

TENDER NO. BHEL/NR/SCT/UHL/MATL. HAND. & ETC/576

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## TENDER SPECIFICATION

TENDER NO. BHEL/NR/SCT/UHL/MATL. HAND. & ETC/576

FOR

Material Handling and Erection, Testing & Commissioning of 3X33.3 MW  
UHL Stage III HEP, Chullah, Distt. Mandi, HP

PART I – TECHNICAL BID



भारत हैवी इलेक्ट्रिकल्स लिमिटेड  
**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.

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**Plot No. 25, Sector - 16A ,**

**Distt. Gautam Budh Nagar, NOIDA – 201 301.INDIA**

**Phone: 0120-2515476/ 2416407/ 2515479**

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**Email: sku@bhelnsnr.co.in/ rb@bhelnsnr.co.in**

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### **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 OF TENDER DOCUMENT COMPLETE IN ALL RESPECTS MUST BE SUBMITTED BACK 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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**TENDER NOTICE**

Sealed tenders are invited from the contractors fulfilling qualifying requirements for the “Material Handling and Erection, Testing & Commissioning of 3X33.3 MW UHL Stage III HEP, Chullah, Distt. Mandi, HP.”

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**QUALIFYING REQUIREMENTS:**

“Tenderers who wish to participate should have carried out erection, testing & commissioning work of at least three Hydro Turbine Generator sets of 10 MW or higher rating in the last seven years and also have an average annual financial turnover of minimum of Rs. 170 Lacs during last three years (2004-05, 05-06 and 06-07) or (2005-06, 06-07 and 07-08)”.

**NOTES:**

- (i) The Tender Documents comprise of following;
  - (a) General Conditions of Contract, Special Conditions of Contract, Tender Notice, Project Synopsis etc.
  - (b) Price Bid
  - (c) Annexure A - Billing Break Up
  - (d) Annexure B - Brief description of Turbine and Generator
- (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. Bidder(s) downloading the tender documents from the web site, shall remit Rs. 1,000/- (Rupees One Thousand Only) in the form of crossed demand draft (non-refundable), in favour of BHEL, NOIDA along with their offer
- (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. **upto 04.12.2008** on payment of Rs. 1,000/- (non-refundable) either in cash or by crossed demand draft in favour of BHEL, NOIDA. Request for issue of tender document should clearly indicate Tender No. and work.

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- (iii) Tenders must be submitted to the undersigned **latest by 04.12.2008** before opening of technical bids commences. Technical bids shall **be opened at 15.30 Hrs. on 04.12.2008**.
- (iv) Earnest Money Deposit (EMD): Refundable, Non-interest bearing **EMD of Rs. 2,00,000/-** shall be deposited by Account Payee Pay Order 'OR' Demand Draft in favour of "Bharat Heavy Electricals Limited" payable at Delhi/ NOIDA. 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.
- (v) Tenders not accompanied with Full Earnest Money Deposit, as indicated above, will not be considered.
- (vi) **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
- (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) BHEL reserves the right to accept or reject any or all tenders without assigning any reason whatsoever.
- (ix) BHEL takes no responsibility for any delay/ loss of documents or correspondences sent by courier/ post.
- (x) Purchase Preference will be given to CPSUs as per Govt. Guidelines.

**DGM/ SCP**

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**DOMESTIC NOTICE INVITING TENDER**

**LAST DATE OF SALE : 04.12.2008**  
**DATE OF OPENING : 04.12.2008**

**NIT NO. / NAME OF WORK**

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**Sealed tenders are invited from the contractors fulfilling qualifying requirements for the “Material Handling and Erection, Testing & Commissioning of 3X33.3 MW UHL Stage III HEP, Chullah, Distt. Mandi, HP.”**

**NOTES**

1. Purchase Preference will be given to CPSU as per Govt. Guidelines.
2. Please visit our website at [www.bhel.com](http://www.bhel.com) for details of NIT including Qualifying Requirements.

**DGM/ SCP**

**PROJECT SYNOPSIS**

**3 X 33.3 MW UHL STAGE III HYDRO ELECTRIC PROJECT**

M/s Himachal Pradesh State Electricity Board (HPSEB) has awarded a contract to BHEL for Supply, Transportation, Storage and Material Handling at site, Erection and Commissioning of 3 x 33.3 MW Francis Turbines, Generators, along with auxiliaries on a lumpsum basis.

On the part of BHEL it has to create its own storage, residential and office facility at site. HPSEB has to give leveled and compacted land and BHEL shall have to develop it for construction of Office/ Stores complex.

UHL Stage III HEP is a surface power house. This scheme (Third stage development of river UHL) utilizes tail water of Bassi Power House, Inflows of Neri Khad and Rana Khad having a net head of 264 meters for generation of 100MW POWER.

UHL Stage III HEP is situated in Joginder Nagar Tehsil of District Mandi of Himachal Pradesh. The power house site has been proposed on the right bank of river Beas near village Chullah. The project area lies between longitudes 76 degrees 43 minutes & 10 seconds to 76 degrees, 48 minutes & 10 seconds East to latitudes 31 degrees, 52 minutes & 15 seconds to 31 degrees, 57 minutes & 45 seconds North. Intake works of Project are 8 Kms from Joginder Nagar.

