves, actuators is covered within the scope of this specification.

**42.32** The following items of work shall also form part of piping erection:

1. Installation, disassembly, reinstallation and normalization of isolating devices, flow nozzles, orifices etc that are required for conducting hydro test of lines, cleaning etc. Required gaskets will be supplied by BHEL free of cost.

2. Welding of carrier plates, support lugs, stubs, etc. on to the pipes if required.

3. Removal of valve internals wherever required for the purpose of conducting Hydraulic Testing/Flushing/Blowing of Lines and subsequent normalization.

4. To re-install and re-align the connected piping in case they cause vibrations in pumps or other auxiliaries and to carry out necessary corrections in piping and its supports till the satisfactory resolution of the problem. No extra payment shall be made if the reason(s) for such re-work are attributable to the contractor.

5. Fabrication and erection of auxiliary structures and pipe supports for all the piping systems included in the scope of work. Structural steel in random length/size will be supplied by BHEL for this purpose. \

6. The hanger assemblies shall not be used for attachment of rigging to hoist the pipes into position. Separate temporary supports shall be used to securely hold the pipe in position till pipe supports are completely assembled and attached to the building structure

7. Layout of small bore piping as required shall be done as per site requirement. Necessary sketch for routing these lines should be got approved from BHEL by the contractor. There is a possibility of slight change in routing the above pipelines even after completion of erection or from aesthetic point of view. Contractor at no extra cost should carry this out.

8. The Erection, testing and commissioning of all electrically operated valves / actuators and dampers is covered within the scope of this specification. Erection of power cylinders, control valve actuators etc. coming under various groups is covered under the scope of this specification. C&I calibration / commissioning for pneumatic valves & power cylinders shall also be arranged by contractor at no extra cost to BHEL for this package. The contractor will be responsible for drawing the materials from the stores and to commission them. Any damage / loss in their custody will be the contractors account. The alignment and any mechanical adjustments including link adjustment, opening & reconnection of links, replacement of valve / actuator or any mechanical part, air filter & regulator cleaning etc. required during calibration and operation, the same shall be carried by the contractor. In case of re-calibration if required till handing over of the equipments the same shall also be done by the contractor without any extra cost to BHEL as detailed above with in the final accepted rates. The contractor will also be responsible for drawing the materials from the stores and to commission them. Any damage / loss in their custody will be the contractors account.

9. All valves, including motorised valves, flap valves, dampers and actuators, shall be serviced and lubricated to the satisfaction of Engineer before erecting the same and during pre-commissioning also. Welding or jointing of extension spindle for valves to suit the site conditions and operational facility shall be part of erection work within the quoted rates.

10. The contractor shall also or grind the valve seat, if required, to ensure satisfactory performance of valves at no extra cost. All parts such as gaskets, gland packing which form the permanent part of equipment shall be supplied by BHEL free of cost.

11. Erection and welding of necessary instrumentation tapping points, thermocouple pads, thermo-wells, valves, battery of first root valves, condensing vessels, flow nozzles and control valves to be provided on TG, auxiliaries and pipe lines covered within the scope of this specification, will also be the responsibility of the contractor. The welding of all the above items will be contractor's responsibility even if the

- Product groups, under which these items are released, are not covered in the scope of this tender.
- Items are supplied by any agency other than BHEL.

***NOTE: ADDITIONAL THERMOWELLS AS REQUIRED FOR CONDUCTANCE OF***

***THE PERFORMANCE GUARANTEE TEST ARE TO BE INSTALLED BY THE CONTRACTOR.***

12. Erection of power cylinders, control valve actuators etc. coming under various groups is covered under the scope of this specification. C&I calibration / commissioning for pneumatic valves & power cylinders shall also be arranged by contractor at no cost to BHEL. The contractor will be responsible for drawing the materials from the stores and to commission them. Any damage / loss in their custody will be the contractors account. The alignment and any mechanical adjustments including link adjustment, opening & reconnection of links, replacement of valve / actuator or any mechanical part, air filter & regulator cleaning etc. required during calibration and operation, the same shall be carried by the contractor for this package. In case of re-calibration if required till handing over of the equipments the same shall also be done by the contractor without any extra cost to BHEL as detailed above with in the final accepted rates. The contractor will however be responsible for drawing the materials from the stores and handing over to the agency that is to commission these. Any damage / loss in their custody will be the contractors account

13. The contractor shall ensure that all supporting elements, anchors & restraint have been installed and adjusted in accordance with the drawings / sketches & other written instructions of the Engineer. The contractor shall inspect the hangers associated with the piping systems as follows:

- After hydraulic test, with the piping in the cold position, with all travel stops removed, with the pipe completely insulated and complete in all respect ready for start up.
- Piping in the hot position with the unit operating at the maximum load.
- Piping in the cold position during the first complete shut down

Erection of filters, flow meters, flow nozzles, other metering elements, flow orifices, flow indicators, valves etc. supplied either by BHEL or their sub-vendors and forming part of the system. This may involve cutting of pipelines, fresh edge preparation and welding.

**42.33** Erection of $CO_2$ and $H_2$ systems complete in all respects, including cylinders stands, connecting piping, valves, distribution headers, main control panels etc is in the scope of contractor. The delivery gas cylinders is to be taken from BHEL / its client stores, their handling and filling of gases in the system as and when required, till unit is commissioned and handed over, shall be the responsibility of the contractor. The empty cylinders are to be returned to BHEL/its client stores.

**42.34** The contractor shall carry out Kerosene oil / dye penetration tests of all the bearing housing of turbine & generator. The Kerosene oil, DPT kit for the tests shall also be arranged by the contractor at his cost.

**42.35** Cabling work for individual packages (system cabling i.e. cables from local control panel to system drives / instruments etc.) including laying of cable trays for oil centrifuge machine, gas drier and on load condenser tube cleaning system **is** in the scope of subject work. The contractor will be responsible for all the electrical and instrumentation installation that come with the mechanical packages and for completion of the package works.

**42.36** The contractor shall assist BHEL in preparation of as built piping drawing.

**42.37** Certain instruments like pressure gauges, pressure transmitters, temperature gauges, flow

switches and indicators, etc., are received in assembled condition as integral part of equipment. Contractor shall be responsible for safe receipt, installation and custody of these instruments supplied mounted on skids / equipment. The calibration of skid / equipment mounted instruments shall also be done by contractor within their quoted rates. All instruments such as pressure gauges / temperature gauges, switches etc. required for the systems under the scope of this contract shall be installed and commissioned by the contractor at no extra cost to BHEL including calibration of these instruments.

## 43.0 WELDING, HEAT TREATMENT, RADIOGRAPHY AND NON-DESTRUCTIVE TESTING

**43.1** The method of welding ( ARC, Gas, TIG or other method) may be indicated in the detailed drawings / schedules. BHEL Engineer will have the option of changing the method of welding as per site requirements

**43.2** The pressure parts, equipment and piping shall be erected in conformity with the provisions of Indian Boiler Regulation and as may be directed by BHEL as per any standard / specification in practice in BHEL. The method of welding (arc, gas, TIG or other method) may be indicated in the detailed drawings / schedules. BHEL Engineer will have the option of changing the method of welding as per site requirements. **Semi automatic welding (GMAW) process shall be used for structures etc to the maximum possible, considering its cost efficiency, better quality and time saving features.**

**43.3** Welding of pressure parts, equipment, piping, high tensile structural steel shall be done by certified high pressure welders who posses valid certificate of CIB of the State in which the equipment is erected as per provision of IBR. The H.P. welder who possesses necessary certificate shall ensure re-validation as per relevant provisions of IBR and keep the certificate valid till the completion of work. The services of such welders, the validity of whose certificates have expired shall not be utilized for high-pressure works.

**43.4** All welders including tack welders, structural and high pressure welder shall be tested as per ASME section IX / IBR and approved by BHEL Engineer before they are actually engaged on work even though they may possess a valid IBR certificate. BHEL reserves the right to reject any welder if the welder's performance is not found to be satisfactory. The contractor shall maintain the records of qualification AND performance of welders. BHEL Engineer will issue all the welders qualified for the work, an identity card. The welder will keep the same with him at work place at all times. He may be stopped from work if he is not found in possession of the same.

**43.5** Engineer may stop any welder from the work if his performance is unsatisfactory for any technical reason or if there is a high percentage of rejection in the joints welded by him. The welder's having passed qualification tests does not absolve the contractor of contractual obligation to continuously check the welder's performance.

**43.6** Faulty welds caused by the poor workmanship shall be cut and re-welded at the contractor's expense. The Engineer prior to any repair being made shall approve the procedure for the repair of defective welds. After the repair has been carried out, the compliance shall be submitted to the quality engineer.

**43.7** The contractor shall carry out the root run welding of all HP / LP piping, valves by TIG welding method only. The contractor shall have to carry out full TIG welding of butt weld joints of tubes / pipes of lesser thickness if required. During the root runs of stainless steel joints, the contractor shall before and during welding have to purge the pipes with inert gas. All arrangements required for the above shall be the responsibility of the contractor at no additional cost.

All expenses for testing of contractor's welders including destructive and nondestructive tests conducted by BHEL at site or at laboratory shall have to be borne by the contractor

only. While the contractor will arrange for the test pieces, limited quantity of tube and pipe material required for making test pieces will be supplied by BHEL free of cost.

**43.8** The regulators used on welding machines shall be calibrated before putting these into use for work. The Contractor at his cost shall also arrange periodic calibration for the same.

**43.9** **Only BHEL approved electrodes and filler wire will be arranged and used by the contractor, within the finally quoted price. BHEL reserves the right to test any approved electrode being used by the contractor. Testing charges for the same shall be borne by the contractor.** All electrodes shall be baked and dried in the electric electrode-drying oven to the required temperature for the period specified by the Engineer before these are used in erection work. All welders shall have electrodes drying portable oven at the work spot. The electrodes brought to the site will have valid manufacturing test certificate. The test certificate should have a co-relation with the lot number / batch number given on electrode packets. No electrodes will be used in the absence of above requirement. The thermostat and thermometer of electrode drying oven will be also calibrated and test certificate from Govt. approved / accredited test house traceable to National / International standards will be submitted to BHEL before putting the oven in use. The contractor shall also arrange periodical calibration for the same.

**43.10** All butt / fillet welds shall be subject to dye penetration test as per the instructions of the engineer at no additional cost.

**43.11** The contractor shall maintain a record in the form as prescribed by BHEL of all operations carried out on each weld. He has to maintain a record indicating the number of welds, the names of welders who welded the same, date and time of start and completion, preheat temperature, radiographic results, rejection if any, percentage of rejection etc. and submit copies of the same to the BHEL Engineer as required. Interpretation of the BHEL Engineer regarding acceptability or other wise of the welds shall be final.

**43.12** The contractor shall carry out the edge preparation of weld joints at site in accordance with the details acceptable to BHEL Engineer. Wherever possible machining or automatic flame cutting should be done. Gas cutting will be allowed only wherever edge preparation otherwise is impractical. All slag / burrs shall be removed from the edge and all the hand cuts shall be ground smooth to the satisfaction of engineer.

**43.13** All welds shall be painted with anticorrosive red oxide paint once radiography and stress reliving works are over. Necessary consumables and scaffolding etc including paints shall be provided by contractor at his own cost.

**43.14** Pre-heating, radiography and other NDT tests, post heating and stress relieving after welding of tubes, pipes, including attachment welding wherever necessary, are part of erection work and shall be carried out by the contractor in accordance with the instructions of the Engineer. Contractor at his cost shall arrange all equipment and consumables essential for carrying out the above process.

The contractor shall also be equipped for carrying out other NDT like LPI / MPI / Hardness test etc. as required as per welding schedules / drawings within the finally accepted price / rates. Ultrasonic testing, wherever required, will be arranged by BHEL. Necessary help in conducting the UT shall however be rendered by contractor

Contractor shall arrange all necessary stress relieving equipment with automatic recording devices. The contractor arrange for labour, heating elements, thermocouples, thermo-chalks, temperature recorders, thermocouple attachment units, graphs, sheets insulating materials like asbestos cloth, ceramic beads, asbestos ropes etc. required for heat treatment/ stress relieving operations. The contractor should take a note of the following:

- Temperature shall be measured by thermocouple and recorded on a continuous

printing type recorder. All the recorded graphs for heat treatment works shall be the property of BHEL.

- All stress relieving equipment will be used after due calibration and submission of test certificate to BHEL. Periodic calibration from Govt. Approved / accredited Test Houses traceable to National / International standards will also be arranged by the contractor for such equipment at his cost

  The contractor shall obtain the signature of Engineer or his representative on the strip chart of the recorder prior to the starting of SR operations

**43.15** The technical particulars, specification and other general details for radiography work shall be in accordance with ASME, IBR or ISO as specified by BHEL.

**43.16** The contractor for radiography work shall use iridium-192. The geometric un-sharpness shall not exceed 1.5 mm. The contractor should take adequate safety precautions while carrying out radiography. Contractor at his cost shall arrange necessary safe guards required for radiography.

**43.17** Low speed high contrasts, fine grain films (D-7 or equivalent) in 10 cm width only be used for weld joint radiography. Film density shall be between 1.5 to 2.0.

**43.18** All radiographs shall be free from mechanical, chemical or process marks, to the extent they should not confuse the radiographic image and defect finding. Pentrameter as per ASME or ISO must be used for each exposure.

**43.19** Lead numbers and letters are to be used (generally 6mm size) for identification of radiographs. Contract number, joint identification, source used, welder's identification and SFD are to be noted down on paper cover of radiograph.

**43.20** Lead intensifying screens for front and back of the film should be used as per the above-referred ASME specification.

**43.21** The joint is to be marked with permanent mark A, B, C to identify the segments. For this a low stress stamp shall be used to stamp the pipe on the down streamside of the weld.

**43.22** For multiple exposures on pipes, an overlap of about 25-mm of film should be provided.

**43.23** Radiography personnel with sufficient experience and certified by M/s BARC for conducting radiographic tests in accordance with safety rules laid down by Division of Radiological protection only have to be deployed. These personnel should also be registered with DRP / BARC for film badge service.

**43.24** All arrangements for carrying out radiography work including dark room and air conditioner and other accessories shall be provided by contractor within the space allotted for office at his cost. As an alternative the contractor may deploy an agency having all above facilities and who are duly approved / accredited by BARC and / or other Regulatory authorities. Detailed particulars of such agencies will be submitted and got approved by BHEL Engineer before the actual deployment of agency for radiography work.

**43.25** The contractor shall have a dark room fully equipped with radiography equipment, film (un-exposed), chemicals and any other dark room accessories.

**43.26** **Contractor shall note that 100% radiography will be done at the initial stages on all the piping welding joints.** Subsequently radiographic inspection will be done on the basis of quality of welding. However minimum percentage of joints to be radiographed shall not be less than the requirement of BHEL welding schedule / IBR / Customer's requirements. The percentage may be increased depending upon the quality of joints and at the discretion of BHEL. Radiography on LP piping joints is not envisaged. However other NDT test as called for in the FQP including LPI, MPI and HT will have to be carried out.

**43.27** All the Radiographs shall be properly preserved and shall become the property of BHEL. They are to be reconciled with the work done, joints radiographed and submitted to BHEL / customer.

**43.28** Since radioisotopes are being used, all precautions and safety rules as prescribed by BHEL/BARC/ Customer shall be strictly followed. BARC / DRP certificate to be provided before taking up the work.

**43.29** Radiography of joints shall be so planned after welding, that the same is done either on the same day or next day of the welding to assess the performance of HP welders. If the performance of welder is unsatisfactory, he is to be replaced immediately.

**43.30** Wherever radiographs are not accepted, on account of bad shot, joints shall be re-radiographed and re- submitted for evaluation.

**43.31** However, if the defect persists after first repair, further repair work followed with radiography shall be repeated till the joint is made acceptable. In case the joint is not repairable, the same shall be cut, re-welded and re-radiographed at contractor's cost.

**43.32** If the contractor does not carry out radiography work due to non-availability of source / film / chemical / operator etc., BHEL will get the work done departmentally or through some other agency at the risk and cost of the contractor.

**43.33** Radiography may be required to be carried out at any time (day and night) to ensure the continuity of the progress. The contractor shall make all necessary arrangements including labour, supervisors/ Engineer required for the work as per directions of BHEL.

**43.34** The contractor shall assist BHEL Engineer in preparing complete field welding schedule for all the field welding activities to be carried out in respect of piping and equipment erected by him involving high pressure welding at least 30 days prior to the scheduled start of erection work at site. The contractor shall strictly adhere to such schedules.

## 44.0 APPLICATION OF INSULATION

**44.1** All attachment welding, including welding of hooks / supports as per pitch both on equipment and piping shall be done as directed by Engineer. Attachment welding shall have to be done by certified welders. If necessary contractor may have to cut the hooks to correct length.

Application of red oxide paint including supply of paint on welded portions as directed by BHEL is also included in scope of work.

**44.2** The mineral wool mattresses (bonded / un-bonded) / LRB mattresses are received at site in standard sizes. These are to be dressed / cut to suit site requirements by the contractor.

**44.3** The number of layers / thickness of mineral wool / LRB mattresses for auxiliaries, pipe lines, valves and other vessels shall be as per various drawings and as directed by Engineer. For applying the mineral wool mattress, the required holding materials, if necessary by fabrication of rings/ hooks shall be fixed as directed and as per drawings and spec.

**44.4** The contractor should ensure, proper finishing of surface of the insulation, sheeting and cementing. It is the responsibility of the contractor to ensure that the insulation materials and sheet metal covering issued to him for application are well protected against loss or damage from weather conditions. Closed / semi closed sheds or any other arrangements required for this will by him at his cost. If any damage occurs to the material due to improper storage or due to any causes attributable to the contractor except for normal breakage or damages allowed in such cases, the cost of such damaged material shall be to the account of the contractor.

Aluminum sheet cladding will be fabricated to the sizes and shapes specified in drawings.

Beading, swaging, beveling of sheets, crowning the sheets if necessary will be carried out by him. Two coats of anti-corrosive black bituminous paint are to be applied on inner surfaces of the cladding. Bitumen sealing compound on the joints if necessary is included in the scope of this work. **Contractor may note that he will also supply anti-corrosive black bituminous paint & bituminous sealing compound required for above works at his cost.**

Aluminum sheet metal cladding over insulation will consists of plain / ribbed / corrugated sheets. The sheets will be supplied in standard sizes. Cutting them to required size, grooving, fabricating bends, boxes etc., for proper covering is contractors responsibility. Any cutting / bending / welding of fabricated skin casing sheets if required will also covered within the scope of this contract.

A logbook shall be maintained by the contractor to obtain clearance for application of insulation. If the contractor does the work on his own accord without prior permission the area may have to be redone at his cost

**44.5** Contractor is liable for the exact accounting of the material issued to him and he shall make any unaccountable losses good. Wastage allowance for the material issued are as below:

1. Wool / LRB mattresses and cladding sheets 2%
2. Insulation bricks and mortar 2%
3. Castable refractory 1%

**44.6** The entire surplus, unused materials etc., supplied by BHEL shall be returned to BHEL after the work is over. Materials like gunny bags and packing materials, empty containers may be returned at periodical intervals

The contractor shall leave certain gaps and opening while doing the work as per instructions of BHEL engineer to facilitate inspection during commissioning and to fix gauges, fittings and instruments. The gaps will have to be finished as per drawings at a later date by the contractor at his cost.

If during erection and commissioning any of the parts are to be insulated temporarily fixed and then replaced by permanent ones at a later date or if any of the parts are to be removed for modification, rectification, adjustment and then refitted or if some parts are to be opened for inspection and checking and for measurement of metal surface temperature the same may necessitate removal and re-application of insulation and sheet metal cladding, which shall be done by the contractor and the erection rate quoted shall be inclusive of such contingencies.

Removable type of insulation shall be provided for valves, fittings, expansion joints etc as per the drawings or as directed by BHEL Engineer

All temporary pipelines required during testing, pre-commissioning and commissioning should be insulated as directed by BHEL at no extra cost to BHEL. However required insulation material shall be issued by BHEL free of cost.

**45.0 TESTING, PRE-COMMISSIONING, COMMISSIONING AND POST-COMMISSIONING .**

**45.1** The contractor shall carry out all the required tests and pre-commissioning and commissioning activities required for their successful and reliable operation. These would include hydraulic test of condenser, land flow test, chemical cleaning, alkali flushing and water flushing of piping, , oil flushing of oil system etc. as instructed by BHEL.

All the chemicals required for carrying out these activities will be supplied by BHEL free of cost.

All required tests (Mechanical and electrical) indicated by BHEL and their clients for successful commissioning are included in the scope of these specifications. These tests / activities may not have been listed in these specifications.

Specialized test equipment, if any, shall be provided by BHEL / its client free of hire charges. However contractor has to take proper care of the equipment issued to him.

**45.2** The contractor shall carry out the air-tightness test on assembled generator to the satisfaction of BHEL Engineer. The necessary arrangement for testing with dry-clean air shall be made by the contractor at his cost. Compressed air for testing can be taken by the contractor from the existing system. The scope of pre-commissioning activities cover installation of all necessary temporary piping, supports, valves, etc. and other accessories with access platforms valves, pressure gauges, electric cables, switches etc., required for hydro test and for any other tests as the case may be and will carry out above activities under this scope of work as per instructions of BHEL. The scope also covers the off site disposal of effluents

**45.3** All the above tests shall be repeated till all the equipments satisfy the requirements of BHEL/customer. In order to rectify the defects/deficiencies noticed during hydro test, water may have to be drained and refilled after repairs for repeating the process of hydro test. In such cases, no extra amount will be payable for rectification of defects / deficiencies attributable to the contractor. Claim of contractor in respect of persons waiting /idling during repairs as also the expenditure incurred for repeating the test due to any reason whatsoever shall not be tenable under any circumstances It shall be specifically noted that the employees of the contractor may have to work round the clock along with BHEL/Customer Engineers and hence overtime payment by the contractor may be involved. The contractor's finally accepted rates/ price shall be inclusive of all these factors also.

**45.4** It shall be the responsibility of the contractor to provide various category of workmen in sufficient numbers along with supervisors with necessary consumables, T&Ps, IMTEs etc., along with any other assistance required during pre-commissioning, commissioning and post -commissioning of equipment and attending any problem in the equipment erected by the contractor till handing over.

Association of BHEL's / Client's staff during above period will not absolve contractor from above responsibilities.

**45.5** In case, any rework is required because of contractor’s faulty erection that is noticed during pre-commissioning and commissioning, the same has to be rectified by the contractor at his cost. If any equipment / part is required to be inspected during pre-commissioning and commissioning, the contractor will dismantle/open up the equipment / part and reassemble / redo the work without any extra claim.

**45.6** During commissioning, opening / closing of valves, changing of gaskets, realignment of rotating and other equipment, attending to leakage and adjustments of erected equipment may arise. This is included in the scope of work.

**45.7** The contractor shall make all necessary arrangements including making of temporary closures on piping / equipment for carrying out the hydro-static testing on al piping equipment covered in the specification at no additional cost.

**45.8** In case any defect is noticed during tests, trial runs and commissioning such as loose components, undue noise or vibration, strain on connected equipment etc., the contractor

shall immediately attend to these defects and take necessary corrective measures. If any readjustment and realignment including repair, rectification and replacement work are necessary, the contractor shall carry out the same as per Engineer's instructions. The parts to be replaced shall be provided by BHEL.

**45.9** During hydraulic testing of pipes, all piping, if any, having variable spring type supports shall be held securely in place by temporary means while constant spring type support hangers shall be pinned or blocked solid during the test.

**45.10** It shall be the responsibility of the contractor to provide various category of workers in sufficient numbers along with Supervisors during Pre-commissioning, commissioning and post commissioning of equipment and attending any problem in the equipment erected by the contractor till handing over. The contractor will provide necessary consumables, T&Ps, IMTEs etc., and any other assistance required during this period. Association of BHEL's / Client's staff during above period will not absolve contractor from above responsibilities.

**45.11** It shall be specifically noted that the above employees of the contractor may have to work round the clock along with BHEL Engineers and hence overtime payment by the contractor to his employees may be involved. The contractors finally accepted rates should be inclusive of all these factors also.

**45.12** In case, any rework is required because of contractor's faulty erection, which is noticed during pre-commissioning and commissioning, the same has to be rectified by the contractor at his cost. If any equipment / part is required to be inspected during pre-commissioning and commissioning, the contractor will dismantle / open up the equipment / part and reassemble / redo the work without any extra claim.

**45.13** During commissioning, opening / closing of valves, changing of gaskets, realignment of rotating and other equipment, attending to leakage and adjustments of erected equipment may arise. The finally accepted price / rates shall also include all such work.

**45.14** The contractor shall make all necessary arrangements including making of temporary closures on piping / equipment for carrying out the hydro-static testing on all piping, equipment covered in the specification at no extra cost.

**45.15** The valves will have to be checked, cleaned or overhauled in full or in part before erection, after testing and during commissioning as may be necessary.

**45.16** In case any defect is noticed during tests, trial runs and commissioning such as loose components, undue noise or vibration, strain on connected equipment etc., the contractor shall immediately attend to these defects and take necessary corrective measures. If any readjustment and realignment are necessary, the contractor at his cost shall do the same as per Engineer's instructions including repair, rectification and replacement work. The parts to be replaced shall be provided by BHEL.

**45.17** All temporary supports shall be removed in such ways that pipe supports are not subjected to any sudden load. During hydraulic testing of pipes, all piping having variable spring type supports shall be held securely in place by temporary means while constant spring type support hangers shall be pinned or blocked solid during the test.

**45.18** The contractor shall carry out cleaning and servicing of valves and valve actuators prior to pre-commissioning tests and / or trial operations of the plant. A system for recording of such servicing operations shall be developed and maintained in a manner acceptable to BHEL Engineer to ensure that no valves and valve actuators are left un-serviced. Wherever necessary as required by BHEL Engineer, the contractor shall arrange to lap / grind valve seats.

**45.19** All items / material required for conducting hydraulic test, chemical cleaning, alkali flushing, steam blowing etc., will be supplied by BHEL/ its customer. However, servicing, erection, dismantling and returning of the same to stores shall be the responsibility of the respective contractor who shall be erecting the equipment / piping. The contractor may note that **no separate payment shall be released for any temporary works** that are to be carried out for conducting pre-commissioning and commissioning tests. **Bidders are advised to include expenses on temporary works along with the rates being quoted by them. Broadly the work on temporary systems will be as under:**

Erection etc. of all temporary piping along with insulation and supports for steam blowing, interfacing for chemical cleaning and affluent disposal are to be carried out as part of Boiler work. However **Installation and operation** of all equipment including tanks and electrical switchgear along with their accessories shall be carried out by **another agency**. Contractor for this work will be responsible for assisting their operation till completion of the commissioning activities. He will also service the equipment and handover the equipment to the other agency for further erection/commissioning activities.

**Dismantling of the temporary equipment and piping including returning the equipment to the stores is also covered in the scope.**

Cleaning and servicing of all the filters / strainers, toppings of oils coming in the system shall be done by the contractor within the accepted price.

Thermal shocks will be required during oil flushing operations. The contractor is required to make all arrangements for the same. This would include fabrication of heating tank with nozzles and requisite piping with supports. Complete erection with pumps, tanks, electrical fittings including and other accessories is to be carried out. All material and equipment will be provided on returnable basis by BHEL.

**45.20** All arrangement required for steam blowing including removal, reinstallation and welding of CRH NRV and installation of steam blowing arrangements including steam blow off piping is included in the scope of work.

It shall be the responsibility of the contractor to preserve the cleaned surface as per BHEL's requirement.

The water boxes of the condenser will be tested hydraulically to 1.5 times the design pressure after its assembly at site. The arrangement of all the blanking for carrying out the hydraulic test shall be the responsibility of the contractor at no additional cost. However only the main blanking flanges with fasteners for CW inlet and CW outlet of the condenser shall be provided by BHEL free of cost. Fabrication of blanks will be carried out by the contractor.

The water-fill test of the steam space shall be carried out by filling the water upto 1 Meter or as required above the top row of tubes to facilitate leak detection. Hydraulic testing shall be carried out on the condenser water boxes. Dummy plates shall be provided by BHEL.

The contractor shall fill the condenser upto the specified level as many times as called for by the Engineer for checking of the turbine at no additional cost.

During hydraulic testing of pipes, all piping having variable spring type supports shall be held securely in place by temporary means while constant spring type support hangers shall be pinned or blocked solid during the test.

The contractor shall carry out cleaning and servicing of valves and valve actuators prior to pre-commissioning tests and / or trial operations of the plant. A system for recording of such servicing operations shall be developed and maintained in a manner acceptable to

BHEL Engineer to ensure that no valves and valve actuators are left un-serviced.

Cleaning & servicing of all the filters / strainers, toppings of oils coming in the system shall be done by the contractor till the completion of trial operation and handing over of the unit

At the time of each inspection, the contractor shall take note of the decisions / changes proposed by the Engineer and incorporate the same at no additional cost. The contractor shall carry out any other test as desired by BHEL Engineer/ Manufacturer on erected equipment covered under scope of this contract during testing and commissioning to demonstrate the physical completion of any part or parts of the work performed by the contractor

## 46.0 CONDENSER PAINTING

**46.1** The condenser main tube plates will be dispatched to site from the works with surface protection only on water box side. The same shall be removed adopting one of the suitable methods indicated elsewhere in this specification. The contractor shall do the surface protection of these tube plates after the completion of the tube insertion and expansion activities. The surface shall be first painted with at least two or more coats of approved quality chemical resistant epoxy zinc chromate primer after thoroughly cleaning all such parts of all dirt, rust scales greases, oils and other foreign materials by adopting suitable methods as approved by BHEL. Afterwards the above parts shall be finished with two or more coats of approved quality high build black coal tar coating. Before the painting is taken up, the contractor shall plug all the holes with suitable tapered plastic / wooden plugs to avoid any damage to the tube ends. The plastic / wooden plugs and paints required for the above operations shall have to be arranged by the contractor at his cost. The above paints are also to be applied on water chamber / box. The thickness is to be confirmed by suitable measurement.

**46.2** The condenser steam space shall be surface protected with at least two coats of suitable steam washable paint. Before the painting is taken up, the contractor shall clean the surfaces to be coated by adopting suitable methods. **The BHEL approved quality paint is to be arranged by the contractor at his own cost**

## 47.0 FINISH PAINTING

**47.1** All exposed metal parts of the equipment, structure, auxiliaries, piping, and other items (covered within the scope of this contract) after installations are to be painted. The surfaces are to be thoroughly cleaned of all dirt, rust, scales, grease, oils and other foreign materials by wire brushing, scrapping, any other method as per requirement of BHEL. The same will be inspected and approved by the engineer before painting.

**47.2** Mostly the equipment / items/ components will be supplied with one coat of primer paint and one coat of finish paint. However during storage and handling, the same may get peeled off / deteriorate. All such surfaces are to be thoroughly cleaned and to be touch up painted with suitable approved primer and finish paint matching with shop paint / approved final colour. Besides above two coats of approved primer paint is to be applied on all the bare / unpainted surfaces. The gas cut stubs would require being ground and rounded.

**47.3** After applying the primer paints, wherever required, all structure / equipment / items, shall be finish painted with paints as specified by BHEL engineer. The number of coats / paint thickness shall be as indicted in the drawing / documents. However at least two coats of finish painting is to be applied. In case proper finish is not obtained in two coats, the contractor shall apply additional coat (s) till proper finish / paint thickness is achieved. Certain equipment / Items are required to be painted with approved quality heat resistant

paint / primer . After completion of painting all bright spots shall be cleaned to the satisfaction of Engineer. Minimum paint thickness is to be ensured at all places as per specifications.

**47.4** Certain equipment like valves etc. may require spray painting. The contractor shall make arrangements of the required equipment for spray painting. Spray painting at the job site shall be permitted only at times and locations approved by Engineer.

**47.5** **Contractor at no extra cost to BHEL shall supply all paints (over & above as supplied by the unit / BOP vendors along with the plant materials, which will be given free of cost to bidder), primers, tools and other consumables including scaffolding materials required for finish painting**. Paint is to be of BHEL approved make only and painting should be as per colour scheme and quality approved / specified by Engineer. Valid Test Certificate for the paint so supplied shall be made available before use of the same on work. All paints should be stored in well-ventilated store. The painters and other personnel deployed should use proper protective equipment to avoid inhalation of fumes.

The contractor shall ensure availability of

- Ford Cup-4 to measure consistency of paint,
- Automatic magnetic gauge to measure the dry film thickness and
- SSPC Visual standards to assess degree of cleanliness of surfaces to be painted

**47.6** The contractor may be required to fill up dents / marks by applying putty before final painting of equipment. All materials and arrangements have to be made within quoted lumpsum price/rates.

**47.7** The contractor shall provide legends with direction of flow on equipment and piping in size specified by Engineer. Letter writing shall be done in Arabic / English or in both languages.

**47.8** The painters have to under go test and only qualified painters will be allowed to work.

**48.0 PROGRESS REPORTING**

**48.1** Contractor is required to draw mutually agreed monthly erection programs in consultation with BHEL well in advance. Contractor shall ensure achievement of agreed program and shall also timely arrange additional resources considered necessary at no extra cost to BHEL.

**48.2** Weekly progress review meetings will be held at site during which actual progress during the week vis-a-vis scheduled program shall be discussed for actions to be taken for achieving targets. Contractor shall also present the program for subsequent week. The contractor shall constantly update / revise his work program to meet the overall requirement. All quality problems shall also be discussed during above review meetings. Necessary preventive and corrective action shall be discussed and decided upon in such review meetings and shall be implemented by the contractor in time bound manner so as to eliminate the cause of non-conformities.

**48.3** The contractor shall submit daily, weekly and monthly progress reports, manpower reports, materials reports, consumables (gases / electrodes) report and other reports as per Performa considered necessary by the Engineer.

**48.4** The progress report shall indicate the progress achieved against planned, with reasons indicating delays, if any. This should give the remedial actions which the contractor intends to take to make good the slippage or lost time, so that further works again proceed as per the original program and the slippage do not accumulate and effect the overall program.

**48.5** The daily manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.

## 49.0 DRAWINGS AND DOCUMENTS

**49.1** The detailed drawings, specifications available with BHEL engineers will form part of this tender specification. These documents will be made available to the contractor during execution of work at site. The contractor will also ensure availability of all drawings / documents at work place.

**49.2** Necessary drawings to carry out the erection work will be furnished to the contractor by BHEL on loan, which shall be returned to BHEL Engineer at site after completion of work. Contractor shall ensure safe storage and quick retrieval of these documents.

**49.3** The contractor shall maintain a record of all drawings and documents available with him in a register as per format given by BHEL Engineer. Contractor shall ensure use of pertinent drawings / data / documents and removal of obsolete ones from work place and returning to BHEL.

**49.4** The data furnished in various annexure enclosed with this tender specification are only approximate and for guidance. However, the change in the design and in the quantity may occur as is usual in any such large scale of work.

**49.5** Should any error or ambiguity be discovered in the specification or information the contractor shall forthwith bring the same to the notice of BHEL before commencement of work. BHEL's interpretation in such cases shall be final and binding on the contractor.

**49.6** Deviation from design dimensions should not exceed permissible limit. The contractor shall not correct or alter any dimension / details, without specific approval of BHEL.

## 50.0 TAXES AND DUTIES

**50.1** **The bidder shall quote their rates inclusive of all taxes/duties applicable for this work, except otherwise expressly set forth herein or under clause no. 50.10.2 of SCC. The Contractor shall be responsible for paying any and all Taxes/Duties assessed on the Contractor, its Sub-Contractor and Suppliers or their respective employees.**

**50.2** **LOCAL TAXES AT SUDAN**: BHEL and / or its Customer shall obtain from the competent Sudanese Authorities all taxes exemption or pay on behalf of Contractor relating to the project including Business Profit Tax and Value Added Tax etc. However, Income Tax for personnel shall be borne by the Contractor.

**50.3** Taxes as required to be deducted at source as per Local Sudanese Laws / Indian Law (applicable in case of only those contractors having their office in India), if any, at prevailing rates shall be deducted on gross invoice value from the running bills unless Exemption Certificate from appropriate Tax Authority is furnished.

**50.4** **Custom duty and demurrage occurred in Port Sudan and Khartoum airport for all equipment, facilities and materials imported by the Contractor for the Project shall be paid by BHEL's Customer (M/s NEC). The contractor shall furnish list of all such items including their temporary imported equipments(temporary imported equipments to be defined and listed clearly) well in advance. However, custom duty , if any, paid by the Contractor for any reason whatsoever shall not be reimbursed.**

**50.5** **BHEL or its Customer(NEC) shall be responsible for the custom clearance agency to clear out the Equipment, tools, materials imported (Plant Materials) and Contractor's equipment and vehicles temporarily imported for the Project as per Procedure given below at 50.6. However, the Contractor shall take all actions for chasing/follow up and bear all expenditure on his own for the same. A bank**

**guarantee shall be issued by the Contractor, if necessary according to the custom authority for custom clearance. The bidders to assume amount of BG equivalent to custom duty pertaining to their equipments/T&Ps brought by them on repatriable basis. The Contractor shall submit all relevant dispatch/shipment documents to Project Coordinator- Sudan, BHEL, PSNR, NOIDA(UP)-India / Construction Manager, BHEL Site, Kosti TPP. The Contractor shall take delivery of materials at Port of Sudan or at Khartoum airport and responsibility of handling (unloading/loading etc) and its transportation to Kosti Power Plant shall be of Contractor at their own cost. Payment of any Que/Quay dues at Port, will be the responsibility of the Contractor.** "Que/Quay dues" are applicable for delay in unloading at the port, the rate will be as applicable.

**For BG of the custom duty if necessary may be in USD, preferably from member banks mentioned in GCC.**

**50.6 CUSTOMS CLEARANCE PROCEDURE**

(A) For all the supplies/ dispatches related to this Project, the consignee will be NEC, SUDAN and the name of supplier to be mentioned either as "BHEL" or "on account of BHEL". The Contractor will submit original + 7 copies of despatch documents to BHEL /BHEL's bankers after despatch of consignment from India. BHEL bankers in India will forward these documents after necessary endorsement to Bank of Sudan in Sudan. Bank of Sudan after stamping will send these original documents to NEC, Khartoum(BHEL's Customer).

(B) The Contractor shall submit scanned / fax copies of documents such as invoice, packing list, certificate for country of origin, insurance, bill of landing etc to BHEL/ NEC, Khartoum after despatch of consignment from India.

(C) NEC (BHEL's customer) at Khartoum will process the document and obtain certification from Sudan customs / Government for zero custom duty and payment exemption for all other applicable taxes, duties, levies etc.

(D) NEC (BHEL's customer) at Khartoum shall forward these documents with certification to NEC-Port Sudan.

NEC (BHEL's customer) at Port Sudan after necessary clearance permit will hand over the documents to the Contractor through BHEL's representative/Transporter for taking delivery and transport to power plant site at Kosti. The Contractor will sign that he has received the consignment..

**50.7 In case the temporary imported equipment is not defined and listed by the Contractor, the responsibility of custom clearance and payment of custom duty/taxes shall lie with them. When it is produced at any time it shall be considered as part of this Contract ( i.e it will be considered as BHEL's Customer property)**

**50.8 Any demurrage incurred due to the reason of the Contractor's delay in unloading at the Port Sudan or airport shall be the Contractor's responsibility. Any other demurrage incurred during custom clearance for reasons other than those attributable to BHEL or its Customer (M/s NEC), shall also be borne by the Contractor**

**50.9 For all the items like T&Ps, Erection equipments, consumables, establishment items etc. to be**

**exported by the Contractor to Sudan on repatriable basis, the Contractor shall furnish list and value of such items to BHEL prior to dispatch. The Contractor shall also give an undertaking to BHEL prior to dispatch declaring these items as returnable/consumable.**

**50.10 COMPLIANCE TO REGULATIONS AND BYELAWS :**

**50.10.1** The Contractor shall conform to the provisions of any statute relating to the work and regulations and bylaws of any local authority and of any water and lighting Companies or Undertaking with whose system the work is proposed to be connected. He shall, before making any variation from the drawings or the specifications that may be necessitated for such connections give the Engineer, notice specifying the variation proposed to be made and the reasons therefore and shall not carryout any such variation until he has received instructions from the Engineer in respect thereof. The Contractor shall be bound to give all notices required by statute, regulations or bye-laws as aforesaid and to pay all fees and taxes payable to any authority in respect thereof.

**50.10.2 The Contract shall be governed by the applicable Laws of Sudan Govt. and the bidders to ensure considering latest Sudanese Laws before quoting. If during Contract execution there may be any Change in such Law which might cause additional or reduced cost to the Contractor in the execution of the works, such additional or reduced cost, if fully justified and approved by BHEL or its Customer (M/s NEC), shall be paid to 'OR' recovered from the Contractor, as the case may be.**

**50.10.3 The Contractor shall ensure conformance in all respects with the provisions of all state and local laws, regulations or other laws in force in Sudan or elsewhere including all regulations and by-laws of any local or other duly constituted authority within Sudan or elsewhere which may be applicable to the performance of the Contract and the rules and regulations of all public bodies and companies whose property or rights are affected or may be affected in any way by the Works or any Temporary Works (which are herein referred to as "Laws"), and shall give all notices and pay all fees required to be given or paid thereby and shall keep BHEL and/or its Customer (NEC) indemnified against all penalties and liability of any kind for breach of any of the same.**

**50.10.4 The Contractor shall comply with all applicable Sudan Government's safety and sanitary laws, transportation rules, regulations and ordinances, as well as the established safety rules and practices of BHEL's Customer (NEC). The Contractor shall also provide insurance cover for his workmen throughout the contract period, under prevailing local Laws.**

**51.0 EXTRA WORK**:

**51.1** BHEL may consider for payment of extra works on man hour basis @ 3 USD per man hour only for such of those works which:

**A** Require major revamping or rework and which are totally unusual to normal erection work.

**B** Require rectification / modification for improvement in the design during commissioning,

**C** Requiring fresh fabrication of components in place of rejected / replaced components.

**51.2** The rates indicated as above, shall include over time, if any, consumables, supervision, use of tools and tackles and other site expenses and incidentals.

**51.3** The extra works, if any, shall be carried out by a separate gang, which will be identified for certification of man-hours. This gang will not be utilized for any other work during the period that they are engaged in the extra-work. Logbook should be maintained and should be signed jointly by the contractor's representative and BHEL Engineer on day-to-day basis. However, signing of the logbook does not necessarily mean acceptance of the extra works, which would be identified by Engineer, whether work is covered in one of the above categories. Only those works and man-hours that are certified by the BHEL Engineer-in-charge will be considered for payment. The decision of BHEL in this regard shall be final and binding on the contractor.

**52.0 PRICE VARIATION**

**52.1 The finally accepted rates for scope of work as defined in this tender shall remain FIRM throughout the contract period including extended period, if any .** NO PRICE VARIATION / COMPENSATION on account of any increase whatsoever, (irrespective of whether escalation are steep/ unanticipated or not compensated by the above escalation provisions in full towards minimum wages, consumables, coarse / fine aggregates, steel , wood, electrodes, gases or any other item / reason), will be payable during the entire period of execution including extended period, if any, unless otherwise specified elsewhere in this 'Special Conditions OF Contract' (SCC).

**53.0 RATE SCHEDULE**

**53.1** Contractor shall fully understand equipment description and scope of work before quoting. The scope of work and responsibility of the contractor as mentioned under these specifications shall be covered within the quoted rates.

**53.2** The tenderer shall quote the rates as per the rate schedule only, in part II price bid (Original). Conditional price bids or price bids with any deviation / clarification etc. are liable to be rejected. No cutting / erasing / over writing shall be done.

**53.3 Further Percentage breakup for payment against clause no. 64.6 will be mutually discussed & finalized at site.**

**54.0 INSTRUCTIONS TO TENDERER**

**54.1** Offers received without data / information, required under tender clauses-11.1 to 11.11, is liable to be rejected. All these data / information should be duly supported by documentary evidences (Refer note below clause-11)

**54.2** No deviations to the tender conditions will normally be accepted.

**54.3** The Tenderers are advised to physically visit the site and fully acquaint themselves with site conditions, transportation routes, various distances and the fact that other contractors would be working in this area. BHEL shall not be responsible in any way for non-familiarization of the site conditions. Once the tenderer has quoted for the work, it is implied that he has ascertained various site conditions and NO CLAIM whatsoever will be entertained by BHEL on any such account. **Tenderers who wish to visit Sudan to collect any information in respect of this tender, may send, preferably within 7 days of tender notice, the details of personnel along with copies of their passports in the soft form to facilitate arrangement of visas. Clarification, if any, required against this tender, should be sent to us through e-mail, preferably within 10 days of issue of this NIT, specifically stating the clause nos. of the NIT**

**54.4** The contractor in the event of this work being awarded to him shall establish a site office at site and keep posted an authorized responsible officer who should hold a valid power of attorney for the purpose of the contract. Any order or instruction of the Engineer or

his duly authorized representative communicated to the contractor's representative at site office, will be deemed to have been communicated to the contractor at his legal address.

**54.5 CLEARANCE OF SITE AND REPAIRS**

The Contractor shall at all times keep the Site free from obstruction and shall at any time, if or if not directed by the BHEL / its Customer(M/s NEC) & their consultant, store or dispose of any constructional plant and surplus materials and clear away and remove from the Site any wreckage or rubbish or Temporary Works no longer required. Contractor has to clear the site / area where mechanical and electrical erection work is to be commenced / or in progress. The contractor shall remove construction materials and equipment lying in the vicinity and causing obstruction in the erection work within 24 hrs. notice. In case, he fails to clear the site, this will be done at his risk & cost by BHEL. On the completion of the Works, the Contractor shall, except as otherwise specifically provided, clear away and remove from the Site and around Site ail construction plant, Temporary Works, surplus materials, wreckage and rubbish of every kind, and shall reinstate and leave the whole of the Site and the Works clear and in a workmanlike condition to the satisfaction of BHEL. If the Contractor fails to remove any Constructional Plant within a reasonable time after the issue of the Provisional Acceptance Certificate then BHEL or its Customer (M/S NEC) may:

a) sell any such plant & materials which are the property of the Contractor;

b) return any such plant & materials which are not the property of the Contractor to the Employer thereof at the Contractor's expense;

and, after deducting from any proceeds of sale the costs, charges and expenses in connection with such sale or return, shall pay the balance, if any, to the Contractor, but to the extent that the proceeds of any sale are insufficient to meet all such costs, charges and expenses, the excess shall be a debt due from the Contractor to BHEL and shall be reimbursed by the Contractor.

## 54.6 OTHERS

**54.6.1** In case of any contradiction between General Conditions of Contract (GCC) and Special Conditions of Contract (SCC), the latter shall prevail.

**54.6.2** The Price Bids of only those bidders will be opened who will be qualified for the subject job on the basis of pre-qualification evaluation / Techno-commercial. BHEL reserves the right to reject the bidders with unsatisfactory past performance in the execution of a contract. BHEL's decision in this regard shall be final & binding.

**54.6.3 PACKING, MARKING AND TRANSPORTATION :** All equipment and material, together with the applicable instruction book, packing list, and special site storage instructions, shall be carefully boxed, crated, or otherwise adequately protected for overseas shipment by the Contractor

**54.6.4** The Contractor shall be responsible for the transport of their tools, plant and equipment and construction materials, from their place of origin to the Site and more precisely to their exact point of utilisation at the Site. The Contractor shall take care that if the machinery is disassembled into components, the weight and size of which are in line with actual transport possibilities.

**54.6.5** Within the limits imposed by local laws, the Contractor shall be entitled to utilise all the roads and other communication facilities existing in the country, to the same extent as any other user. BHEL and its Customer(M/s NEC) shall assist the Contractor for obtaining licenses, permits, etc. from all the local authorities.

**54.6.6** The Contractor shall repair or replace the Works lost, damaged, or destroyed, without waiting for the settlement of claims from insurance company to ensure completion in accordance with the Overall Project Schedule.

**54.6.7** The Contractor shall be responsible for the safety and security of all the Works and shall replace promptly at Site each part of any and all Works which may be lost or damaged or destroyed due to fire, explosion, lightning, earthquake, theft, flood, storm, tempest, aircraft and other aerial devices or articles dropped therefrom, malicious damage, etc. and the actions of the BHEL or its Customer (M/s NEC) in the operation of appliances on behalf of the Contractor in case the contractor do not act from the date of arrival of equipment, plant, materials, machinery, etc. at the Site until Provisional Acceptance Certificate has been issued.

**54.6.8** The Contractor shall repair or replace the Works lost, damaged, or destroyed, within shortest possible time at Site to ensure commissioning and operation of the Works without delay. If the Contractor shall fail to promptly replace or repair the Works damaged as per above clause, the Employer, at his discretion, will get such works repaired or replaced as the case may be and such costs will be reimbursed by the Contractor.

**54.6.9** **SECURITY DEPOSIT**: The contractor shall submit Security Deposit (SD) in USD with a option to give 50% SD in form of BG in Indian Rupees (For this, BG amount in INR will be increased by 5% to cover exchange rate fluctuation) within 15 days from the date of issue of LOI as per clause no. 16.0 of the General Conditions of Contract (GCC). For Calculation purpose SD as per clause 16.2 of GCC will first be worked out in INR based on the TT selling rate prevailing on the date of technical bid opening. The SD amount in USD shall further be worked out based on the State Bank Of India TT Buying Rate prevailing on the date of technical bid opening based on the amount of INR so worked out.

In case the contractor opts to furnish Bank Guarantee as a part of Security Deposit, the BG shall be issued as per the Performa enclosed as per Annexure-H of the GCC and also that the BG should be issued preferably through any of the Member Banks listed in the GCC. The BG may also be accepted from a Foreign Bank at the sole discretion of BHEL, provided BG is duly endorsed by any of the BHEL's Member Bank listed in the GCC 'OR' any Nationalized Bank in India.

For BG through any other Indian Nationalized Bank (Not covered in the list of Member Banks of GCC), the discretion of its acceptance shall lie solely with BHEL.

**54.6.10** **LIQUIDATED DAMAGES(LD):** For delay in completion of work attributable to the contractor, the LD shall be applicable at the rate of ½% of the contract value per week of delay or part thereof limited to a ceiling of 10% of the contract value as mentioned under clause no.25.5 of the GCC of the tender.

**54.6.11 FORCE MAJEURE**

**The term "Force Majeure" means any cause beyond the control of either party, which either party could not foresee and / or reasonably provide against and which prevents either party from performing his duties under the Contract. Force Majeure includes but is not limited to the following:**

**War, revolution, insurrection, or hostilities (whether declared or not)**

**Riots, civil commotion or civil uprisings (other than among Contractor's employees)**
**Earthquake, flood, tempest, hurricane, lightning, or any other natural disaster.**
**Any fire of major proportions, or explosions.**

**Strike, lockout, or other industrial disturbance other than among Contractor's employees.**

**If either party to this Contract because of a Force Majeure Event is rendered wholly or partly unable to perform its obligations under this Contract, other than the obligation of that party to make payments of money, that party shall to the extent provided in this Contract, be excused from the performance directly affected by the Force Majeure Event, provided that;**

a) The non-performing party, as soon as possible but in no event more than ten (10) business Days after it becomes aware of its inability to perform, shall declare that a Force Majeure Event has occurred and give the other party written notice of the particulars of the occurrence(s), including, without limitation, the nature, cause and date and time of commencement of the occurrence(s), the anticipated scope and duration of any delay, and any date(s) that may be affected thereby. If it is impracticable to specify the length of such delay at the time such notice is delivered, the non-performing party shall provide the other party with periodic (not less frequently than weekly) supplemental notices during the period the Force Majeure Event continues. Such supplemental notices shall keep such other party informed of any change, development, progress or other relevant information concerning the Force Majeure Event.

b) The suspension of performance is of no greater scope and of no longer duration than is required by the Force Majeure Event.

c) Obligations of either party which arose before the Force Majeure Event causing the suspension of performance are not excused as a result of the Force Majeure Event.

d) The non-performing party immediately and continuously uses its best efforts to remedy its inability to perform with all reasonable dispatch.

e) When the non-performing party is able to resume performance of its obligations under this Contract, that party shall promptly so notify the other party in writing.
During and following the occurrence of any Force Majeure Event, Contractor and Employer each shall use its best efforts to minimize the delay and costs caused by such Force Majeure Event and shall continue actively and in good faith consider the need for and, when appropriate, execute a change order covering such event, which may result in the extension of such Guaranteed Taking-Over Date or / and additional cost.

**54.6.12 INSURANCE**

Besides provisions under clause no. 29.0 of GCC regarding insurance, the following shall also be applicable. The contractor shall also take care of the same while submitting their offer.

1 BHEL / its customer shall arrange for insuring the materials of BHEL / its customer covering the risks during transit, storage, erection and commissioning.

2 If due to negligence/ carelessness on the part of the contractor, any material/ equipment gets damaged, the contractor shall submit necessary documents for lodging insurance claims as required by BHEL Engineer. BHEL shall however reserve

the right to recover deductible franchise and also unsettled portion of insurance claim amount from the contractor.

3 If due to negligence/ carelessness on the part of the contractor, any surrounding properties also get damaged, the contractor shall submit necessary documents for lodging insurance claims as required by BHEL Engineer. BHEL shall however reserves the right to recover deductible franchise and to unsettled portion of insurance claim amount from the contractor.

4 Insurance for all materials pertaining to the Contractor(T&Ps, Construction Materials etc.) during transit, storage and during construction shall be in his (Contractor's) scope**.**

**5 The Contractor shall provide insurance cover to all persons employed/engaged by him throughout the period of Contract, including the extended period, if any, under prevailing local laws**.

## SECTION - III `B'

## SPECIAL CONDITIONS OF CONTRACT –

## (ELECTRICAL AND INSTRUMENTATION )

## INDEX

# SECTION - III `B'

## 55.0 SCOPE OF WORK

55.1 Scope of these specifications cover complete work of handling, transportation of materials from Project storage yard / stores to erection site / place of erection , storage at erection site, preservation, watch and ward, dressing, chipping and levelling of foundations, cleaning , checking, testing, pre-assembly, erection, calibration, alignment, grouting, welding, NDT wherever required, preservative/ touch-up painting including supply of paints etc, earthing of equipment, including other activities **required for erection, testing, commissioning, post commissioning, trial operations & handing over of all ELECTRICAL and C&I equipment and items indicated in the rate schedule** covered within the scope of these specifications for **4 X 125 MW units at Kosti TPP, Sudan**

55.2 The scope of work shall also include the following within the quoted item rates:

i.) Re-rolling of cables on drums as required by site engineer.
ii.) Providing supports for impulse lines, instruments, air lines, cable trays wherever required by fabricating at site. Required material for these will be provided by BHEL & all consumables including gas, welding electrodes etc. will be arranged by the contractor.

55.3 The scope of work also covers all performance tests necessary to ensure that workmanship conforms to relevant standards and that such tests are adequate to demonstrate that the installations complies with the requirements of this specification. All arrangement for conducting tests are to be made by contractor within their quoted rates and tests may have to be repeated to satisfy BHEL / NEC.

**55.4** The brief description of major equipment/ items to be erected, tested and commissioning under the scope of subject work are as described below. However change in design/specification may occur as is usual in any such large work for which no compensation will be payable. Contractor shall complete the entire work as detailed in tender specification including dry out / centrifuging of transformers within the contractual rates. In case during testing, commissioning, post commissioning, trial operation the IR valves of electrical equipment is found low, the contractor shall make arrangements and dry out the equipment within the quoted rates. Removing & reconnection of equipment will be the part of scope at no extra cost to BHEL.

### A) EHV SYSTEM :

The EHV System comprises of 220 kV Switchyard Electrical System Equipments and the the other auxiliaries associated with the Switchyard Island . The scope also includes installation of 11 kV Outdoor equipments .Brief description of the major equipments of the Switchyard to be installed is as under :

| Sl No | Equip Description | Unit | Qty | Appx Size ( L X D X H ) mm |
|---|---|---|---|---|
| 1 | 245 kV, 2000 / 3150 A, 40 kA, 3- phase, SF6 Circuit Breaker WITH SUPPORTING LATTICE STRUCTURE, | nos | 9 | |

| Sl No | Equip Description | Unit | Qty | Appx Size ( L X D X H ) mm |
|---|---|---|---|---|
| 2 | 245 kV, 2000 /3150A, 40 kA, 3- phase, HCB, Isolator with one/two Earth Switch (mechanically ganged ) COMPLETE | nos | 18 | |
| 3 | 245 kV, 2000 /3150A, 40 kA, 3- phase, HCB, Isolator without Switch (mechanically ganged) COMPLETE | nos | 6 | |
| 4 | 245 kV Single Tension / Suspension String insulator hardware set with all hardware accessories including Corona ring , tension clamp and with / without Turn Buckle set suitable for Twin / Three TARANTULA AAC Conductor( Sub conductor spacing 250mm). | nos | 186 | |
| 5 | 120 kN Disc Insulators for above | nos | 4000 | |
| 6 | Bus Post Insulator with Structure | nos | 40 | |
| 7 | Bay Marshalling Box | nos | 9 | |
| 8 | 245 kV CT / VT /CVT with Structure , marshalling Box | nos | 54 | |
| 9 | 245 kV Lightning Arrestor with Structure , marshalling Box | nos | 18 | |
| 10 | 250 sq mm Underground Copper Earth Conductor | KM | 17 | |
| 11 | 20 mm dia copper rod electrode | Nos | 80 | |
| 13 | Shield Wire complete with all clamps | RM | 3000 | |
| 14 | AAC TARANTULA Conductor complete with all clamps | KM | 17 | |
| 15 | 4" IPS aluminium tube including cutting, bending, al. welding with sleeves, radiography testing & d.p. testing of 100 % welded joints, fixing corona end bells etc. to complete | RM | 1200 | |
| 16 | Galvanized Iron Pipe 50/100mm NB | RM | 1500 | |
| 17 | 2/3-tier cable rack assembly 400 /700 mm wide with anchor fasters | nos | 610 | |
| 18 | Cable trays 600 / 300 / 150 mm wide | Nos | 1200 | |
| 19 | Control / Protection Panels | Nos | 20 | 750 x 800 x 2355 |
| 20 | SCADA Panels | Nos | 5 | 750 x 800 x 2355 |
| 21 | Disturbance Recorder panels | Nos | 4 | 600 x 800 x 2315 |
| 22 | Metering panel | Nos | 2 | 800 x 800 x 2315 |
| 23 | 100 A 110 V battery Charger | Nos | 2 | 75 X 700 X 2415 |
| 24 | 376 AH , 110 V Ni Cd battery bank | Nos | 2 | 4400 X 800 |
| 25 | LT Control Cables | KM | 94 | |
| 26 | LT Power cables | KM | 20 | |
| 27 | 630 kVA, 6.6 / 0.415 V Oil Filled Transformer | Nos | 2 | |
| 28 | 415 V SP Busduct | Nos | 2 | |
| 29 | 415 V LT MCC | Nos | 1 | 8400 X 1000 X 2415 |
| 30 | 110 V DCDB | Nos | 1 | 3200 X 550 X 2415 |
| 31 | AC Lighting Distribution Board | nos | 1 | 2000 X 1500 X 1500 |
| 32 | DC Lighting Distribution Board | nos | 1 | 600 X 500 X 700 |
| 33 | AC / DC Lighting Panel Indoor | nos | 151 | |
| 34 | AC / DC Lighting Panel Outdoor | nos | 15 | |
| 35 | Outdoor Flood Lights 1 / 2 x 125 / 400 W | nos | 53 | |

| Sl No | Equip Description | Unit | Qty | Appx Size ( L X D X H ) mm |
|---|---|---|---|---|
| 36 | Indoor Lighting Fixtures / Fans/ Power Points with surface / concealed conduiting , Copper wiring and GI earthing | nos | 168 | |
| 37 | 9 m / 4.5 m Swaged Poles for Lighting | nos | 7 | |
| 38 | Air cooled Package unit of 15 TR nominal capacity complete with Reciprocating Compressor, Condenser coil with condenser fan, DX cooling Coilwith Air handling unit, Copper refrigrant interconnecting Piping, self contained Control Panel . All are housed in sturdy construction enclosure. | nos | 3 | 750 x 800 x 2355 |
| 39 | Duct Mounted Fine Filter 610x610x300 mm -8 Nos. , Duct Mounted Booster Fan , | nos | 1 | |
| 40 | GI Sheet for Ducting Gr.275 with frames , hangers , grills , diffusers , etc | Sq M | 242 | |
| 41 | Thermal Insulation with 50 mm thick Aluminium foil faced Poly Eurethene Foam pasted with CPRX compound 50mm width. Self adhesive Pvc. | Sq M | 218 | |
| 42 | Copper hard Drawn Refrigerant piping with all accesseries to inter connect Air cooled Condenser and Package AC unit. | Rmt | 140 | |
| 43 | Misc Items – Humidstat , Pan Humidifier ,Thermostat , Level switch , Temp / Humidity indicator , Strip Heaters | Nos. | 6 | |
| 44 | Solenoid operated Fire Dampers | Nos. | 4 | |
| 45 | Axial Flow Fresh Air Fan complete with TEFC sq. Motor ,rain protection cowl with bird screen, Back Draft damper | | 1 | |
| 46 | Axial Flow Exhaust Fan complete with TEFC sq. Motor ,rain protection cowl with bird screen, Back Draft damper | Nos. | 4 | |
| 47 | HVAC MCC | No. | 1 | 2650 X 650 X 2415 |
| 48 | HVAC Annunciation Panel | No. | 1 | |
| 49 | 80/ 150 nb Fire Fighting Hydrant piping Corrosive Protective tapes of thickness 4 mm (in two layers) of coal tar Type A as per AWWA C 203 | Mtr. | 720 | |
| 50 | GM Hydrant Valve , Branch Pipes | Nos. | 36 | |
| 51 | Fire Hose with Glass fronted cabinet | Nos. | 72 | 750 x 800 x 2355 |
| 52 | Hume Pipes / CI Gate Valves | | | |
| 53 | Addressable Multi sensor / photoelectric smoke / Heat detector | Nos. | 30 | |
| 54 | Response Indicator . Manual Call Point , | Nos. | 18 | |
| 55 | Fire alarm Panel with Hooter , Control Modules etc | Nos. | 5 | 500 X 200 X 400 |
| 56 | Portable Fire Extinguishers | Nos. | 14 | |
| 57 | Lattice Structure for Towers / LM ( 31 / 11.7 / 16.2 m ) , Beams ( 18 m ) , Shield wire Peak ( 5 m ) | MT | 270 | |

| Sl No | Equip Description | Unit | Qty | Appx Size |
|---|---|---|---|---|
| 58 | 11 kV Outdoor Breaker with Supporting Structure | Nos. | 2 | |
| 59 | 11 kV Outdoor CT with Supporting Structure | Nos. | 2 | |
| 60 | 11 kV Outdoor Isolator with Earth Switch and Supporting Structure | Nos. | 6 | |
| 61 | 11 kV Outdoor LA with Supporting Structure | Nos. | 2 | |
| 62 | Phase Discs , Danger Boards , Bay Identifiers | Lot | 1 | |

## B) POWER TRANSFORMERS :

2 nos. Station Transformer of 25 MVA , 230 kV / 6.9 kV , Star Star, ONAN / ONAF with On Load Tap Changer . The shipping weight of the Nitrogen filled Tank is about 49 MT and the quantity of oil for the first fill is appx 31000 L . The weight of the accessories is appx 13 MT . The appx tank dimensions 5950x 2300 x 3700 mm and the overall dimensions is 10000 x 5800 x 7200 mm

4 nos. Generator Transformer of 150 MVA , 230/11 kV , Star Delta , OFAF with Off Load Tap Changer . The shipping weight of the Nitrogen filled Tank is about 128 MT and the quantity of oil for the first fill is appx 48000 L . The weight of the accessories is appx 15 MT . The appx tank dimensions is 7650 x 3650 x 4125 mm and the overall dimensions is 13200 x 7350 x 8000 mm .

4 nos. Unit Auxillary Transformer of 16 MVA , 11kV / 6.9 kV , Delta Star, ONAN / ONAF with On Load Tap Changer . The shipping weight of the Nitrogen filled Tank is about 26 MT and the quantity of oil for the first fill is appx 9700 L . The weight of the accessories is appx 4 MT . The appx tank dimensions is 4200 x 3000 x 2250 mm. and the overall dimensions is 6900 x 6200 x 3400mm

## C) ISOLATED PHASE BUSDUCT :

4 nos 11 kV , 10000 A , Al Conductor , Al Alloy Enclosure Busduct . The Busduct connects Gen Transformer to the Generator and has Tap Off for 1 nos UAT , LAVT and NG Cubicle . In the Nuetral Side , the Star Formation is is made to form the star point and the Generator is earthed thru the NG Transformer . The average per phase route length of the Main Run , UAT Tap Off , LAVT is 50 m , 5 m , 5 m respectively . The conductor section in the Main Run is 465 mm OD , 15 mm thick and that of Tap Off is 114.3 OD , 8.56 mm thk . The duct diameters for Main and TapOff is 1000 mm , 6.35 thk and 680 mm , 4.78 mm thk . The total number of welded joints ( butt and flexible ) on the Main Run and Tap Off are 25 nos and 20 nos respectively .The appx weights of the supporting structure is 20 MT . In addition the there is 1 set of 3 nos LAVT having dimensions 2450 mm x 1200 mm x 2900 mm and having weight of 1.5 MT each . Total nos of CTs envisaged is 42 nos and nos of VTs is 9 . 1 nos NG Cubicle consisting of 1 nos NGT and 1 nos NGR and having a total weight of 1.6 MT is envisaged .Hot Air Blowing Unit having a total weight of 1.0 MT is envisaged .Seal Off Bushing and Rubber bellows are also provided in the busduct .

## D) 6.6 kV SWITCHGEAR :

6.6 kV Switchgear System consists of One board consisting of 25 panels (Breakers ) The Switchgear is Spring Operated Metal Clad Vacuum Interrupters with Protection and Metering CTs , PTs , Relays and Meters .

The weight of each Panel ( including trolley ) is appx 1.5 MT and panels will be shipped in sections of 2-3 panels . In addition , 1 no each FEB and BEB will be supplied with each panel

| Sl no | Name of Board | No. of Panels | Panel dimensions (MM) |
|---|---|---|---|
| 1 | Unit Board – 1CA | 13 nos | 11310 X 2692 X 2355 |
| 2 | Unit Board – 1CB | 11 nos | 9570 X 2692 X 2355 |
| 3 | Unit Board – 2CA | 13 nos | 11310 X 2692 X 2355 |
| 4 | Unit Board – 2CB | 11 nos | 9570 X 2692 X 2355 |
| 5 | Unit Board – 3CA | 13 nos | 11310 X 2692 X 2355 |
| 6 | Unit Board – 3CB | 11 nos | 9570 X 2692 X 2355 |
| 7 | Unit Board – 4CA | 13 nos | 11310 X 2692 X 2355 |
| 8 | Unit Board – 4CB | 11 nos | 9570 X 2692 X 2355 |
| 9 | Station Board – 0CA | 13 nos | 11310 X 2692 X 2355 |
| 10 | Station Board – 0CB | 13 nos | 11310 X 2692 X 2355 |
| 11 | Station Board – 0CC | 13 nos | 11310 X 2692 X 2355 |
| 12 | Station Board – 0CD | 12 nos | 10440 X 2692 X 2355 |
| 13 | Station Board – 0CE | 14 nos | 12180 X 2692 X 2355 |

**E) 6.6 kV SPB :**

6.6 kV Segregated Phase Busduct consists of Aluminums Bus Ducts and conductor supported on Steel structure and consists of all bolted connections . The list of SPB is as under :

| Sl no | Name of Board | Length | Section |
|---|---|---|---|
| 1 | UAT-1 - 1CA / 1CB | 65 M | 1600 A / 800 A |
| 2 | UAT-2 - 2CA / 2CB | 65 M | 1600 A / 800 A |
| 3 | UAT-3 - 3CA / 3CB | 65 M | 1600 A / 800 A |
| 4 | UAT-4 - 4CA / 4CB | 65 M | 1600 A / 800 A |
| 5 | STN TRF -1 - 0CA / 0CB | 125 M | 2500A / 1250 A |
| 6 | STN TRF -2 - 0CC / 0CD | 125 M | 2500A / 1250 A |
| 7 | 0CA – 1CA | 12 M | 800 A |
| 8 | 0CA – 2CA | 55 M | 800 A |
| 9 | 0CB – 1CB | 12 M | 800 A |
| 10 | 0CB – 2CB | 45 M | 800 A |
| 11 | 0CA – 0CC | 120 M | 2500 A |
| **Sl No.** | **Name of Board** | **Length** | **Section** |
| 12 | 0CB– 0CD | 120 M | 2500 A |
| 13 | 0CC – 3CA | 12 M | 800 A |
| 14 | 0CC – 4CA | 55 M | 800 A |
| 15 | 0CD – 3CB | 12 M | 800 A |
| 16 | 0CD – 4CB | 45 M | 800 A |

Section Sizes and weights are as under :

| SL NO | SPB Current rating | Enclosure Dimension( MM) | Bus Bar Dimensions ( MM ) | Weight per Mtr. ( KG ) |
|---|---|---|---|---|
| 1 | 2500 A | 1435 X 535 X 3.15 TK | 2 X 127 X 48 X 8 TK | 110 |
| 2 | 1250 A / 1600 A | 1285 X 485 X 3.15 TK | 2 X 101.6 X 42 X 6.68 TK | 110 |
| 3 | 800 A | 1285 X 485 X 3.15 TK | 101.6 X 42 X 6.68 TK | 100 |

## F) LT SWITCHGEAR

The applicable panel are listed below :

| Sl No | PANEL NAME | CODE | LENGTH ( MM ) | DEPTH ( MM ) | HEIGHT ( MM ) |
|---|---|---|---|---|---|
| 1 | 415V UNIT PCC-1 | 1DA | 10400 | 1200 | 2435 |
| 2 | 415V UNIT PCC-2 | 2DA | 10400 | 1200 | 2435 |
| 3 | 415V UNIT PCC-3 | 3DA | 10400 | 1200 | 2435 |
| 4 | 415V UNIT PCC-4 | 4DA | 10400 | 1200 | 2435 |
| 5 | 415V DG PCC-1 | 0DG | 9300 | 1200 | 2435 |
| 6 | 415V EMERGENCY MCC-1 | 1EA | 10300 | 1200 | 2435 |
| 7 | 415V EMERGENCY MCC-2 | 2EA | 9400 | 1200 | 2435 |
| 8 | 415V EMERGENCY MCC-3 | 3EA | 10300 | 1200 | 2435 |
| 9 | 415V EMERGENCY MCC-4 | 4EA | 9400 | 1200 | 2435 |
| 10 | 415V BOILER & BOILER VALVE MCC-1 | 1HA | 11700 | 1200 | 2435 |
| 11 | 415V BOILER & BOILER VALVE MCC-2 | 2HA | 12000 | 1200 | 2435 |
| 12 | 415V BOILER & BOILER VALVE MCC-3 | 3HA | 11700 | 1200 | 2435 |
| 13 | 415V BOILER & BOILER VALVE MCC-4 | 4HA | 12000 | 1200 | 2435 |
| 14 | 415V TURBINE & TURBINE VALVE MCC-1 | 1KA | 19500 | 1200 | 2435 |
| 15 | 415V TURBINE & TURBINE VALVE MCC-2 | 2KA | 19200 | 1200 | 2435 |
| **Sl No** | **PANEL NAME** | **CODE** | **LENGTH ( MM )** | **DEPTH ( MM )** | **HEIGHT ( MM )** |
| 16 | 415V TURBINE & TURBINE VALVE MCC-3 | 3KA | 19500 | 1200 | 2435 |
| 17 | 415V TURBINE & TURBINE VALVE MCC-4 | 4KA | 19200 | 1200 | 2435 |
| 18 | 415V STATION PCC-1 | 0DA | 8600 | 1200 | 2435 |
| 19 | 415V STATION PCC-2 | 0DB | 8600 | 1200 | 2435 |

| | | | | | |
|---|---|---|---|---|---|
| 20 | 415V WORKSHOP DB | 0SE | 0 | | |
| 21 | 415V FUEL OIL PMCC | 0DE | 9600 | 1200 | 2435 |
| 22 | 415V VANTILLATION MCC-1 | 0QA | 11200 | 1200 | 2435 |
| 23 | 415V VANTILLATION MCC-2 | 0QB | 11200 | 1200 | 2435 |
| 24 | 415V MISC. MCC-1 | 0QC | 8500 | 1200 | 2435 |
| 25 | 415V MISC. MCC-2 | 0QD | 8500 | 1200 | 2435 |
| 26 | 415V CONTROL ROOM A/C MCC | 0QE | 7200 | 1200 | 2435 |
| 27 | 415V SERVICE BUILDING A/C MCC | 0QF | 5400 | 1200 | 2435 |
| 28 | 415V ESP AREA MCC-1 | 1QA | 1800 | 1200 | 2435 |
| 29 | 415V ESP AREA MCC-2 | 2QA | 1800 | 1200 | 2435 |
| 30 | 415V CT PMCC-1 | 1DC | 10300 | 1200 | 2435 |
| 31 | 415V CT PMCC-3 | 3DC | 12200 | 1200 | 2435 |
| 32 | 415V CLWPH SWGR | 0DC | 13500 | 1200 | 2435 |
| 33 | 415V ETP MCC | 0SA | 8100 | 1200 | 2435 |
| 34 | 415V DM PLANT MCC | 0SB | 9000 | 1200 | 2435 |
| 35 | 415V PT PLANT MCC | 0SC | 6300 | 1200 | 2435 |
| 36 | 415V CHLORINATION PLANT MCC | 0SG | 7200 | 1200 | 2435 |
| 37 | 415V RAW WATER PH (PLANT SIDE) MCC | 0SF | 7200 | 1200 | 2435 |
| 38 | 415V RAW WATER PH (RIVER SIDE) MCC | 0DD | 6300 | 1200 | 2435 |
| 39 | 110V UNIT DC DB-1 | 1FA | 10000 | 700 | 2435 |
| 40 | 110V UNIT DC DB-2 | 2FA | 10000 | 700 | 2435 |
| 41 | 110V UNIT DC DB-3 | 3FA | 10000 | 700 | 2435 |
| 42 | 110V UNIT DC DB-4 | 4FA | 10000 | 700 | 2435 |
| 43 | 415V ADMIN BUILDING MCC | 0QG | 6300 | 1200 | 2435 |
| 44 | SOOTBLOWER MCC PANEL (4 NOS ) | | 2500 | 1000 | 2400 |

## G) NGR :

8 nos. Nuetral Grounding Resistance are supplied for the UAT and Station Transformer . The NGR are structure mounted with structure having dimension 950 x 650 x 2000 mm and weight of appx 250 kg. The size of the NGR is 1818 x 685 x 1210 and weighs appx 400 kg . The NGR will be supplied in knocked down condition and is to be assembled at site .

## H) LT SERVICE TRANSFORMERS :

36 nos. Unit Service Transformers Transformer of ratings and details given below are envisaged . All Oil filled transformers will be partially filled at the time of dispatch

| Sl No | Tranf Rating | Type | Nos | Oil Qty ( Ltr ) | Dimension ( L X D X H ) ( MM) | Weight ( KG ) |
|---|---|---|---|---|---|---|
| 1 | 1000 kVA , 6.6 kV / 433 V , Off CTS | Dry | 8 | - | 2500 X 1700 X 2500 | 4500 |
| | 1600 KVA , 6.6 kV / 433 V , Off CTS | Dry | 4 | - | 2800 X 2100 X 2700 | 7000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | 1000 kVA , 6.6 kV / 433 V , Off CTS | Oil | 10 | 740 | 2510 X 1975 X 2710 | 3500 |
| 3 | 1600 kVA , 6.6 kV / 433 V , Off CTS | Oil | 4 | 1050 | 2665 X 2630 X 2750 | 4700 |
| 4 | 2000 kVA , 6.6 kV / 433 V , Off CTS | Oil | 2 | 1200 | 2750 X 3050 X 2550 | 5500 |
| 5 | 2500 kVA , 6.6 kV / 11.5 kV , Off CTS | Oil | 2 | 1400 | 2545 X 3365 X 3955 | 6500 |
| 6 | 2500 kVA , 11 kV /6.9 kV, Off CTS | Oil | 2 | 1400 | 2545 X 3365 X 3955 | 6500 |
| 7 | 630 kVA , 6.6 kV / 433 V , Off CTS | Oil | 4 | 525 | 2200 X 1900 X 2200 | 2750 |

## I) LT SEGREGATED PHASE BUSDUCT :

400 V , Al conductor , Al Alloy Enclosure Busduct connecting Service Transformers and the LT Switchgear . The bus duct is supplied in sections and is to be installed at site with loose supplied components Viz. structure, bus duct section, JBs, seal off bushings, split covers, , earthing strip, Jointing of various sections supplied shall be done by bolting as specified. The installation includes wiring / cabling of space heaters is to be done at site .

Busduct Rated 1600A – 10 Set (oil filled transformer)
2500A – 16 Set (12 dry type transformer+ 4 oil filled transformer)
3000A – 2 Set (oil filled transformer)

## J) LOCAL PUSH BUTTON STATIONS AND STARTERS :

300 nos. LPBs ( average size - 200 mm x 200 mm x 200 mm ) and 80 nos Local starters ( average size - 200 mm x 200 mm x 200 mm )are envisaged.