The power house site is approachable by road Chandigarh - Bilaspur - Mandi - Joginder Nagar (NH 21 from Chandigarh - Mandi & NH 20 from Mandi - Pathankot), Baijnath - Kandapatan road or Joginder Nagar - Kandapatan. Baijnath and Joginder Nagar are two small towns connected with Pathankot through NH - 20. Baijnath, Joginder Nagar and Mandi are approximately 40, 75 & 140 Kms from Chullah village. Nearest Airport is Kullu at Bhunter about 60 Kms from Mandi. Regarding Seismicity of project area, as per IS code 1893 of 1972, the project has been placed in zone V.

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**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 specification & Special terms and condition” (Part-I) issued by BHEL 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 and no duplicate copy of same is required.

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.

**3X33.3 MW UHL HEP**

**SPECIAL CONDITIONS OF CONTRACT**

**PART `A`**

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<b>Clause</b>	<b>Description</b>
34.	General
35.	Civil works
36.	Consumables
37.	Tools & Plants/ IMTE's
38.	Supervisory staff & workmen
39.	Materials Management
40.	Material handling and storage
41.	Preservation of components
42.	Cleaning of equipment
43.	Erection
44.	Welding, NDT
45.	Testing, pre-commissioning and post commissioning
46.	Progress reporting
47.	Drawings & documents
48.	Taxes
49.	Extra work
50.	Price Variation
51.	Rate schedule
52.	Instructions to tenderers

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**3X33.3 MW UHL HEP**

**SPECIAL CONDITIONS OF CONTRACT**

**SECTION III-A**

**34.0 GENERAL SCOPE OF WORKS**

- A. Receiving and Unloading of consignments from the Trucks/Trailers arriving from BHEL manufacturing units and its suppliers/vendors.
- B. Proper Stacking and Preservations of all the material.
- C. Keeping records and status of all materials as per BHEL practices. Verification of all the material received by contractor. Prepare shortages/damaged reports, if any.
- D. Transportation of materials from site stores to the powerhouse service bay or the pre assembly area as per site requirement and the instructions of site engineer.
- E. Construction of temporary shelters on some of the special items as per the instruction of the site engineer.
- F. Unloading and stacking of certain items in the service bay/ work area with the help of EOT cranes/ loading arrangement as per the instruction of BHEL engineer.
- G. Proper House keeping and safe working.
- H. Handing over of all the spares to customer at their stores.
- I. Handling and Transportation of scrap from power house to HPSEB stores/ scrap yard as per the instructions of BHEL engineer
- J. Re-conciliation of materials with BHEL and HPSEB.
- K. Erection, Testing, Commissioning and Handing over as per BHEL drawing, contract specifications and as per the instructions of the BHEL engineer.

BHEL has been awarded the work of Design, Manufacture, supply, installation, erection, testing & commissioning of 3 X 33.3 MW UHL HYDRO ELECTRIC POWER PROJECT. The equipment mainly consists of:

- |   |
|---|
| <ul style="list-style-type: none"><li>• <b>Brief Description of Equipment</b></li></ul> |
|---|

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- Embedded Parts including embedded pipelines,
- Stay ring and Spiral Casing
- Francis Turbine & accessories
- Governing System & accessories
- Main Inlet valves (Spherical) & Accessories
- Generator, & Accessories
- Plant and unit auxiliaries of Power House
- Digital Excitation system. & DVR & accessories.
- 11 KV SP Bus Duct including CTs & PTs, LAVT& NG cubicles
- Protection System
- Cooling Water system including Pipings

- Drainage & Dewatering systems including Pipings
- Centralised Grease lubrication system
- Water Sprinkler type Fire fighting system for generator.
- HP compressed air system for Turbine &. HP compressed air system for MIV
- LP compressed air system (synchronous condenser operation)
- 41 MVA three phase generator transformers.
- 500KVA unit aux. transformers (DTT)
- 1000kva Station Aux. Transformers (DTT)
- 6.3 MVA Station Transformer
- Dry type cast resin Excitation transformer.
- Control & Monitoring system
- 24 V DC Battery system
- Cables & cable carrier system, power & control cables including cable trays & accessories.
- Optical fibre cable).
- 132 KV CTs & PTs for switchyard
- EOT crane 120/ 20T.
- Starter Panels for auxilliaries

These materials will be supplied from our manufacturing units located all over the country as well as our vendors located both inland and overseas. The scope of work under this tender consists of taking delivery of the materials from transporters, unloading, shifting to their designated locations, verification & stacking etc. The

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delivery of these materials will mostly be inside the project campus by road transport. However, delivery of some items may also have to be taken from Godowns of transporters.

Approx. weight to be handled under this contract will be around 2,575 MT. Brief description of Turbine and Generator is as per Annexure B. Brief descriptions of different packages with their weights are indicated under Annexure-I. The contractor has to handle whatever actual materials are dispatched for the project irrespective of any variations and payments shall be released for the actual gross tonnage handled for material handling purposes.

Though most of the material is being planned to be made available at site well in time for erection requiring proper handling, verification and storage, however certain items may be delayed, requiring direct delivery at site for erection. In such cases contractor has to unload the material directly in powerhouse/ work place and verification to be carried out, contractor for subject work will be eligible for payment as per item 3 of the rate schedule. Besides above BHEL, entirely at its discretion may get unloaded / handle at any location in the premises of powerhouse, items like Generator stator sectors, shafts, transformers or any other materials at the discretion of BHEL engineer and availability of space in powerhouse.