## K) DC SYSTEM:

The DC System consists of 8 sets of 110 V Battery Chargers and 220 V Ni-Cd. batteries .
The Float cum Boost Battery Charger size is 2200*1000*2200 mm and there are 2 nos Fuse Boxes ( 1000 x 1000 mm) also supplied.
Each Battery Bank consists of 110 cells of 645 AH and each Bank dimension is 2 x (1600 x 924) .

## L) UPS SYSTEM :

The UPS System envisaged is as under

| SL NO | NAME of equipment | Nos | PANELS | DIMENSIONS ( EACH PANEL ) ( MM ) | | |
|---|---|---|---|---|---|---|
| | | | | Length | Depth | Height |
| 1 | 35 kVA UPS | 1 set | UPS | 3700 | 900 | 1870 |
| | | 1 no | ACDB | 2400 | 900 | 1850 |
| | | 1 no | VOLTAGE STAB | 900 | 900 | 1850 |
| | KPH 120P | 276 nos | BATTERY | 1900 | 3200 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | 60 kVA UPS | 4 sets | UPS | 4900 | 900 | 1870 |
| | | 4 no | ACDB-1 | 2400 | 900 | 1850 |
| | | 4 no | ACDB -2 | 2400 | 900 | 1850 |
| | | 4 no | VOLTAGE STAB | 900 | 820 | 1600 |
| | KPH 206 | 276 nos | BATTERY | 3700 | 2760 | |
| 3 | 250 kVA UPS | 1 set | UPS | 8800 | 900 | 1870 |
| | | 1 no | ACDB | 3000 | 900 | 1850 |
| | | 1 no | VOLTAGE STAB | 2000 | 800 | 1850 |
| | KPH 890 | 276 nos | BATTERY | 3700 | 6700 | |

## M) CONTROL AND RELAY PANELS :

The Dimensions of the Relay and Control Panels , Instrumentation of the Steam Turbine Generator , Auxillaries is as under :

| SL NO | NAME of equipment | NO OF PANELS | DIMENSIONS ( EACH PANEL ) ( MM ) | | |
|---|---|---|---|---|---|
| | | | Length | Depth | Height |
| 1 | U C P | 4 | 1400 | 1000 | 2355 |
| 2 | E C P | 2 | 3656 | 1000 | 2355 |
| 3 | GEN/ GT / UAT Protection Panel | 4 | 3000 | 1000 | 2295 |
| 4 | Station Trf Relay Panel | 2 | 1000 | 1000 | 2295 |
| 5 | AVR Panel | 4 | 3050 | 750 | 2295 |
| SL NO | NAME of equipment | NO OF PANELS | DIMENSIONS ( EACH PANEL ) ( MM) | | |
| | | | Length | Depth | Height |
| 6 | Unit Control Desk | 8 | 6000 | 1000 | 776 |
| 7 | DCS PANELS – SG , TG , BOP, HMI | 232 | 750 | 750 | 2355 |
| 8 | VIBRATION MONITORING SYSTEM PANEL | 4 | 800 | 800 | 2415 |
| 9 | FURNACE TEMP PROBE STARTER BOX | 4 | 300 | 300 | 600 |
| 10 | DC SCANNER AIR FAN STARTER BOX | 4 | 900 | 375 | 1120 |
| 11 | BHEL-VISION EWLI ASCERTOR CABINET | 8 | 600 | 350 | 600 |

| | | | | | |
|---|---|---|---|---|---|
| 12 | BHEL-VISION EWLI DISPLAY UNIT | 8 | 99 | 81 | 194 |
| 13 | FURNACE CCTV – LOCAL UNIT | | 1200 | 800 | 2415 |
| 14 | LARGE VIDEO SCREEN | 2 | 2030 | 1400 | 2834 |
| 15 | MASTER CLOCK PANEL | 4 | 900 | 600 | 2415 |
| 16 | CCTV PANEL | 4 | 1200 | 800 | 2415 |
| 17 | SWAS – PRIMARY SAMPLING RACK | 4 | 1500 | 600 | 2000 |
| 18 | SWAS – PRIMARY SAMPLING RACK | 4 | 600 | 600 | 2000 |
| 19 | SWAS – WET PANEL | 4 | 3000 | 1500 | 2300 |
| 20 | SWAS DRY PANEL | 4 | 1900 | 600 | 2300 |
| 21 | SWAS - CHILLER | 4 | 3040 | 1340 | 1800 |
| 22 | SWAS – HOTWELL CONDUCTIVITY BOX | 8 | 400 | 300 | 400 |
| 23 | DG AMF CONTROL PANEL | 3 | 800 | 830 | 2100 |
| 24 | DG MCC PANEL | 1 | 10500 | 1200 | 2435 |
| 25 | DG 24 V CHARGER | 3 | 700 | 750 | 1230 |
| 26 | DG 24 V BATTERY | 3 | 1000 | 500 | 1000 |
| 27 | DG Aux ACDB | 3 sets | 3400 | 650 | 2325 |

## A) INSTRUMENTATION:

The total Instrumentation of the Boiler Steam Turbine Generator and associated Auxillaries comprises of panels , Instruments and Hook Up materials as specified below . The instruments of the BOP packages are listed in the respective Packages

| Sl No | Name | UNIT | QTY |
|---|---|---|---|
| 1 | Pressure / Temp / Level Gauges | NOS | 1862 |
| 2 | Pressure / Temp / Level Switches | NOS | 548 |
| 3 | Pressure / Temp/ Level Transmitters | NOS | 966 |
| 4 | Analysers | NOS | 92 |

| Sl No | Name | UNIT | QTY |
|---|---|---|---|
| 5 | Flow meters | NOS | 8 |
| 6 | EWLI | NOS | 8 |
| 7 | RTDs / Thermocouples | NOS | 733 |
| 8 | MTM Thermocouples | NOS | 298 |
| 9 | Bearing thermo Elements | NOS | 124 |
| 10 | Opacity Monitor with accesories | NOS | 4 |
| 11 | Relative / Absolute Vibration Sensors (with proximeters ) | NOS | 168 |
| 12 | Shaft Expansion Sensors (with proximeters ) | NOS | 16 |
| 13 | Axial Shift Sensors (with proximeters ) | NOS | 12 |
| 14 | Speed Probes | NOS | 24 |
| 15 | Calibration of SOV operated Trip Valves | NOS | 50 |
| 16 | Callibration / commissioning of regulating Control Valves with positioners / LS / PFT | NOS | 80 |
| 17 | Commissioning of motorised actuators | NOS | 400 |
| 18 | Flame Scanner Assembly | NOS | 48 |
| 19 | Pnuematic Power Cylinders with PFT ( Boiler ) | NOS | 192 |
| 20 | Limit Switches /Heavy duty Limit Switches (for BTPS) | NOS | 228 |
| 21 | Air Filter Regulators + I / P Convertor | NOS | 72 |
| 22 | Flexible hoses - $^{1}/_{4}$ " ( 2 meter long) , 1" ( 3 meter long) | NOS | 48 |
| 23 | Temperature / controller | NOS | 40 |
| 24 | Position Transmitters | NOS | 50 |
| 25 | Junction Boxes – 6/12/24/36/48way | NOS | 248 |
| 26 | Junction Boxes – 64/72/96 way | NOS | 321 |
| 27 | SS / Copper Tubing ( ¼ “ , ½ “ ) | RM | 2800 |
| 28 | 1/2 , 3/4 " CS impulse Pipe | RM | 24,000 |

| Sl No | Name | UNIT | QTY |
|---|---|---|---|
| 29 | 1/2 , 3/4 " AS impulse Pipe | RM | 1800 |
| 30 | 3/4",1/2 " SS impulse Pipe | RM | 5160 |
| 31 | Special Pipes – Cr- Mo | RM | 2000 |
| 32 | Gi Pipe – ½ “, ¾” , 1” , 1 ½” | RM | 3000 |
| 33 | LOCAL INSTRUMENT RACK ( LIR ) TYPE A/B | NOS | 171 |
| 34 | LOCAL INSTRUMENT PANEL ( LIE ) TYPE A/B | NOS | 56 |
| 35 | PC set with monitor / keyboard / power supply unit | NOS | 40 |
| 36 | UCB Loose Supplied Inserts | NOS | 58 |

The wiring for the installed instruments to the Junction Boxes also have to be done . In addition , certain mechanical equipments will be installed on the skids at site for which the wiring connections will have to be completed .

**The Instrumentation scope for the other Mechanical Packages are covered in their respective Packages .**

## N) COMMUNICATION SYSTEM:

The Communication System consists of the following systems:

a) 500 line **Telephone Exchange** and the communication network over the entire plant with about 400 Desk Top telephones , 20 nos Weather and Dust Proof Tel Kisoks to be installed Other than the Telephone Exchange ( appx size 750 x 750 x 2300 mm ) , PC based Operator Console and a 48 V Battery and Charger system, the system consists of the cable network and the other equipments eg Junction Boxes , handsets etc.

b) **PA System :** The system consists of 3 nos operator console , cabinet for recorder ,amplifier etc and approx. 20 loudspeakers in the field . The cabinet size is 750 x 750 x 1500 mm

c) **CCTV System :** This consists of Desk Top Monitor , PC Keyboard besides the cabinet for the matrix switcher , recorder , multiplexer etc .The cabinet size is 750 x 750 x 1500 mm . 16 cameras are to be installed in the plant along with the power supplies

d) **Master Clock System :** The system consists of the Main Clock Panel along with about 20 clocks to me mounted in the plant area . GPS antenna is also envisaged .

## O) UNDER GROUND AND OVER GROUND EARTHING :

The Over ground and Underground Earthing is by Stranded Bare Conductor . The total quantity of Bare Conductor of various sizes being supplied is appx 41.4 KM . The conductors are to be joined by Thermowelding , for which sufficient kits will be supplied .

For underground earthing , while the major civil works will be carried out by a different agency , minor civil works will have to be carried out by the contractor . Further , approx.

220 Copper Clad Steel Earthing electrodes are to be installed . T**he installation of the Electrode , all electrical connections and the civil works are to be done by the Contractor.**

## P) STATION LIGHTING :

The Station Lighting System provided lighting for the entire Power Station – both indoors and outdoors . The System broadly consists of the following sub-systems :

| | | | |
|---|---|---|---|
| i. | Lighting Distribution Boards ( AC + DC) | -- | 11 nos |
| ii. | Lighting Panels ( AC + DC) | -- | 86 nos |
| iii. | Lighting Fixtures ( AC + DC) | -- | 2600 nos |
| iv. | Receptacles | -- | 425 nos |
| v. | Street Lighting Poles | -- | 225 nos |
| vi. | Emergency Lighting Units | -- | 60 nos |
| vii. | Ceiling Fans | -- | 10 nos |
| viii. | Switch Board for Local Control | -- | 140 nos |
| ix. | GI Conduit | -- | 45 KM |
| x. | Wires ( 1 core ) | -- | 95 KM |
| xi. | Earthing Wire | -- | 50 KM |
| xii. | Structural steel | -- | 25 MT |

## Q) STATION CABLING :

The Cabling System consists of Cable Tray Installation , Cable Laying and Cable Termination . The brief description of the systems is as under :

### a. CABLE TRAYS ( MAIN PLANT ):

The cable Tray system consists of Boltable Cable Support system . The total quantity of Single and Double Channel is 10000 m and 1500 m respectively . Fixing of the Base Plates to the concrete is by Anchor Bolts ( M10 ) and to steel structures by Clamps and Fittings .

The total quantity of trays envisaged is 34 kms and is of Ladder Type . Also included are various bends , reducers and Tees . For the EHV System , refre to EHV section

### b. CABLE LAYING ( MAIN PLANT ) :

The list of total Cables envisaged for the Plant ( BTG and BOP )- HT , LT Power , LT Control , Signal and Special -- is as under . The Cables for the BOP Packages is also included in the quantities mentioned below . The cables for the Switchyard Package is mentioned in the section EHV .The termination of cables will be considered in the laying rate for billing purposes .

| Sl No | **CABLE SIZE / TYPE** | | LENGTH ( RM ) |
|---|---|---|---|
| A | **6.6 kV HT Cu Cable** | | |
| 1 | | 3C X 120 Sq. mm. | 10,000 |
| **2** | | 3C X 150 Sq. mm. | 2,000 |
| 3 | | 1C X 300 Sq. mm. | 1,000 |
| | | **TOTAL** | 13,000 |

| | | | |
|---|---|---|---|
| B | **1.1 kV LT Cu Power Cable** | | |
| 1 | | 3C-240 | 7,000 |
| 2 | | 3C-185 | 10,000 |
| 3 | | 3C-95 | 2,000 |
| 4 | | 3C-50 | 3,000 |
| 5 | | 3C-25 | 6,000 |
| 6 | | 3C-16 | 2,000 |
| 7 | | 3C-10 | 10,000 |
| 8 | | 3C-06 | 10,500 |
| 9 | | 3C-04 | 12,000 |
| 10 | | 3.5C-150 | 7,500 |
| 11 | | 3.5C-35 | 12,500 |
| 12 | | 1C-630 | 7,000 |
| 13 | | 1C-400 | 19,000 |
| 14 | | 2C-185 | 1,500 |
| 15 | | 2C-50 | 1,000 |
| 16 | | 2C-25 | 11,000 |
| 17 | | 2C-16 | 9,500 |
| 18 | | 2C-10 | 4,000 |
| 19 | | 2C-06 | 3,000 |
| Sl No | **CABLE SIZE / TYPE** | | LENGTH ( RM ) |
| 20 | | 5C-04 | 14,000 |
| 21 | | 4C-16 | 11,500 |
| | | **TOTAL** | 164,000 |
| C | **1.1 kV LT Cu Control Cable** | | |
| 1 | | 2C – 2.5 Sq. mm | 108,000 |
| 2 | | 3C – 2.5 Sq. mm | 202,000 |
| 3 | | 4C – 2.5 Sq. mm | 81,600 |
| 4 | | 7C – 2.5 Sq. mm | 132,000 |
| 5 | | 10C – 2.5 Sq. mm | 2,000 |
| | | 12C – 2.5 Sq. mm | 72,000 |
| 6 | | 19C – 2.5 Sq. mm | 46,000 |
| 7 | | 24C – 2.5 Sq. mm | 4,000 |
| | | **TOTAL** | 647,600 |
| D | **Signal Cable** | | |
| 1 | | 2P, 0.5 | 241,000 |
| 2 | | 4P, 0.5 | 682,000 |
| 3 | | 6P, 0.5 | 86,000 |
| 4 | | 8P,0.5 | 159,000 |
| 5 | | 12P, 0.5 | 41,000 |
| | | 16P, 0.5 | 4,000 |
| 6 | | 24P, 0.5 | 6,000 |
| 7 | | Compensating Cable | 148,000 |

| | | | |
|---|---|---|---|
| | | **TOTAL** | 1367,000 |
| E | **Special Cables** | | |
| 1 | | UTP Cable for DCS | 25,000 |
| 2 | | Fibre Optic cables for DCS / CCTV | 15,000 |
| 3 | | Pre fab cables | 5,000 |
| | | **TOTAL** | 45,000 |

The work of tray erections includes erection of all require support structures . Cabling work includes cable laying and termination . All cable accessories except wire ferrules and cable tags will be supplied . No of HT Terminations is appx 170 nos

**R) FIRE SEALING SYSTEM:**

Fire Sealing System will be applied to close all cable openings . The system will be Mortar type or Foaming Type . The approx. area to be covered is 1165 sq mtr

55.5 Contractor shall erect, test, commission all the equipment, cabinets, panels, instruments etc. as per sequence prescribed by BHEL Engineer at site. The sequence of erection / commissioning methodology will be decided by the BHEL Engineer depending upon the availability of materials / work fronts etc. No claim for extra payment from the contractor will be entertained on the grounds of deviation from the methods of erection / commissioning adopted in erection / commissioning of similar jobs elsewhere or for any reasons whatsoever.

55.6 The customer NEC may depute their representative for checking and supervision of important stages of work. The contractor shall be required to provide all facilities for inspection of works, without any cost implications to the Engineer. Any defect in quality of work or deviations from drawings / specifications pointed out during such inspection shall be made good by the contractor in the same way if pointed out by the Engineer, without any cost implication to BHEL.

55.7 Contractor shall plan and transport equipment / components from storage yard sheds to erection site and erect them in such a manner and in a sequence that material accumulation at site should not lead to congestion. Contractor shall plan activities considering plying of his vehicles on ring road also. Materials shall be stacked neatly, preserved and stored in the contractor's shed and work areas in an orderly manner. If required, the contractor shall arrange shifting of surplus material expeditiously failing which the same will be arranged by BHEL at contractor's risk and cost.

## 56.0 ERECTION (ELECTRICAL WORKS)

56.1 All works such as cleaning, checking, leveling, aligning, assembling, temporary erection for alignment, dismantling of certain equipment for checking, cleaning, surface preparation, fabrication at site, cutting, grinding, straightening, blue matching, chamfering, filing, chipping, drilling, machining, surface grinding, shaping, fitting up etc. as may be applicable in such erection works are to be treated as incidental to erection and necessary to complete the work satisfactorily and shall be carried out by the contractor as part of the work.

56.2 Any fixtures, scaffolding materials, concrete block supports, steel structures required for temporary supporting, for pre-assembly or checking, welding, lifting and handling during pre-assembly and erection shall be arranged by contractor at his cost.

56.3 The following provisions cover the technical requirements for some of equipment installation. The brief idea about the work involved is indicated below however the work is to be carried out in accordance with the recommendations of the equipment manufacturer drawings, documents furnished to the contractor by BHEL or as directed by BHEL Engineer.

**(A) HT TRANSFORMERS**

Scope of work includes checking and preparation foundation, erection of accessories and auxiliaries, carrying out minor modification wherever required; Preparation of oil and oil filling under vacuum, dry out of transformer, testing of transformer, oil and other auxiliaries, laying of cable trays upto marshalling box, cabling upto marshalling box and termination for auxiliaries, earthing of accessories to earth conductor / riser, testing of all auxiliaries, pre-commissioning and back charging of transformers.
Painting of Transformer as approved by BHEL Engineer .

**( B) ISOLATED PHASE BUSDUCT** :
Foundation checking and carrying out minor modifications wherever required , erection of Structure , Busduct , LAVT , NG Cubicle etc , alignment of total busduct and readiness for welding , Welding of Bus , Ducts and shunts , by MIG /TIG and NDT and X-ray tests . Fixing of Rubber Bellows , SOB , Wall Frame assembly , Flexible and Rigid Bus Connections , CTs , VTs , NGT and NGR . Erection of earth Conductors, HAB equipment and carrying out Water and Air Tightness Tests **.** Cabling of CTs upto Marshalling Box after MB erection , testing of CTs and wiring and other tests , Hipot of Main Busduct .
Painting of Busduct as approved by BHEL Engineer .

**(C) SEGREGATED PHASE BUSDUCT:**
Foundation checking and carrying out minor modification wherever required, erection of structures, Busduct sections, and other loose items as per relevant drawings / documents, alignments and jointing by bolting of total Busduct , fixing of Rubber Bellows, seal Off Bushings, wall frame assembly, Flexible & rigid Bus connections, erection of earth conductors,, cabling upto JB / Marshalling Box , contact resistance checks on bus duct, Hi-pot of Busduct, earthing of system with main earth conductor / riser.
Painting of Busduct with paint as approved by BHEL Engineer .

**(D) 6.6 KV SWITCH GEAR**
Erection of Panels after foundation checking and carrying out minor modification wherever required, Jointing of panels, inter panel wiring, busbar & earthbar connections, mounting of loose supplied items, testing of complete panels, BEB, FEB and spare trucks, HV test of main and Control bus, testing & commissioning of breakers after scheme checking including testing / calibration of all instruments and relays.

**( E ) LT SERVICE TRANSFORMERS :**

Scope of work includes checking and preparation foundation, erection of accessories and auxiliaries, carrying out minor modification wherever required; Preparation of oil and oil filling under vacuum, dry out of transformer, testing of transformer, oil and other auxiliaries, laying of cable trays upto marshalling box, cabling upto marshalling box and termination for auxiliaries,

earthing of accessories to earth conductor / riser, testing of all auxiliaries, pre-commissioning and back charging of transformers.
Painting of Transformer as approved by BHEL Engineer .

**(F) DC BATTERY CHARGERS / UPS**

Erection of Panels after foundations checking / fabrication of base frames or stools (wherever applicable) and carrying out minor modification wherever required; Joining of panels, inter-panel wiring, busbar & earthbar connections, mounting of loose supplied items, Testing of complete board & including testing / calibration of all instruments and schemes; Dummy load test of Chargers including arranging of dummy load and temporary power supply etc.

**(G) DC BATTERY**

Erection of battery after assembly of battery stands, inter-connection of batteries and first charging; Capacity testing using dummy load and subsequent recharging ( in case of failure of capacity test, the charging Discharging cycle is to be repeated ) Dummy load test of chargers includes arrangement of dummy load and temporary connection in absence of regular power supply.

**(H) PANELS – POWER , CONTROL & RELAY ( LTMCCs , STRP / GCPs ,ECB etc.)**

Erection at site / control room including chipping of floor, fabrication and fixing of base channel frame, leveling & alignment with spirit level, welding the base channel to the embedded plates / channels, grouting , fixing of anti-vibration pads, termination of inter panel connections, mounting / connections of loose instruments, inter panel bus bar connections, commissioning including loop checking, system checking, and putting necessary controls on automatics. Terminations of cables will be by conventional screwed connections. Checking of internal wiring, rectification, testing and calibration of equipment mounted inside is in the scope of contractor. The contractor may have to change / replace items found faulty without any extra cost, however materials for this shall be provided by BHEL. Mostly panels will be delivered fully wired. However wherever required termination of loose wires , bus wires is to be done. Canopy for panels will be supplied loose & shall be installed by the contractor after erection of panels. The cleaning of panels have to be done with electrical vacuum cleaner, besides conventional cleaning with brush etc. The drilling of holes in the gland plates for cable entry shall be part of panel erection. All blank holes / gaps in the gland plates / boxes etc. shall be properly sealed. The base frames shall be painted suitably. The contractor shall carry out the plugging and sealing of left out holes in the gland plates and other openings at the bottom of panels at his own cost by using fire retardant mortar or good quality sealing material as advised by BHEL . Any minor alterations required in the bus bar arrangement, wiring in the panels/ cubicles shall also form part of the work. During testing, commissioning, some equipment / modules may need replacement / repairs. All such replacements / repairs and assistance during commissioning and running of the unit till handing over to the Customer are part of the scope as some of the test / commissioning will have to be done after the machine is running on various loads..
Touch-Up Painting as approved by BHEL Engineer .

## (I) CABLING:

a) Fixing of Cable Tray Support Structure to concrete foundations / brick walls by anchor bolts or to steel structure by suitable clamps , including fabrication / fixing of any other structure required to install the support structure .
b) Fixing of cable trays and tray bends and accessories to the tray supporting structure including modification of the trays to suit the local tray route conditions is to be carried out .
c) Laying, dressing & clamping of the cables in the cable trays / angles / conduit pipes as per the cable schedule and as instructed by the BHEL Engineer . Nylon / PVC ties / Tre Foil Clamps required for dressing / clamping shall be provided to the Contractor .
d) The cable tags , as approved by the BHEL Engineer , are to be provided by the contractor ( at both ends and at regular intervals as advised by BHEL Engineer ) at his cost . Similarly Wire ferrules of approved category is to be provided by the Contractor at his cost .
e) While laying cables, existing cable trench covers and false flooring may require to be removed and re-fixed. The same has to be done at no extra cost to BHEL
f) Gland plate hole drilling is to be carried out by the contractor at no extra cost
g) Cable Termination shall be carried out by the contractor as per approved drawings / as per instructions of the Engineer . Lugs , Glands , cable termination kits will be supplied by BHEL . **Wire ferrules of approved category is to be provided by the Contractor at his cost .** All required crimping tools and other tools will be provided by the Contractor

## J) STATION LIGHTING :

Erection of lighting boards ,panels, light poles, fittings and other suitable fixtures required for light fittings, conduiting, cabling and wiring as per drawing, testing of wiring and circuit checking, energizing of system forms part of erection job. All conduits, lighting fittings / panels and accessories required for lighting work shall be supplied by BHEL .
**Fabrication / erection of required supporting structures and control-gear of respective fitting , all civil work for lighting poles including supply of cement , all civil works for buried cables etc is included in the scope of the Contractor**
Conduiting required for light fittings shall also include fixing of conduit accessories like bends, tees, 3 / 4 way JBs etc. and the laying of PVC wires in respective conduit as per circuits shown in drawing.

## K) INSTRUMENTATION

### i. GUAGES / SWITCHES / TRANSMITTERS :

For instruments supplied loose, the scope includes issue from stores, calibration, erection (including fabrication and fixing of frames / stands by welding to steel structure or by chipping & grouting with RCC columns / floor) and charging / loop checking. The work includes installation of housing connecting manifold / PG valve on supports / racks to be suitably fabricated for the instruments being supplied loose.
For instruments supplied duly mounted on skids / racks / gauge boards , the scope includes erection of gauge board / rack, dismantling from skids / racks / gauge board, reinstallation after testing / calibration, restoring electrical connections, if any , pressure testing of connected piping and charging / loop checking. Servicing of manifolds PG valves shall also form part of erection job.

Some instruments may need repeated calibration / replacement. The same will be carried out by the contractor including calibration of instruments needed for replacement, which will be

supplied by BHEL. Erection of thermoelements like RTDs & Thermocouples includes erection of thermowells, wherever required, at no extra cost to BHEL.

### ii. DETECTORS / VIBRATION , SPEED & OTHER TURBOVISORY PICK UPS:

Blue matching with the assembly fixtures / main equipment surface, trial fixing, fixing by drilling / tapping, final doweling. Moreover some detectors may have piggy-backs signal detectors mounted on them as such these forms part of detectors assembly. The integral cables of the above shall be routed & dressed properly up to their JB / Proximeter. Erection of proximitors, proximitor housings / JB required for respective pick up and calibration / commissioning of pick ups will be included in quoted / accepted item rate of respective pickup.

### iii. PROCESS CONNECTIONS

#### a. PNEUMATIC TUBES (COPPER / SS TUBING) :

Fabrication and erection of single angle supports / tray supports for single multi run tube. Laying tubes in the angles / trays from the panel to the equipment, instrument to instrument, air supply line to drive / instrument, air line connections, clamping properly as per standard ferruling and termination at both ends. This includes all fittings and needle valves, stop valves etc. also. Proper tagging of valves and pneumatic tubes on both ends shall be done for proper identification

#### b. IMPULSE LINE (CS/ AS / SS)

Fabrication and erection of channel / angle / slotted angle supports, cleaning impulse pipe with wire brush and compressed air, edge preparation, cold bending, laying to the required slopes, clamping, welding of isolation / drain valves and fittings by butt / socket welding / swoze lock joints. Servicing of valves, connecting with the process end and to the instruments, NDT, Hydraulic testing the impulse lines, and painting the lines as per requirement of BHEL engineer. The impulse line may have to be cleaned chemically for removing grease / rusting. Proper tagging of valves and impulse lines on both ends shall be done for proper identification.

#### c. RIGID PIPE/CONDUITS

Cutting / threading of standard lengths of conduits, laying on fabricated supports or on floor, using screwed fittings, clamping, sealing of open ends. Approved Good quality sealant shall be used to make the joint water proof.

#### d. PLICA FLEXIBLE CONDUIT

Laying of conduits in cable trays, end connection with instrument / J.B. / panel, using suitable connectors / unions etc. (which shall be supplied by BHEL). Suitable thread / Plica sealant shall be used to make the conduit system water proof. Aluminum painting, clamping and tagging in tray / angle forms part of erection job.

### L) JUNCTION BOX, PUSH BUTTONS ETC

Includes fabrication / fixing / painting of stands for junction boxes / push buttons / frame mounted panels etc

**M) COMPUTERS / PLC BASED EQUIPMENTS**

All computer related items / equipment like CRT, monitors, printers, key boards, pre-fabricated connecting leads etc shall be installed in control room and control desk as per direction of BHEL Engineer. The Software installation and commissioning is not included in the scope of this contract. However, any assistance required for testing / commissioning have to be provided by the contractor within the quoted price. Hardware found defective during testing / commissioning and till handing over to Customer, have to be removed for repair / replacement and reinstalled within the quoted rates.

**N) SAMPLE HANDLING SYSTEM / ANALYZER SYSTEM**

Includes installation of main analyzer panel, analyzer, probes, sensors and other accessories like sample gas cylinders, mechanical / electrical interconnections (including SS Tubing & Electrical heat Tracing, wherever required) between various components, energizing, testing & commissioning .

**O) ELECTRONIC WATER LEVEL INDICATOR SYSTEM**

EWLI includes fixing of electrodes, local and remote indicator panel / display units and interconnection of these by cables. Only cost of laying cables for interconnection of EWLI system shall be measured and paid separately. Erection of all other equipments / panels/ display units forming EWLI system shall be included in the quoted rate per system.

**p) CALIBRATION OF CONTROL VALVES , DAMPERS**

The work also includes minor rectification / alterations in tubing, servicing of accessories, setting of limit switches, calibration of Actuators and position feedback transmitters.

**q) POWER CYLINDER ERECTION**

Platforms on which Power Cylinders are to be mounted are usually provided by the Civil Contractor / other agency. However minor structure work required shall form a part of the work within the quoted rate of the the respective cylinder . Fabrication / erection of stands for mounting of the cylinders The work also includes minor rectifications/alterationin the tubing , servicing of accessories , setting of limit switches , calibration of actuators and feedback position transmitters

56.4 Any cutting of masonry work, which is necessary shall be done by the contractor at his own cost and shall be made good to match the original work. The Contractor shall obtain prior approval before cutting any masonry / concrete work.

56.5 Conduits shall be thoroughly cleaned before pulling in the cable.

56.6 Pipes sent in standard length shall be cut to suit the site conditions and the layouts. Tubes or pipes wherever deemed to be convenient will be sent in running lengths with sufficient bends. Bends upto 80 mm Nb will have to be fabricated at site.

56.7 Contractor shall fabricate and erect stands / supports for Junction boxes, push button stations, fixing of push button and plugging of holes in JB's. This is considered inclusive in the item erection.

56.8 For calibration of pneumatic valves / controllers / power cylinders etc., the contractor shall attend to minor leakages from the tubing etc., and prepare exact cam-profiles as part of the work, if required.

56.9 DRIP SHIELDS shall be fabricated for all field mounted panels / instruments / instrument racks / JB Racks / control cabinets etc. The hardware / material shall be supplied by BHEL. The fabrication forms part of erection work.

56.10 The Motors, power cylinders, control valve actuators, motorised valves actuators and solenoid valves will be erected by other agency. However their electrical and C&I commissioning is to be carried out by the agency within the subject scope of work. The staff earmarked for commissioning will carry out the work in association and guidance of BHEL Engineer as a part of system commissioning for which no extra cost will be paid by BHEL.

56.11 Certain instrumentation like gauges, transmitters, switches and indicators are received in assembled condition and will be erected along with main equipment by other agency. Contractor for subject work will get these equipment dismantled for calibration and will reinstall them in original location as and when directed by BHEL. Payment for above work shall be released as per respective items indicated in the price bid

56.12 In case of Transformers if any leakage / sweating is observed from field assembled / shop assembled gasket joints, valves, welded joints the same shall be attended by the contractor including draining of oil, refilling of oil & centrifuging if required at no extra cost to BHEL till handing over period. Sealing compound and any other consumable, if needed, shall be arranged by the contractor with in the quoted rates.

56.13 Calibration log-sheets / history cards of all the instruments, panels, drives, relay testing etc. under the scope shall be recorded and submitted on BHEL approved formats. Proper logging will form a part of calibration / erection activity for the purpose of monthly running bills payments.

56.**14** **The contractor shall use only SHEARING machine or HACKSAW for cutting angles, flats, channels and trays. No gas cutting is permitted . Drill machine shall be used for drilling holes.**

56.15 The contractor should note that after execution of work they will hand over marked up drawings "as erected" drawings to BHEL Engineer at site for preparation of firm "as built" drawings. "As erected" drawings will bear the signature of BHEL Engineer and contractor.

56.16 The contractor shall paint the name / put tag numbers on all the equipment / instruments / cables etc. erected by him. Materials for tagging shall be supplied by the contractor . The adhesive etc. shall also be arranged by contractor at his cost.

## 57.0 TESTING PRE-COMMISSIONING, COMMISSIONING AND POST-COMMISSIONING (ELECTRICAL WORKS).

57.1 Site testing shall be required for all equipment installed by the contractor to ensure proper installation, setting, connection and functioning in accordance with drawings, specifications and manufacturer's recommendations.

57.2 Commissioning protocols are to be prepared as advised by BHEL Engineer for getting approved by customer/ Consultant.

57.3 Testing, and pre-commissioning checks shall be as per relevant codes / practices and BHEL drawings / specifications/ approved commissioning Protocols and same shall include, but not be limited to the following :

**(I) TRANSFORMERS**

(a) Insulation resistance and earth resistance checks.
(b) Oil testing like BDV of oil of each drum before pouring, after processing and in the couse of dy out, moisture content tests as and hen required. Provision should be made for preparation of oil in a separate tank before filling in the main transformer tank.
(c) Checking of Buchholz Relay, oil level indicator PRV, calibration of OTI, WTI etc.
(d) Winding resistance, vector group, turns ratio test on different taps, magnetizing current, core balance check etc.
(d) After installation the contractor will get oil samples tested at an accredited test lab as advised by BHEL Engineer and submit the test results, in case the test results are found unsatisfactory the tests will be got repeated by the contractor after reprocessing of oil & submitted to BHEL for approval/acceptance.
(e) Turns ratio, polarity, insulation resistance and winding resistance checks on all CT's.

**(II) HT / LT SWITCHGEAR PANELS:**

(a) IR test of power and control circuits & High voltage test of Bus bar.
(b) Checking of protections and interlocks of all related schemes.
(c) Calibration of all indicating & metering instruments, relays, timers etc.
(d) Checking of operation of all relays and other protective devices e.g. thermal overload relays, single phasing preventers etc.
(e) Carrying out of suitable modifications as per system requirement.
(f) Operation of all illumination, space heating circuits etc.

**(III) BUSDUCTS**

(a) Insulation and earth resistance checks.
(b) High voltage test on Bus bars after drawing out VTs and disconnecting lightning arresters surge capacitors and other connected equipment e.g. generator, generator transformer etc.
(c) Measurement of contact resistance of joints, bus bar loop resistance etc.
(d) Testing of CTs, VTs, NGC including primary and secondary injection tests.
(e) Making all arrangements for testing of the Generator , Gen Trf and UAT
(f) Testing pre-commissioning & trial run of hot air blowing unit.

**(IV) BATTERY AND BATTERY CHARGER / UPS**

(a) Checking of battery charger panel.
(b) Calibration of all indicating and measuring instruments.
(c) Dummy load test of battery charger.
(d) Charging of battery and recharging after carrying out battery discharge test/ capability test of battery using dummy load.
(e) In the absence of regular power supply to battery chargers arrangements are to made for battery charging from temporary construction power supply points.

**(V) CONTROL & PROTECTION PANELS**

(a) Checking of complete wiring and insulation resistance.
(b) IR test and loop checking of all field wiring in the panel.

(c) Checking of all protection, metering and indicating schemes.
(d) Calibration of all indicating and measuring instruments, relays, timers.
(e) Checking of all auxiliary schemes e.g. space heating, illumination.
(f) Checking of operation of all relays, switches and other indicators.
(g) Commissioning of total scheme including relevant internal equipment.
(h) Carrying out suitable modifications as per system requirement.
(i) Carrying out primary injection, secondary injection, stability checks etc.

**(VI) INSTRUMENTATION**

a) All instruments shall be checked for proper installation, supports, impulse lines, cabling etc. and corrected, wherever required.
b) All instruments shall be calibrated before installation and proper calibration record shall be maintained to the satisfaction of BHEL Engineer. Instruments received in assembled condition in panels etc. shall also be dismantled, calibrated and re-assembled as per advise of BHEL Engineer.
c) All impulse and pneumatic lines shall be properly cleaned (oil flushed / chemical cleaned / air blown/ steam blown/ Hydraulic tested etc.) before being charged.
d) Some of the instruments may require re-calibration during commissioning. The contractor shall remove such instruments, recalibrate and install within the quoted rates.

**(VIII) DRIVES AND CONTROLLERS**

a) All drives such as power cylinders, pneumatic / motorised valves / dampers etc. and controllers shall be checked for proper installation supports etc. before commissioning.
b) All transmitters shall be calibrated and limit switches shall be adjusted.
c) All pneumatic and impulse lines shall be cleaned as per instructions of BHEL Engineer.
d) All drives shall be operated by simulating various conditions to ensure healthiness of components of the system.
e) Re-calibration / rectification wherever required shall be carried out by the contractor within the quoted rates.
f) Remote operation of all drives, valves, dampers shall be checked from control room as per instruction of BHEL Engineer.

57.4 In case any defect is noticed during tests, trial runs and commissioning such as loose components, undue noise or vibration, strain on connected equipment etc. the contractor shall immediately attend to these defects and take necessary corrective measures. If any readjustment and realignment are necessary, the same shall be done as per Engineer's instructions including repair, rectification and replacement work by the contractor at his cost. The parts to be replaced shall be provided by BHEL.

57.5 During this period, though the BHEL's / Client's staff will also be associated in the work, the contractor's responsibility will be to arrange for the complete requirement of supervision , labour , consumable, T&P and IMTEs required till such time the commissioned units are taken over by the BHEL's customer.

57.6 During commissioning activities and for carrying out various tests, special instruments etc , have to be temporarily erected and commissioned to suit the commissioning activities. Contractor will provide the necessary equipment. Contractor has to carry out the erection, calibration,

dismantling of the same. After completion of activities the temporary systems have to be removed and to be taken back at no extra cost to BHEL.

57.7 During erection of various equipment, prior to commissioning and after commissioning, protocols have to be made with BHEL's customer. The proforma and formats as approved have to be printed by the contractor in adequate numbers. The pre-commissioning activities will start with various trials, commissioning operations shall continue till units are handed over to customer. Simultaneous commissioning activities will be progress in various areas, checking of equipment erected, making ready for trial runs, all these works need specialized gangs including electricians / instrument technicians in each area to render assistance to BHEL commissioning staff. Contractor shall earmark separate manpower for various commissioning activities. The manpower shall not be disturbed or diverted.

57.8 It shall be the responsibility of the contractor to provide workmen of various categories in sufficient numbers along with Engineers/ Supervisors including necessary consumables, T&P etc. during pre-commissioning, commissioning and post commissioning period for commissioning of equipment and attending any problem in equipment erected by the contractor till handing over. The rates quoted shall include all these contingencies also.

57.9 It shall be specifically noted that the above employees of the contractor may have to work round the clock alongwith BHEL commissioning Engineer and hence overtime payment by the contractor to his employees may be involved. The contractor's accepted rates shall be inclusive of all these factors also.