### **Note:**

**The scope of work consists of material handling of all items dispatched from BHEL Manufacturing units and their vendors as detailed in clause 53.1A, erection of I stage embedment and embedded parts PG 201, erection of II stage embedments & foundation parts PG 202 and subsequent erection, testing of Francis type turbine and generator and auxiliaries as detailed in clause 53.1B. While material handling work is expected to commence immediately, work of erection of I stage embedment and foundation parts PG 201, erection of II stage PG 202 and subsequent erection, testing of Francis type turbine and generator and auxiliaries will be taken up in phases depending on availability of fronts from customer. Bidders are advised to note this and quote accordingly. No additional charges/compensation will be paid by BHEL on this account.**

- 34.1 The intent of this specification is to provide services for execution of project according to most modern and proven techniques and codes. The omission of specific reference to any methods, 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/ Customer from time to time.

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- 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 effected 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 of all types of Skilled labour, Adequately qualified and experienced supervisors, Engineers, Watch and ward as required, Tools & plants, Calibrated IMTE equipment as specified and otherwise required for the work and consumables for storage, material handling, fabrication, erection, testing etc. for the entire scope under this contract.
  - (b) Proper out-turn as per BHEL plan and commitment.
  - (c) Completion of work as per Schedule given by BHEL.
  - (d) Good quality and accurate workmanship for proper performances of equipment to the satisfaction of BHEL/ CUSTOMER.
  - (e) Repair and rectification as per instruction of BHEL engineer.
  - (f) Preservation/ Re-conservation of all components during storage/ erection till handing over.
  - (g) Keeping all the storage and erection areas neat and clean.
  - (h) Documentation and records (Films/ Movies/ Photographs) from embedment to evacuation
- 34.5 The contractor under this contract shall also provide free of cost services of skilled persons for a total period of 300 Man-months exclusively for use by BHEL. This manpower will be required for following services:
- Highly skilled workers (Qualified computer operators) for office and stores work for **50 manmonths**
  - Skilled workers for office, colony, stores, for **100 manmonths**
  - Unskilled workers for office, colony, stores for **150 manmonths**

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Persons so deployed shall have to work in extended hours whenever required. Workmen provided as per the above provisions shall be fully trained and experienced in the nature of work for which they are deployed.

*In case contractor fails to provide above-mentioned manpower as desired by BHEL, the latter shall have the right to hire such services from other agencies at the risk and cost of the contractor. However, if BHEL does not utilize the manmonths as per above provision, fully or partly, recovery at the rate of the prevailing minimum wages at Site for the categories given plus 10% will be made from the final bill of the contractor.*

- 34.6 BHEL-Power Sector Northern Region is ISO 9002-2000 & OHSAS-18001 certified company. Quality of work, to customer's satisfaction and safe working system requirements are the essence of ISO 9002 –2000 & OHSE-18001 certification. The contractor in all respects will organise his work, systems, environment, process control documentation, T&P, inspection, measuring and testing equipment etc as per instructions of BHEL engineer. Contractor have also to comply with the applicable legislation and regulations with regard to their scope of work including health, safety and environment aspects of minimising risks arising from occupational health, safety hazard, controlling pollution and wastages. Besides the above technical clearances from respective statutory bodies for the above shall be obtained by contractor at their cost to meet regulatory/statutory requirements.**

Contractor shall arrange for following provisions of HSE.

- 1.** Contractor has to maintain contact with local hospital having scanning and other ultramodern medical facilities and ambulance services on call required during emergency. The addresses of local hospital shall be prominently displayed.
2. Contractor has to ensure pre employment medical check for all staff and workers.
3. Contractor has to ensure that availability of adequate First Aid facilities with trained nurse at site for emergency purposes. This emergency set up should include but not limited to the following;
  - Male Nurse (in shifts).
  - Oxygen set up
  - Breathing apparatus
  - Eye wash facility
  - Stretcher
  - Trauma blanket
  - Medicines.

- 34.7** In order to meet the environmental concerns it is expected that the contractor shall **plant at least 50 trees and maintain the trees throughout the period of Contract** in the vicinity of the project as per advice of Engineers.

- 34.8 The contractor shall comply with following towards Social Accountability;**

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- (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 not engage Forced/ Bonded Labour and shall abide by abolition of Bonded Labour System (Abolition) Act, 1976.
- (c) The contractor shall maintain Health & safety requirement as stipulated in the Contract and Contract Labour (Regulation & Abolition) Act, 1970.
- (d) The Contractor shall abide by UN convention w.r.t Human Rights and shall be liable for Discrimination/ Corporal punishment for failure in meeting with relevant requirements.
- (e) The Contractor shall abide the requirement of Contract Labour (Regulation & Abolition) Act, 1970 for working hours.
- (f) The Contractor shall abide by the Statutory requirement of Minimum Wages Act 1948, payment of Wages Act 1936.
- (g) The Contractor shall arrange potable drinking water to its employees & workers.

34.9 Tenderer may note that as the place of work is inside the POWER PROJECT and being manned by Security/Safety Force of HPSEB, all necessary system related to entry of men, vehicle & material, safety & security systems, work permit system etc. as applicable will have to be followed by the contractor.

### 35.0 PRILIMINARY & CIVIL WORKS

- 35.1 The contractor shall as a first field activity check all the foundations for the correctness of the same as per the drawings and satisfy himself in all respects such as location of foundations, absence of voids, **levels**, correctness of **bolt holes, pocket levels**, centre lines etc. and all measurements should be recorded and submitted to engineer **for approval** before erection.
- 35.2 Before starting erection job, contractor shall ensure that area connected to his scope of work is sufficiently enclosed against ingress of dust and water and all debris have been cleared of from the floor to a designated area as per instruction of engineer. The contractor shall arrange to get the working area and surroundings cleared daily to ensure the dust free atmosphere **and free from seepage water** for working and shall maintain sufficient labour for general cleaning of work areas. Delay of work on this account will not be acceptable.
- 35.3 The contractor shall cover all opening on floor and put temporary hand railing on all sides of the floor to avoid any accident to the working personnel.
- 35.4 Contractor shall fix up and maintain plates, supports for X & Y axis and elevation at different locations as required for each unit and **transfer the same from bench mark and XY axis given at one point by BHEL's client**. Joint protocol records

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for such benchmarks shall be got signed from BHEL's Engineer, customer's Supervisory and QA Engineer.

- 35.5 Once X-Y axis and elevation are fixed at different floors and protected, marking for other equipment's shall be transferred from these and joint protocol as above shall be got signed for each equipment or as required as per drawings.
- 35.6 All matching surfaces of components shall be well cleaned with cleaning agent and burrs shall be removed by filing and blue matched. Wherever necessary sealing/ lubricating/ anti-sieze 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.
- 35.7 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, at any time during erection, the contractor shall arrange the checking of tools/ equipment/ instruments at his cost.
- 35.8 All the works shall be performed to the lines, grades and elevations indicated on the drawings. The contractor shall be responsible to locate and layout the works. The horizontal & vertical control points established by the engineer shall be used as datum for the works under this contract. Any work done without being properly located may be removed and dismantled by the Engineer at the contractor's expenses if the contractor refuse to do it.
- 35.9 The contractor shall create all the facility at storage site as per the tender scope of work for unloading the equipment, its safekeeping and proper record and well protected. No material should be lying loose any where in the power house as well as stores.
- 35.10 De-watering of the areas/ floors in general will be carried out by M/s HPSEB. However contractor has to take care of general cleanliness in his area of work. For area cleaning within the premises of his work, the cleanliness shall be the total responsibility of contractor. Contractor within his scope of work shall keep the separate gang of workers for cleanliness operations. If the area under the scope is found unclean, BHEL can take measures on its own for cleaning and deduct the amount so spent from the running bills of contractor.
- 35.11 Necessary civil works shall be provided by BHEL client. The dimensions & locations shall be checked by the contractor for their correctness as per drawings. Further, top elevation and axis/ centrelines of all the foundations shall be checked with respect to benchmark etc. During the civil works, contractor shall check for all the block-outs, dimensions as required in their various mechanical drawings for installation of components/ assemblies and help BHEL wherever required for checking. All minor adjustments of foundation level, dressing and chipping of foundation surfaces up to 25 to 50 mm, enlarging the pockets in foundations etc., and repair of same as may be required for the erection of equipment shall be carried out by the contractor within the finally accepted rates.

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- 35.12 Besides above, any 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 scaffoldings etc. or any other temporary supports shall also be the contractor's responsibility. For these works all materials including cement/ steel and required facilities will have to be arranged by contractor at his own cost.
- 35.13 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 as per drawings/ manufacturing unit, the embedded sole plates shall be scraped and checked with Prussian blue to get the required contact with frames at no extra cost to BHEL.
- 35.14 The contractor shall ensure perfect matching of packer plates including 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.
- 35.16 The contractor shall provide his T&P stores for special tools and instruments at a convenient place near to the working area.
- 35.17 All mechanical works of machine related to civil works including foundations, grouting, concreting, erection of chequered plates along with embedment in concrete, grouting of liners, any civil works relating to setting of anchor bolts and foundation bolts including preparation of bolt holes will be in the scope of contractor.
- 35.18 Customer has given land and closed sheds to BHEL near their project office and BHEL shall develop the plot area approx. 2500 Sq. m. fenced from all sides with entrance, closed storage shed and open storage yard. More open area may be provided by Customer subsequently. Both these locations shall be used for storage of materials. Contractor has to take over that area including open area for storage of plant material supplied by various manufacturing units of BHEL. BHEL shall be providing the security arrangement at stores and powerhouse, whereas necessary watch and ward shall be the responsibility of the contractor for the items and equipments under his custody. BHEL shall develop the land one time. Temporary works like soling of land from time to time for upkeep of the storage area shall be the responsibility of the contractor.

### **36.0 CONSUMABLES**

- 36.1 The contractor shall provide within finally accepted price, all consumables like gaskets for temporary work, gland packing, general purpose welding electrodes, filler wires, all gases (for inert, welding & cutting), soldering material, dye penetrants, radiography source, films, chemicals etc and other erection consumables such as tapes, jointing compound, grease, mobil oil, M-seal, Araldite,