57.10 In case, any rework is required because of contractor's faulty erection which is noticed during commissioning , the same has to be rectified by the contractor at his cost. If any equipment / part is required to be inspected during commissioning, the contractor will dismantle / open up the equipment / part and reassemble/redo the work without any extra claim.

57.11 During commissioning, opening and closing of valves, attending to leakage, changing of gaskets, modifications in wiring, realigning of equipment, re-calibration of instrument, attending to leakage, minor adjustments of erected equipment may arise. The accepted rates shall include all such works.

## 58.0 FINISH PAINTING

58.1 All equipment within the scope of these specifications shall be received duly painted. However during storage and handling the same may get peeled off / damaged / deteriorate. All such surfaces are to be thoroughly cleaned and to be touch up painted with suitable approved primer / finish paint matching with shop paint / approved final colour. Besides above two coats of approved primer paint and at least two coats of approved finish paint to get the desired dry film thickness, is to be applied on various loose equipment, all impulse lines and structures fabricated and erected at site. **All paints, tools and other consumables including scaffolding materials required for painting shall be arranged and provided by contractor within the quoted rates. Paint and other materials so purchased shall be approved by BHEL and painting should be as per colour scheme and quality approved / specified by Engineer.** Valid Test certificate for the paint so supplied shall be made available before use of the same on work. The contractor shall provide legend on equipment in size specified by Engineer. Letter writing shall be done in Hindi / English or in both language. The printer have to under go test and only qualified painters will be allowed to work.

58.2 Certain equipment shall require spray painting (touch up). The contractor shall make arrangements of the required equipment for spray painting of such equipment at his own cost. Spray painting at the job site shall be permitted only at times and locations approved by the owner / Engineer.

# SECTION - III C

## SPECIAL CONDITIONS OF CONTRACT

| CLAUSE NUMBER | DESCRIPTION |
|---|---|
| 59 | SCOPE OF WORK |
| 60 | CIVIL WORKS |
| 61 | FACILITIES TO BE PROVIDED BY BHEL / CONTRACTOR |
| 62 | TIME SCHEDULE |
| 63 | OVER RUN |
| 64 | TERMS OF PAYMENT |

## SECTION - III C

## SPECIAL CONDITIONS OF CONTRACT

### 59.0 SCOPE OF WORK

**59.1** BHEL has been awarded the work of setting up 4 x 125 MW Power Plant in Kosti, Sudan on EPC basis. This tender specifications covers complete scope of works related with installation of

a) 4 sets of Turbo-generator materials consisting of condenser, turbine, generator along with their rotating & static auxiliaries like BFPs, CEPs, De-aerator, FST, Heaters and other auxiliaries, Piping ,Valves, H&S etc and DG set.

b) Complete scope of works related with installation Balance of Plant materials consisting of all the balance of plant packages like raw water system, Pre-treatment plant, DM plant, Electro chlorination plant, Clarified water system, ACW system, DMCW system, Induced draft cooling tower, Effluent treatment plant, Fuel oil system, Compressed air system, Fire protection & alarm system, EOT cranes for TG building & CW pump house, site fabricated miscellaneous tanks, air conditioning & ventilation system etc.

c) Complete scope of works related with installation Electrical and control & Instrumentation Systems consisting of 220 kV Outdoor Switchyard and interconnection , 11 kV Outdoor Switchgear , Generator , Station , and Unit Transformers ,Isolated Phase Busduct , 6.6 kV Switchgear, Busducts and Service Transformers , AC / DC LV Switchgear , DC System and UPS , Plant Cabling and Earthing System , Plant Illumination, Plant Communication System , Control and Relay panels , Plant Instrumentation etc.

The work consists of taking delivery of the materials from the project storage yard / stores / sheds to erection site, their preservation, safe keeping, watch and ward, Checking, dressing, chipping and leveling of foundations, wherever required, excavation of trenches, bed preparation, back filling, construction of manhole pits & valve pits, rolling of plates, pre-assembly fabrication, erection, fit up & alignment, Welding, radiography and other non-destructive tests wherever required , application of wrapping / coating (including supply of material) wherever applicable, painting including supply of paints etc., interconnection with tanks and other equipment erected by other vendors, hydraulic test, including erection & dismantling of all temporary piping, valves, pumps, tanks etc required for pressure testing & other commissioning activities including Cleaning & flushing of pipelines, Pre commissioning checks/tests, commissioning activities including post commissioning assistance for stabilization of piping systems under this scope. Pre Commissioning operations required for above operations and other commissioning activities including Unit trial operation, resolving any deficiencies observed, P G Testing, completion of all jobs required for PAC & FAC and stabilization of the unit handing over of units, and handing over of units at Kosti Thermal Power Project, Kosti Sudan.

**The Engineer/ Supervisor of Supplier of BOP Packages will be available at site as per site requirement on the instructions of BHEL Engineer.**

**59.2** All the four generator stators shall be received & unloaded near the TG building by another agency. All efforts shall be made to unload the stator as near to unloading bay as possible. However, depending on site situation at the time of receipt of stator, some of the stators may have to be unloaded at another location but within the plant

premises. Shifting / dragging of stator from stored location to the TG hall unloading / service bay is to be carried out by the contractor under this contract. All resources , including arrangement of suitable capacity crane & power driven low-bed trailer of suitable capacity, for shifting of stators from its stored location to TG hall unloading / service bay are to be arranged by the contractor within the finally accepted rates against item no 1 of Rate Schedule. The bidders may note that suitable capacity crane & low-bed power driven trailer of suitable capacity for this purpose are available with agencies working at Kosti Sudan.

**59.3** All the Generator, Station and Unit Transformers shall be received & unloaded near the Transformer yard by another agency. All efforts shall be made to unload the transformers on / near the rails on the main track . However, depending on site situation at the time of receipt of transformers, some of the transformers may have to be unloaded at another location but within the plant premises. Shifting / dragging of transformers from stored location to the TG hall unloading / service bay is to be carried out by the contractor under this contract. All resources , including arrangement of suitable capacity crane & power driven low-bed trailer of suitable capacity, for shifting of transformers from its stored location to Transformer rail track are to be arranged by the contractor within the finally accepted rates against item no 1 of Rate Schedule. The bidders may note that suitable capacity crane & low-bed power driven trailer of suitable capacity for this purpose are available with agencies working at Kosti Sudan.

**59.4** **Bidders are required to quote Lump sum price against Item No. 1 of Rate Schedule for the complete work of 4 sets of Steam Turbine & Generator along with all related auxiliaries & Balance of Plant equipments**. Major equipment to be installed, tested and commissioned under this specification are as per Annexure-1-a. However, changes in design may occur as is usual in any such large scale work. for lump sum rate of equipments / auxiliaries of rate schedule, no additional payment/ recovery shall be made towards any variation in weights and quantities and contractor shall complete the entire work as detailed in tender specifications within finally accepted rate**s**.

**59.5** **Major piping systems to be erected, tested and commissioned under this specification are as per Annexure-1-b**. **Bidders are required to quote rate in per metric ton for entire work of as per tender specification for piping systems as per item no. 3 and 4 of rate schedule.** The quantities indicated against item no 3 and 4 of rate schedule may vary to any extent and No compensation will be payable in variation of Individual quantity. The contractor is required to erect actual tonnage (irrespective of any variation plus or minus) which may be necessary to complete their work and commission above systems and complete the work in all respects as detailed in tender specifications, for which payments shall be released on finally accepted tonnage rates. The contractor undertakes to erect / commission actual quantities as per advice of BHEL Engineer and accordingly the final contract price shall be worked out on the basis of quantities actually erected at site and payments will also be regulated for the same

**59.6** Bidders are required to quote Lump sum price against Item No. 2 of Rate Schedule for the complete Electrical and Instrumentation work related to 4 sets of Steam Turbine & Generator along with all related auxiliaries . **Major equipment to be installed, tested and commissioned under this specification are as per Section-III B (Clause 55.4)**.

**The works for Electrical and Instrumentation works of Balance of Plant equipments are included and will be payable under the respective Package under the Mechanical works as indicated in the Annexure-IA.**

**However, changes in design may occur as is usual in any such large scale work. for lump sum rate of equipments / auxiliaries of rate schedule, no additional payment/ recovery shall be made towards any variation in weights and quantities and contractor shall complete the entire work as detailed in tender specifications within finally accepted rates.**

**59.7** **The NATIONAL ELECTRICITY CORPORATION (NEC), Sudan and / or their Consultant M/s. Fichtner may depute their representative for checking and supervision at different stages of work. The contractor shall be required to provide all facilities (Facilities related to inspection and testing of materials) for inspection of works at no extra cost to BHEL. Any defect in quality of work or deviations from drawings / specifications pointed out during such inspections shall be made good by the contractor in the same way as if pointed out by the BHEL Engineer, without any cost implication to BHEL.**

## 59.8 Health, Safety & Environment management (HSE)

**59.8.1** Besides provision with regard to SAFETY under Clause 27 of GCC, the contractor will be responsible for Health, Safety & Environment management at site for the construction activities to be carried out by them in accordance with requirements **given under section I(a) of GCC of this document**. The contractor shall continuously take special care to ensure the safety and prevention of human and equipment accidents and maintain good sanitary conditions in and around the site. All the construction work and plant operation must be carried out in the safest possible manner. The Engineer reserves the right to stop any process which, in the Engineer's opinion, is being performed dangerously. In this case the contractor must immediately adhere the requisite safety precautions and any delays attributed to the work stoppage on this account shall not affect the agreed contractual finishing dates.

The contractor shall appoint dedicated full-time Qualified Safety Officers who shall have full authority to ensure that all necessary safety precautions are observed by the Contractor's employees and sub-contractors. These appointees shall have full responsibility for the safety of all personnel within the contractor's area of the works.

Some of the common safety rules to be followed during working are as follows **:-**

- No body is allowed to enter at construction site without Safety Shoe.
- Never enter work area without Safety helmet & chin strap in place.
- No climbing/working allowed without proper safety belt above 2 m. height.
- Do not exceed the speed limit 25 Kmph within premises.
- No debris obstacles allowed on the roads & passages.
- Do not walk on pipelines or false ceiling.
- Maintain good Housekeeping at work site.
- All Site supervisors & engineers (including subcontractor's) must be imparted structured training on construction safety before start of the job & record to

be maintained.

- Availability of qualified & trained Site Engineer at site during all working hours.
- Site Safety training to be imparted to all workers & plan to be made to cover every worker.
- Tools box talk (5-15 minutes) by supervisor prior to commencement of any job.
- All accident / incidents(Near Miss) to be reported & investigated.(formats & procedure should be finalized)
- Daily Safety Checking by Each Site Engineer along with Safety engineer.
- Weekly co-ordination meeting of all Safety engineers with BHEL safety officer.
- Monthly safety meeting with Site In-charges.
- All Safety equipment must be ISI marked & checked by Safety officer before use.
- Bamboo/wooden Scaffolding material not allowed.
- LPG cylinders not allowed for gas cutting.
- Good House keeping. Separate waste bins to be used for flammable & non flammable material.
- Safety awareness programs for workers by display of boards, posters, competitions, talks etc.
- Deployment of Safety Supervisors for every 250 workers and part there of at work site.
- Display of List of First Aid trained persons.
- Testing certificates for lifting tools & tackle.
- Provision & maintenance of fire extinguishers at construction site & material stores.
- Display of emergency telephone numbers at various locations.
- For work in confined space use 24 V lamp fitting & use tools with air motors or electric tools with max. 24 V.
- For confined space entry Gas test must be done before & at regular intervals.
- Checking & tag of equipment like grinding machine, welding machine, gas cutting set etc. by supervisors before use.

**Further, the contractor is required to provide proper Safety Net System wherever the hazard of fall from height is present as per instructions of BHEL Engineer at site. The safety net shall be fire resistant, duly tested and shall be of ISI mark and the nets shall be located as per site requirement to arrest or to reduce the consequences of a possible fall of persons working at different heights.**

**59.8.2** Contractor shall make necessary arrangements to ensure that the atmosphere in working area (under the scope of work in this tender) and on roads is free from particulate matter like dust, sand etc. by keeping the top surface wet for ease in breathing. Provision of required tanker with spraying arrangement has to be ensured by contractor within the quoted rates, at no extra cost to BHEL.

**Contractor shall ensure following**:

1. Contractor has to maintain contact with local hospital having scanning & other modern medical facilities required during emergency including ambulance.
2. Contractor has to ensure pre employment medical check for all staff & workers.
3. Contractor has to ensure that adequate First Aid facilities with trained nurse are available at work site for emergency purpose. This emergency set-up should include, but not limited to, following;

- Male nurse (in shifts)
- Oxygen set up
- Breathing apparatus
- Eye wash facility
- Stretcher
- Trauma blanket
- Medicines.

In addition to above, BHEL has arranged ambulance at work site for emergency purpose, which can be utilized, free of cost, by contractor in case of emergency. In case , under unavoidable circumstances , if the ambulance is not available , the contractor will have to arrange for the same as under clause 59.8.2.1 mentioned above.

**59.8.3 The contractor shall comply with following towards Social Accountability;**

(a) The contractor shall not employ any employee less than 15 years of age in pursuant to ILO convention. If any child labour were found to have been engaged ,the Contractor shall be levied with expenses of bearing his education expenditure which will include stipend to substantiate appropriate education or employ any other member of family enabling to bear the child education expenditure.

(b) The Contractor shall abide by UN convention w.r.t Human Rights and shall be liable for Discrimation/Corporal punishment for failure in meeting with relevant requirements.

**(c)** The Contractor shall arrange potable drinking water to its employees & workers.

**59.8.4** Contractor shall make necessary arrangements to ensure following:

- **The contractor shall ensure deployment of Qualified level-2 Engineer for NDT services at site.**
- Contractor shall ensure **deployment of Qualified & Experienced Safety Engineer / Officer** at site.
- Contractor shall ensure that all the **T & Ps deployed** by them, including cranes, **are regularly certified by approved testing agency** & the relevant certificates to this effect are to be given to BHEL for records**.**

**It may be noted that non-compliance to the above three conditions will result in penal action as may be decided by BHEL.**

**Additional safety requirement of BHEL's Customer(M/S NEC), if any, shall be provided by the Contractor without any extra cost. Non adherence of safety requirements will attract penalty, which shall be as follows;**

a) Penalty equivalent to USD 15 for the first violation.

b) Penalty equivalent to USD 30 for the subsequent violations.

For serious lapses, as decided by BHEL, even fines upto USD 500 at a time can be imposed

**60.0 Civil works:**

**All civil works related to ST / STG / Electrical / Instrumentation & Balance of plant packages is excluded from the scope of this contract**

**61.0 FACILITIES TO BE PROVIDED BY BHEL/ CONTRACTOR**

**61.1** The Contractor shall during the progress of the work, provide, erect and maintain at his own expenses all necessary temporary workshops, stores, consumables, offices, etc. required for the proper and efficient execution of the work. The planning, setting and erection of these buildings shall have the approval of the Engineer and the Contractor shall at all times keep them tidy and clean and sanitary condition to the entire satisfaction of the Engineer. BHEL shall provide free of charge limited open space for office & storage shed, as and where made available **by BHEL's customer**. It is the responsibility of the contractor to construct sheds, provide all utilities and dismantle and clear the site after completion of work or as and when required , as a part of his scope of work. On completion of work or as and when required by BHEL, all the temporary buildings, structures, pipe lines, cables etc. shall be dismantled and leveled and debris shall be removed as per instruction of BHEL by the contractor at his cost. In the event of his failure to do so, same will be got done by the Engineer and expanses incurred shall be recovered from the contractor along with prevailing overhead. The decision of BHEL Engineer in this regard shall be final.

**61.2** Contractor shall be responsible for providing all necessary facilities like residential accommodation, transport , electricity , water , medical facilities etc. as required under various labour laws and statutory rules and regulations framed there under to the personnel employed by him. Land for construction of temporary accommodation for the contractor's personnel including labour colony shall be provided by BHEL free of cost. **This land shall be within/near plant boundary wall of the power station. The contractor shall at his own cost, provide temporary housing and / or camp accommodation for his site personnel, including sanitary facilities, canteen facilities etc. The contractor shall submit for prior approval of BHEL, plans for all such accommodation he proposes to erect before any construction commences. The contractor shall be responsible for all costs associated with any temporary housing and / or camp accommodation provided by him**.

**61.3 All temporary housing and camp accommodation shall be run and maintained by the Contractor in efficient condition in accordance with the laws in force in Sudan. The sanitary facilities shall be kept in clean and orderly conditions to the approval of BHEL and public health authorities of Sudan. The Contractor shall comply with sanitary laws, regulations and ordinances of Sudan Govt.**

**61.4 BHEL shall provide Power supply at 240 V, 1 phase for labour colony free of charge at one point . Further distribution will be done by the Contractor. BHEL shall provide potable/drinking water supply for labour colony free of charge, at one point. Further distribution will be done by the Contractor at his own cost**.

**61.5 The Contractor shall be responsible for providing adequate transport to and from the site for his own and his personnel who may be brought in daily from their living quarters or housing areas.**

**61.6 Medical facilities available to BHEL staff shall be extended to Contractor's personnel, if possible. However, the Contractor shall bear all costs in respect of the Doctor's fees and all other expenses**.

**61.7** **The Contractor shall be fully responsible for the death or injury to any person employed by him for the purposes of or in connection with the execution of the Contract. The Contractor shall also provide insurance cover to all persons employed/engaged by him throughout the period of Contract under prevailing local laws**.

**61.8** **Construction power, for construction purposes will be provided free of cost and at one point near erection/construction site from supply point. Further distribution of power shall be done by contractor at his cost. All wiring must comply with local regulations and will be subject to BHEL's inspection and approval before connecting supply**.

**61.9** Provision of distribution lines of power from the central points to the required place with proper distribution boards observing the safety rules laid down by the authorities of the state shall be done by the contractor, supplying all the materials like cables, distribution board, switch boards, TPN, CBS, ELCBS/ MCCBS / Copper / Brass clamps, copper conductor, change over switches pipes etc. at his own cost. If any failure is caused in supply of the power and water, it is the responsibility of the contractor to make alternate arrangements at his cost. The contractor shall adjust his working shift / hours accordingly and deploy additional manpower if necessary so as to achieve the targets.

**61.10** Following points should be strictly adhered to by the contractor while drawing construction power supply from Distribution Board.

(a) All electrical installations should be as per Sudan / International Electricity rules.
(b) All distribution Boards installed by the contractor should be constructed with fire proof materials viz. steel frames, bakelite sheets etc.
(c ) Connection for single phase should be taken from phase and neutral. No where the connection should be taken with earth as neutral.
(d) All electrical connections should be made through connectors, nuts and bolts, switches, plug and sockets. Loose connections or hooking up of wires shall not be permitted.
(e) Contractor have to make their own earthing arrangement for their equipment / DB earthing. Earthing connection have to be done with copper conductor and copper / brass clamps with BHEL's prior permission.
(f) All electrical equipment / tools and plants should be properly earthed. DBs to be earthed diagonally opposite at two points.
(g) Contractor should use "MCCB" and "ELCB" either on incoming or outgoing connections to the DBs.
(h) Contractor should ensure that all the CBs / TPNs / Fuses / MCCB / ELCB cables etc. should be of adequate rating/ capacity.
(i) For permission of supply connections contractor has to submit a test report of their installations with a single line diagram of connected / proposed loads. Contractor will also submit a report on all electrical connected load by the 7$^{th}$ of every month.
(j) ELCB will be tested once in a week or as deemed fit by BHEL Engineer by actually simulating the earth leakage for all installations and the same shall be recorded by BHEL Engineer in the log book to be maintained by the contractor.
(k) In case of power cuts / load shedding no compensation for idle labour or extension of time for completion of work will be given to contractor.

**61.11** Adequate lighting facilities such as flood lamps, hand lamps and area lighting shall be arranged by the contractor at the site of construction, contractor's material storage area etc. within finally accepted rates.

**61.12** **BHEL will make available water for construction/testing purposes close to the construction areas including potable/drinking water supply for site free of charge. Distribution within the plant area will be done by the Contractor at his own cost. BHEL will provide support and assistance to the contractor in arranging necessary connections with the local water supply authority. However, the contractor shall bear all cost on this account.** Contractor to satisfy himself that the water drawn by him is fit for construction / consumption and adequately treat such water at his cost when it is not found fit for the said purposes.

**61.13** Though the contractor will be provided electricity and water free of charges at one point ,the contractor shall however ensure that there is no wastage . Periodical audits will be held to ensure that these resources are being optimally used .In case any wastage is observed , BHEL reserves the right to recover any charges /penalty as deemed fit to be decided by BHEL Engineer**.**

**62.0 TIME SCHEDULE**

**62.1** The Contractor shall commence the works within 30 days from the date of issue of letter of intent (unless BHEL decides to fix any other later date) and shall thereafter proceed to carry out and complete the Works continuously, diligently and without delay. Time shall be of the essence in the performance of the Contractor of its obligation under the Contract.

**62.2** **Entire work as detailed in tender specifications shall be completed, in all respect, within 21 months** from the scheduled date of start of work as per the programs / milestones indicated by BHEL from time to time**. However, finishing works shall be allowed to be completed upto one month after synchronization of last unit**. The Contractor has to mobilise adequate resources to meet BHEL's commitments to their customer as indicated from time to time. In case due to reasons not attributable to the contractor, the work gets delayed and additional manpower / resources have to be mobilized so as to expedite the work to meet various milestones, same shall be done within the quoted rates, at no extra cost to BHEL. In the event the contractor fails to respond to these requirements, BHEL shall take appropriate actions in line with the provisions of General Conditions of Contract

**62.3** Unit # 4 is scheduled to be commissioned by 14$^{th}$ month from Zero date of this contract. Unit #3, 1 & 2 shall follow at interval of two month respectively. All related works of respective units are to be scheduled accordingly. The various milestone dates to be achieved as per the current status of contract, are as below :

**A. <u>MECHANICAL WORKS</u>**

| **MILE STONES** | **MONTHS** |
|---|---|
| a) Release of LOI | Zero date |
| b) Erection Start (BOP area) | 2$^{rd}$ month |
| c) Commissioning of EOT Crane | 3$^{rd}$ month |
| d) Condenser Erection Start | 3$^{rd}$ month |
| e) Turbine erection start | 4$^{th}$ month |
| f) Box – up for oil flushing | 11$^{th}$ month |

| | | |
|---|---|---|
| g) | Oil Flushing Completion. | 12th month |
| h) | Barring Gear | 13th month |
| i) | Rolling & Synchronizing | 14th month |
| j) | Trial operation | 15th month |

**B. ELECTRICAL AND INSTRUMENTATION WORKS**

| | **MILE STONES** | **MONTHS** |
|---|---|---|
| a) | Start of Switchyard Erection | 2rd month |
| b) | Start of Cabling System Erection | 2rd month |
| c) | Start of HT / LT Switchgear erection | 3nd month |
| d) | Start of Transformer erection | 3th month |
| e) | CCR Panel Erection Start | 4th month |
| f) | Charging of 220 kV Switchyard | 8th month |
| g) | Charging of station Transformer #2 . | 8th month |
| h) | Start Up HT / LT Power Availability | 8th month |
| i) | Readiness for Boiler Light Up | 10th month |
| j) | Readiness for Barring Gear | 12th month |
| k) | Readiness for Rolling and Synchronization | 13th month |

All the BOP erection works are to be completed to meet the requirement of Unit #4 commissioning. Based on above time schedule, the contractor shall submit, within one month from Zero date, detailed programme for construction activities envisaged under this contract. However, the submission for approval by BHEL of such program shall not relieve the contractor of any of his duties or responsibilities under this contract**.**

**62.4** The work under the scope of this contract is deemed to be completed in all respects, only when the contractor has discharged all the responsibilities laid down in the contract. The decision of BHEL on completion date shall be final and binding on the contractor.

**63.0 OVER RUN**

**63.1** In case due to reasons not attributable to the contractor, the work gets delayed and the scheduled completion gets extended, the contractor shall not be entitled for any over run compensation for a period of first 3 (THREE) months after the contractual completion date. In case the scheduled completion time gets extended beyond 3 (THREE) months as stated above, the contractor shall be considered for payment of fixed over run charges,@ 20000 USD per month on receipt of advance notice intending to claim over run and on fulfillment of following conditions:-

(a) The reasons for delay in completion of work are not attributable to contractor but however subject to the provisions of clause – 31.

(b) Contractor achieves the targets fixed during the over run period

**However, the over run charges shall be limited to 10% of the contract value.**

**63.2** Once the claim of over run charges is admitted no other compensation whatsoever

(like for delays in receipt of materials, availability of fronts etc.) will be entertained.

**63.3** The contractor shall maintain sufficient workforce (both skilled and unskilled) and other resources required for completion of the job expeditiously for the entire contractual period including total extended period.

**64.0 TERMS OF PAYMENT**

**64.1** The 'Engineer' will certify regarding the actual work executed in the measurement books and bills, which shall be accepted by the contractor in measurement book.

**64.2** Contractor shall submit bills for the work completed under the specification, once in a month detailing work done during the month. The format for billing shall be approved by BHEL before raising invoices.

**64.3** Subject to any deduction that BHEL may be authorized to make under the contract, the contractor on the certificate of the Engineer at site be entitled for payment as explained hereunder.

**64.4** **MODE OF PAYMENT:**

(a) Payments shall be made by cheque or bank transfer.

(b) BHEL Engineer shall certify regarding the actual work executed in the measurement books in line with approved billing schedule. The contractor shall submit progressive bills for the works completed in line with approved billing schedule, once in a month. The Contractor shall be paid monthly running bill to a maximum of 95% of the value of the work actually executed on site provided the work has been executed to the satisfaction of the Engineer.

**(c)** Any certificate relating to the work done may be modified by any subsequent interim certificates or by the final certificates and no certificate of the Engineer supporting an advance payment shall by itself be conclusive evidence that any work or materials to which it relates are in accordance with the contract.

**(d) Currency of Payment and Exchange Rate**

**(i) Payment IN USD**

**85% of the Total Contract Price will be paid in USD subject to Reserve Bank of India (RBI) guidelines.**

Bidder has to ensure that total imports (CIF Value) from 3rd country i.e. steel (wherever required), cement and other materials which is going directly from the 3rd Country to Kosti Site in Sudan shall not be more than 50% of the Total Contract Price to ensure that total Imports from the 3rd country going directly to Sudan Site shall meet the RBI guidelines.

**(ii) Local Currency Payment**

**Balance 15% of the Total Contract Price will be paid in local currency (i.e. Sudanese Pounds) for the supplies and services carried out in Sudan.**

Exchange rate from one currency to another applicable for the entire period of contract including extended period, if any, shall be the rate prevailing on the date of

opening of technical bid (Part-I). For conversion from USD to Sudanese Pounds, buying rate of USD as available on the website of Bank Of Sudan (www.bankofsudan.org) on the date of opening of technical bids (Part-I), shall be considered and will be applicable for the entire period of Contract including extended period, if any. If the date happens to be a holiday, the exchange rate of next working day will be considered

**64.5** **Advance Payment**

(a) 5% of the contract value shall be paid as interest bearing advance against submission of a Bank Guarantee for an amount equal to 1.20 times of advance valid for 12 months initially and thereafter extension for a period upto which the advance is fully adjusted. The interest chargeable shall be Prime Lending Rate of State Bank of India plus 2%.

The BG should be issued preferably through any of the Member Banks listed in the GCC. The BG may also be accepted from a Foreign Bank at the sole discretion of BHEL, provided the BG is duly endorsed by any bank of the BHEL's Member Bank listed in the GCC 'OR' any Nationalized Bank in India.

(b) The advance paid shall be recovered from the contractor's monthly running bills to an extent of 10% of each bill amount along with interest, till it is fully recovered. The BG amount shall be allowed to be reduced every six months by an amount equal to the amount adjusted against running bills.

(c) The BG against advance shall be returned after full adjustment of the entire amount of advance along with interest.

**64.6** **PROGRESSIVE PAYMENT on pro-rata basis**

**I.A** **85 % of Contract value shall be payable on pro-rata basis as follows :**

**I.A-1** **85 % of Unit Rates for Item no. 1 of rate schedule:**

| | | |
|---|---|---|
| 1. | CONDENSER | 4 x 2.5 % |
| 2. | TURBINE | 4 x 3 % |
| 3. | GENERATOR | 4 x 2 % |
| 4. | STATIC AUXILIARIES | 4 x 1.0 % |
| 5. | ROTATING AUXILIARIES | 4 x 1.5 % |
| 6. | BALANCE OF PLANT EQUIPMENT | 43 % |
| 7. | On final painting of ST . STG sets equipments | 4 x 0.25 % |
| 8. | On final painting of BOP systems (further breakup, if required shall be mutually discussed & finalized at site). | 1 % |

**I.A-2** **85 % of Unit Rates for Item no. 3 & 4 of rate schedule:**

| | | |
|---|---|---|
| **a** | On transportation, pre assembly wherever applicable, placement in position and rough alignment. | 30 % |
| **b** | On completion of alignment / fastening / welding / | 38 % |

| | | |
|---|---|---|
| | grouting along with proper supports. | |
| **c** | On completion of radiography / NDT / stress relieving / other quality checks. | 10 % |
| **d** | On system completion | 5 % |
| **e** | On final painting of piping | 2% |

**I.A-3 85 % of Unit Rates for Item no. 2 of rate schedule:**

| SL NO | EQUIPMENT | % APPLICABLE |
|---|---|---|
| a | 220 kV Switchyard | 12.5 % |
| b | Power Transformers and IPB | 12.5 % |
| c | SPB , HT Switchgear , LT Transformers, NGR | 7.5 % |
| d | LT Switchgear , LT Busduct | 7.5 % |
| e | DC Battery and Chargers , UPS | 2.5 % |
| f | Control and Relay Panels | 7.5 % |
| g | Instruments , Process Connections | 10.0 % |
| h | Plant Communication – PA system , CCTV System , | 2.5 % |
| i | Plant Earthing System | 5.0 % |
| j | Plant Illumination System | 5.0 % |
| k | Cable Trays , Cable Laying and Termination | 10.0 % |
| l | Fire sealing System | 2.5 % |

**I-B MILESTONE PAYMENTS (10 % of awarded CV)**

| | | |
|---|---|---|
| **a** | Deployment of first 75 MT Crane** | 0.75 % |
| **b** | Deployment of second 75 MT Crane** | 0.75% |
| **c** | Initial Deployment of 100 workers within three months of issue of LOI ** | 0.50% |
| **d** | Oil flushing completion | 4 x 0.15 % |
| **e** | Barring gear | 4 x 0.15 % |
| **f** | Completion of Steam rolling and synchronizing | 4 x 0.2 % |
| **g** | DM water availability | 0.20 % |
| **h** | Cooling tower readiness for water filling in basin | 4 x 0.20 % |
| **i** | Fuel oil system readiness for forwarding oil to Boiler | 0.15 % |
| **j** | Fire fighting main hydrant readiness for charging | 0.25 % |
| **k** | Control room A/C system readiness | 0.120 % |
| **l** | Compressed air availability | 0.120 % |
| **m** | Charging of 220 kV Bus in Switchyard | 2 x 0.20 % |

| | | |
|---|---|---|
| **n** | Charging of Station Transformer | 2 x 0.20 % |
| **o** | Charging of Unit LT MCC | 4 x 0.120% |
| **p** | Hi Pot Test of IPB | 4 x 0.20 % |
| **q** | Charging of Generator Transformer / UAT | 4 x 0.25 % |
| **r** | Readiness of Instrumentation for Boiler Light Up | 4 x 0.12 % |
| **o** | Readiness of Instrumentation for Crude Oil Firing | 4 x 0.20 % |

**I-C** **2.5%** of contract value will be payable on handing over of the unit to BHEL's Customer or 3 months after contractor has discharged his responsibilities as stipulated in this contract, whichever is earlier, if delay in handing over is not attributable to contractor. Further system wise breakup of 2.5 % shall be as follows:

Unit #4 + BOP systems common for Unit #4 & 3 : 1.0 %

Unit #3 : 0.25 %

Unit #1 or 2 + BOP systems common for Unit #1 & 2 : 1.0 % {which ever unit will {come first.

Unit #2 or 1 : 0.25 %

**I-D** **The balance 2.5% CV shall be payable on completion of all pending work, rework wherever required, area cleaning, reconciliation of materials, fulfillment of contractual obligations, and on submission and passing of Final Bill. However, the balance 2.5% payment shall be paid subject to handing over of units to customer.**

**NOTE: (1)Payments at I-C & I-D shall be released after adjustment of the CV based on actual work carried out.**

**** (2) Contractor is required to deploy 75 MT cranes in good condition and initial deployment of manpower {As per I-B(a) , I-B(b) and I-B(c) above} within three months of issue of LOI. In case the contractor fails to mobilize these resources within three months of issue of the LOI, payment against I-B(a) , I-B(b) and I-B(c) shall be made only to the extent of 50% on completion of respective milestone .**

## Annexure – 1-A

### SYSTEM DESCRIPTION / WEIGHT SCHEDULE
### (TUROBO-GENERATING SETS + BALANCE OF PLANT SYSTEM)

## AA : Four sets of Steam turbo-generating sets are envisaged to be installed under this specification. Major systems to be erected in each unit are as follows

### (A) CONDENSER (APPROXIMATE WEIGHT PER UNIT: 300 MT)

Condenser complete with all accessories such as;

- Hot-well, hinge assemblies, nozzles for various connections along with baffles.
- Steam throw off devices, air extraction piping,
- Stand pipes along with fittings including gauge glasses for level indication, hangers & supports to make the system complete in all respects.

**Total approximate weight of condenser is 300 MT (per unit) & overall dimensions are around 13 M x 6.6 m x 10 m. Condenser will be dispatched in knocked down condition. Tubing of Condenser will be done at site (Weight of 300 T indicated above is inclusive of tube weight of 50 T). Dome, Hotwell, Waterboxes, Springs, Standpipes, Surge pipe etc. will be dispatched loose for welding and final assembly at site.**

### (B) STEAM TURBINE (APPROXIMATE WEIGHT PER UNIT: 400 MT)

**High Pressure and low pressure steam turbines complete with sole plates, foundation holding down bolts, bearing, bearing pedestals, rotors, couplings, main oil pumps, steam gland seals, hydraulic turning gear and hand barring gear.**

- Combined main steam stop and control valves, combined reheat stop and control valves, steam strainers for main and reheat steam lines etc., LP bypass stop and control valves along with their servomotors necessary supports for Integral piping and secondary structure if required.
- Cold reheat and extraction NRV along with their servomotors, necessary supports and secondary structure if required.
- Complete Installation of necessary blanking to protect the valves and turbine internals during hydraulic testing and steam blowing. If required CRH NRV may have to be dismantled and replace with a spool during steam blowing. It will be re-installed after completion of steam blowing. Both side-welding joints of spool piece and CRH - NRV are in the scope of this tender.
- Complete governing system for the turbine including governing control rack, LP bypass control, rack, valve test devices and racks, turbine gland sealing system complete with converters, associated piping, valves and fittings, specialties, fire protection valves and devices, hangers and supports to make the system complete in all respects.
- Complete cross around piping along with their supports from IP turbine to LP turbine.
- Complete extraction piping along with their supports and protective covers from LP turbine to condenser dome walls.

***MAJOR DIMENSIONS & WEIGHTS OF ITEMS OF KN TURBINE ARE AS FOLLOW:***

| | TURBINE TYPE: K30-16+N30-2X3.2, M/C NO. T0659, T 0668 | | | | |
|---|---|---|---|---|---|
| | | | | | |
| S.NO | ITEM DESCRIPTION | DIMENSIONS OF ITEM(LXBXH)MM | QTY | WT./ PIECE (TON) | TOTAL WEIGHT (TON) |
| 1 | COMBINED HP-IP (K)-MODULE | 6370X4360X3120 | 1 | 113.0 | 113.0 |
| 2 | HP EXHAUST INSERT | 1150X1100X1100 | 1 | 2.0 | 2.0 |
| 3 | HP VALVE | 3915X3350X1300 | 2 | 5.8 | 11.6 |
| 4 | HP OVERLOAD BYPASS VALVE | 1500X1300X680 | 1 | 5.0 | 5.0 |
| 5 | IP VALVE | 4230X1350X4360 | 2 | 9.3 | 18.6 |
| 6 | VALVE ACTUATORS* | 1500X400X400 | 9 | 1.0 | 9.0 |
| 7 | FRONT BEARING PEDESTAL (K-TURBINE) | 1700X2500X1435 | 1 | 9.0 | 9.0 |
| 8 | REAR BEARING PEDESTAL (K-TURBINE) | 1600X3100X1610 | 1 | 9.6 | 9.6 |
| 9 | REAR BEARING PEDESTAL (LP TURBINE) | 1350X2600X1430 | 1 | 6.2 | 6.2 |
| 10 | BEARING PEDESTAL LOOSE PARTS | 1000X1000X1000 | 1 | 1.1 | 1.1 |
| 11 | LP ROTOR | 5510X2240X2240 | 1 | 26.4 | 26.4 |
| 12 | UPPER LP INNER CASING-I | 1070X2690X1280 | 1 | 4.2 | 4.2 |
| 13 | UPPER LP INNER CASING-II (INCL. GUIDE WHEELS) | 2550X4960X1500 | 1 | 13.0 | 13.0 |
| 14 | LOWER LP INNER CASING-II(INCL. LOWER LP INNER CASING-I & GUIDE WHEELS) | 2550X4960X1720 | 1 | 18.5 | 18.5 |
| 15 | DIFFUSER (LP) | 450X3025X3025 | 2 | 1.4 | 2.8 |
| 16 | LP LONGITUDINAL GIRDER | 5280X1050X1210 | 2 | 7.0 | 14.0 |
| 17 | LP SIDE WALL | 760X4960X2750 | 2 | 5.3 | 10.6 |
| 18 | LP OUTER CASING | 2400X5200X2150 | 2 | 6.5 | 13.0 |
| 19 | LP TURBINE LOOSE PARTS | 2000X2000X2000 | 1 | 7.3 | 7.3 |
| 20 | CROSS AROUND PIPING** | 1500X1200X962 | 2 | 0.9 | 1.8 |
| 21 | CROSS AROUND PIPING** | 2750X1200X962 | 2 | 1.5 | 3.0 |
| 22 | CROSS AROUND PIPING LOOSE PARTS** | 1000X1000X1000 | 2 | 0.5 | 1.0 |
| 23 | LP BYPASS VALVE** | 850X1100X5500 | 2 | 3.0 | 6.0 |
| 24 | LP BASE PLATES | 500X500X600 | 1 | 2.2 | 2.2 |
| 25 | LP EXTRACTION PIPING | 4500X3000X3500 | 1 | 5.3 | 5.3 |
| 26 | MS STEAM STRAINER | 1400X685X960 | 2 | 1.5 | 3.0 |
| 27 | HRH STEAM STRAINER | 2075X860X1260 | 2 | 2.5 | 5.0 |
| 28 | FOUNDATION BOLTS | 4500X3000X2000 | 1 | 4.6 | 4.6 |
| 29 | INTER CONNECTING PIPING BET. HP VALVE & HP OVERLOAD VALVE | 4500X3000X3000 | 2 | 2.0 | 4.0 |
| 30 | HP OIL SUPPLY UNIT | 2900X1300X2350 | 1 | 3.0 | 3.0 |

| S.NO | ITEM DESCRIPTION | DIMENSIONS OF ITEM(LXBXH)MM | QTY | WT./ PIECE (TON) | TOTAL WEIGHT (TON) |
|---|---|---|---|---|---|
| 31 | LUBE OIL PUMP | | 2 | 0.8 | 1.6 |
| 32 | LUBE OIL PUMP MOTOR | | 1 | 0.7 | 0.7 |
| 33 | EMERGENCY OIL PUMP | | 1 | 0.3 | 0.3 |
| 34 | EMERGENCY OIL PUMP MOTOR | | 1 | 0.6 | 0.6 |
| 35 | JACKING OIL PUMP | | 2 | 0.8 | 1.6 |
| 36 | JACKING OIL PUMP MOTOR | | 2 | 0.5 | 1.0 |
| 37 | OIL PURIFICATION UNIT | | 1 | 2.0 | 2.0 |
| 38 | LUBE OIL FILTER | | 1 | 0.8 | 0.8 |
| 39 | JACKING OIL FILTER | | 1 | 0.5 | 0.5 |
| 40 | LUBE OIL ACCULUMATOR ASSEMBLY | | 1 | 0.8 | 0.8 |
| 41 | CENTRIFUGAL EXT. FAN ASSLY | | 2 | 0.2 | 0.4 |
| 42 | LUBE OIL TANK | | 1 | 6.0 | 6.0 |
| 43 | DC STARTING CUBICLE | | 1 | 1.6 | 1.6 |

## (C) GENERATOR (APPROXIMATE WEIGHT PER UNIT: 250 MT)

**Generators complete with its auxiliary systems. THE GENERATOR STATOR SHALL BE ERECTED USING EOT CRANES.**

- Installation of side mounted Air to water coolers.
- Insertion of rotor, leveling, alignment & coupling with LPR.
- Erection of Bushings.
- Brush less excitation system along with PMG, placement, leveling, centering and coupling with generator rotor.
- End shields, Shaft seals, gas coolers, terminal bushings, connected piping, valves, fittings, hangers and supports etc.
- CO2 fire extinguishing equipment for generator.

*MAJOR DIMENSIONS & WEIGHTS OF ITEMS OF GENERATOR ARE AS FOLLOW:*

| S.No | Item description | Dimensions of item (LxBxH)mm | Qty. | Wt./Piece (tons) | Total weight (tons) |
|---|---|---|---|---|---|
| 1. | STATOR | **8200x4000x3900** | 1 | 168 | 173 |
| 2. | ROTOR | **10150x1750x1800** | 1 | 37 | 37 |
| 3. | BEARINGS | **1900X560X1250** | 2 | 5 | 10 |
| 4. | COOLER | **6700X3400X1900** | 1 | 10 | 10 |
| 5. | EXITER STATOR& ROTOR AS A PACKAGE | **1600X3700X1300** | 1 | 8.5 | 8.5 |
| | | | | | |
| 6. | FOUNDATION ITEMS | **4000X4000X1000** | 1 | 7 | 7 |

## (D) STATIC AUXILLIARIES (APPROXIMATE WEIGHT PER UNIT: 150 MT)

- Flash tanks with drains & vents.
- Deaerator & Feed storage tank (in single pieces), complete with ladders, platform and other accessories.
- Drain coolers along with fittings, piping, steam traps and Gland steam condensers and air exhausters with motor and fittings, associated piping, hangers and supports etc. to make the system complete in all respects.
- LP Heater-1 horizontal located in condenser neck.
- LP and HP heaters, fittings, group protection device, stand pipes along with fittings including gauge glasses for level indication, safety valves etc. to make the equipment complete in all respects.
- RE Joints along with in built CW pipes, flanges and tie rods and spool pieces, H &S etc. to make system complete in all respect.
- CW Butterfly valves along with counter flanges, gaskets and fasteners to complete the system in the main CW supply and return lines of size1400 NB approximately, 04 nos. in each unit.
- Condenser online tube cleaning system (COLTCS) complete.
- 2X 100% main Air Ejectors and one starting ejectors for maintaining condenser vacuum, along with its accessories, to make the equipments complete in all respects.
- Suction strainers for boiler feed and condensate extraction pumps along with supports and other fixtures.
- Turbine oil coolers, Control oil coolers, gland steam condenser, drain coolers, steam jet main ejectors, along with stand pipes and fittings including gauge glasses for level indication, safety valves etc. to make the equipment complete in all respects.
- Oil strippers, strainers, oil injectors and duplex oil filters.
- Main oil tank, Control oil tank, drain oil and dirty oil tanks along with fittings including gauge glasses for level indication, to make the equipment complete in all respects.
- Working oil and lubricating oil coolers of Boiler feed pumps.
- Air cooling system, carbon dioxide systems including dryers, CO2 gas control units and gas stands, racks and distributors to make the system complete in all respects.
- Electric hoists & Chain pulley blocks

## (E) ROTATING AUXILLIARIES (APPROXIMATE WEIGHT PER UNIT: 100 MT)

- Emergency DG sets and it's all associated scope of works i.e. equipments, skids, piping, fittings, supports, structural works etc.
- AC motor driven boiler feed pumps mounted on common frames, hydraulic couplings, and BFP motors, BFP booster pumps, working oil and lube oil coolers including integral piping.
- AC Motor driven condensate extraction pumps complete with associated motor and its accessories including integral piping.

- A.C. motor driven Main oil pumps.
- A.C. and DC motor driven lubricating oil pumps including DC motors starters along with resistance box.
- 2 nos. AC Control oil pumps.
- Recirculation oil pump with motor
- AC & DC motor driven jacking oil pumps including DC motors starters along with resistance box.
- Unit oil centrifuging and purification equipment machines.
- Oil vapour and gland steam exhausters.
- Gas Driers.
- HP/LP dozing skids. Accessories etc.
- **Central lube oil storage & purifying system consisting of clean oil storage tank, dirty oil storage tank, central oil purifier, dirty & clean oil transfer pumps, drain oil return pumps, oil unloading vessel & interconnecting piping. (Common system for ALL STG units)**

## SIZE AND WEIGHT SCHEDULE OF MAJOR COMPONENTS OF BFP, BP, CEP & CWP ARE AS FOLLOW:

**The Total weights of rotating equipments Viz. BFP, CEP and CWP given in tabular form are for all the four units.**

### (A) Boiler Feed Pump (BFP) :FK6D30 & Booster Pump (BP) :FA1B56 (Total Nos: 8+8)

| S.N. | Description of Equipmen | No of equipments per Pump | Unit Weight (kg) | Total Equipments (No.) | Total Weight (kg) |
|---|---|---|---|---|---|
| 1 | BFP Skid (Pump Assly. + Base Plate + tubing + Seal Coolers) | 2 | 5770 | 8 | **46160** |
| 2 | BP Skid (Pump Assly. + Base Plate + tubing) | 2 | 2511 | 8 | **20088** |
| 3 | Hydraulic Coupling (DD) Assly. | 2 | 3560 | 8 | **28480** |
| 4 | Hyd. Coupling W. O. Cooler (DD) | 2 | 1475 | 8 | **11800** |
| 5 | Hyd. Coupling L. O. Cooler (DD) | 2 | 775 | 8 | **6200** |
| 6 | Hyd. Coupling Loose Items | 2 | 710 | 8 | **5680** |
| 7 | Suction Strainer at BP Suction DD) | 2 | 800 | 8 | **6400** |
| 8 | BFP Recirculation valve (DD) | 2 | 350 | 8 | **2800** |
| 09 | Local Gauge Boards with instruments (DD) | 2 | 650 | 8 | **5200** |
| 10 | Loose Items | 2 | 2449 | 8 | **19592** |
| 11 | Local Instrument Rack (LIR) | 1 ( For 2 pumps) | 250 | 4 | **1000** |

## (B) Condensate Extraction Pump (CEP) : EN8H32 (Total Nos : 8)

| S.N. | Description Equipment | No of equipments per Pump | Unit Weight (kg) | Total Equipments (No.). | Total Weight (kg) |
|---|---|---|---|---|---|
| 1 | CEP Assembly | 2 | 1900 | 8 | **15200** |
| 2 | Canister | 2 | 510 | 8 | **4080** |
| 3 | CEP Foundation Ring | 2 | 185 | 8 | **1480** |
| 4 | CEP Suction Strainer | 2 | 800 | 8 | **6400** |
| 5 | Local Gauge Board with Instruments (DD) | 1 | 500 | 4 | **2000** |
| 6 | Loose Items | 1(set) | 210 | 8 | **1680** |
| 7 | Local Instrument Rack (LIR) | 1 ( For 2 pumps) | 250 | 4 | **1000** |

## (C) COOLING WATER PUMP :CW 1Q (Total Nos : 6)

| S.NO. | Description equipment | No of equipments per Pump | Weight / equipment (kg) | Total equipments (Nos.) | Total Weight (kg) |
|---|---|---|---|---|---|
| 1 | Suction bell mouth assembly | 1 | 1600 | 6 | **9600** |
| 2 | Pump casing assembly | 1 | 2200 | 6 | **13200** |
| 3 | Impeller assembly | 1 | 485 | 6 | **2910** |
| 4 | Element Assemblies | 4 | 5269(for 4 equipments ) | 24 | **31614** |
| 8 | Discharge elbow Assembly | 1 | 3435 | 6 | **20610** |
| 9 | Distance piece Assemblies | 2 | 4743(for 2 equipments ) | 12 | **28458** |
| 11 | Motor stool assembly | 1 | 1850 | 6 | **11100** |
| 12 | Inter Foundation ring | 1 | 1991 | 6 | **11946** |
| 13 | Motor Foundation Frame | 1 | 3072 | 6 | **18432** |
| 14 | Shafts | 4 | 1600(for 4 equipments ) | 24 | **9600** |
| 15 | Thrust bearing | 1 | 1100 | 6 | **6600** |
| 16 | Connecting coupling | 1 | 540 | 6 | **3240** |
| 17 | Counter flange | 1 | 480 | 6 | **2880** |

| | | | | | |
|---|---|---|---|---|---|
| 18 | Local control panel | 1 | 200 | 6 | **1200** |
| 19 | Reverse rotation indicator | 1 | 100 | 6 | **600** |
| 20 | Loose items | 1( set) | 150 | 6 | **900** |

## BB : All the Balance of Plant systems being supplied for this project are envisaged to be installed under this specification. Major systems to be erected with brief description of respective system are as follows:

### A) FUEL OIL HANDLING SYSTEM :

Crude Oil supply to power plant is from tap off of crude oil trunk pipeline transporting crude to refinery. The tap-off point for supply is approximately 10 Kms from power plant boundary & piping from tap off to plant boundary is being done by other vendor of BHEL. The scope under this package covers Crude Oil and gas oil receipt in the plant and storing the same before supplying to fuel forwarding system for boiler. Scope of work will comprise of Erection & Commissioning of the following

a) One number Pig launching station
b) Crude Oil Pipe and Oil Flushing pipe
c) One number Pig receiving station
d) One number Multi orifice type Pressure Regulating Station in the plant boundary
e) One number pressure regulating station at the plant end
f) One number Emergency shut down (ESD) valve
g) One number Flow meter cum totalizer at the plant end
h) Three number Oil flushing pump (50 CUM / Hr)
i) Four number of CO storage tanks duly insulated on shell each provided with floor coil heater and suction heater
j) Two number of GO unloading hose.
k) Two nos. GO unloading pumps (25 CUM / Hr)
l) 2 Nos. GO storage tanks
m) 1 Nos. GO flow meter
n) One number drain oil tank
o) Two numbers drain oil pumps (10 CUM / Hr)
p) Four numbers vertical screw sump pumps (10 CUM / Hr)
q) All piping, fittings & valves. The MOC of piping for oil line shall be API 5L ERW while steam & condensate piping shall be of ASTM A 106 Gr.B
r) Fire safe Ball / Plug Valves for oil line

Tanks have to be fabricated at site from the shop fabricated, pre-formed / rolled and painted steel plates. Pre-formed plates (around 600 MT, 8 mm thick plates) and pre-fabricated structure (around 135 Mt) for tanks shall be supplied for further assembly, fabrication & erection of fire water tanks. Erection of tank includes erection of accessories like valves, NaOH breather, seal pot, staircase / handrails etc.

**The tentative list of equipment to be erected against this package is as follow:**
**(The data given in tabular format gives the tentative list of quantities to be erected.)**

| S.No. | Item Description | Unit | Qty. |
|---|---|---|---|
| 01.00 | **Gas Oil Unloading Pumps , capacity 25 Cu.M/hr.** | Nos. | 2 |
| | | | |
| 02.00 | **Gas Oil Flushing Pumps, capacity 50 Cu.M/hr.** | Nos. | 3 |
| | | | |
| 03.00 | **Drain Oil Pump , capacity 10 Cu.M/hr.** | Nos. | 2 |
| | | | |
| 04.00 | **Oil Water seperator pump,capacity 10 Cu.M/hr.** | Nos. | 4 |
| | | | |
| 05.00 | **Steel Structure, Pre Fabricated** | MT | 80 |
| | | | |
| 06.00 | **MS Plates, Pre Fabricated** | MT | 745 |
| | | | |
| 07.00 | **Pipes & Fittings** | | |
| 07.01 | CS Pipe ERW to API 5L,Gr. B,Non IBR 350 NB,Sch10 | Mtrs. | 486 |
| 07.02 | CS Pipe ERW to API 5L,Gr. B,Non IBR 200 NB,Sch 20 | Mtrs. | 288 |
| 07.03 | CS Seamless Pipes to ASTM 106,Gr. B,IBR 300 NB,Sch. 20 | Mtrs. | 240 |
| 07.04 | CS Seamless Pipes to ASTM 106,Gr. B,IBR 200 NB,Sch. 20 | Mtrs. | 48 |
| 07.05 | CS Seamless pipe to ASTM 106,Gr. B,IBR 150 NB,Sch. 40 | Mtrs. | 336 |
| 07.06 | CS Seamless pipe to ASTM 106,Gr. B,IBR 100 NB,Sch. 40 | Mtrs. | 672 |
| 07.07 | CS Seamless pipe to ASTM 106,Gr. B,IBR 80 NB,Sch. 40 | Mtrs. | 228 |
| 07.08 | CS Seamless Pipes to ASTM 106,Gr. B,IBR 50 NB,Sch. 40 | Mtrs. | 594 |
| 07.09 | CS Seamless pipe to ASTM 106,Gr. B,IBR 40 NB,Sch. 80 | Mtrs. | 78 |
| 07.10 | CS Seamless Pipes to ASTM 106,Gr. B,IBR 25 NB,Sch. 80 | Mtrs. | 180 |
| 07.11 | MS Galvanised ERW Pipe to IS:1239, 40 NB,Medium Gr. | Mtrs. | 210 |
| 07.12 | MS Galvanised ERW Pipe to IS:1239, 25 NB,Medium Gr. | Mtrs. | 18 |
| 07.13 | Fittings & Flanges | Lot | 1 |
| | | | |
| 08.00 | **Valves** | | |
| 08.01 | **Plug Valves** | | |
| 08.01.01 | Plug Valve, 350 NB,#150 | Nos. | 8 |
| 08.01.02 | Plug Valve, 350 NB,#150, Pnuematically Operated | Nos. | 8 |
| 08.01.03 | Plug Valve, 200 NB,#150 | Nos. | 18 |
| 08.01.04 | Plug Valve, 200 NB,#150, Pnuematically Operated | Nos. | 8 |
| | | | |
| 08.02 | **Carbon Steel Ball Valves** | | |
| 08.02.01 | CS Ball Valve,200 NB,# 600 | Nos. | 9 |
| 08.02.02 | CS Ball Valve,200 NB,#600,Pnuematically Operated | Nos. | 5 |
| 08.02.03 | CS Ball Valve,150 NB,# 600 | Nos. | 3 |
| 08.02.04 | CS Ball Valve,100 NB,# 600 | Nos. | 11 |
| 08.02.05 | CS Ball Valve,50 NB,# 600 | Nos. | 6 |
| 08.02.06 | CS Ball Valve,150 NB,# 150 | Nos. | 15 |
| 08.02.07 | CS Ball Valve,100 NB,# 150 | Nos. | 16 |
| 08.02.08 | CS Ball Valve,80 NB,# 150 | Nos. | 7 |
| 08.02.09 | CS Ball Valve,50 NB,# 150 | Nos. | 2 |

| | | | |
|---|---|---|---|
| 08.02.10 | CS Ball Valve,40 NB,# 150 | Nos. | 28 |
| | | | |
| 08.03 | **Carbon Steel Non Return Valve** | | |
| 08.03.01 | CS Non Return Valve, 350 NB,#150 | Nos. | 4 |
| 08.03.02 | CS Non Return Valve, 200 NB,#600 | Nos. | 1 |
| 08.03.03 | CS Non Return Valve, 200 NB,#150 | Nos. | 4 |
| 08.03.04 | CS Non Return Valve, 150 NB,#150 | Nos. | 1 |
| 08.03.05 | CS Non Return Valve, 100 NB,#150 | Nos. | 10 |
| 08.03.06 | CS Non Return Valve, 50 NB,#150 | Nos. | 2 |
| 08.03.07 | CS Non Return Valve, 40 NB,#150 | Nos. | 2 |
| | | | |
| 08.04 | **Carbon Steel Gate Valve** | | |
| 08.04.01 | CS Gate Valve,200 NB,#150 | Nos. | 5 |
| 08.04.02 | CS Gate Valve,150 NB,#150 | Nos. | 5 |
| 08.04.03 | CS Gate Valve,100 NB,#150 | Nos. | 10 |
| 08.04.04 | CS Gate Valve,80 NB,#150 | Nos. | 8 |
| 08.04.05 | CS Gate Valve,50 NB,#150 | Nos. | 2 |
| 08.04.06 | CS Gate Valve,40 NB,#150 | Nos. | 9 |
| 08.04.07 | CS Gate Valve,25 NB,#150 | Nos. | 3 |
| 08.04.08 | CS Gate Valve,25 NB,#600 | Nos. | 16 |
| 08.04.09 | CS Gate Valve,15 NB,#150 | Nos. | 20 |
| 08.04.10 | CS Gate Valve,15 NB,#600 | Nos. | 22 |
| | | | |
| 08.05 | **Carbon Steel Globe Valves** | | |
| 08.05.01 | CS Globe Valve,200 NB,#150 | Nos. | 1 |
| 08.05.02 | CS Globe Valve,80 NB, #150 | Nos. | 8 |
| 08.05.03 | CS Globe Valve,40 NB, #150 | Nos. | 8 |
| | | | |
| 09.00 | **Basket Strainers** | | |
| 09.01 | Basket Strainer,200 NB | Nos. | 2 |
| 09.02 | Basket Strainer,150 NB | Nos. | 7 |
| 09.03 | Basket Strainer,100 NB | Nos. | 1 |
| | | | |
| 10.00 | **Rubber Hose,80 NB** | Nos. | 2 |
| | | | |
| 11.00 | **Electricals and Instruments** | | |
| 11.01 | Differential Pressure Switch | Nos. | 4 |
| 11.02 | Pressure Indicator (0-10 Kg/cm2) | Nos. | 9 |
| 11.03 | Pressure Indicator (0-90 Kg/cm2) | Nos. | 6 |
| 11.04 | Temparture Indicator | Nos. | 7 |
| 11.05 | Pressure switch | Nos. | 11 |
| 11.06 | Pressure Transmitter | Nos. | 4 |
| 11.07 | Level Indicator | Nos. | 7 |
| 11.08 | Level Transmitter | Nos. | 4 |
| 11.09 | Level Switch | Nos. | 18 |
| 11.10 | Differential Pressure Indicator | Nos. | 7 |
| 11.11 | Temperature Transmitter | Nos. | 18 |
| 11.12 | Flow Transmitter | Nos. | 2 |
| 11.13 | Control Valve On/Off type - 350 NB | Nos. | 4 |
| 11.14 | Control Valve On/Off type - 200 NB | Nos. | 12 |
| 11.15 | Control Valve Modulating type - 100 NB | Nos. | 9 |
| | | | |

| | | | |
|---|---|---|---|
| 12.00 | **Control Panel** | Nos. | 1 |
| | | | |
| 13.00 | **Cables** | Lot | 1 |
| | | | |
| 14.00 | **Insulation** | | |
| 14.01 | **LRB Mattress** | M2 | 6000 |
| 14.02 | **Aluminium Cladding** | kg. | 20000 |
| | | | |
| 15.00 | **Steam Control Station** | Set | 1 |
| | | | |
| 16.00 | **Misc. Items** | | |
| 16.01 | Pressure Reducing Station - 200 NB | Nos. | 1 |
| 16.02 | Steam Trap Assy. | Lot | 1 |
| 16.03 | Air Vent Assembly | Nos. | 5 |
| 16.04 | Pressure Relieve Valve, 200 NB | Nos. | 13 |
| 16.05 | Thermal Relief Valve | Nos. | 1 |
| 16.06 | Pig Launcher & Reciever System | Lot | 1 |
| 16.07 | Monolithic Isolation Joints | Sets | 4 |
| 16.08 | Multiorifice PRDS | Nos. | 4 |
| 16.09 | Flame Arrestors | Nos. | 3 |
| 16.10 | Suction Heater | Nos. | 4 |
| 16.11 | Any Other Item to complete the System | Lot | 1 |
| | | | |
| 17.00 | **Spares** | Lot | 1 |

## B) FIRE FIGHTING SYSTEM :

The Fire |Fighting System consists of the following :

### a) Fire Fighting Pump House :

The main equipments in the Fire Fighting Pump House are :

- 6.6 kV Motor Driven Fire Pump - 2 nos
- Diesel Engine Driven Fire Pump – 2 nos
- Electric Motor Driven Jockey Pump – 2 nos
- Hydro Pnuematic System consisting of 2 sets of package Air Compressors and one no 18 CUM capacity Tank
- Interconnecting Piping
- Associated Electrical and Instrumentation for the above including Control Panels , Battery and Chargers , cables , Process Connections etc

### b) Fire Water Tanks

2 nos 2000 m3, around 16 mtr diameter & 11 m high over ground Fire Water Tanks are envisaged. Tanks have to be fabricated at site from the shop fabricated, pre-formed / rolled and painted steel plates. Pre-formed plates (around 120 MT, 8 mm thick plates) and pre-fabricated structure (around 16 Mt) for tanks shall be supplied for further assembly, fabrication & erection of fire water tanks. Erection of tank includes erection of accessories like valves, NaOH breather, seal pot, staircase / handrails etc.

## c) Fire Fighting Piping

The fire water mains shall be installed aboveground as a ring loop throughout the power plant to serve the yard hydrants, stand pipe and hose system and proposed fire-fighting installations such as fixed water spray systems, fixed water/foam monitors, fixed foam injection system etc. The aboveground fire water main shall be provided with sufficient no of isolating gate valves for maintenance purpose. The fire water main shall be generally routed aboveground on RCC pedestal or on supports provided from column of pipe racks / trusses and where over ground routing of pipes is not possible, pipes shall be buried with pre-cast cover. The fire water main wherever crossing road/rail tracks or pipe/cable trenches shall be laid underground in RCC Hume pipe and shall be provided with coating and wrapping as per AWWA C203 (wrapping coating material shall be supplied by BHEL).
Outdoor hydrants shall be of wet barrel type. The wet barrel type hydrants shall consist of two (2) nos upper outlets of size 2.5" for hose connections and one (1) no lower outlet of size 4" for pumper connection. Each outlet shall be provided with an instantaneous coupling with cap and chain. An isolating valve shall be provided between each wet barrel type hydrant and the tap-off taken from above ground fire water mains. The distance between two outdoor hydrants shall not exceed 90 m**.**

Outdoor hydrants shall be provided to following buildings/areas**: -** TG & Boiler areas, Central control room building, Transformer yard area, Fuel oil pump house, DM plant building, Workshop building, D.G set house, Administrative building, Service Building, Compressor house, Stores, Clarified water pump house, Raw water pump house, CW pump house, Canteen, Car parking, Fire station building, Chemical house, central lube oil system, fuel oil storage tanks area and Guest house.

Apart from outdoor hydrants, fixed water cum foam monitors shall also be provided around fuel oil storage tanks areas

The various piping systems are:

(a) Fire Water Main
(b) Medium Velocity Spray for Fuel Oil tanks , Cable vaults / galleries located in TG building, central control building and ESP control buildings s
(c) Auto High Velocity Spray for Oil filled transformers located in transformer yard of main plant , Steam turbine lube oil storage tanks and its purifier units, Boiler burner fronts, Central lube oil purifier unit including dirty and clean oil tanks, Diesel generator sets including its fuel oil storage tanks etc
(d) An automatic fixed foam injection system shall be provided for control of fire inside the fuel oil storage tanks located in dyke. System shall consist of Foam concentrate storage tanks (2 nos) filled with foam concentrate, Balance pressure proportioners, Balancing line with automatic controlling valves, flow controllers etc, Foam maker for individual fuel oil storage tanks, Adequate number of discharge outlets for each of the fuel oil tanks & Interconnecting piping, isolation valves, check valves, relief valves, instrumentations etc

The detection system and other items e.g. deluge valves, control panels required to complete the system are included. Hose Boxes and hoses are to be installed at various locations .

### d) Fire Detection and Annunciation System

A centralized microprocessor based fire detection & alarm system shall be provided which shall include, the followings:

- Analog addressable fire alarm panels having redundant processor.
- Pentium based monitoring station with colour graphic display.
- Printer.
- power supplies, batteries and battery chargers.
- Analog addressable smoke/ heat detectors/multisensor detector.
- Non-addressable type detectors i.e. linear heat sensing cables and switching devices like pressure switches, level switches etc with its own addressable interface units/ modules.
- Software and hardware as required for system operation.
- Cabling.

The Fire Detection System consists of Fire Detectors of the following types : Ionic / Photoelectric / Heat , including Response Indicators , Junction Boxes etc . MICC Cables are envisaged for most of the system. In addition LHS cables are envisaged for the Cable trays in the plant .Fire Alarm Panels with Battery Backups are envisaged in the CCR , FWPH , Fire station and the Foam Pump House , with central control in the CCR.

### e) Miscellaneous items:

i) Manual call points shall be provided throughout the power station at strategic locations both inside the buildings and in yard areas for local fire alarm and the same shall be exhibited in the main fire alarm panel located in the control room of common control building

ii) Inert gas extinguishing system is envisaged for protection of control room, computer room and electronic equipment room of common control building. The system shall be automatic and shall be activated by a dedicated detection system. The system shall consist of cylinders filled with the inert gas, cylinder mounting accessories, cylinder manifold, automatic discharge valves, discharge piping, nozzles, automatic operating devices, manual actuation devices/abort switches, associated fire detection /alarm system, audio-visual safety warning devices, instrumentations etc. The design and installation of inert gas extinguishing system shall be in accordance with NFPA – 2001

iii) Following types of portable/mobile fire extinguishers are envisaged to be provided to various buildings/areas/equipments depending upon the hazard.

a. Dry chemical powder type fire extinguishers of 5.44 Kgs. capacity.
b. Dry chemical powder type fire extinguishers of 10.43 Kgs. capacity.

c. Dry chemical powder type fire extinguishers of 68.0 Kgs. capacity.
d. Carbon dioxide type fire extinguishers of 6.8 kgs. Capacity.
e. Carbon dioxide type fire extinguishers of 9.07 kgs. Capacity.
f. Carbon dioxide type fire extinguishers of 22.68 kgs. Capacity

**The tentative list of equipment to be erected against this package is as follow:**

| Sl no | Item Description | Unit | Qty. |
|---|---|---|---|
| **A** | **HYDRANT, FOAM AND SPRAY SYSTEM** | | |
| **A.1** | **ROTATING EQUIPMENT & TANK** | | |
| **A.1a** | Electric motor driven Fire Pump Set Cap.454 m3/hr at 90 mtr. Head alongwith motor,controller assembled on base frame with accessories | Set | 2 |
| **A.1b** | Diesel Engine Driven Fire Pump Set Cap.454 m3/hr at 90 mtr. Head alongwith Diesel engine,controller assembled on base frame with accessories | Set | 2 |
| **A.1c** | Electric Motor Driven Jockey Pump Set Cap.45.4m3/hr at 95 mtr. Head alongwith electric motor assembled on base frame with accessories | Set | 2 |
| **A.1d** | Electric motor driven Foam Pump Set Cap. 35 LPM @ 12 bar pressure alongwith electric motor assembled on base frame with accessories | Set | 1 |
| **A.1e** | Diesel Engine driven Foam Pump Set Cap. 35 LPM @ 12 bar pressure alongwith Diesel engine assembled on base frame with accessories | Set | 1 |
| **A.1f** | Air Compressor Package | Sets | 2 |
| **A.1g** | Hydropneumatic Tank Cap. 18 m3 | No | 1 |
| **A.1h** | Foam Tank Cap. 600 Ltr. | No | 2 |
| **A.2** | **MS Black ERW Pipes to ASTM -A-53-Gr .B** | | |
| **A.2a** | MS Black ERW Pipes ASTM -A-53-Gr .B, Sch.40 400 NB | Mtr. | 70 |
| **A.2b** | MS Black ERW Pipes ASTM -A-53-Gr .B, Sch.40 250 NB | Mtr. | 1050 |
| **A.2c** | MS Black ERW Pipes ASTM -A-53-Gr .B, Sch.40 200 NB | Mtr. | 1150 |
| **A.2d** | MS Black ERW Pipes ASTM -A-53-Gr .B, Sch.40 150 NB | Mtr. | 3610 |
| **A.2e** | MS Black ERW Pipes ASTM -A-53-Gr .B, Sch.40 100 NB | Mtr. | 200 |
| **A.2f** | MS Black ERW Pipes ASTM -A-53-Gr .B, Sch.40 80 NB | Mtr. | 180 |
| **A.2g** | MS Black ERW Pipes ASTM -A-53-Gr .B, Sch.40 65 NB | Mtr. | 35 |

| | | | |
|---|---|---|---|
| **A.2h** | MS Black ERW Pipes ASTM -A-53-Gr .B, Sch.40 50 NB | Mtr. | 6 |
| **A.2i** | MS Black ERW Pipes ASTM -A-53-Gr .B, Sch.40 40 NB | Mtr. | 12 |
| **A.2j** | MS Black ERW Pipes ASTM -A-53-Gr .B, Sch.40 25 NB | Mtr. | 800 |
| **A.2k** | Wrapping & Coating Material | Sq.M | 250 |
| **A.4** | **S S ERW Pipes ASTM -A-312, Gr.304** | | |
| **A.4a** | S S ERW Pipes ASTM -A-312, Gr.304 Sch.10 Size- 100 NB | Mtrs. | 0 |
| **A.4b** | S S ERW Pipes ASTM -A-312, Gr.304 Sch.10 Size- 80 NB | Mtrs. | 756 |
| **A.4c** | S S ERW Pipes ASTM -A-312, Gr.304 Sch.10 Size- 65 NB | Mtrs. | 72 |
| **A.4d** | S S ERW Pipes ASTM -A-312, Gr.304 Sch.10 Size- 50 NB | Mtrs. | 40 |
| **A.4e** | S S ERW Pipes ASTM -A-312, Gr.304 Sch.10 Size- 40 NB | Mtrs. | 18 |
| **A.4f** | S S ERW Pipes ASTM -A-312, Gr.304 Sch.10 Size- 25 NB | Mtrs. | 18 |
| **A.5** | **HYDRANT & FOAM SYSTEM ACCESSORIES** | | |
| **A.5a** | Wet Barrel Type Hydrant Valve | Nos. | 45 |
| **A.5b** | Internal Hydrant Valve | Nos. | 68 |
| **A.5c** | Foam Hydrant Valve | Nos. | 8 |
| **A.5d** | Branch Pipe | Nos. | 158 |
| **A.5e** | Water Monitor | Nos. | 11 |
| **A.5f** | Fire Hose : 30 m Long | Nos. | 180 |
| **A.5g** | Fire Hose : 15 m Long | Nos. | 152 |
| **A.5h** | Hose Cabinet External | Nos. | 45 |
| **A.5i** | Hose Cabinet Internal | Nos. | 76 |
| **A.5j** | Fire Deppt. Connection | Nos. | 2 |
| **A.5k** | Foam Branch Pipe | Nos. | 8 |
| **A.5l** | Foam Maker Assembly 65 NB | Nos. | 2 |
| **A.5m** | Foam Maker Assembly 50 NB | Nos. | 16 |
| **A.5n** | Water cum Foam Monitor | Nos. | 5 |
| **A.5o** | Balance Pressure Propotioner | Nos. | 6 |
| **A.5p** | Foam Concentrate | Ltrs | 1000 |
| **A.5q** | Foam Jerican, Cap. 200 Ltr. | Nos. | 26 |
| **A.6.0** | **VALVES AND STRAINERS** | | |
| **A.6.1** | **CI Gate Valves** | | |
| **A.6.1a** | CI Gate Valves : 400 NB | Nos. | 2 |
| **A.6.1b** | CI Gate Valves : 300 NB | | 0 |
| **A.6.1c** | CI Gate Valves : 250 NB | Nos. | 19 |
| **A.6.1d** | CI Gate Valves : 200 NB | Nos. | 9 |
| **A.6.1e** | CI Gate Valves : 150 NB | Nos. | 32 |
| **A.6.1f** | CI Gate Valves : 100 NB | Nos. | 77 |
| **A.6.1g** | CI Gate Valves : 80 NB | Nos. | 16 |

| | | | |
|---|---|---|---|
| **A.6.1h** | CI Gate Valves : 65 NB | Nos. | 7 |
| **A.6.1i** | CI Gate Valves : 50 NB | Nos. | 0 |
| **A.6.1j** | CI Gate Valves : 40 NB | Nos. | 0 |
| **A.6.1k** | CI Gate Valves : 25 NB | Nos. | 0 |
| **A.6.1l** | CI Gate Valve : 200 NB (Motorised) | Nos. | 2 |
| **A.6.2** | **SS Gate Valves** | | |
| **A.6.2a** | SS Gate Valves : 80 NB | Nos. | 6 |
| **A.6.2b** | SS Gate Valves : 65 NB | Nos. | 2 |
| **A.6.3** | **SS Ball Valves** | | |
| **A.6.3a** | SS Ball Valves : 50 NB | Nos. | 2 |
| **A.6.3b** | SS Ball Valves : 40 NB | Nos. | 5 |
| **A.6.3c** | SS Ball Valves : 25 NB | Nos. | 3 |
| **A.6.4** | SS Ball valve 40 NB ( Motorised) | Nos. | 2 |
| **A.6.5** | **Air Release Valve** | Nos. | 22 |
| **A.6.6** | **CI Non-Return Valves** | | |
| **A.6.6a** | CI NRV : 250 NB | Nos. | 4 |
| **A.6.6b** | CI NRV : 200 NB | Nos. | 0 |
| **A.6.6c** | CI NRV : 150 NB | Nos. | 0 |
| **A.6.6d** | CI NRV : 65 NB | Nos. | 3 |
| **A.6.7** | **SS Non-Return Valves** | | |
| **A.6.7a** | SS NRV : 40 NB | Nos. | 2 |
| **A.6.7b** | SS NRV : 25 NB | Nos. | 6 |
| **A.6.8** | **GM Valve** | | |
| **A.6.8a** | GM Gate Valve 40 NB | Nos. | 3 |
| **A.6.8b** | GM Gate Valve 25 NB | Nos. | 61 |
| **A.6.8c** | GM Valve NRV 25 NB | Nos. | 2 |
| **A.6.9** | **Strainers** | | |
| **A.6.9a** | Basket type Strainer : 250 NB | Nos. | 2 |
| **A.6.9b** | Y-type Strainer : 150 NB | Nos. | 4 |
| **A.6.9c** | Y-type Strainer : 100 NB | Nos. | 27 |
| **A.6.9d** | Y-type Strainer : 80 NB | Nos. | 6 |
| **A.7** | **ELECTRICALS AND INSTRUMENTATION** | | |
| **A.7.1** | Starter cum Control Panel | No. | 1 |
| **A.7.2** | Annunciation Panel | No | 2 |
| **A.7.3** | Logic Control Panel | No | 1 |
| **A.7.4** | **Flow Meter** | | |
| **A.7.4a** | Flow Meter 300 NB | No | 1 |
| **A.7.4b** | Flow Meter 100 NB | No | 1 |
| **A.7.5** | **Pressure Gauges** | Nos. | 23 |
| **A.7.6** | **Pressure Switches** | Nos. | 98 |
| **A.7.7** | **Differential Pressure Gauge** | Nos. | 2 |
| **A.7.8** | **Level Transmitter** | Nos. | 4 |
| **A.7.9** | **Pressure Transmitter** | Nos. | 2 |
| **A.7.10** | **Level Switch** | Nos. | 4 |
| **A.7.11** | **Level Gauge** | Nos. | 3 |
| **A.7.12** | **Level Indicator** | Nos. | 2 |
| **A.7.13** | **Solenoid Vaive** | Nos. | 21 |

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|---|---|---|---|
| **A.8** | **DELUGE VALVE AND ACCESSORIES** | | |
| **A.8a** | Deluge Valve with Water Motor Gong and Trim : 150 NB | Nos. | 4 |
| **A.8b** | Deluge Valve with Water Motor Gong and Trim : 100 NB | Nos. | 27 |
| **A.8c** | Deluge Valve with Water Motor Gong and Trim : 80 NB | Nos. | 6 |
| **A.8d** | Nozzles (HVW/MVW) | Lot | 1 |
| **A.8e** | Q.B. Detector | Lot | 1 |
| **A.9** | **Pipes Fittings and Flanges** | Lot | 1 |
| **A.10** | **MISC. & BALANCE ITEMS to complete above system** | Lot | 1 |
| **B** | **FIRE ALARM & DETECTION SYSTEM** | | |
| **B.01** | **Fire Alarm cum Annunciation Panel** | Nos. | 1 |
| **B.02** | **Repeater Panel** | No. | 1 |
| **B.03** | **PC with Printer** | Set | 1 |
| **B.04** | **Multisensor Detectors with Base** | Nos. | 650 |
| **B.05** | **Heat Detectors with Base** | Nos. | 80 |
| **B.06** | **Beam Detectors** | Nos. | 4 |
| **B.07** | **Linear Heat Sensing cable--Digital Type** | Mtr. | 15000 |
| **B.08** | **Linear Heat Sensing cable--Analogue Type** | Mtr. | 600 |
| **B.09** | **Manual Call Points** | | |
| **B.09a** | **Manual Call Points Indoor Type** | Nos. | 80 |
| **B.09b** | **Manual Call Points Outdoor Type** | Nos. | 40 |
| **B.10** | **Electronic Hooters** | Nos. | 70 |
| **B.11** | **Response Indicators** | Nos. | 240 |
| **B.12** | **MI Control Cable** | | |
| **B.12a** | MI Cable 2C X 1.5 mm2 | Mtr. | 15000 |
| **B.12b** | MI Cable 2C X 2.5 mm2 | Mtr. | 8000 |
| **B.13** | **Interface Modules** | Nos. | 180 |
| **B.14** | **Electric Siren** | No. | 1 |
| **B.15** | **LHD Unit** | Nos | 4 |
| **B.16** | **Probe type Heat Detectors** | Nos. | 4 |
| **B.17** | **Balance items to complete the Fire Alarm System** | Lot | 1 |
| **C** | **INERT GAS SYSTEM** | | |
| **C.1** | NN-100 cylinder with valve | Nos. | 74 |
| **C.2** | NN100 system Accessories | LOT | 1 |
| **C.3** | Nitrogen gas (Kg) | Kg | 1700 |
| **C.4** | C.S seamless pipes | LOT | 1 |

## C) AIR-CONDITIONING SYSTEM:

The Air Conditioning System consists of the following Areas :

a) **Central Control Room** :

The AC Plant consists of 3x50% duty water-cooled water chilling unit. Water chilling unit comprises of Reciprocating compressor (open/semi-hermetic), shell and tube type water-cooled condenser and water chiller. The condenser cooling water shall be circulated through these units by means of horizontal centrifugal pump (3 nos. i.e 3 x 50% duty) and FRP cooling towers (3 nos. i.e 3 x 50% duty). The chilled water produced by the chilling units shall be circulated to the Air Handling Units (AHUs) of Control Room, Electronic Equipment Room & Battery Room, located adjacent to the air-conditioned areas, by centrifugal pump sets (3x50% duty). The conditioned air from AHUs is distributed to the air-conditioned areas by galvanised sheet steel ducting. The return air is collected in the space above the false ceiling and led back to the AHU rooms where fresh air is added. Minimum 1 no. AHU would be provided as standby.