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- Parmali wood, petrol, CRC/ other cleaning agents, wooden sleepers, steel required for temporary works such as supports , packing , H&S , shims etc. hardware items, sealing compound required for completion of work. **The welding electrodes required for site welding of major components of turbine like draft tube, staying and spiral casing, inlet & outlet pipes of spiral casing and MIV and any other special consumables which are supplied by manufacturing units along with plant material, shall be issued to contractor for subject work free of cost. Contractor shall maintain proper records for all those consumables.**
- 36.2 All the shims & gaskets which go finally as part of equipment shall be supplied by BHEL free of cost.
- 36.3 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.
- 36.4 It shall be the responsibility of the contractor to obtain prior approval of BHEL, regarding supplies of consumables such as welding electrodes/ filler wires/ gases lubricants etc. before procurement. On receipt of consumables at site these shall be subjected to inspection and approval by BHEL. The contractor shall inform to BHEL all details regarding type of consumable batch No. date of expiry etc. and produce test certificate for each lot/ batch with correlation of batch/ lot no. with respective test certificate. No consumable will be allowed to be used without valid test certificate.
- 36.5. Only special welding electrodes for the Turbine, Spherical valves shall be supplied by BHEL. The contractor shall keep the record of the use for these electrodes. All other electrodes including special electrode if any shall have to be arranged by contractor. In case the electrodes supplied by BHEL are found to be inadequate/ unusable, contractor has to arrange the same from the market as per provisions of clause No. 36.4 within their quoted price for subject work.
- 36.6 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. Storage of all consumables including welding electrodes shall be done as per requirement/ instruction of the Engineer by the contractor at his cost.
- 36.7 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). The decision of Engineer in this regard shall be final and binding on the Contractor.
- 36.8. Special consumables that are supplied by manufacturing units for erection and commissioning purposes will be issued by BHEL as free issue item. However the

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- contractor shall use them to the satisfaction of BHEL Engineer and keep proper records for accountability
- 36.9. All lubricants and chemicals required for pre-commissioning, commissioning and testing, and lubricants for trial runs of the equipment shall be supplied by BHEL/ its 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/ packed and returned to stores.
- 36.10 It shall be responsibility of the contractor to arrange the complete radiography equipment & Dark Room alongwith the required consumables and the U/T equipment for NDT at site. For carrying out these tests for staying & spiral casing and embedded piping, the contractor has to do the work as per drawing requirements with the quoted price.
- 36.11 Filling of oil for flushing, first filling of oil and subsequent change over or topping/ making up for generator, turbine, transformer etc till the unit is fully commissioned and handed over to customer is included in scope of BHEL. The contractor shall not waste any oil during flushing/ filling. Such wastages shall be on the account of contractor. The contractor shall return all the empty drums to BHEL / BHEL's client store at no extra cost. Any loss/ damage to above drums shall be to contractor's account.
- 37.0 TOOLS AND PLANTS/ IMTE's**
- 37.1 T&Ps and IMTEs (Inspection, Measuring & Testing Equipment), provided by BHEL/ Customer to sub-contractor free of hire charges shall be shared by other sub contractors working for BHEL at site and the allotment done by BHEL Engineer shall be final and binding.
- 37.2 Besides the T&Ps and IMTEs being made available to contractor free of hire charges by BHEL/ Customer, all other 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. 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 at the risk and cost of contractor and hire charges as applicable shall be deducted from contractor's bill. Decision of BHEL in this regard shall be final and binding on contractor.
- 37.3 All distribution boards, connecting cables/ welding cables, wire ropes, hoses etc. including temporary air/ water/ electrical connections etc, shall have to be arranged by the contractor at his own cost.
- 37.4 In case of non-availability of the T&Ps to be provided by BHEL due to breakdown, major overhauls, distribution pattern or any other reason, the contractor shall plan/ amend/ alter his activities to meet erection/ commissioning targets in consultation with BHEL.

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- 37.5 The operation of all BHEL's T&P being provided free of hire charges shall be in the scope of the contractor. The contractor shall arrange at his own cost operators, fuel, mobil oil, grease and other consumables/ lubricants etc. for the operation.
- 37.6 The contractor shall engage trained and experienced operators for the operation of BHEL's T&Ps and IMTEs. Their skill/ performance will be checked by BHEL Engineer before they are allowed to operate the same.
- 37.7 The day to day and routine maintenance of BHEL's T&Ps and IMTEs is to be carried out by contractor as per manufacturer's/ BHEL's maintenance schedule at his cost. These shall be maintained in good working condition during the entire period of use. T&Ps and IMTEs in defective/ damaged condition shall be rectified promptly to the full satisfaction of BHEL engineer. Contractor shall maintain records for maintenance of major T&Ps and IMTEs, which shall be made available for Inspection whenever, required. In case of any lapses on the part of the contractor BHEL at its own discretion get the servicing/ repair of equipment done at the risk and cost of the contractor with BHEL overheads.
- 37.8 The contractor shall arrange at his cost all spares needed for upkeep of all T&Ps other than mobile cranes and Hydraulic Test pumps supplied by BHEL. For cranes, repair/ replacement of filter, batteries, self, dynamo shall be the responsibility of the contractor. However, the charges of the replacement of the damaged/ worn out parts of BHEL cranes will be borne by BHEL, provided the damage is not due to the negligence of the contractor. However, if there are breakdowns / damages due to negligence of the contractor, the complete service/ repair charges and cost of all the spares damaged with BHEL overheads shall be to the account of contractor and shall be recovered from his RA bills.
- 37.9 Supervision and labour required for Routine maintenance and attending breakdowns shall be arranged by the contractor at his own cost. Specialist supervision shall be arranged by BHEL as assessed by BHEL Engineer.
- 37.10 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.
- 37.11 In the event of contractor not using and maintaining BHEL T&Ps and IMTEs according to BHEL's instructions, BHEL will have the right to withdraw such item without any notice and no claim in this regard shall be entertained and contractor shall be responsible for delay in execution on this account.
- 37.12 Regular utilisation report of the BHEL T&Ps and IMTEs as per requirement of BHEL shall be furnished by the contractor.
- 37.13 Any loss/ damage to any part of BHEL T&Ps and IMTEs shall be to the contractor's account and any expenditure on these accounts by BHEL will be recovered from the contractor's bill in case the contractor fails to make good the loss.