**b) Administration & canteen Building :**

The AC Plant consists of 4 sets (3w + 1 s) of water-cooled water chilling unit. Water chilling unit comprises of Reciprocating compressor (open/semi-hermetic), shell and tube type water-cooled condenser and water chiller. The condenser cooling water shall be circulated through these units by means of horizontal centrifugal pump (4 nos. i.e 3w + 1 s)) and FRP cooling towers (4 nos. i.e 3 w + 1 s). The chilled water produced by the chilling units shall be circulated to the Air Handling Units (AHUs) located adjacent to the air-conditioned areas, by centrifugal pump sets (3 w + 1 s). The conditioned air from AHUs is distributed to the air-conditioned areas by galvanised sheet steel ducting. The return air is collected in the space above the false ceiling and led back to the AHU rooms where fresh air is added. For the Administration & Canteen building complex no standby AHU is to be provided.

c) **ESP control rooms** :

2 sets (with each set consisting of 2x100% duty air-cooled split air-conditioners) of Air Cooled Split Air-conditioner (ductable type) would be provided to cater to the air conditioning requirements of the ESP Control Room (one set common for unit – 1 & 2 & other set common for unit – 3 & 4)

d) **Service building** :

Water Cooled Package type AC Plant would be provided to cater to the air conditioning requirements of the offices in different floors of Service Building. AC Plant consists of 3x50% duty Water Cooled Package type AC units. Package AC unit comprises of Reciprocating / Scroll compressor (open/semi-hermetic), shell and tube type water-cooled condenser, DX type chiller, cooling coil & air handling fan. The condenser cooling water shall be circulated through these units by means of horizontal centrifugal pump (3 nos. i.e 3 x 50% duty) and FRP cooling towers (3 nos. i.e 3 x 50% duty). The conditioned air from Package AC is distributed to the air-conditioned areas by galvanised sheet steel ducting. The return air is collected in the space above the false ceiling and led back to the Package AC room where fresh air is added

**e) Other Areas :**

Non-ductable type Split AC units are provided to cater to the air conditioning requirements of the areas Wherever PLC/microprocessor based control room is coming (the same shall be provided with 1x100% duty or 2x50% duty wall mounted split AC based on final layout) and Offices & Stores of the Workshop Building (as applicable).

**f) Ducting :**

The ducting will be supplied in finished Galvanized Steel Sheets ( L- Form ) which will have to be assembled at site complete with hangers ,supports The total quantity of 18G / 20G / 22G / 24 G sheets shall be as per following tentative list of equipment . In addition some material will be supplied in sheets , to be fabricated at site for site changes . Thermal Insulation of supply and return air duct with finish is to be applied. Acoustic Insulation for the first 5 mtr from the AHU is to be applied.

**The tentative list of equipment to be erected against this package is as follow:**

| S. NO. | DESCRIPTION | QTY | UNIT |
|---|---|---|---|
| | | | |
| 2.1.1 | Water chilling package minimum 100TR with reciprocating compressor, motor, control panel, multi drive set, controls and interlocks, water cooled condenser, shell and tube chiller | 3 | Nos |
| 2.1.2 | Double skin type air handling units consisting of chilled water cooling coil, centrifugal blower, TEFC sq. cage motor, drivers set, filters (prefilters, post filter), 3 way motorized mixing valve with thermosatic control and other accessories for 10.5m le | 3 | Nos |
| 2.1.3 | Double skin type air handling units consisting of chilled water cooling coil, centrifugal blower, TEFC Sq. cage induction motor, drive set, filters (pre filter, fine filter), 3 way motorised mixing valve with thermostatic controls and other accessories to | 3 | Nos |
| 2.1.4 | Double skin type air handling units consisting of chilled water cooling coil, centrifugal blower, TEFC Sq. cage induction motor, drive set, filters (pre filter, fine filter), 3 way motorised mixing valve with thermostatic controls and other accessories to | 1 | Nos |
| 2.1.5 | Fibreglass reinforced plastic(FRP) construction cooling towers complete with fan, motor, FRP basin, nozzles, make up water & quick fill water connection, Level switch, drains, piping, valves, strainers, ladder & all accessories specified to meet system re | 3 | Nos |
| 2.1.6 | Centrifugal pump sets for condenser water recirculation complete with TEFC motor & all accessories specified. | 3 | Nos |
| 2.1.7 | Centrifugal pump sets for chilled water recirculation complete with TEFC motor & all accessories specified. | 3 | Nos |
| 2.1.8 | Condenser water piping with necessary fittings, strainers, valves etc. | 1 | Lot |
| 2.1.9 | Chilled water piping complete with valves supports, fittings, strainers, expanded polystyrene insulation with finish. | 1 | Lot |
| 2.1.10 | MS medium class drain piping up to the nearest drain points | 1 | Lot |

| | | | |
|---|---|---|---|
| 2.1.11 | MS medium class drain piping insulated and cladded up to the nearest drain point. | 1 | Lot |
| 2.1.12 | Expansion tank (insulated) for chilled water with all accessories as specified. | 1 | No |
| 2.1.13 | Monsoon reheating/winter heating kit comprising strip heaters, safety controls, air-stat, contactors, frame-work, thermostat & humidistat etc. | 1 | Lot |
| 2.1.14 | Pan type humidifier for AHU room | 1 | Lot |
| 2.1.15 | Fire damper (Motorized) with all accessories as specified. | | |
| 2.1.15.1 | Fire damper with auto resetting, limit switches, indication lamps etc. | 10 | sqm* |
| | | | |
| 2.1.15.2 | Motorized Actuator with single phase power supply for the above Fire damper. | 15 | Nos* |
| | | | |
| 2.1.16 | Finished GSS (grade 275 as per IS-277) ducting, supply & return air (properly cut to sizes in L shape & numbered) complete with hangers/supports, dampers, grilles, diffusers (with & without VCD) etc. | | |
| 2.1.16.1 | 18G | 300 | sqm* |
| 2.1.16.2 | 20G | 300 | sqm* |
| 2.1.16.3 | 22G | 750 | sqm* |
| 2.1.16.4 | 24G | 2000 | sqm* |
| 2.1.16.5 | Supply Air Diffuser with VCD (Al) | 30 | sqm* |
| 2.1.16.6 | Return air diffuser without VCD (Al) | 30 | sqm* |
| 2.1.17 | Finished percent GSS(grade 275 as per IS-277) plain sheets of various sizes. (Refer Note 3 below) | | |
| 2.1.17.1 | 18G | 45 | sqm* |
| 2.1.17.2 | 20G | 45 | sqm* |
| 2.1.17.3 | 22G | 115 | sqm* |
| 2.1.17.4 | 24G | 300 | sqm* |
| 2.1.18 | Acoustic insulation of the first 5M of ducting from AHU outlets. | 1 | Lot |
| 2.1.19 | Thermal insulation of supply air duct with finish. | 3525 | sqm* |
| 2.1.20 | Fresh Air arrangement for Control Building AHUs | 1 | Lot |
| 2.1.21 | Field Instruments like Pressure gauges, Temperature gauges, Temperature & RH sensor etc as specified. | 1 | Lot |
| 2.1.22 | Control-cum-Annunciation panel (solid state type) incorporating all relays, interlocks, window type individual annunciations, push-buttons of all drives, DDC controller for AHU etc. as specified for AC plant for Control Building. | 1 | No |

| | | | |
|---|---|---|---|
| 2.2.1 | Water chilling package minimum 35TR with reciprocating compressor, motor, control panel, multi drive set, controls and interlocks, water cooled condenser, shell and tube chiller | 4 | Nos |
| 2.2.2 | Double skin type air handling units consisting of chilled water cooling coil, centrifugal blower, TEFC Sq. cage induction motor, drive set, filters (pre filter, fine filter), 3 way motorised mixing valve with thermostatic controls and other accessories to meet the AC load of Office Areas at First Floor as specified. | 1 | Nos |
| 2.2.3 | Double skin type air handling units consisting of chilled water cooling coil, centrifugal blower, TEFC Sq. cage induction motor, drive set, filters (pre filter, fine filter), 3 way motorised mixing valve with thermostatic controls and other accessories to meet the AC load of Dining Hall for Canteen as specified. | 1 | Nos |
| 2.2.3 (a) | Double skin type air handling units consisting of chilled water cooling coil, centrifugal blower, TEFC Sq. cage induction motor, drive set, filters (pre filter, fine filter), 3 way motorised mixing valve with thermostatic controls and other accessories to meet the AC load of Second Floor Admin Building as specified. | 1 | Nos |
| 2.2.4 | Fibreglass reinforced plastic (FRP) construction cooling towers complete with fan, motor, FRP basin, nozzles, make up water & quick fill water connection, Level switch, drains, piping, valves, strainers, ladder & all accessories specified to meet system requirement. | 4 | Nos |
| 2.2.5 | Centrifugal pump sets for condenser water recirculation complete with TEFC motor & all accessories specified. | 4 | Nos |
| 2.2.6 | Centrifugal pump sets for chilled water recirculation complete with TEFC motor & all accessories specified. | 4 | Nos |
| 2.2.7 | Condenser water piping with necessary fittings, strainers, valves etc. | 1.25 | Lot |
| | | | |
| 2.2.8 | Chilled water piping complete with valves supports, fittings, strainers, expanded polystyrene insulation with finish. | 1.25 | Lot |
| 2.2.9 | MS medium class drain piping up to the nearest drain points | 1.25 | Lot |
| 2.2.10 | MS medium class drain piping insulated and cladded up to the nearest drain point. | 1.25 | Lot |
| 2.2.11 | Expansion tank (insulated) for chilled water with all accessories as specified. | 1 | No |
| | | | |

| | | | |
|---|---|---|---|
| | | | |
| 2.2.12 | Monsoon reheating/winter heating kit comprising strip heaters, safety controls, air-stat, contactors, frame-work, thermostat & humidistat etc. | 1.25 | Lot |
| 2.2.13 | Pan type humidifier for AHU room | 1.25 | Lot |
| 2.2.14 | Acoustic insulation of the first 5M of ducting from AHU outlets. | 1.25 | Lot |
| 2.2.15 | Fresh air arrangement for Administrative Building AHUs. | 1 | Lot |
| | | | |
| 2.2.16 | Field Instruments like Pressure gauges, Temperature gauges, Temperature & RH sensor etc as specified. | 1 | Lot |
| 2.2.17 | Control-cum-Annunciation panel (solid state type) incorporating all relays, interlocks, window type individual annunciations, push-buttons of all drives, DDC controller for AHU ets. As specified for AC plant for administration cum Canteen Building. | 1.25 | No |
| 2.3.1 | Air cooled split type AC units of 5.0 TR (Ductable) consisting of condensing unit & evaporating unit including refrigerant pipes & fittings with insulation, controls interlocks etc suitable for taking care the AC load of ESP Control Room unit-1 & 2 | 2 | Nos* |
| 2.3.2 | Fresh Air arrangement for above split Acs | 1 | Lot |
| 2.3.3 | Winter heating kit comprising strip heaters, safety controls, air-stat, contactors, frame-work, thermostat etc | 1 | Lot |
| 2.4.1 | Air cooled split type AC units of 5.0 TR (Ductable) consisting of condensing unit & evaporating unit including refrigerant pipes & fittings with insulation, controls interlocks etc suitable for taking care the AC load of ESP Control Room unit-1 & 2 | 2 | Nos* |
| 2.4.2 | Fresh Air arrangement for above split Acs | 1 | Lot |
| | | | |
| 2.4.3 | Winter heating kit comprising strip heaters, safety controls, air-stat, contactors, frame-work, thermostat etc | 1 | Lot |
| 2.5.1 | Water cooled Package AC units consisting of condensing unit, evaporating unit including refrigerant pipes & fittings with insulation, humidifier etc. to suit AC Load of Ground & First floor of the Service Building. (Minimum Capacity- 15 TR (Net) each). | 3 | Nos |
| 2.5.2 | Monsoon reheating/winter heating kit comprising strip heaters, safety controls, air-stat, contactors for heaters, frame-work, thermostat & humidistat etc. | 1 | Lot |

| | | | |
|---|---|---|---|
| 2.5.3 | Fresh Air arrangement for Package AC Room of Service Building. | 1 | Lot |
| | | | |
| 2.5.4 | Fibre glass reinforced plastic(FRP) construction cooling towers complete with fan, motor, FRP basin, nozzles, make up water & quick fill water connection, Level switch, drains, piping, valves, strainers, ladder & all accessories to meet system requirement. | 3 | Nos |
| 2.5.5 | Centrifugal pump sets for condenser water recirculation complete with TEFC motor & all accessories specified. | 3 | Nos |
| 2.5.6 | Condenser water piping with necessary fittings, strainers, valves etc. | 1 | Lot |
| 2.5.7 | MS medium class drain piping up to the nearest drain points | 1 | Lot |
| 2.5.8 | MS medium class drain piping insulated and cladded up to the nearest drain point. | 1 | Lot |
| 2.5.9 | Cooling tower make up tank with level switch, Pr. Switch and other accessories as required. | 1 | Lot |
| 2.5.10 | Acoustic insulation of the first 5M of ducting from AHU outlets. | 1 | Lot |
| 2.5.11 | Control-cum-Annunciation panel (solid state type) incorporating all relays, interlocks, window type individual annunciations, push-buttons of all drives, as specified for AC plant for Service building. | 1 | No |
| 2.6.1 | 7.5 TR capacity (Ductable type) suitable for 3 phase 415 V power supply. | 1 | Nos* |
| 2.6.2 | 5.0 TR capacity (Ductable type) suitable for 3 phase 415 V power supply. | 1 | Nos* |
| 2.6.3 | 3.0 TR capacity (Ductable type) suitable for 3 phase 415 V power supply. | 2 | Nos* |
| 2.6.4 | 3.0 TR capacity (Non-Ductable type) suitable for 1 phase 240 V power supply. | 15 | Nos* |
| 2.6.5 | 1.5 TR capacity (Non-Ductable type) suitable for 1 phase 240 V power supply. | 20 | Nos* |

## D) VENTILATION SYSTEM:

The Ventilation Package consists of the following :

**Air washer Units** : 3 nos. Air Washer of Capacity 1,00,000 CMH each for each unit is being provided, i.e., total 12 nos Air Washers would be provided for the Power Station. The air washer units shall be of Sheet metal type and shall consist of Double skin panels (inside and outside) fabricated using minimum 0.6 mm (24 G) galvanized steel, with 25 mm thick polyurethane insulation of minimum 40 kg/m3 density in between, GSS channels shall be used as reinforcing to give structural strength. Each Air Washer Units

consists of Centrifugal Fan , with Motor , Centrifugal water circulation pumps (2x100 % duty pump for each Air washer unit), dry panel filters , air washer internals , piping , instruments , Control Panel etc.

**Ducting** : The ducting will be supplied in finished Galvanised Steel Sheets ( L-Form ) which will have to be assembled at site complete with hangers ,supports The total quantity of 18G / 20G / 22G / 24 G sheets of appx 5500 SQ MTR . In addition about 800 SQ MTR will be supplied in sheets , to be fabricated at site for site changes . Thermal Insulation of supply and return air duct with finish is to be applied for 1000 SQ MTR

**Roof Extractor Fans** : Axial Flow Roof Extractor units with hood , disconnection switch and all accessories .

**Axial Fan Supply Air** : As per following tentative list of equipment.

**Fire and Gravity Dampers :** As per following tentative list of equipment

**The tentative list of equipment to be erected against this package is as follow:**

| Sl.No. | Description of work | Qty | Unit |
|---|---|---|---|
| 2.1 | Double skin sheet metat type air washer unit with Centrifugal Fan (DIDW) with motor, local control panel, pumps with motors, air washer internals, inlet air louvers, SS filters with back wash arrangement, piping, valves, nozzles, Rigid media pads, level switch,. Temp. indicators, back wash arrangement, galvanised drain piping, pumps etc. as per spec of Capacity 1,00,000 CMH (Each Air Washer has I no Centrifugal Fan of Capacity 1,00,000 CMH at 60 mm SP). | 12 | Nos. |
| 2.1.1 | Centrifugal Fan | 12 | Nos. |
| 2.1.2 | Centrifugal Fan Motor | 12 | Nos. |
| 2.1.3 | Pump | 24 | Nos. |
| 2.1.4 | Pump Motor | 24 | Nos. |
| 2.1.5 | Air Washer Housing with internals | 12 | Nos. |
| 2.1.6 | Cell deck pad | 12 | Nos. |
| 2.1.7 | External piping | 12 | Nos. |
| 2.1.8 | **Valves** | | |
| 2.1.8.1 | CI Butterfly Valve 100 NB | 60 | Nos. |
| 2.1.8.2 | CI Globe Valve 80 NB | 12 | Nos. |
| 2.1.8.3 | CI Globe Valve 80 NB | 12 | Nos. |
| 2.1.8.4 | GM Butterfly Valve 32 NB | 12 | Nos. |
| 2.1.8.5 | GM Gate valve 40 NB | 24 | Nos. |
| 2.1.8.6 | GM Float Valve 25 NB | 12 | Nos. |
| 2.1.8.7 | GM Gate Valve 25 NB | 12 | Nos. |
| 2.1.9 | Air intake louver | 12 | Nos. |
| 2.1.10 | Filter | 12 | Nos. |
| 2.1.11 | Instruments | 12 | Nos. |
| | | | |
| 2.2* | Finished GSS (zinc coating 275 gms / sq.m) Ducting with support structure etc. | | |

| | | | |
|---|---|---|---|
| 2.2.1* | 18 G | 2000 | Sqm.* |
| 2.2.2* | 20 G | 3000 | Sqm.* |
| 2.2.3* | 22 G | 3000 | Sqm.* |
| 2.2.4* | 24 G | 2000 | Sqm.* |
| 2.2.5 | Angle,rods | 30 | MT |
| 2.4* | MS Grilles (Powder coated) with VCD | 140 | Sqm.* |
| 2.5* | MS Grilles (Powder Coated) without VCD | 10 | Sqm.* |
| 2.6* | Wall mounted dampers (gravity operated) for different areas | 30 | Sqm.* |
| 2.7* | Fusible Link type Fire Damper with all accessories as specified. | 25 | Sqm.* |
| 2.8* | Thermal insulation (FRK - Fibre Reinforced Kraft faced blanket insulation rolls with fibre glass insulation material with protective covering) on all ducting exposedto Sun. | 4000 | Sqm.* |
| 2.9* | Roof extractor units (Axial Flow type) with hood, disconnect switch and all accessories as specified. | | |
| 2.9.1* | 30,000 CMH at 15 mm WC | 32 | Nos. |
| 2.9.2* | 20,000 CMH at 15 mm WC | 6 | Nos. |
| 2.10* | Axial Flow Supply Fan with pre filter (Wall mounted) complete with casing. TEFC Squirrel Cage induction motors & mounting frame, MS rain protection cowl, bird screen and all other accessories (suitable for 415V) 3 Phase Supply) | | |
| 2.10.1* | 7500 CMH at 15 mm WC | 10 | Nos. |
| 2.10.1.1 | Pre filter for above | 40 | Nos. |
| 2.10.2* | 6000 CMH 15 mm WC | 6 | Nos. |
| 2.10.2.1 | prefilter above | 12 | Nos. |
| | | | |
| 2.11* | Axial Flow Supply Fan with pre filter (Wall mounted) complete with casing. TEFC Squirrel Cage induction motors & mounting frame, MS rain protection cowl, bird screen and all other accessories (suitable for 415V), 3 Phase Supply) | | |
| 2.11.1* | 10000 CMH at 30 mm WC | 6 | Nos. |
| | Pre filter for above | 36 | Nos. |
| 2.11.2* | 6000 CMH at 30 mm WC | 10 | Nos. |
| | Pre filter for above | 20 | Nos. |
| 2.11.3* | 4000 CMH at 30 mm WC | 6 | Nos. |
| | Pre filter for above | 24 | Nos. |
| 2.12* | Axial flow exhaust fans (Flame proof construction, Wall Mounted)complete with casing, flame proof motors & mounting frame, MS rain protection cowl, bird screenand all other accessories epoxy painted (suitable for 415V/3 Phase Supply) as specified. | | |

| | | | |
|---|---|---|---|
| 2.12.1* | 10000 CMH at 15 mm WC | 4 | Nos. |
| 2.12.2* | 7500 CMH at 15 mm WC | 4 | Nos. |
| 213* | Axial Flow Exhaust Fans (Wall mounted) complete with casing. TEFC Squirrel Cage induction motors & mounting frame, MS rain protection cowl, bird screen and all other accessories (suitable for 415V) 3 Phase Supply) | | |
| 2.13.1* | 6300 CMH at 7 mm WC | 30 | Nos. |
| 2.13.2* | 2000 CMH at 7 mm WC | 6 | Nos. |
| 2.14* | Exhaust Fan (Propeller type) completes with induction motor & mounting frame MS rain protection cowl, bird screen and all other accessories as specified (suitble for 240V/1Phase) | | |
| 2.14.1* | 1200 CMH at 5 mm WC | 10 | Nos. |

## E) COMPRESSED AIR SYSTEM:

Compressed air system includes the following:

a) Three (3) nos. (2 working + 1 standby) Instrument air compressors and two (2) nos. Service air compressor (2 working), including drives, intercoolers, after coolers, step up gearbox, silencer and other accessories.

b) Three (3) nos. (2 working + 1 standby) air-drying plants (ADP) of HOC type (Conventional twin tower desiccant type or Single Rotary Drum type) each suitable for connecting to individual instrument air compressor.

c) Intake air filters.

d) Five (5) nos. air receivers, i.e., one for each compressor near compressor house.

**e)** All interconnecting piping, valves, fittings, supports/hangers, control air tubing (complete with valves and fittings between air receiver, compressor and local panel for each compressor), cooling water piping & valves for safe and satisfactory operation of air compressors.

## F) PRE-TREATMENT PLANT:

Pre Treatment Plant (PTP) shall receive raw water. PTP shall mainly consist of equipment such as aerator, stilling chamber, parshall flume, clarifliers, alum dosing system , polyelctrolyte dosing system, sludge sump and sludge pumps. The stream has one number inlet (regulating) valve to regulate inlet flow entering the aerator. Water from the aerator is fed to stilling chamber where hypochloride from Electro Chlorination plant is dosed. The flow after stilling chamber is passed through parshall flume where alum is dosed with the help of metering pumps in the inlet channel leading to clarifiers to form colloids so that the suspended solids gets settled down

and the effluent has turbidity of less than 10 NTU. The flow after parshall flume gets divided into two streams each leading to a flash mixer followed by a clarifier. Coagulant aid may also be dosed if necessary in the clarifier. The sludge from the clarifiers gets discharged by gravity into a sludge sump from where it is pumped to Effluent Treatment Plant (ETP). For this purpose telescopic type continuous bleed and intermittent bleed through valve on sludge line shall be provided. Motorized operated butterfly valve with isolation valve and its bypass valve shall be provided for bypass the pretreatment plant and connect to the Clarified water storage tank inlet. A chemical house is located near the clarifiers with Alum and polyelectrolyte dosing systems. The solution preparation tanks are on the first floor and space for storage of chemicals on the ground floor. A clarified water overhead tank is provided for preparation of alum and polyelectrolyte solutions as well as for flushing. All civil works related to PT Plant are excluded from the scope of this tender.

**The tentative list of equipment to be erected against this package is as follow:**

| SI.No. | ITEM DESCRIPTION | QTY. | UNIT |
|---|---|---|---|
| **1.0** | **MECHANICAL EQUIPMENTS** | | |
| 1.1 | Clariflocculator | 2 | Nos. |
| 1.2 | Overhead Clarified Tank Filling pumps | 2 | Nos. |
| 1.3 | Sludge Disposal pumps | 2 | Nos. |
| 1.4 | Alum Dosing pumps | 2 | Nos. |
| 1.5 | Poly Electrolyte Dosing pumps | 2 | Nos. |
| 1.6 | NaOH Dosing pumps | 1 | No. |
| 1.7 | Poly Electrolyte Dosing tanks | 2 | Nos. |
| 1.8 | NaOH Dosing tanks | 1 | No. |
| 1.9 | Flash Mixer | 2 | Nos. |
| 1.10 | Alum Agitator | 2 | Nos. |
| 1.11 | Poly Agitator | 2 | Nos. |
| 1.12 | NaOH Agitator | 1 | No. |
| **2.0** | **VALVES** | | |
| **2.1** | **GATE VALVES (GV)** | | |
| 2.1.1 | 15 NB(SS) | 4 | Nos. |
| 2.1.2 | 25 NB (SS) | 5 | Nos. |
| 2.1.3 | 50 NB | 4 | Nos. |
| 2.1.4 | 100 NB | 5 | Nos. |
| 2.1.5 | 125 NB | 3 | Nos. |
| **2.2** | **BUTTER FLY VALVES** | | |
| 2.2.1 | 600 NB | 9 | Nos. |
| 2.2.2 | 600 NB MOTORISED | 2 | Nos. |
| **2.3** | **GLOBLE VALVES (GL)** | | |
| 2.3.1 | 25 NB (SS) | 11 | Nos. |
| **2.4** | **NON-REUTRN VALVE (CHECK VALVE)** | | |

| | | | |
|---|---|---|---|
| 2.4.1 | 15 NB (SS) | 4 | Nos. |
| 2.4.2 | 25 NB (SS) | 2 | Nos. |
| 2.4.3 | 100 NB | 2 | Nos. |
| 2.4.4 | 125 NB | 2 | Nos. |
| **2.5** | **DIAPHRAGM VALVES (DV)** | | |
| 2.5.1 | 15 NB (SS) | 10 | Nos. |
| 2.5.2 | 25 NB (SS) | 11 | Nos. |
| **2.6** | **SLUICE GATE** | | |
| 2.6.1 | RAW WATER CHANNEL | 2 | Nos. |
| 2.6.2 | CLARIFIED WATER CHANNEL | 2 | Nos. |
| 2.6.3 | MAIN CLARIFIED WATER CHANNEL | 2 | Nos. |
| **3.0** | **INSRTUMENTS :** | | |
| 3.1 | PRESSURE INDICATORS | 16 | Nos. |
| 3.2 | FLOW INDICATOR / TOTALIZER | 2 | Nos. |
| 3.3 | LEVEL INDICATOR (REFLEX) | 5 | Nos. |
| 3.4 | LEVEL INDICATOR (FLOAT & DIAL) | 3 | Nos. |
| 3.5 | LEVEL TRANSMITTER (ULTRASONIC) | 2 | Nos. |
| 3.6 | LEVEL SWITCH FLOAT TYPE | 6 | Nos. |
| 3.7 | LEVEL SWITCH CONDUTIVITY | 3 | Nos. |
| **4.0** | **PIPES** | | |
| 4.1 | 15 NB (SS) PIPE (SS 316 ) | 50 | Meters |
| 4.2 | 15 NB (SS) PIPE (SS 316 L ) | 50 | Meters |
| 4.3 | 25 NB (SS) PIPE (SS 316L) | 65 | Meters |
| 4.4 | 100 NB (MS) PIPE | 250 | Meters |
| 4.5 | 100 NB (CI) PIPE (S&S) | 70 | Meters |
| 4.6 | 125 NB (MS) PIPE | 250 | Meters |
| 4.7 | 150 NB (CI) PIPE (S&S) | 170 | Meters |
| 4.8 | 600 NB (MS) PIPE | 120 | Meters |
| 4.9 | 700 NB (MS) PIPE | 50 | Meters |

## G) DM PLANT:

DM plant consists of 3 x 45 $M^3$/hr streams (2 working + 1 under regeneration), each consisting of a Pressure Sand Filter (PSF), Activated Carbon Filter (ACF), Layered Bed Cation Exchanger (LBC), Decarbonator, Layered bed Anion Exchanger (LBA) and Mixed Bed Exchanger (MB). The three streams shall be interconnected as per flow diagram. Re-generation shall be done with Suluphuric acid ($H_2SO_4$) and Sodium Hydroxide (NaOH). Storage facilities for NaOH flakes in sacks and sulphuric acid in plastic containers shall be provided for three months capacity. One common Cation resin flushing tank and one common anion resin-flushing tank shall be provided for all the streams. **All civil works related to DM Plant are excluded from the scope of this tender.**

**The tentative list of equipment to be erected against this package is as follow:**

| Sr | Description | UOM | Qty |
|---|---|---|---|
| **A** | **MECHANICAL** | | |
| a | PRESSURE VESSELS | | |
| a1 | Pressure sand filter For DM | Nos | 3 |
| a2 | Pressure sand filter For Colony Portable Water | Nos | 1 |
| a3 | Pressure sand filter For Plant Portable Water | Nos | 1 |
| a4 | Activated Carbon Filter | Nos | 3 |
| a5 | Activated Carbon Filter For Alkali | Nos | 4 |
| a6 | Floating Bed Anion Exchanger | Nos | 3 |
| a7 | Floating Bed Cation Exchanger | Nos | 3 |
| a8 | Mixed Bed Exchanger | Nos | 3 |
| a9 | Priming Chamber | Nos | 2 |
| **b** | **HORIZONTAL TANKS** | | |
| b1 | Decarbonator Water Storage Tank | Nos | 3 |
| **c** | **VERTICAL TANKS** | | |
| c1 | Cation Resin Flushing Unit | Nos | 1 |
| c2 | Anion Resin Flushing Unit | Nos | 1 |
| c3 | Acid Measuring Tank | Nos | 2 |
| c4 | Caustic Measuring Tank | Nos | 2 |
| c5 | Dilution Water Tank | Nos | 1 |
| c6 | Filter Water Overhead Tank | Nos | 2 |
| **d** | **STORAGE TANKS & ATMOSPHERIC EQUIPMENTS** | | |
| d1 | Decarbonator Tower | Nos | 3 |
| d2 | Decarbonator Tower Packing | m3 | 4.95 |
| **e** | **FILTER MEDIA** | | |
| e1 | Supporting sand for PSF of DM plant | m3 | 0.942 |
| | | m3 | 0.942 |
| e2 | Sand for Pressure sand filter of DM plant | m3 | 6.594 |
| e3 | Supporting sand for PSF for potable water for colony | m3 | 0.45216 |
| | | m3 | 0.45216 |
| e4 | Sand for PSF for potable water for colony | m3 | 1.78 |
| e5 | Supporting sand for PSF for potable water for plant | m3 | 0.25434 |
| | | m3 | 0.25434 |
| e6 | Sand for PSF for Potable water for plant | m3 | 3.16512 |
| e7 | Supporting sand for Activated carbon filter | m3 | 1.038555 |
| | | m3 | 1.038555 |
| e8 | Supporting sand for ACF for Alkali regeneration | m3 | 0.314 |
| | | m3 | 0.314 |
| e9 | Activated carbon for ACF of DM Plant | m3 | 12.36 |
| e10 | Activated carbon for ACF for Alkali regeneration | m3 | 3.77 |
| **f** | **RESINS** | | |
| f1 | Resin for weak acid cation exchanger | Ltr | 3000 |

| | | | |
|---|---|---|---|
| f2 | Resin for strong acid cation exchanger | Ltr | 4050 |
| f3 | Resin for weak base anion exchanger | Ltr | 2850 |
| f4 | Resin for strong base anion exchanger | Ltr | 2850 |
| f5 | Resin for MB strong acid cation exchanger. | Ltr | 1500 |
| f6 | Resin for MB strong base anion exchanger | Ltr | 1500 |
| **g** | **CENTRIFUGAL PUMPS** | | |
| | **VERTICAL** | | |
| g1 | DM Plant feed pumps with motors & canopies | Nos | 3 |
| | **HORIZONTAL** | | |
| g2 | Decarbonator water transfer pump with motors & canopies | Nos | 3 |
| g3 | DM Water Regeneration Pumps with motors & canopies | Nos | 2 |
| g4 | Acid unloading barrel pumps with motors & canopies | Nos | 4 |
| g5 | Neutralized effluent disposal pumps with motors & canopies | Nos | 2 |
| g6 | Potable PSF back wash sump pump with motors & canopies | Nos | 2 |
| g7 | Potable PSF back washed water pump with motors & canopies | Nos | 2 |
| g8 | ACF Alkali Feed pump with motors & canopies | Nos | 2 |
| g9 | Acid Dosing Pump with motors & canopies | Nos | 2 |
| g10 | Caustic Dosing Pump with motors & canopies | Nos | 2 |
| **h** | **AIR BLOWERS / COMPRESSORS** | | |
| h1 | Centrifugal Fan for Decarbonator Tower - CS with motors & canopies | Nos | 6 |
| h2 | Twin Lobe blower for PSF of DM with motors & canopies | Nos | 6 |
| h3 | Twin Lobe blower for PSF of colony potable water with motors & canopies | Nos | 2 |
| h4 | Twin Lobe blower for PSF of plant potable water with motors & canopies | Nos | 2 |
| h5 | Twin Lobe blower for MB with motors & canopies | Nos | 2 |
| **i** | **AGITATORS** | | |
| i1 | Agitator with motor for CMT- Anion Exchanger | Nos | 1 |
| i2 | Agitator with motor for CMT- MB | Nos | 1 |
| **j** | **MISCELLANEOUS** | | |
| j1 | Acid Mixing Tee for FBCE & MB cation | Nos | 2 |
| j2 | Caustic Mixing Tee for FBAE & MB anion | Nos | 2 |
| j3 | Resin / Media traps | Nos | 17 |
| j5 | Fume absorber for Acid storage tank | Nos | 2 |
| j6 | Foundation bolts | Lot | 1 |
| j7 | MISC.- V Notch, Hardware | Lot | 1 |
| j8 | Gaskets, Hardware for piping | Lot | 1 |

| | | | |
|---|---|---|---|
| j9 | Ladder Platform | Lot | 1 |
| j10 | Gates for N-Pit | Nos | 3 |
| j11 | Gates for Potable PSF Backwashed Sump | Nos | 2 |
| j13 | Sight glasses | Nos | 25 |
| j14 | Safety Shower | Nos | 2 |
| j15 | Ejector for Resin transfer | Nos | 2 |
| **k** | **VALVES** | | |
| k1 | Manual Diaphragm valves | Nos | 171 |
| k2 | Auto Diaphragm valves | Nos | 96 |
| k3 | Manual Butterfly valves | Nos | 57 |
| k4 | Auto Butterfly valves | Nos | 60 |
| k5 | Manual Ball valves | Nos | 243 |
| k6 | Auto Ball valves | Nos | 5 |
| k7 | Non return valves | Nos | 41 |
| k8 | Manual Plug Valves | Nos | 20 |
| k9 | Actuated Plug Valves | Nos | 23 |
| k10 | Pressure Relief Valve | Nos | 2 |
| k11 | Butterfly Control valves | Nos | 4 |
| | | | |
| **B.** | **INSTRUMENTATION** | | |
| B1 | Pressure Gauge | Nos. | 49 |
| B2 | Pressure Gauge | Nos. | 34 |
| B5 | Tmp Element | Nos. | 1 |
| B6 | Flow indicators | Nos. | 8 |
| B7 | Flow indicators | Nos. | 5 |
| B8 | Level Gauges | Nos. | 4 |
| B9 | Pressure Switch | Nos. | 4 |
| B10 | Differential Pressure Switch | Nos. | 17 |
| B12 | Level Switch | Nos. | 1 |
| B13 | Flow Element | Nos. | 10 |
| B14 | Flow transmitters | Nos. | 10 |
| B15 | Temperature transmitters | Nos. | 1 |
| B16 | Solenoid valves 3/2 Way | Nos. | 184 |
| B17 | Solenoid valves 2/2 Way | Nos. | 6 |
| B18 | Limit switches | Nos. | 368 |
| B19 | AFR | Nos. | 24 |
| B20 | SM boxes | Nos. | 24 |
| B21 | Junction boxes | Nos. | 5 |
| B22 | Density indicator | Nos. | 4 |
| B23 | Level indicator | Nos. | 5 |
| B24 | Conductivity analysers | Nos. | 6 |
| B26 | pH analysers | Nos. | 2 |
| B27 | Silica analyser | Nos. | 1 |
| B28 | PLC system | Lot | 1 |
| B29 | Inst. Fittings | Lot | 1 |
| B30 | Manifold | Nos. | 32 |

| | | | |
|---|---|---|---|
| B31 | Manifold | Nos. | 87 |
| B32 | Impulse tubing | Mtrs | 275 |
| B33 | Pneumatic tubing | Mtrs | 2895.6 |
| B34 | Air Header | | |
| | | | |
| **C.** | **ELECTRICAL** | | |
| C1 | UPS | No. | 1 |
| C2 | Heater | No. | 2 |
| C3 | Glands & Lugs | Lot | 1 |

## H) ELECTROCHLORINATION PLANT:

To prevent bio-fouling in the condenser, cooling tower and other CW system components, chlorine Dosing System for CW system shall be provided. Similarly to remove organic/micro organisms from water, chlorine Dosing System shall be provided in the Raw Water Pre-Treatment plant. Chlorine dosing is also done in the Potable Water system for disinfection.

**A common electro-chlorination plant is provided as follows:**

a) **Circulating Water (CW) chlorination system:** Chlorination system has been designed for **shock dosing** of Hypochlorite solution (equivalent to 5 ppm chlorine) for half an hour once in shift of 8 hours, at the suction of the working CW pumps of one unit at a time. The dosing shall be done sequentially in the CW pump pits for one unit at a time, from Hypochlorite Storage cum Degassing tank, which stores the generated hypochlorite.

b) **Raw Water (RW) Chlorination system:** Chlorination system for Raw water has been designed for **continuous** dosing of Hypochlorite solution (equivalent to 2 ppm chlorine) from Hypochlorite Storage cum Degassing tank, which stores the generated hypochlorite.

**Potable Water chlorination System:** Chlorination system for Potable water has been designed for **continuous** dosing of Hypochlorite solution (equivalent to 5 ppm chlorine) from Hypochlorite Storage cum Degassing tank, which stores the generated hypochlorite.
**All civil works related to electro-chlorination Plant are excluded from the scope of this tender.**

**The tentative list of equipment to be erected against this package is as follow:**

| SL NO. | PARTICULARS | |
|---|---|---|
| **1.0** | **ELECTROLYTIC GENERATOR (ELECTROLYSER)** | |
| | Number of Electrolyser | 3 Nos. (2W+1S). |
| **2.0** | **CHILLER** | |
| | Purpose | To maintain water inlet to electrolyser in the temperature range of 5 to 20 deg C |

| | | |
|---|---|---|
| | Quantity | 2 Nos. (2x100 %). |
| **3.0** | **SOFTENER** | |
| | Purpose | To maintain hardness in water inlet to electrolyser at about 20 ppm $CaCO_3$ |
| | Quantity | 2 Nos (1W+1Regeneration). |
| | Capacity | 4 m3 /hr. |
| | Brine regeneration Water storage tank | One (1) No. |
| **4.0** | **BRINE PREPARATION TANK** | |
| | Quantity | 1 No. |
| | Capacity | Minimum 48 hours storage |
| **5.0** | **STATIC MIXER** | |
| | Quantity | 2 Nos. (2x100 %). |
| | MOC | PP/equivalent. |
| **6.0** | **TRANSFORMER RECTIFIER** | |
| | Quantity | Two (2) nos. (`1W+1S). |
| | Type | Air cooled/oil cooled. |
| **7.0** | **HYPOCHLORITE STORAGE CUM DEGASSING TANK** | |
| | Quantity | Two (2) nos. |
| | Type | Cylindrical vertical |
| | MOC | FRP/HDPE/ equivalent. |
| **8.0** | **AIR DILUTION BLOWERS** | |
| | Quantity | Two (2) nos. (`1W+1S). |
| | MOC | MS-FRP coating/ equivalent. |
| **9.0** | **BRINE TRANSFER PUMP** | |
| | Quantity | 2 Nos. (1W+1S). |
| | MOC | PP/PVDF/GRP/equivalent. |
| **10.0** | **HYPOCHLORITE DOSING PUMPS** | |
| | Quantity | Six (6) nos. [Two (2X100 %) for CW Treatment, Two (2X100 %) for RW Treatment and Two (2X100 %) for each of Colony and Plant Potable Water Treatment]. |
| **11.0** | **ACID CLEANING TANK FOR ELECTROLYSER** | |
| | Quantity | One (1) No. |
| | Type | Cylindrical vertical |
| | MOC | FRP/HDPE/equivalent. |
| **12.0** | **ACID CLEANING PUMPS FOR ELECTROLYSER** | |
| | Quantity | Two (2) nos. (`1W+1S) |
| **13.0** | **PIPES AND VALVES** | |
| | Quantity | One lot within the skid to complete the system. |
| | Size | As applicable/vendor specific. |
| | MOC | CPVC/equivalent. |
| **14.0** | **CONTROL PANEL** | |
| | Quantity | 1 No. |
| | Type | PLC based. |
| | Protection | IP 55 |
| | Display | Fascia mounted MMI. |
| **15.0** | **SKID** | |
| | Quantity | One no. |
| | Purpose | To accommodate necessary hardware, electrical and instrumentation. |

## I) EFFLUENT TREATMENT PLANT:

Following effluents will be collected /treated in the Effluent treatment plant:

a) Waste Oil from Fuel Oil Handling area.
b) Service water waste, SG area.
c) Service water waste Turbine area.
d) Waste from DM plant N-pit.
e) Boiler blow down.
f) Sludge from PT plant.
g) CW blow down.

The oily waste from fuel oil handling area is treated in TPI separator from where oil is separated and collected manually in drum/bucket. The clear water and sludge from TPI is transferred to CMB and ETP sludge sump respectively.

Service water waste collected through floor drains shall be treated in lamella clarifiers/tube settler. The lamella clarifiers are compact clarification units that remove suspended solids by reducing the travel time of rising water and high surface velocity can be achieved. The clear water and sludge from lamella clarifiers/tube settler is transferred to CMB and ETP sludge sump respectively.

Regeneration waste from neutralization pit (N-pit) in DM Plant area shall be pumped to central monitoring basin (CMB).

Boiler blow down is taken to CMB with the help of Boiler Blow Down Sump Pumps from Boiler Blow Down sump.

The sludge from ETP sludge sump and PT Plant sludge is treated in thickener followed by centrifuge. The treated water from thickener and centrifuge is collected in filtrate water sump and transferred to CMB by using filtrate water pump. The solid waste from centrifuge is collected in Dumpers for disposal.

CW blow down is taken to CMB.

Transfer pump shall be provided in the CMB to transfer the treated water in CMB for agriculture.

One pH meter is connected in pump discharge to check the pH of dischargeable water. In case the water is not suitable for discharge, the same shall be re-circulated into the CMB for correction by dosing

**All civil works related to effluent treatment Plant are excluded from the scope of this tender.**

**The tentative list of equipment to be erected against this package is as follow:**

| Sl. No. | Particulars | |
|---|---|---|
| **1.0** | **TPI** | |
| 1.1 | Numbers | Two (2 x 60%). |
| 1.2 | Capacity (each) | 6 M3/Hr.( Minimum). |

| | | |
|---|---|---|
| 1.3 | Type | Circular / rectangular of R.C.C. / Steel construction & with plate separation zone. |
| **2.0** | **LAMELLA / TUBE SETTLER** | |
| 2.1 | Numbers | Two (2 x 60%) |
| 2.2 | Capacity | 12 M3/Hr.( Each) |
| 2.5 | Angle of inclination | 50 - 80 degree. |
| **3.0** | **THICKENER** | |
| 3.1 | Type | Circular (Center Drive Mechanism). |
| 3.2 | Number of units | 2 nos (2 X 60%). |
| 3.3 | Capacity (each) | 18 Cu.M/Hr. |
| **4.0** | **CENTRIFUGE** | |
| 4.1 | Number | 2 nos (2 X 60%). |
| 4.2 | Type | Variable differential speed control type. |
| 4.3 | Lining material of scrapper bowl | Tiles. |
| 4.4 | Capacity (each) | 6 Cu.M/Hr. |
| **5.0** | **ETP SLUDGE SUMP** | |
| 5.1 | Number | One (1) number. |
| 5.7 | Level switch | Two (2) numbers. |
| **6.0** | **THICKENED SLUDGE SUMP** | |
| 6.1 | Number | One (1) number. |
| 6.4 | Level switch | Two (2) numbers. |
| **7.0** | **FILTRATE WATER SUMP** | |
| 7.1 | Number | Two hours storage capacity. |
| 7.3 | Material | RCC. |
| 7.4 | Level switch | Two (2) numbers. |
| **8.0** | **BOILER BLOW DOWN SUMP** | |
| 8.1 | Number | Two (2) numbers. |
| 8.2 | Capacity (each) | Two hours storage capacity. |
| 8.3 | Material | RCC. |
| 8.4 | Level switch | Two (2) numbers. |
| **9.0** | **COMMON SERVICE WATER WASTE SUMP** | |
| 9.1 | Number | One (1) number. |
| 9.2 | Capacity | Two hours storage capacity. |
| 9.3 | Material | RCC. |
| 9.4 | Level switch | Two (2) numbers. |
| **10.0** | **CENTRAL MONITORING BASIN** | |
| 10.1 | Number | 1 no. |
| 10.2 | No. of Sections | Two |
| 10.3 | Type | Open. Below ground. Top of CMB shall be 300 mm above the graded level. |
| 10.4 | Material of construction | RCC |
| 10.5 | Capacity of each section | One hour storage capacity. |
| 10.7 | pH indicator cum transmitter | Number- One(1) number. |
| **11.0** | **POLYMER DOSING SYSTEM** | |
| 11.1 | For centrifuge | |
| | a) Tank – | Number-Two (2) numbers<br>Capacity- 1 Cu.M. (each).<br>Type – vertical cylindrical.<br>Material- MSRL, IS 2062, Gr. B.<br>Level switch- Two (2) numbers per each tank.<br>Level Indicator (Float & Board type)- One (1) number per each tank. |

| | | |
|---|---|---|
| | b) Pump - | Number-Two (2) numbers (1W+1S)<br>Type – Plunger Type positive displacement pump.<br>Capacity- Capacity shall be suitable so that required dosage can be met with even at 50% stroke.<br>Material- SS-316 (all wetted parts).<br>Pressure indicator (chemical Diaphragm type)- One (1) no in common header. |
| 11.2 | For clarifier and Thickener | |
| | a) Tank – | Number-Two (2) numbers.<br>Capacity- 1 Cu.M. (each).<br>Type – vertical cylindrical.<br>Material- MSRL, IS 2062, Gr. B.<br>Level switch- Two (2) numbers<br>Level Indicator (Float & Board type)- One (1) number per each tank. |
| | b) Pump- | Number-Two (2) numbers (1W+1S).<br>Type – Plunger Type positive displacement pump.<br>Capacity- Capacity shall be suitable so that required dosage can be met with even at 50% stroke.<br>Material- SS-316 (all wetted parts).<br>Pressure indicator (chemical Diaphragm type)- One (1) no in common header. |
| **12.0** | **NaOH DOSING SYSTEM FOR CMB** | |
| | Tank – | Number- One (1) number.<br>Capacity- 1 Cu.M. (each).<br>Type – vertical cylindrical<br>Material- MSRL, IS 2062, Gr. B.<br>Level switch- Two (2) numbers.<br>Level Indicator (Float & Board type)- One (1) number. |
| **13.0** | **$H_2SO_4$ DOSING SYSTEM FOR CMB** | |
| | Tank – | Number- One (1) number.<br>Capacity- 1 Cu.M.<br>Type – vertical cylindrical.<br>Material- MSRL, IS 2062, Gr. B.<br>Level Gauge- One (1) number.<br>Level Indicator (Float & Board type)- One (1) number. |

## J) CW TREATMENT PLANT:

Circulating Water (CW) Chemical Treatment which shall comprise of Scale / Corrosion Inhibitor, Bio-Dispersant and $H_2SO_4$ dosing System.

The Anti-Scalant / Corrosin Inhibitor is dosed in CW forebay to control scaling and corrosion in the system. For this purpose one (1) no. skid mounted Anti-Scalant/Corrosin Inhibitor dosing system for each unit has been provided. The skid (located outdoor under a shed) shall mainly consist of the following equipments:

a) Two (2) Nos. Solution Preparation cum Metering tank with accessories for 24 hours storage capacity.
b) Two (2) Nos. Anti-Scalant/Corrosin Inhibitor Dosing pumps (2x100%, 1W+1S).
c) All necessary piping, valves and fittings etc

The Bio-Dispersant is dosed to control bio growth in the cooling water cycle. For this purpose one (1) no. Skid mounted Bio-dispersant dosing system for each unit has been provided. The skid (located outdoor under a shed) shall mainly consist of the following equipments:

a) Two (2) Nos. Solution Preparation cum Metering tank with accessories for 24 hours storage capacity.
b) Two (2) Nos. Bio-Dispersant Dosing pumps (2x100%, 1W+1S).
c) All necessary piping, valves and fittings etc.

$H_2SO_4$ is dosed to control the pH in the cooling water cycle. For this purpose one (1) no. skid mounted $H_2SO_4$ dosing system has been provided. The $H_2SO_4$ dosing system shall consist of the following:

a) One No. skid (located outdoor under a shed) consisting of two (2) Nos. $H_2SO_4$ Metering tank with accessories for 24 hours storage capacity, Two (2) Nos. $H_2SO_4$ Dosing pumps (2x100%, 1W+1S).
b) Two (2) Nos. Bulk Acid storage tanks.
c) Two (2) Nos. (2x100%, 1W+1S) Acid unloading pumps.
d) All necessary piping, valves and fittings etc

**All civil works related to CW treatment Plant are excluded from the scope of this tender.**

**The tentative list of equipment to be erected against this package is as follow:**

| Sl no. | Description | ANTI-SCALANT /CORROSION INHIBITOR DOSING SYSTEM | BIODISPERSANT DOSING SYSTEM | $H_2SO_4$ DOSING SYSTEM |
|---|---|---|---|---|
| 1.1.0 | Total No. of skids | One (1) | One (1) | One (1) |
| **1.2.0** | **PREPARATION CUM METERING TANK** | | | **METERING TANK** |
| 1.2.1 | No. of tanks per Skid | Two (2) | Two (2) | Two (2) |
| 1.2.2 | Capacity | 750 Liter | 750 Liter | 1000 Liter |
| 1.2.3 | Type | ----------Vertical cylindrical, Dished End. ---------- | | |
| 1.2.4 | Material of the tank | SS-304 | SS-304 | Carbon Steel. |
| 1.2.5 | Thickness | ----------6 mm (including 3 mm corrosion allowance). ---------- | | |
| 1.2.6 | Breather with vent | Provided | Provided | Provided |
| 1.2.7 | Level switch (LS) | Two (2) Nos per Tank. | Two (2) Nos per Tank. | Two (2) Nos per Tank. |
| 1.2.7.1 | Type of LS | ----------Float Displacement type, magnetically operated. ---------- | | |
| 1.2.7.2 | Wetted parts of LS | SS 316 | SS 316 | Alloy-20 |
| 1.2.8 | Level gauge (LG) | One (1) No per Tank. | One (1) No per Tank. | One (1) No per Tank. |
| 1.2.8.1 | Type of LG | Direct mounting tubular type. | Direct mounting tubular type. | Direct mounting tubular type. |
| 1.2.8.2 | Wetted parts of LG | SS 304 | SS 304 | Alloy-20 |
| **1.3.0** | **METERING PUMP** | | | |
| 1.3.1 | Type of pump | ----------Positive displacement (Plunger type)---------- | | |
| 1.3.2 | Mode of control | Manual | Manual | Manual |
| 1.3.3 | No. of pumps motor assembly. | Two (2) nos. (2X100%) | Two (2) nos. (2X100%) | Two (2) nos. (2X100%) |
| 1.3.4 | Capacity (LPH) | 0-30 LPH | 0-30 LPH | 0-50 LPH |
| 1.3.5 | Discharge pressure ($Kg/Cm^2$) | 4 $Kg/Cm^2$ | 4 $Kg/Cm^2$ | 4 $Kg/Cm^2$ |

| | | | | |
|---|---|---|---|---|
| 1.3.6 | All Wetted parts of pumps. | SS-316 | SS-316 | Alloy-20. |
| 1.3.7 | Pressure Gauge (PG) | One (1) No per pump | One (1) No per pump | One (1) No per pump |
| 1.3.7.1 | Type of PG | Chemical seal Diaphragm type. | Chemical seal Diaphragm type. | Chemical seal Diaphragm type. |
| 1.3.7.2 | Wetted parts of PG | SS-316L | SS-316L | Alloy-20. |
| **1.4.0** | **STRAINERS** | | | |
| 1.4.1 | No. of strainers | Two (2X100%) | Two (2X100%) | Two (2X100%) |
| 1.4.2 | Type | 'Y'-Type | 'Y'-Type | 'Y'-Type |
| 1.4.3 | Material of screen | SS 316 | SS 316 | Carbon Steel. |
| 1.4.4 | Mesh Size | 50(BS) | 50(BS) | 50(BS) |
| **1.5.0** | **PIPING** | | | |
| 1.5.1 | Material | SS-316 | SS-316 | SS-316. |
| 1.5.2 | Material Code | ----------ASTM 312 Gr. TP 316 (seamless)------- | | |
| 1.5.3 | Diameter | ----------Main & Drain Pipe-25 NB and Overflow pipe-25 NB-------- | | |
| **1.5.4** | **Pressure Rating** | Class ASA 800 | Class ASA 800 | Class ASA 800 |
| **1.6.0** | **VALVES** | | | |
| 1.6.1 | Body, Cover, Yoke & Trim Material | SS-316, ASA 800 | SS-316, ASA 800 | Cast Iron, ASA 800 |
| **1.7.0** | **Fittings** | **Forged steel to A182 F304, Dimension to ANSI B 16.11 socket weld ends. Pressure rating-ASA 800.** | | |
| **1.7.0** | **Structural steel** | **IS 2062** | **IS 2062** | **IS 2062** |

| **Sl no.** | **Description** | **BULK $H_2SO_4$ STORAGE CUM TRANSFER SYSTEM** |
|---|---|---|
| **2.1.0** | Storage tank | |
| 2.1.1 | No. of tanks per Skid | Two (2) |
| 2.1.2 | Capacity (each) | 15 Cu M. |
| 2.1.3 | Type | Horizontal cylindrical, Dished End. |
| 2.1.4 | Material of the tank | Carbon Steel as per IS 2062. |
| 2.1.5 | Thickness | 6 mm (including 3 mm corrosion allowance). |
| 2.1.6 | Breather with vent | Provided |
| 2.1.7 | Level switch (LS) | Three (3) No per Tank. |
| 2.1.7.1 | Type of LS | Float Displacement type, magnetically operated. |
| 2.1.7.2 | Wetted parts of LS | Alloy-20 |
| 2.1.8 | Level gauge (LG) | Two (2) No per Tank. |
| 2.1.8.1 | Type of LG | Tubular type, direct mounting. |
| 2.1.8.2 | Wetted parts of LG | Alloy-20 |
| **2.2.0** | **UNLOADING PUMP** | |
| 2.2.1 | Type of pump | Horizontal Centrifugal. |
| 2.2.2 | Mode of control | Manual |
| 2.2.3 | No. of pumps motor assembly. | Two (2) nos. (2X100%) |
| 2.2.4 | Capacity (LPH) | 10000 LPH |
| 2.2.5 | Discharge pressure ($Kg/Cm^2$) | 4 $Kg/Cm^2$ |
| 2.2.6 | All Wetted parts of pumps. | Alloy-20. |
| 2.2.7 | Pressure Gauge (PG) | One (1) No per pump |
| 2.2.7.1 | Type of PG | Chemical seal Diaphragm type. |
| 2.2.7.2 | Wetted parts of PG | Alloy-20. |

## K) INDUCED DRAFT COOLING TOWER:

Four numbers of Induced draft cooling towers are envisaged for this project. **All civil works related to IDCTs are excluded from the scope of this tender**. Each IDCT consists of eight cells. Fans (of dia around 10 m) in knocked down condition, Gear box assembly & motors for each fan shall has to be erected per cell. Other major equipments to be erected are hot water pipe, PVC eliminator, PV fills on GRP grids, HW distribution nozzles, 1200 NB B/ F valves (two no. per cell), 500 dia B / F valves (two no. per cells), stair case / handrail, monorail & chain pulley block for lifting screens, mechanical equipment handling facility, Basin fittings like screen (SS 304 mesh on HDG steel), sluice

gate (one per outlet), 150 dia drain valve (one / outlet), 150mm dia spool pieces for drain & overflow connection, sludge pump (1w + 1s per tower).

**The tentative list of equipment to be erected against this package is as follow:**

| Sl No. | Item Description | Qty | Unit |
|---|---|---|---|
| 1 | HST COL ASSY 01-4033-01 | 4 | nos |
| 2 | HST COL TIE ASSY 01-4033-02 HDG | 8 | nos |
| 3 | ST-GA-GL SUPT ASSY 96-2082-3 MS HDG | 32 | nos |
| 4 | COUPLING GUARD 96-2022-15 MS HDG | 32 | nos |
| 5 | LATCH SHAFT 97-1080-6 MS HDG | 36 | nos |
| 6 | LATCH SPACER 97-1080-7 MS HDG | 36 | nos |
| 7 | SHEET 3.15MM 97-1080-8 MS HDG | 108 | nos |
| 8 | GRDR WLDMNT ASSY SR32.2 P91-3068-1 | 32 | nos |
| 9 | MOTOR WLDMNT ASSY 280S/M P79-4143-1 | 32 | nos |
| 10 | HOIST BOOM ASSY P79-457-01 MS HDG | 4 | nos |
| 11 | DOLLY CART ASSY P83-2060-01 MS HDG | 4 | nos |
| 12 | LOL-SWCH SUPT 96-1035-1 MS HDG | 32 | nos |
| 13 | MNTG BRKT VTS MMR-2X P88-1134-3 MS HDG | 32 | nos |
| 14 | DOOR STOP P91-4217-02 MS HDG | 36 | nos |
| 15 | DOOR STOP P91-4217-03 MS HDG | 36 | nos |
| 16 | DOOR STOP P91-4217-08 MS HDG | 36 | nos |
| 17 | D/S GUARD SUPT P95-3136-01 MS HDG | 32 | nos |
| 18 | DRIVE SHAFT GUARD P95-3136-11 MS HDG | 32 | nos |
| 19 | BEAM ISMB200 X 7500 MS SEL | 32 | nos |
| 20 | BEAM ISMB250 X 3500 MS SEL | 4 | nos |
| 21 | TROLLEY STOP 150MM 99-1002-001 HDG | 128 | nos |
| 22 | TROLLEY STOP 180MM 99-1002-002 HDG | 48 | nos |
| 23 | FLAT 6X100MM GI | 1020 | m |
| 24 | GRATING 910X2290 99-3056-08 MS HDG | 4 | nos |
| 25 | GRATING 910X1410 99-3056-09 MS HDG | 4 | nos |
| 26 | GRATING 750X 900 99-3056-12 MS HDG | 4 | nos |
| 27 | SCREEN ASSY 1900X1950 97-4044-474 | 12 | nos |
| 28 | SCREEN ASSY 1900X1950 97-4044-475 | 12 | nos |
| 29 | BEAM ISMB250 X 4500 MS SEL | 8 | nos |
| 30 | GRDR 32.2 RT-15:1 03-4046-2 | 32 | nos |
| 31 | OIL SEAL P7-312-06 | 16 | nos |
| 32 | BUTTERFLY VALVE 500NB P86-4096-01 | 64 | nos |
| 33 | LOW OIL LVL SWITCH ASSY P87-4116-1 | 32 | nos |
| 34 | ANCHOR BOLT M10X 80 96-1002-03 SS316 | 648 | nos |
| 35 | ANCHOR BOLT M24X225 P80-136-203 SS316 | 324 | nos |
| 36 | ANCHOR BOLT M12X200 P80-136-212 SS316 | 64 | nos |
| 37 | ANCHOR BOLT M20X150 P80-136-248 SS316 | 132 | nos |
| 38 | ANCHOR PLATE ASSY P82-134-1 MS HDG | 256 | nos |

| | | | |
|---|---|---|---|
| 39 | ANCHOR PLATE ASSY P82-134-5 MS HDG | 24 | nos |
| 40 | PLATE 6MM 00-1055-001 MS HDG | 1544 | nos |
| 41 | INSERT SUPT PLATE 00-1055-003 MS HDG | 512 | nos |
| 42 | ANGLE 35X 35X 5 P82-190-05 MS HDG | 492 | nos |
| 43 | Y NOZZLE P76-242 PP | 600 | nos |
| 44 | SCREEN GUIDE ASSY P80-115-96 MS HDG | 32 | nos |
| 45 | SCREEN SUPT ASSY P80-116-107 MS HDG | 16 | nos |
| 46 | ANCHOR BOLT M16X200 P80-136-233 SS316 | 32 | nos |
| 47 | OVERFLOW PIPE ASSY P91-1051-47 MS HDG | 8 | nos |
| 48 | DRAIN PIPE ASSY P80-134-02 MS HDG | 8 | nos |
| 49 | DRAIN PIPE ASSY P84-1071-14 MS HDG | 8 | nos |
| 50 | BEND 150NB 90D GI P80-133-01 | 8 | nos |
| 51 | DRAIN PIPE ASSY P80-112-59 MS HDG | 8 | nos |
| 52 | EDGE PROT SPLASH BOX 03-3013-08 MS HDG | 64 | nos |
| 53 | HW PIPE SUPT ASSY P80-140-3 MS HDG | 40 | nos |
| 54 | HW PIPE SUPT ASSY P80-140-18 MS HDG | 72 | nos |
| 55 | HW PIPE SUPT ASSY P80-140-2 MS HDG | 80 | nos |
| 56 | HW PIPE SUPT ASSY P80-140-1 MS HDG | 16 | nos |
| 57 | BEVEL PROTRACTOR HEAD MITUTOYO 180-301 | 4 | nos |
| 58 | WRENCH TORQUE 5-125 LBF-FT | 4 | nos |
| 59 | KIT D/S ALIGNMENT 72-3968-2 | 4 | nos |
| 60 | ANCHOR FASTENER EXPANDED NUT M6 MS EG | 56 | nos |
| 61 | ANCHOR FASTENER EXPANDED NUT M10 MS EG | 556 | nos |
| 62 | ANCHOR FASTENER EXPANDED NUT M12 MS EG | 136 | nos |
| 63 | BOLT HEX HD M 6X 25 SS316 | 76 | nos |
| 64 | SCREW HEX HD. M 6X 35 SS316 | 52 | nos |
| 65 | SPLIT PIN 6X 50 SS316 | 76 | nos |
| 66 | SCREW HEX HD. M10X 30 SS316 | 132 | nos |
| 67 | BOLT HEX HD M10X 40 SS316 | 844 | nos |
| 68 | SCREW HEX HD. M10X 50 SS316 | 556 | nos |
| 69 | SCREW HEX HD. M12X 50 SS316 | 212 | nos |
| 70 | SCREW HEX HD. M12X 60 SS316 | 132 | nos |
| 71 | BOLT HEX HD M16X 65 SS316 | 8 | nos |
| 72 | BOLT HEX HD M16X 75 SS316 | 96 | nos |
| 73 | BOLT HEX HD M20X 90 SS316 | 388 | nos |
| 74 | BOLT HEX HD M20X100 SS316 | 128 | nos |
| 75 | SCREW HEX HD. M20X 75 SS316 | 128 | nos |
| 76 | SCREW HEX HD. M24X 50 SS316 | 260 | nos |
| 77 | BOLT HEX HD M27X 90 SS316 | 1688 | nos |
| 78 | KIT-HUB COVER H/W P90-1084-2 SS316 | 32 | nos |
| 79 | HEX NUT M 6-1.0 IS1364 SS316 | 336 | nos |
| 80 | HEX NUT M10-1.5 IS1364 SS316 | 1632 | nos |
| 81 | HEX NUT M12-1.75 IS1364 SS316 | 280 | nos |
| 82 | HEX NUT M16-2.0 IS1364 SS316 | 140 | nos |

| | | | |
|---|---|---|---|
| 83 | HEX NUT M20-2.5 IS1364 SS316 | 656 | nos |
| 84 | JAM NUT M20 SS316 | 264 | nos |
| 85 | HEX NUT M27-3.0 IS1364 SS316 | 1704 | nos |
| 86 | HEX NUT M24-3.0 IS1364 SS316 | 328 | nos |
| 87 | WASHER SC M6 SS316 | 416 | nos |
| 88 | WASHER SC M10 SS316 | 792 | nos |
| 89 | WASHER SC M12 SS316 | 112 | nos |
| 90 | WASHER SC M16 SS316 | 100 | nos |
| 91 | WASHER SC M20 SS316 | 304 | nos |
| 92 | WASHER LOCK M10 SS316 | 856 | nos |
| 93 | WASHER LOCK M16 SS316 | 100 | nos |
| 94 | WASHER LOCK M20 SS316 | 132 | nos |
| 95 | FLOW DIRECTIONER P86-3007-1 | 64 | nos |
| 96 | RATCHET HOIST 1.5MT X 1.3M LIFT | 4 | nos |
| 97 | TROLLEY TRV PUSH 2.00MT 3.0M ISMB200 | 32 | nos |
| 98 | TROLLEY TRV PUSH 2.00MT 3.0M ISMB250 | 4 | nos |
| 99 | CHAIN PULLEY BLOCK 2.00MT X 3.0M | 4 | nos |
| 100 | CHAIN PULLEY BLOCK 2.00MT X 13.0M | 4 | nos |
| 101 | TROLLEY TRV PUSH 1.00MT 3.0M ISMB250 | 4 | nos |
| 102 | CHAIN PULLEY BLOCK 1.00MT X 5.0M | 4 | nos |
| 103 | ST.ELBOW 25(F)X25(M)NB 90D BSP GI | 36 | nos |
| 104 | UNION 25NB BSP FML MEDIUM GI | 32 | nos |
| 105 | GTV 25NB CI BSP | 32 | nos |
| 106 | PIPE 25NB X 225 BSPTBE MG | 32 | nos |
| 107 | PIPE NIPPLE 25NBX230 MED BSPTBE GI | 64 | nos |
| 108 | PIPE NIPPLE 25NBX305 MED BSPTBE GI | 32 | nos |
| 109 | PIPE 25NB X 4550 MED BSPTBE GI | 32 | nos |
| 110 | PIPE 25NB X 100 MED BSPTBE GI | 32 | nos |
| 111 | PIPE PLUG 25NB GI | 36 | nos |
| 112 | PIPE SOCKET 25NB BSP MED MS HDG | 64 | nos |
| 113 | TEE 25NB BSP GI | 72 | nos |
| 114 | TAPE - TEFLON 12MM WIDE X 3M ROLL | 64 | nos |
| 115 | GSKT 6THK 700OD 510ID RUBBER | 140 | nos |
| 116 | PIPE ERW 25NB MEDIUM IS1239 GI | 260 | m |
| 117 | PIPE ERW 32NB LIGHT IS1239 GI | 4620 | m |
| 118 | PIPE ERW 40NB MEDIUM IS1239 GI | 1696 | m |
| 119 | GSKT 6THK 285OD 175ID RUBBER | 48 | nos |
| 120 | SIGHT GLASS ASSY 74-3688-1 | 32 | nos |
| 121 | FRONT DOOR HANDLE OF MARUTI 800 | 40 | nos |
| 122 | SHIM SET P7-3104-05 SS304 | 32 | nos |
| 123 | SHIM SET P7-3104-14 SS304 | 32 | nos |
| 124 | NAME PLATE P79-331-1 S AL ALLOY | 8 | nos |
| 125 | U BOLT M 6 P80-490-9 SS304 | 128 | nos |
| 126 | HOSE 1INX50IN P87-4090-230 SS316 | 32 | nos |

| | | | |
|---|---|---|---|
| 127 | CASTOR WHEEL SWIVEL TH5/CIW/RB | 8 | nos |
| 128 | CASTOR WHEEL FIXED THR5/CIW/RB | 8 | nos |
| 129 | WASHER 10ID 25OD 5THK NEOP | 276 | nos |
| 130 | SLING 4 LEGGED 0.45MTX 0.6M 00-2033-01 | 4 | nos |
| 131 | SLING 3 LEGGED .65MTX .76M 00-2033-03 | 4 | nos |
| 132 | NAME PLATE 0-19-1 AL ALLOY | 32 | nos |
| 133 | ACCESS DOOR LATCH 01-2040-1 30-GL-PP | 80 | nos |
| 134 | HINGE HOOK 01-2041-1 30-GL-PP | 116 | nos |
| 135 | LATCH LVR SUPT HOOK 01-2042-1 30-GL-PP | 40 | nos |
| 136 | HINGE STRAP 01-2044-1 30-GL-PP | 116 | nos |
| 137 | S.T.NOZZLE 71-3462-039 PP | 57448 | nos |
| 138 | SPACER BLACK 06-4052-1 PP | 297912 | nos |
| 139 | BENCH TIE 80-31132-1 PP | 1E+06 | nos |
| 140 | TURNKEY GRID LOCK 72-4565-3 ACETAL | 155720 | nos |
| 141 | CABLE TIE 100 NYLON | 285080 | nos |
| 142 | PAINT BRUSH 20MM | 4 | nos |
| 143 | OIL - SAE-30 | 1512 | ltr |
| 144 | ADHESIVE - HOLDTITE 50 GM | 36 | nos |
| 145 | OIL - KEROSENE | 32 | ltr |
| 146 | GROMMET 10M HP FAN 78-2647-1 NEOP | 264 | nos |
| 147 | D/S 351 CLII 4530 GB2.3/8 MB75 | 32 | nos |
| 148 | FAN ASSY 10M HP-6-8 '03-4063-2 | 32 | nos |
| 149 | SEAL SHEET 3-3294-1 GRP | 256 | nos |
| 150 | HUB COVER 92.1/4IN 69-9142-1 GRP | 64 | nos |
| 151 | ACCESS DOOR PANEL 97-2129-1 GRP | 36 | nos |
| 152 | ACCESS DOOR PANEL BOT P95-3123-1 GRP | 32 | nos |
| 153 | ACCESS DOOR PANEL TOP P95-3123-2 GRP | 32 | nos |
| 154 | ANGLE 50X 40X 5 P95-3123-7 GRP | 32 | nos |
| 155 | GRID P82-343-17 GRP | 3960 | nos |
| 156 | GRID P82-343-18 GRP | 4900 | nos |
| 157 | GRID P82-343-19 GRP | 16648 | nos |
| 158 | GRID P82-343-20 GRP | 3960 | nos |
| 159 | GRID P82-343-22 GRP | 5880 | nos |
| 160 | EL BLADE IL-146/49 1080 PVC | 27420 | nos |
| 161 | EL BLADE IL-146/49 1235 PVC | 47000 | nos |
| 162 | EL BLADE IL-146/49 1185 PVC | 62680 | nos |
| 163 | EL BLADE IL-146/49 585 PVC | 4040 | nos |
| 164 | SPLASH V-BAR 2100MM 96-3005-214 PVC | 187460 | nos |
| 165 | SPLASH V-BAR 980MM 96-3005-66 PVC | 187460 | nos |
| 166 | SPLASH V-BAR 2590MM 96-3005-78 PVC | 187460 | nos |
| 167 | SPLASH V-BAR 1905MM 96-3005-24 PVC | 93740 | nos |
| 168 | VTS MMR-2X P87-3059-1 | 32 | nos |
| 169 | HW MANIFOLD ASSY X07-2I-0084A/M/01 | 4 | nos |
| 170 | MTR FTM 120.0HP 280M 4P 415V50HZ S | 32 | nos |

| | | | |
|---|---|---|---|
| 171 | SLUICE GATE 1525SQ SF RTS CI | 8 | nos |
| 172 | HDSTK W SPD 2838MM FOR SLGTE 1524SQ | 8 | set |
| 173 | SLUICE VALVE 150NB CI | 8 | nos |
| 174 | HDSTK W SPD 2495MM FOR SLVLV 150NB | 8 | set |
| 175 | TEMPERATURE GAUGE | 8 | nos |
| 176 | PRESSURE GAUGE | 8 | nos |
| 177 | JUNCTON BOX | 4 | nos |
| 178 | 1200NB BUTTERFLY VALVE | 8 | NOS |
| 179 | SUBMERSIBLE PUMP | 8 | NOS |

## L) MISCELLANEOUS TANKS :

Other than the tanks of the Fuel Oil System & Fire Fighting system , the following Steel Tanks are envisaged :

a) Condensate storage tank – 4 no , 350 m3 , appx. 8 m dia , 7 m height :

b) DM water storage tanks – 2 no , 200 m3 , appx 11 m dia , 11 m height

Tanks have to be fabricated at site from the shop fabricated, pre-formed / rolled and painted steel plates. Pre-formed plates (around 150 MT, 8 mm thick plates) and pre-fabricated structure (around 18 Mt) for tanks shall be supplied for further assembly, fabrication & erection of fire water tanks. Erection of tank includes erection of accessories like valves, NaOH breather, seal pot, staircase / handrails etc.