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- 37.14 It shall be responsibility of the contractor to take delivery of T&Ps and IMTEs from stores or place of use by other contractor at project site, transport the same to site and return the same to BHEL store/ place as intimated by BHEL Engineer in project site in good working conditions after use.
- 37.15 Replacement cost including BHEL overheads in respect of irreparable/ completely damaged/ non return of T&Ps and IMTEs shall be recovered from the contractor's running bills.
- 37.16 The contractor shall return all BHEL T&Ps and IMTEs issued to him in good working condition (as handed over to him) as and when desired by BHEL (on completion or reduction of work load). If return of T&P and IMTE is delayed by contractor, hire charges as applicable shall be levied by BHEL from time, it was requisitioned till the time of actual return. Hire charges shall also be charged on the T&Ps and IMTEs returned in damaged/ un-serviced condition to BHEL till its satisfactory repair. T&Ps & IMTEs returned in damaged/ unserviced condition shall be got repaired by BHEL at its own discretion and entire cost of repair with BHEL overheads shall be recovered from the contractor.
- 37.17 The Contractor shall ensure deployment of serviced and healthy T&Ps including cranes, lifting tackles, wire ropes, Manila ropes, winches and slings, jacks of different sizes & capacity, test pump etc. History card, maintenance and valid fitness certificates of 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. Identification for such T&Ps will be done as per BHEL Engineer's advice.
- 37.18 Contractor shall ensure deployment of reliable and calibrated IMTEs (Inspection, measuring and Test equipment). The IMTEs shall have test/ calibration certificates from authorised/ Govt. 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.
- 37.19 Re-testing/ re-calibration shall also be arranged at regular intervals during the period of use as advised by BHEL Engineer with in 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. Also if any IMTEs not found fit for use, BHEL shall have the right to stop the use of such item and instruct the contractor to deploy proper item and recall i.e. repeat the readings taken by that instrument. Failing which BHEL may deploy IMTEs and re-take the readings at contractor's cost.
- 37.20 BHEL shall have lien on all T&PS, IMTEs & 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.

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No material brought to the Site shall be removed from the Site by the Contractor or his Sub-contractors without the prior written approval of the Engineer.

- 37.21 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.

### **38.0 SUPERVISORY STAFF AND WORKMEN**

- 38.1 The contractor shall deploy all the skilled, semi-skilled and un-skilled workmen and experienced supervisors/ engineers required for all the work under this specification. Only fully trained and competent persons with previous adequate experience on the job shall be deployed. 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 workman of the contractor at any time, if they find him unsuitable and the contractor shall forthwith remove him.
- 38.2 The supervisory staff 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 and in general see that the works are carried out in a safe and proper manner and in co-ordination with other labour and staff deployed directly by BHEL or other contractors of BHEL or BHEL's client / other agency.

**The bidders may note that they have to deploy within the awarded rates following minimum staff having at-least 3 years of working experience at Hydro Electric project powerhouse installation and material handling works for entire period of the contract as per the plan given by the BHEL site incharge.**

- i) Engineers (Degree holders) 2 nos for total 50 manmonths MINIMUM**
- ii) Supervisors (Diploma holders) 3 nos for total 75 manmonths MINIMUM**
- iii) Welding/ NDT Level II inspector 2 nos for total 50 manmonths MINIMUM**
- iv) Safety supervisor 1 nos for total 26 manmonths MINIMUM**

**If the contractor fails to deploy this minimum manmonths (MM), then deduction shall be made from his bills at the rate of Rs 15000/= per MM for (i) above and Rs 10,000/- per MM for (ii), (iii) & (iv) above.**

**The contractor shall specifically mention the deployment of the above persons in the deployment plan so submitted by him along with the tender.**

- 38.3 The work shall be executed under the usual conditions without affecting major power plant construction and in conjunction with numerous other operations at

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- site. The contractor and his personnel shall co-operate with other personnel/contractor, co-ordinating his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.
- 38.4 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 conform to the dimensions and tolerances given in the drawings/ documents/ instructions given by BHEL Engineer from time to time.
- 38.5 The contractor shall deploy the necessary number of qualified/ certified and approved full time electricians at his cost to maintain his temporary electrical installation till the completion of work.
- 38.6 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.
- 38.7 During the course of erection, if the progress is found unsatisfactory or if the target dates fixed from time to time for every mile stones are to be advanced or in the opinion of BHEL if it is found that the skilled workmen like fitters, operators, welders, 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 and recover from the contractor's bills any charges incurred for engaging the additional workmen with overheads.
- 38.8 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 or telephone posts or wire, trees or any other property or to any part of erected components etc., the contractor shall make the same good at his own expense or in default, BHEL may cause the same to be made good by other workmen or by other means and deduct the expenses (of which BHEL's decision is final) from any money due to the contractor.
- 38.9 The monthwise 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. Separate persons shall be identified at site for Quality control and Safety by the contractor as per ISO9002/OHSAS18001 REQUIREMENT.
- 39.0 MATERIAL MANAGEMENT AT STORES & POWERHOUSE**