## M) MISCELLANEOUS CRANES & HOISTS :

The following Cranes sent in knocked down condition are to be assembled and erected:

a) 100 / 20 MT EOT Crane - 2 nos : This is a 22.7 M Span Double Girder Crane to be installed in the TG Hall , with DSL Length of 237 m, gantry rail with all the accessories.

b) 30 MT EOT Crane - 1 no. : This is a 10.5 M Span Double Girder Crane to be installed in the CW pump house , with Bay Length of 41.5 m gantry rail with all the accessories

c) One no. of 8 T capacity for Air Compressor Building Single Girder Under Slung Crane of 9.8 m span, 6m lift and 30.0m baylength

d) One no. of 5.0 T capacity for Clarified water pump house Single Girder Under Slung EOT Crane with a span of 5.3m, 27.0m bay length and a lift of 11.0 m

e) One no. of 5.0 T capacity for Raw water pump house (river side) Single girder underslung EOT crane with a span of 5.3m, 12m bay length and a lift of 11m

f) One no. of 5.0 T capacity for Raw water pump house (Plant side) Single girder underslung

g) One no. of 5.0 T capacity Fire Water Pump House Single Girder Under Slung EOT Crane with a span of 6.3m, 25.0m bay length and a lift of 4.0m

h) One no. of 5.0 T capacity for Raw water pump house (river side) Gantry crane with a span of 6.5m, 26.0m bay length and a lift of 14.5m

i) Chain pully block with traveling trolley (1- 2 MT capacity, 5.0 m lift) : 4 nos

## N) WATER SYSTEM PUMPS & MIS. EQUIPMENTS :

Scope of erection of all the pumps & required accessories including platen heat exchangers required for water system is also included in scope of work. Major systems covered are as follows:

- Raw water forwarding pumps at river side pump house.
- Raw water forwarding pumps at plant side pump house
- Clarified water pumps.
- ACW pumps
- DMCW pumps
- Drinking water system

**Scope of erection of piping / valves etc (required for interconnection of these equipment) shall be as per P & I Diagram, Piping layouts & Isometrics. However, same shall be paid as per LP piping erection rate (Item no 3 of rate schedule).**

**The tentative list of equipment to be erected against this package is as follow:**

| I | HORIZONTAL PUMPS (GROUP-I) | | | |
|---|---|---|---|---|
| 1.0 | **ACW PUMPS** | Pump | 8 | nos |
| | | Pump Accessories | 8 | sets |
| | | MOTOR | 8 | nos. |
| 2.0 | **DMCW PUMPS** | Pump | 12 | nos |
| | | Pump Accessories | 12 | sets |
| | | Motor | 12 | nos. |
| 3.0 | **DMCW BOOSTER PUMPS** | Pump | 8 | nos |
| | | Pump Accessories | 8 | sets |
| | | MOTOR | 8 | nos. |
| 4.0 | **BOILER FILL PUMPS** | Pump | 2 | nos |
| | | Pump Accessories | 2 | sets |
| | | MOTOR | 2 | nos. |
| 5.0 | **DM MAKE UP PUMPS** | Pump | 3 | nos |
| | | Pump Accessories | 3 | sets |
| | | MOTOR | 3 | nos. |
| 6.0 | **HOTWELL MAKE UP PUMPS** | Pump | 6 | nos |
| | | Pump Accessories | 6 | sets |
| | | MOTOR | 6 | nos. |
| 7.0 | **FIRE WATER MAKE-UP PUMPS ( VERTICAL )** | Pump | 2 | nos |
| | | Pump Accessories | 2 | sets |
| | | MOTOR | 2 | nos. |

| | | | | |
|---|---|---|---|---|
| **II** | **VERTICAL PUMPS (GROUP-II)** | | | |
| **1.0** | **RAW WATER INTAKE PUMPS** | Pump | 3 | nos |
| | | Pump Accessories | 3 | sets |
| | | MOTOR | 3 | nos. |
| | | Seal/Lubrication water system common | 1 | no. |
| **2.0** | **RAW WATER FORWARDING PUMPS** | Pump | 3 | nos |
| | | Pump Accessories | 3 | sets |
| | | Motor | 3 | nos. |
| | | Seal/Lubrication water system common (if applicable) | 1 | no. |
| **3.0** | **POTABLE WATER PUMPS FOR COLONY** | Pump | 2 | nos |
| | | Pump Accessories | 2 | sets |
| | | MOTOR | 2 | nos. |
| **4.0** | **POTABLE WATER PUMPS FOR PLANT** | Pump | 2 | nos |
| | | Pump Accessories | 2 | sets |
| | | MOTOR | 2 | nos. |
| **5.0** | **HVAC MAKE UP PUMPS** | Pump | 3 | nos |
| | | Pump Accessories | 3 | sets |
| | | MOTOR | 3 | nos. |
| | | | | |
| **6.0** | **CW MAKE UP PUMPS** | Pump | 3 | nos |
| | | Pump Accessories | 3 | sets |
| | | MOTOR | 3 | nos. |
| **7.0** | **APH WASHING PUMPS** | Pump | 2 | nos |
| | | Pump Accessories | 2 | sets |
| | | MOTOR | 2 | nos. |
| **8.0** | **SERVICE WATER PUMPS** | Pump | 2 | nos |
| | | Pump Accessories | 2 | sets |

| | | | | |
|---|---|---|---|---|
| | | MOTOR | 2 | nos. |

## O) WORKSHOP EQUIPMENTS & CHEMICAL LAB EQUIPMENTS :

The workshop equipments like Column drilling machine, radial drilling machine, lathe. Precision lathe, hydraulic press, grinding / shearing machine, power hacksaw, electrically heated annealing furnace, universal milling machine, will be supplied in knocked down condition and will have to be assembled at site under the supervision of the equipment supplier

**NOTE:**

- Above details are only to give a general idea to the contractor to quote the lumpsum price for Item No 1 of rate schedule.
- Above system can regrouped / renamed or any addition / deletion can be made to make system complete. No extra claim shall be entertained on this account.
- Equipment and piping systems indicated above are only major items & does not cover all the equipment / piping system being supplied and are required to be erected / commissioned under this contract. Contractor is however required to erect / commission within the price quoted by them, all connected equipment / system shown in manufacturer's drawings/ other documents which may be necessary for erection completion & overall commissioning of ST / STG sets.

## Annexure – 1-B

**SYSTEM DESCRIPTION / WEIGHT SCHEDULE**
**(PIPING SYSTEMS)**

# AA : TG CYCLE PIPING (APPROXIMATE WEIGHT : 700 MT):

**Major PIPING SYSTEMS are to be erected, tested and commissioned under this specification are given below. Bidders are required to quote rate in per metric ton for entire work as per tender specification for these piping systems as per item no. 2 of rate schedule**

- Lube oil piping
- Control oil piping
- Seal steam system
- Drainage piping
- Spray piping
- Gas system piping
- ACW of generator cooler piping
- CRH piping- to deaerating heater.
- Main condensate suction.
- Main condensate discharge including excess return and minimum re-circulation.
- Condensate supply for CEP sealing, L.P. dosing dilution, spray to LP BP valve / exhaust hood / turbine etc., spray to HP flash box, valve gland sealing.
- Condensate supply from condensate surge tank to CEP sealing and makeup to condenser and valve gland sealing.
- Steam extraction to HPH 5 & 6.
- Steam extraction to deaerator from turbine.
- Steam extraction to LPH –2 & 3.
- Cascading piping between heaters to condenser and to deaerator.
- Drains from GSC, LPH-1 through drain cooler.
- Deaerator overflow and drain
- HP & LP flash box vent and drain.
- Steam from aux. Steam header to turbine sealing system and its drain to flash box.
- Oil piping of central lube oil system.
- Vent pipes from HPH – 5 & 6 to flash box and start up vents.
- Vent pipes from LPH – 1, 2 & 3 to condenser.
- Vent pipe from CEP to condenser.
- Vent pipe from GSC to atmosphere.
- Drain & vents from above piping.
- Condenser hot well drain.
- Turbine wet steam-washing system.

**Indicative weights of some of the major systems are as follow:**

| SL NO | PGMA | DESCRIPTION | WEIGHT (MT) |
|---|---|---|---|
| 1 | 80312 | LPBP VALVE UPSTREAM & DOWNSTREAM | 64 |
| 2 | 80322 | CRH PIPING TO DEAERATING HEATER | 18 |

| | | | |
|---|---|---|---|
| 3 | 80331 | EXTRACTION STEAM TO LP HEATER-2 | 12 |
| 4 | 80332 | EXTRACTION STEAM TO LP HEATER-3 | 6 |
| 5 | 80335 | EXTRACTION STEAM TO DEAERATING HEATER | 11 |
| 6 | 80336 | EXTRACTION STEAM TO HP HEATER NO.1 | 3 |
| 7 | 80337 | EXTRACTION STEAM TO HP HEATER-2 | 2 |
| 8 | 80347 | AUX STEAM TO SJAE - TG SCOPE | 4 |
| 9 | 80349 | AUX STEAM TO GLAND SEALS - TG SCOPE | 2 |
| 10 | 80375 | UNLISTED SV EXHAUSTS - TG SCOPE | 43 |
| 11 | 80381 | HP HEATER VENTS - TG SCOPE | 6 |
| 12 | 80388 | CONDENSER AIR EVACUATION PIPING | 7 |
| 13 | 80400 | CONDENSATE SUCTION | 9 |
| 14 | 80401 | CD FROM PUMP TO LPH1/DC INLET TEE&RECIR | 48 |
| 15 | 80407 | CONDENSATE FOR SEALING OF VACUUM | 50 |
| 16 | 80408 | CONDENSATE DUMP FROM HEADER | 5 |
| 17 | 80411 | CONDENSATE/MAKE-UP TO CONDENSER | 4 |
| 18 | 80442 | GLAND STEAM COOLER DRAINS | 1 |
| 19 | 80443 | LP HEATER-1 TO CONDENSER | 5 |
| 20 | 80444 | LP HEATER-2/3/4/5 DRAINS&DRIP PUMP INCL | 7 |
| 21 | 80446 | DEAERATING HEATER OVER FLOW AND DRAIN | 7 |
| 22 | 80447 | HP HEATER DRAINS | 11 |
| 23 | 80449 | TG CYCLE PIPING DRAINS & VENTS | 177 |
| 24 | 80493 | HP FLASH TANK VENT TO CONDENSER | 6 |
| 25 | 80612 | SERVICE AIR FOR INDIVIDUAL UNITS | 46 |
| 26 | 80616 | INSTRUMENT AIR FOR INDIVIDUAL UNIT | 41 |
| 27 | 80673 | LUBE OIL PIPING SYSTEM | 25 |
| 28 | 80924 | H&S FOR TG CYCLE PIPING | 80 |
| | | **TOTAL** | **700** |

## BB : LP PIPING (APPROXIMATE WEIGHT : 700 MT):

**Major PIPING SYSTEMS are to be erected, tested and commissioned under this specification are given below. Bidders are required to quote rate in per metric ton for entire work as per tender specification for these piping systems as per item no. 3 of rate schedule**

.

- ACW system piping (from ACW pumps to Plate heat Exchangers to ACW cooling tower).
- DM CW piping for GT / GTG auxiliaries. (from ECW tank to DMCW pumps to Plate heat Exchangers to GT / GTG auxiliaries).
- CW piping from RE Joints terminals of condenser including BF Valves & flanges etc
- DM water piping for injection skid, HP / LP dosing system,
- Instrument, plant & service air piping.
- Drains & vents
- Service water piping
- NG Line from gas terminal to Gas conditioning skid.
- NG Line from Gas conditioning skid to GT skid.

**NOTES**

a) All the above systems of piping include the erection of pipes, bends, valves, fittings, impulse piping and including root valves, sampling lines, drains, hangers and supports & other accessories so as to make the systems complete in all respect.

b) Above system of piping can be regrouped / renamed or any addition / deletion in the system can be made in order to make system complete as per requirement. No extra cost shall be entertained on this account.

c) The piping systems mentioned above are only indicative and does not cover all the piping systems to be erected / commissioned. Contractors are however required to erect commission all piping systems shown in drawings & other documents which may be necessary for erection, completion & overall commissioning of Cogeneration plant at the accepted unit rates.

d) The tonnages indicated are tentative only and may vary during execution of work. The contractor is required to erect / commission all piping systems shown in drawings and documents which may be necessary for overall commissioning of ST / STG sets. Payment shall be released on the basis of actual work executed as per final accepted rates.

e) Pipes are supplied in standard commercial lengths without edge preparation.

f) Bidders may note above while quoting / accepting tonnage rates for subject work.

**ANNEXURE-II**

## TERMINAL POINTS

## STEAM TURBINE AND AUXILIARY SYSTEM

| SYSTEMS | TERMINAL POINTS |
|---|---|
| Main Steam | Inlet of ESV (piping upto ESV & from ESV to turbine is excluded from the scope) |
| Hot reheat | Inlet of IV (piping upto IV & from IV to turbine is excluded from the scope) |
| Cold reheat | only CRH NRV excluding both side welding joints |
| LP Bypass | Inlet nozzles of condenser |
| Aux. Steam | Inlet ends of gland seals for inlet of Aux. steam. |
| Feed water | Inlet and outlets of HPH-5 and HPH-6, BFP discharge end and recirculation lines terminal points at feed discharge headers. |
| CW system | Condenser CW inlet / outlet flange and CW pump discharge flange. However erection of RE joints / expansion joints at Condenser / CW pump end & ball collection vessel (COLTS) package) erection is included in the scope of this contract . |

**Note:**

1. All terminal points shall be as shown in BHEL drawings and documents and also depending on site conditions and mutually agreed with BHEL Site engineer. The contractor has to execute the work within the scope of this contract. The terminal points decided by BHEL shall be final and binding on the contractor for deciding the scope of work and effecting payment for the work done.

**ANNEXURE – III**

# EXCLUSIONS

1 All civil works other than dressing and chipping of foundation surfaces, fixing of supports and hangers in trenches, walls.

2 All AC & DC motor starters, switchgears and associated controls center other than those specifically included in this specification.

3 Application of spray insulation for steam turbine and other equipment.

4 Supply of lubricating oil for TG set.

5 Supply of chemicals required for chemical cleaning.

6 Supply of CO2 gases for generator protection.

7 Supply of all shims and gaskets, which go finally as part of equipment.

**ANNEXURE-IV**

## INDICATIVE LIST OF MAJOR T&P TO BE PROVIDED BY CONTRACTOR FOR EXECUTION OF MECHANICAL WORKS FOR MOST DURATION OF THE CONTRACT

| SL NO | EQUIPMENT | QUANTITY |
|---|---|---|
| 1 | CRAWLER CRANE 75 T | 1 NO |
| 2 | MOBILE CRANE 18 / 20 T | 2 NOS. |
| 3 | HYDRA CRANE 8 / 10 T | 2 NOS |
| 4 | TRAILER WITH PULLING UNIT (40 T) | 1 NO |
| 5 | TRAILER WITH PULLING UNIT (10/15 T) | 1 NO |
| 6 | LOW BED TRAILER ( 50 MT ) | @@@ |
| 7 | AIR COMPRESSOR 250 CFM | @@@ |
| 8 | ELECTRIC WINCH 2/3/5 T | @@@ |
| 9 | WELDING SETS WITH ACCESSORIES | @@@ |
| 10 | POWER DRILL MACHINE FOR PLATFORM GRILL & ROOF | 3 NO |
| 11 | MOTORISED HYDRAULIC TEST PUMP | 1 NO |
| 12 | TORQUE TENSION METER / WRENCH | 1 SET |
| 13 | TUBE EXPANDER | 2 NO |
| 14 | HYDRAULIC PIPE BENDING MACHINE FOR BENDING PIPES OF SCH 180UPTO 80 nb | 2 NO |

**NOTE:**

1. The above list specifies only major T&P (may not be complete) to be deployed by the contractor exclusively for Mechanical works and is based on minimum requirement. All additional / other tools and plants including suitable capacity crane, D shackles, slings, rails sleepers hydraulic / mechanical jacks etc which are required for satisfactory & timely completion of work shall also be deployed by the contractor within finally accepted rate / price.

2. Other terms and conditions regarding above items shall be as per clause no 38 (Tools & Plants/IMTE) .

3. @@@ AS PER REQUIREMENT

**ANNEXURE-V**

## INDICATIVE LIST OF MAJOR IMTEs TO BE PROVIDED BY CONTRACTOR FOR EXECUTION OF MECHANICAL WORKS FOR MOST DURATION OF THE CONTRACT

| SL NO | EQUIPMENT | QUANTITY |
|---|---|---|
| 1 | HAND OPERATED MEGGER 500 / 1000 V | As per requirement |
| 2 | TONG TESTER10,20 OR 50 Amp + / - 3 % ACCURACY | As per requirement |
| 3 | DIGITAL MULTIMETER | As per requirement |
| 4 | ANALOGUE MULTIMETER | As per requirement |
| 5 | 6 / 12 POINT TEMPERATURE RECORDER (0 TO 1000 DEGREE C) FOR STRESS RELIEVING INCLUDING THERMOCOUPLES, CABLES ETC | As per requirement |
| 6 | U TUBE MANOMETER 0-2000 MM WATER COLOUM | As per requirement |
| 7 | INCLINED MANOMETER 0-50 MM WATER COLOUM | As per requirement |
| 8 | BOLT TENSION CALIBRATOR | As per requirement |
| 9 | ANEOMETER 0-15 M / SEC | 1 NO |
| 10 | SURFACE PLATE | 1 NO |
| 11 | STRAIGHT EDGE | 1 NO |
| 12 | 5 KV MOTORISED MEGGER | 1 NO |

**NOTES:**

1. The above list specifies only major IMTEs (may not be complete) to be deployed exclusively for Mechanical works by the contractor and is based on minimum requirement. All additional / other IMTEs which are required for satisfactory & timely completion of work shall also be deployed by the contractor within finally accepted rate / price.
2. Contractor must re-ascertain / recheck range and accuracy of each IMTE from BHEL Engineer well in advance before arranging calibration / deployment.
3. Other terms and conditions regarding above items shall be as per clause no. 38 (tools & plants / testing & measuring instruments).

# ANNEXURE-VI

## INDICATIVE LIST OF T & P TO BE ARRANGED BY THE CONTRACTOR FOR ELECTRICAL WORKS

| SL NO | EQUIPMENT | QUANTITY |
|---|---|---|
| 1. | 75 MT Crane | 1 no |
| 2. | 18 / 20 MT Crane | 2 nos |
| 3. | 12 / 15 MT Hydra | 3 nos |
| 4. | 100 T Hydraulic Jacks suitable for handling of Power Transformers | 4 nos |
| 5. | 10,000 litre Oil Tank | 2 no |
| 6. | 6000 LPH Hi- Vacuum Oil Filter Machine suitable for HT Transformers | 1 no |
| 7. | High Vacuum Pump suitable for HT Transformers | 1 no |
| 8. | 1000 LPH Hi- Vacuum Oil Filter Machine suitable for HT Transformers | 1no |
| 9. | MIG / TIG Welding Machine | 3 nos |
| 10. | Welding Transformers | APR |
| 11. | Radiography Setup | APR |
| 12. | Calibrated Torque wrenches for Bus duct / Panel application | 3 nos |
| 13. | Pedestal mounted Drill Machine ( upto 36 mm ) | 3 nos |
| 14. | Pull Lifts & Ratchet hoist | APR |
| 15. | Hydraulic crimping tool | 2 no |
| 16. | Hand crimping tools | Adequate numbers |
| 17. | Electrical Tool Box | Adequate numbers |
| 18. | Cable Drum Winch ( SIZE WISE ) | 3 no |
| 19. | Portable Compressor | 2 nos |
| 20. | Air Compressor for Maxi Gun | 1 no |
| 21. | Special Tools for EHV Cables | set |
| 22. | Brazing Kit | set |
| 23. | Electrical Connectors of various sizes | Adequate numbers. |

**NOTES:**

1. The above list specifies only major T&P (may not be complete) to be deployed exclusively for Electrical works by the contractor and is based on minimum requirement. All additional / other tools and plants including suitable capacity crane, D shackles, slings, rails sleepers hydraulic / mechanical jacks etc which are required for satisfactory & timely completion of work shall also be deployed by the contractor within finally accepted rate / price.

2. Other terms and conditions regarding above items shall be as per clause no 38 (Tools & Plants/IMTE) .

3. APR denote “AS PER REQUIREMENT”

# ANNEXURE-VII

| TENTATIVE LIST OF MAJOR ELECTRICAL TESTING INSTRUMENTS / EQUIPMENT TO BE ARRANGED BY CONTRACTOR AT HIS OWN COST. | | | | |
|---|---|---|---|---|
| **SL. No.** | **DESCRIPTION** | **RANGE** | **ACCURACY** | **QTY** |
| 1. | Motorised Megger 2.5 / 5 kV | | | 3 no |
| 2. | 500 V / 1000V, (Hand operated ) megger | | | 5 no |
| 3. | Transformer Oil Testing Kit (Motor operated) | 0-100 KV | | 1 no |
| 4. | Digital Multimeters | | | 10 no |
| 5. | Primary Injection Kit | | | 1 no |
| 6 | Secondary Injection Kit | | | 1 no |
| 7 | Relay Testing Kit | | | 1 no |
| 8 | Tong Testers | | | Range Wise |
| | HV Test Kit | 0-50 kV | | 1 no |
| 9 | Micro ohm meter with 100Amps DC Source | | | 1 no |
| 10 | Motor checker , TTR | | | 1 no each |
| 11 | KELVIN DOUBLE BRIDGE | | | 1 no |
| 12 | PPM Measuring Kit | | | 1 no |
| 13 | Analog Multimeters | | | 3 no |
| 14 | Single / three phase variac | | | 2 no each |
| 1. | Decade Box / Rheostat | | | Range Wise |
| 2. | Phase Sequence Indicator | | | 3 no |
| 3. | Dead Weight Tester | 0-600Kg/cm2 | LC-0.5Kg/cm2 | 2 no |
| 4. | Comparison test set | 0-4 k g/cm2<br>0-6 Kg/cm2<br>0-10kg/cm2<br>0-25Kg/cm2<br>0-60Kg/cm2<br>0-250 Kg/cm2 | +0.25%Lc-0.25 Kg/cm2 | set |
| 5. | Variable DC regulated supply | 0-30V DC | 0.2% | 1 no |
| 6. | Oil bath with thermostat Stirrer and sub-standard | | | 2 no |

| | | | | |
|---|---|---|---|---|
| | Glass Thermometers in Multiple ranges | 0-300 Degree Cel. | | |
| 7. | Glass U tube mercury mano-meter with standard steel Scale having leveling arrangement | 0-760 mm | | 2 no |
| 8. | mA/mV source with Digital display | 0-200 mA/200mV | | 2 no |

| **NOTES:** | |
|---|---|
| 1 | The above list of testing instruments/equipment required for testing / commissioning ( EXCLUSIVELY to be deployed for Electrical & C&I works) is only for guidance to contractor and not complete. Any other / additional testing instruments / equipment required for timely and satisfactory completion of job will also be arranged by contractor at his own cost. |
| 2 | Contractor must re-ascertain / recheck range and accuracy of each IMTE from BHEL Engineer well in advance before arranging calibration / deployment. |
| 3 | Other terms and conditions regarding above items shall be as per clause no. 38 (tools & plants / testing & measuring instruments). |

**ANNEXURE-VIII**

**CERTIFICATE OF DECLARATION FOR CONFIRMING THE KNOWLEDGE OF SITE CONDITIONS**

We,…… …… Hereby declare and confirm that we have visited the project site under the subject namely, ……and acquired full knowledge and information about the ***site conditions, wage structure, Industrial climate and total work involved***. We further confirm that the above information is true and correct and we will not raise any claim of any nature due to lack of knowledge of site condition.

Tenderers Name and Address

Place: (Signature of the Tenderer with stamp)

Date:

**ANNEXURE-IX**

## NON DISCLOSURE AGREEMENT
## Memorandum of Understanding

BHEL PSNR is committed to Information Security Management System as per Information Security Policy.

M/s……, providing……..service to BHEL PSNR, Noida hereby undertake to comply with the following in line with Information Security Policy of BHEL PSNR;

- To maintain confidentiality of documents & information which shall be used during the execution of the Contract.
- The documents & information shall not be revealed to or shared with third party which shall not be in the business interest of BHEL PSNR.

| | |
|---|---|
| ( ) | ( ) |
| M/s. BHEL, PSNR | M/s…….. |

# ANNEXURE-X

## GENERAL TERMS AND CONDITIONS OF REVERSE AUCTION (RA)

Against this enquiry for the subject item/ system with detailed scope of supply as per our tender specification, BHEL-PSNR, NOIDA may resort to "REVERSE AUCTION PROCEDURE" i.e. **ONLINE BIDDING on INTERNET.**

1. For the proposed reverse auction, technically and commercially acceptable bidders only shall be eligible to participate.
2. BHEL will engage the services of a service provider who will provide all necessary training and assistance before commencement of on line bidding on Internet.
3. BHEL will inform the vendor in writing in case reverse auction, the details of service provider to enable them to contact and get trained.
4. Business rules like event date, time, start price, bid decrement, extensions, etc. also will be communicated through service provider for compliance.
5. Vendors have to fax the compliance form in the prescribed (provided by service provider) before start of Reverse auction. Without this the vendor will not be eligible to participate in the event.
6. BHEL will provide the calculation sheet (e.g.: EXCEL sheet)/ BOQ, as applicable, which will help to arrive at "Total Amount of all the items of the Rate Schedule" as per clause no. 50.1 of the NIT, for each the vendor to enable them to fill-in the price and keep it ready for keying in during the auction.
7. Reverse auction will be conducted on schedule date & time.
8. At the end of reverse auction event, the lowest bidder value will be known on the network.
9. The lowest bidder has to fax the duly signed filled-in prescribed format as provided on case-to-case basis to BHEL through service provider within 24 hours of auction without fail.
10. Any variation between the on-line bid value and signed document will be considered as sabotaging the tender process and will invite disqualification of vender to conduct business with BHEL as per prevailing procedure.
11. In case BHEL decides not to go for Reverse auction procedure for this tender enquiry, the price bids and price impacts, if any already submitted and available with BHEL shall be opened as per BHEL standard practice.

# ANNEXURE -XI

## FORMAT FOR NO DEVIATION CERTIFICATE

**(To be submitted in the bidder's letter head)**

**Bharat Heavy Electricals Limited**
**Power Sector – Northern Region,**
**Plot No. 25 , Sector - 16A ,**
**Distt. Gautam Budh Nagar,**
**NOIDA – 201 301. INDIA**

**Sub.: No Deviation Certificate for the work of "ERECTION, TESTING, COMMISSIONING AND TRIAL OPERATION OF 4 X 125 MW TG SETS & BOP PACKAGES AT KOSTI TPP (4 X 125 MW UNITS) SUDAN".**

TENDER NO. **BHEL: NR: SCT: KOSTI:MEI:646**

Dear Sirs,

With reference to above, this is to confirm that as per tender conditions, we have visited site before submission of our offer and noted the job content & site conditions etc. We also confirm that we have not changed / modified the tender documents as appeared in the website and in case of observance at any stage; it shall be treated as null and void. We hereby confirm that we have not taken any deviation from tender clauses together with other references as enumerated in the above referred NIT and confirm our acceptance to reverse auctioning process and we hereby convey our unqualified acceptance to all terms and conditions as stipulated in the tender and NIT. In the event of observance of any deviation in any part of our offer at a later date whether implicit or explicit, the deviations shall stand null & void.

We confirm to have submitted offer strictly in accordance with tender instructions.

Thanking you,

Yours faithfully,

(Signature, date & seal of authorized
representative of the bidder)

ANNEXURE- XII

## BANK GUARANTEE FOR PAYMENT OF ADVANCE

B.G. No. Date

This deed of Guarantee made this _____day of_____two thousand_____by_____(Bank) hereinafter called the "The Guarantor" (which expression shall unless repugnant to the context or meaning thereof be deemed to include its successors and assigns) in favour of M/S Bharat Heavy Electricals Limited a Company incorporated under the Companies Act, 1956, having its registered office at BHEL House, Siri Fort, New Delhi - 110049 through its unit at Power Sector-Northern Region, Noida, Distt. Gautam Budh Nagar, (U.P.) India, hereinafter called "The Company" (which expression shall unless repugnant to the context or meaning thereof be deemed to include its successors and assigns).

WHEREAS M/s. _____(hereinafter referred to as the Contractor) have entered into a Contract arising out of Letter of Intent no._____dtd_____(hereinafter referred to as "the Contract") for the --< Name of_work >-- with the Company.

AND WHEREAS the Contract inter-alia provides that the Company will pay to the Contractor interest bearing advance of Rs._____ (Rupees_____ only) on certain terms and conditions specified in the Contract subject to the Contractor furnishing a Bank Guarantee for Rs._____ (Rupees_____ only) in favour of the Company.

AND WHEREAS the Company has agreed to accept a Bank Guarantee from a Bank to cover the said advance.

AND WHEREAS the Contractor has approached the Guarantor and in consideration of the arrangement arrived at between the Contractor and the Guarantor, the Guarantor has agreed to give the Guarantee as hereinafter mentioned in favour of the Company.

NOW THIS DEED WITNESSES AS FOLLOWS:-

(1) In consideration of the Company having agreed to advance a sum of Rs._____ (Rupees_____ only) to the Contractor , the Guarantor do hereby guarantee the due recovery by the Company of the said advance with interest thereon as provided according to the terms and conditions of the Contract. If the said Contractor fails to utilise the said advance for the purpose of the Contract and /or the said advance together with interest as aforesaid is not fully recovered by the Company the Guarantor do hereby unconditionally and irrevocably undertake to pay to the Company without demur and merely on a demand, to the extent of the said sum of Rs._____ (Rupees_____ only) any claim made by the Company on them for the loss or damage caused to or suffered by

the Company by reasons of the Company not being able to recover in full the advance with interest as aforesaid.

(2) The decision of the Company whether the Contractor has failed to utilise the said advance or any part thereof for the purpose of the Contract and / or as to the extent of loss or damage caused to or suffered by the Company by reason of the Company not being able to recover in full the said sum of Rs._____ with interest if any shall be final and binding on the Guarantor, irrespective of the fact whether the Contractor admits or denies the default or questions the correctness of any demand made by the Company in any Court Tribunal or Arbitration proceedings or before any other Authority.

(3) The Company shall have the fullest liberty without affecting in any way the liability of the Guarantor under this Guarantee, from time to time to vary any of the terms and conditions of the Contract or extend time of performance by the Contractor or to postpone for any time and from time to time any of the powers exercisable by it against the Contractor and either enforce or forebear from enforcing any of the terms and conditions governing the Contract or securities available to the Company and the Guarantor shall not be released from its liability under these presents by any exercise by the Company of the liberty with reference to the matters aforesaid or by reasons of time being given to the Contractor or any other forbearance, act or commission on the part of the Company or any indulgence by the Company to the Contractor or of any other matter or thing whatsoever which under the law relating to sureties would, but for this provision have the effect of so releasing the Guarantor from its liability under this guarantee.

(4) The Guarantor further agrees that the Guarantee herein contained shall remain in full force and effect during the period till the Company discharges this Guarantee, subject to however, that the Company shall have no claim under this Guarantee after_____ i.e. (the present date of validity of Bank Guarantee unless the date of validity of this Bank Guarantee is further extended from time to time, as the case may be) unless a notice of the claim under this Guarantee has been served on the Guarantor before the expiry of the said period in which case the same shall be enforceable against the Guarantor not withstanding the fact that the same is enforced after the expiry of the said period.

(5) The Guarantor undertakes not to revoke this Guarantee during the period it is in force except with the previous consent of the Company in writing and agrees that any liquidation or winding up or insolvency or dissolution or any change in the constitution of the Contractor or the Guarantor shall not discharge the Guarantor's liability hereunder.

(6) It shall not be necessary for the Company to proceed against the Contractor before proceeding against the Guarantor and the Guarantee herein contained shall be enforceable against them notwithstanding any security which the Company may have obtained or obtain from the Contractor shall at the time when proceedings are taken against the Guarantor hereunder be outstanding or unrealised.

(7) Notwithstanding anything contained herein before, our liability under the Guarantee is restricted to Rs._____(Rupees_____). Our guarantee shall remain inforce until _____, i.e. the present date of validity of Bank Guarantee

unless the date of validity of this Bank Guarantee is further extended from time to time. Unless a claim or demand under this guarantee is made against us on or before----------, we shall be discharged from our liabilities under this Guarantee thereafter.

(8) Any claim or dispute arising under the terms of this documents shall only be enforced or settled in the courts at New Delhi/ Delhi only.

(9) The Guarantor hereby declares that it has power to execute this Guarantee under its Memorandum and Articles of Association and the executant has full powers to do so on its behalf under the Power of Attorney dated_____ (To be incorporated by the Bank) granted to him by the proper authorities of the Guarantor.

IN WITNESS whereof the _____(Bank) has hereunto set and subscribed its hand the day, month and year first, above written.

Signed for and on behalf of the Bank

WITNESSES

1. Name & Address

2. Name & Address

Notes:

1. The above BG shall be executed on the non-judicial stamp papers of adequate value procured in the name of the Bank in the state where the Bank is located.

2. The above BG is required to be sent by the executing bank directly to BHEL at the address where tender is submitted /accepted under sealed cover.

# INTEGRITY PACT

## Between

Bharat Heavy Electricals Ltd. (BHEL), a company registered under the Companies Act 1956 and having its registered office at "BHEL House", Siri Fort, New Delhi – 110049 (India) hereinafter referred to as "The Principal", which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the ONE PART

## and

_____, (description of the party along with address), hereinafter referred to as "The Bidder/ Contractor" which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the OTHER PART

## Preamble

The Principal intends to award, under laid-down organizational procedures, contract/s for _____

_____

_____. The Principal values full compliance with all relevant laws of the land, rules and regulations, and the principles of economic use of resources, and of fairness and transparency in its relations with its Bidder(s)/ Contractor(s).

In order to achieve these goals, the Principal will appoint Independent External Monitor(s), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

## Section 1 – Commitments of the Principal

1.1 The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles:-

1.1.1 No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

1.1.2 The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential / additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.

1.1.3 The Principal will exclude from the process all known prejudiced persons.

1.2 If the Principal obtains information on the conduct of any of its employees which is a penal offence under the Indian Penal Code 1860 and Prevention of Corruption Act 1988 or any other statutory penal enactment, or if there be a substantive suspicion in this regard, the Principal will inform its Vigilance Office and in addition can initiate disciplinary actions.

## Section 2 – Commitments of the Bidder(s)/ Contractor(s)

2.1 The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.

2.1.1 The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to the Principal or to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material, immaterial or any other benefit which he / she is not legally entitled to, in

order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

2.1.2 The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any illegal or undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

2.1.3 The Bidder(s)/ Contractor(s) will not commit any penal offence under the relevant IPC/ PC Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

2.1.4 The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

2.2 The Bidder(s)/ Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

## Section 3 – Disqualification from tender process and exclusion from future contracts

If the Bidder(s)/ Contractor(s), before award or during execution has committed a transgression through a violation of Section 2 above, or acts in any other manner such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidders(s)/ Contractor(s) from the tender process or take action as per the separate “Guidelines for Suspension of Business Dealings with Suppliers/ Contractors” framed by the Principal.

## Section 4 – Compensation for Damages

4.1 If the Principal has disqualified the Bidder(s) from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/ Bid Security.

4.2 If the Principal has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to section 3, the Principal shall be entitled to demand and recover from the Contractor liquidated damages equivalent to 5% of the contract value or the amount equivalent to Security Deposit/Performance Bank Guarantee, whichever is higher.

## Section 5 – Previous Transgression

5.1 The Bidder declares that no previous transgressions occurred in the last 3 years with any other company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.

5.2 If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

## Section 6 – Equal treatment of all Bidders/ Contractors/ Sub-contractors

6.1 The Bidder(s)/ Contractor(s) undertake(s) to demand from his sub-contractors a commitment consistent with this Integrity Pact. This commitment shall be taken only from those sub-contractors whose contract value is more than 20% of Bidder's/ Contractor's contract value with the Principal.

6.2 The Principal will enter into agreements with identical conditions as this one with all Bidders and Contractors.

6.3 The Principal will disqualify from the tender process all bidders who do not sign this pact or violate its provisions.

## Section 7 – Criminal Charges against violating Bidders/ Contractors /Sub-contractors

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the Vigilance Office.

## Section 8 –Independent External Monitor(s)

8.1 The Principal appoints competent and credible Independent External Monitor for this Pact. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.

8.2 The Monitor is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the CMD, BHEL.

8.3 The Bidder(s)/ Contractor(s) accepts that the Monitor has the right to access without restriction to all contract documentation of the Principal including that provided by the Bidder(s)/ Contractor(s). The Bidder(s)/ Contractor(s) will grant the monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his contract documentation. The same is applicable to Sub-contractor(s). The Monitor is under contractual obligation to treat the information and documents of the Bidder(s)/ Contractor(s) / Sub-contractor(s) with confidentiality.

8.4 The Principal will provide to the Monitor sufficient information about all meetings among the parties related to the contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitor the option to participate in such meetings.

8.5 As soon as the Monitor notices, or believes to notice, a violation of this agreement, he will so inform the Management of the Principal and request the Management to discontinue or

take corrective action, or heal the situation, or to take other relevant action. The Monitor can in this regard submit non-binding recommendations. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.

8.6 The Monitor will submit a written report to the CMD, BHEL within 8 to 10 weeks from the date of reference or intimation to him by the Principal and, should the occasion arise, submit proposals for correcting problematic situations.

8.7 The CMD, BHEL shall decide the compensation to be paid to the Monitor and its terms and conditions.

8.8 If the Monitor has reported to the CMD, BHEL, a substantiated suspicion of an offence under relevant IPC / PC Act, and the CMD, BHEL has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Office, the Monitor may also transmit this information directly to the Central Vigilance Commissioner, Government of India.

8.9 The number of Independent External Monitor(s) shall be decided by the CMD, BHEL.

8.10 The word 'Monitor' would include both singular and plural.

## Section 9 – Pact Duration

9.1 This Pact begins when both parties have legally signed it. It expires for the Contractor 12 months after the last payment under the respective contract and for all other Bidders 6 months after the contract has been awarded.

9.2 If any claim is made / lodged during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified as above, unless it is discharged/ determined by the CMD, BHEL.

## Section 10 – Other Provisions

10.1 This agreement is subject to Indian Laws and jurisdiction shall be registered office of the Principal, i.e. New Delhi.

10.2 Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.

10.3 If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.

10.4 Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

10.5 Only those bidders/ contractors who have entered into this agreement with the Principal would be competent to participate in the bidding. In other words, entering into this agreement would be a preliminary qualification.

| | |
|---|---|
| ---------- | ---------- |
| For & On behalf of the Principal | For & On behalf of the Bidder/ Contractor |
| (Office Seal) | (Office Seal) |

Place----------

Date----------

| | |
|---|---|
| Witness: _____ | Witness: _____ |
| (Name & Address) _____ | (Name & Address)_____ |
| _____ | _____ |

**ANNEXURE-XIV**

# RATE SCHEDULE

| Sl. No | DESCRIPTION OF WORK | Unit Rate in USD (In figures and words) | TOTAL VALUE in USD (In figures and words) |
|---|---|---|---|
| 1 | Lump sum price for complete scope of work as per tender specification (for items indicated under Annexure-I-a - Item AA & BB for 4 X 125 MW TG sets including auxiliaries & Balance of Plant system equipments & auxiliaries. (Items as per Item AA & BB of Annexure-1-A). | LUMPSUM | |
| 2. | Lump sum price for complete scope of Electrical and C&I work as detailed in tender Section-IIIB for 4 X 125 MW KTPP. | LUMPSUM | |
| 3 | Rate in Rs. / MT for complete scope of work as per tender specification for piping systems indicated under annexure-1-B Item AA. | | |
| a | Carbon steel piping system (Approx. 600 MT) | | |
| b | Alloy steel piping system (Approx. 50 MT) | | |
| c | Stainless steel piping system (Approx. 50 MT) | | |
| 4 | Rate in Rs. / MT for complete scope of work as per tender specification for piping systems indicated under Annexure- I-B item- BB | | |
| a | Carbon steel piping system (Approx. 600 MT) | | |
| b | Stainless steel piping system (Approx. 100 MT) | | |
| | | | |
| | **TOTAL VALUE** | | |

**NOTES:**

1. The piping system include pipe, insulation (wherever required), bends, fitting etc. to make the system complete in all respect & payment will be released for above items as per applicable rates against rates for Item No 3 & 4 of Rate schedule, as applicable.
2. Evaluation of the bids shall be done based on total price against this rate schedule. However in case of ambiguity between unit rate and total value for Item at Sl No. 3

& 4, Unit rate shall be considered for calculation of total value for evaluation and award of work.

3. The rate shall be entered in figures as well as in words. In case of difference in rates between words and figures, the lesser of the two will be treated as valid rate.
4. In case of omission in quoting any rate, the evaluation will be done considering the highest quoted rate obtained against that item. But the work, if awarded, will be on the lowest quoted rate obtained against that item.
5. Rates against each item shall be quoted in US Dollars (USD) Only.

**(Seal and Signature of Tenderer)**