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39.1 The scope of work mainly involves receipt, unloading from road carriers (Trucks/Trailers etc) of total materials for three units of 33.3 MW of BHEL (like Hydro-turbines, valves, generators, transformers, bus-duct, piping, auxiliaries equipment, C&I, BOP and other miscellaneous materials/ equipment) at site or bringing from road carrier godowns to site stores/ storage yards and shifting from place of unloading (stores developed by BHEL), proper storing, stacking/ restacking of materials/ equipment (in closed store sheds/ open storage yards/ project site), verification of components including opening of cases, re-packing/ stacking and preservation of the same after verification including liasioning with carrier for waiver/ reduction of demurrage, watch and ward, to provide fire fighting equipment including fire extinguishers in closed and open storage yard wherever required. Also transportation of material to erection site as and when required. The contractor is to use equipments (supplied by BHEL or arranged by contractor) like suitable cranes/ trucks/ tractor-trailers and other material handling equipment including all necessary small/ major T&P required for the same for the above work.

The contractor shall maintain record of material such as receipts, issue, return, in Day – Book, ledgers, stock registers and computers, issue gate passes, record of shortages & MDR etc as per BHEL procedures and instructions. The contractor shall also assist BHEL for all correspondence regarding the insurance including preparation of claims.

39.2 Approx. weight to be handled for four units as indicated in **Annexure- I** is of the order of 2570 MT (Approx.). But the contractor required handling whatever actual materials are dispatched for the project irrespective of variations in weight and sizes. Some equipment as per the direction of engineer may be unloaded in powerhouse with the help of EOT crane from the truck/ trailers depending upon the requirement. The bidders are required to take note of above points while quoting.

39.3 **Annexure - I** gives the general idea for tender's information about the weights and dimensions of some major components/ equipment. The weights and dimensions shown are approximate and are liable to vary. No increase in quoted/ accepted rates/ prices should be allowed due to change in weights and dimensions of the equipment/ materials.

39.4 Some consignments mainly small/ parcels may also be received at carriers godown through road at MANDI/VAIJNATH TOWNS. The contractor shall have to handle such consignments also as per rate quoted/ accepted.

39.5 The contractor shall deploy adequate number of supervisors, storekeepers, riggers, carpenter, fitters and other skilled and unskilled workers as per requirement having adequate experience of jobs of similar nature till completion of work.

39.6 Contractor shall provide all necessary preservatives, paints, thinners, rust preventives, grease, lubricants etc. for preservation of components. All tools and tackles and other consumables required for the contractor at his own cost shall

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- also provide preservation of components including supervision. Preservation of components also includes applying preservatives, paints, rust preventives, greasing of threaded portions, repainting of work order Nos./ DU nos./ component codes etc. After preservation wherever necessary, components will be stacked properly as per original stacking for which no additional payment shall be made.
- 39.7 It shall be the responsibility of the contractor to keep in touch with Engineer at site and find out arrival of road consignments. The Contractor shall collect all the lorry waybills from BHEL site office either personally or through an authorised representative. The customer or his authorised representative shall, for the purpose, visit the said office every day and collect available LWB, PWB etc. While collecting the LWB, PWB contractor or his authorised representative will sign the register maintained for the purpose indicating the date and time of collection. The contractor shall keep in touch with carriers and arrange to effect delivery of consignments immediately on their receipts. Delay may cause deterioration of goods apart from attracting demurrage charges. Contractor shall also maintain a register indicating date of LWB, PWB date of collection of the materials from road transport agencies/ lorries and date of stacking them at storage yard of BHEL.
- 39.8 The contractor is required to find out and follow up regularly with carriers regarding arrival of consignments even prior to the receipt of GR, if any, and take delivery of the same on 'INDEMNITY BOND'. Indemnity bonds would be executed by BHEL when the Contractor furnishes intimation regarding arrival of consignment.
- 39.9 It is possible that in certain cases, LWBs, PWB may not be received in time but BHEL may receive Photostat copies of the same, it is, therefore, the responsibility of contractor to collect such Photostat copies while furnishing indemnity bond from BHEL authorities at site.
- 39.10 Payment of all demurrages/ wharfages that results due to contractor's faults would be the responsibility of contractor and to his account. If BHEL have to make payment of demurrage/ wharfage together with freight, the amount so paid as demurrage/ wharfage for the reasons stated above shall be paid by the contractor forthwith or would be recovered from bills of the contractor.
- 39.11 In any case contractor will pursue with concerned Carrier authorities at all level (local/ HQ etc) for waiver/ reduction to the minimum of such demurrage /wharfage charges. Whenever such demurrages/ wharfages become payable due to reasons not attributable to contractor, contractor will immediately bring it to the notice of BHEL with specific request to bear such charges. The decision of the Engineer in such case will be final and binding on the contractor.
- 39.12 The contractor has to ensure the unloading and removal of materials from unloading place within the permitted time and ensure to keep the area free and avoid jamming. Any loss to BHEL on this account shall be recovered from the contractor.

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- 39.13 Any discrepancy/ shortage/ damage found in the consignment after taking delivery from the carriers after giving clear receipt would be the responsibility of the contractor and the amount liable to be lost by BHEL on such accounts is recoverable from the contractor.
- 39.14 In case of apparent damages/ shortages in consignments/ packing noticed by the contractor, such cases shall be brought to the notice of BHEL and cleared only with their consent/ approval. The contractor shall provide all the necessary assistance to BHEL for lodging the insurance claim and all correspondence with the insurer, surveyor and transport agency. The contractor shall also help in maintaining all the records in connection of insurance claims.
- 39.15 It would be responsibility of the contractor to examine the packages, consignments etc. on arrival and bring to the notice of carriers and BHEL authorities regarding loss/ damages, if any, observed in the consignments proposed to be taken delivery of.
- 39.16 Before taking delivery, particularly of consignments in 'smalls' the weight of the package shall be checked with the invoiced weight of the packages and any discrepancy shall be reported immediately to BHEL/ carriers. In all case of loss/ damages the contractor will take open delivery from the carriers and forward such open delivery certificates (ODC) to the engineer with in 15 days of receipt of such consignment. All expenses connected there with shall be to the account of contractor. BHEL reserves right to claim losses, if any, accrued to BHEL in the event of contractor non-compliance to above.
- 39.17 In case of short delivery and non-delivery, immediate notice of loss shall be filed with the carrier at places of dispatch and destination as also at any intermediate stations, if it is different one, under intimation to BHEL authorities at site.
- 39.18 BHEL reserves the right to recover from the contractor any loss which arises out of undue delay/ discrepancy/ shortage/ damages or any other cause during transit between the carriers godown/ weigh bridges and BHEL storage yard/ store sheds/ project site or during unloading at carrier godown/ storage yard/ store shed/ project site or during stacking or any time during the custody of contractor. This is applicable for optional items.
- 39.19 Unloading from lorries, transportation, unloading at storage area/ work site of heavy sophisticated equipment like stator, panels etc. shall be done in the presence of and as per the directions of BHEL representative, including stacking and re-stacking, if necessity arises.
- 39.20 Certain packages are likely to be received by BHEL by passenger bus. The relevant waybills will also be handed over to the contractor for clearing the from the Bus station. It is the responsibility of the contractor to clear the same at the bus station, transport and hand over to BHEL authorities at site under the scope of the contract. All the tender provisions indicated in the tender shall be applicable in this case also.

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- 39.21 Since the trucks/ trailers are expected to arrive during any time of the day/ night, the contractor shall have his workmen round the clock at site as well as other places as required to unload the materials.
- 39.22 Consignments coming on Sundays and Holidays are also required to be handled by the contractor promptly. It will be the responsibility of the contractor to contact the site engineer /his authorised representative of BHEL at their residence, if required, and obtain instructions to make suitable arrangements.
- 39.23 In the event unloading from the carrier is delayed by the contractor, the detention charges, if any, will be contractors account.
- 39.24 Under the scope of this contract, it shall be the responsibility of the contractor to provide all necessary facilities to open the packages in the presence of the engineer, verifying the contents of the packages, repackaging where ever and whenever necessary, properly stacking them as may be directed by the engineer so as to facilitate proper handling, periodical verification of material, receipt position, stock taking etc. for this, the contractor shall have experienced person at site who can maintain the records of dispatch/ receipt/ stacking/ verification/ shortages/ damage/ missing items etc. The verification of materials shall be carried out with in 15 days and report shall be submitted as a documentary proof.
- 39.25 All material shall be stored 6 inches above ground level by use of concrete or wooden sleepers. No material shall be left to remain on ground at any time. Material shall not be stacked in low-lying areas where it is likely flooded during rains. Wooden sleepers/ concrete block and tarpaulins for this purpose, wherever deemed necessary be arranged by the contractor. These items shall be stacked/ stored properly at the location(s) specified by BHEL when not in use.
- It is possible that certain heavy items/ consignments will require fabrication of temporary steel coverings over it. These shelters will be covered with suitable CGI sheets or tarpaulin. The contractor will be required to fabricate such sheds. All materials for these will be provided by BHEL. However all expenses towards manpower, T&P, consumables, etc. will be borne by the contractor. After completion of the work the contractor will dismantle the same and return the same to BHEL stores. Contractor shall be paid @ Rs 3000/MT for such works.
- 39.26 The material/ equipment requiring indoor storage will be handed and stacked inside the storage shed (provided by BHEL) by the contractor using material handling equipment like Hydra crane, Fork lift etc.
- 39.27 For checking/ verification of the components with packing slips/ LWB/ PWB etc. The contractor shall provide sufficient experience persons and other facilities as and when required by the engineer.
- 39.28 Stacking of the material shall be done as per the instruction and to the satisfaction of engineer. The materials shall be so stacked that the same should facilitate easy

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- handling. In the event of any improper stacking BHEL may ask the contractor to restock the material properly or failing which BHEL may get the job done by another agency at the risk and cost of the contractor.
- 39.29 The contractor shall execute the work in the most substantial and workman like manner. The stores shall be handled with care and diligence. Any loss to BHEL due to contractor's lapse /negligence shall have to be made good by the contractor.
- 39.30 In case contractor is not able to unload, transport, stack the material at a pre-determined area, as per direction of the engineer for any reason whatsoever (including non-availability of crane, tractor, trailer and other T&P etc.) BHEL shall be at liberty to get the work done by engaging other agency/ equipment / T&P etc at the risk and cost of the contractor.
- 39.31 It shall be responsibility of the contractor to keep the storage areas (closed/ open) in neat and tidy conditions. Any vegetation like grass, bushes, sarkandas etc. shall be cut in open storage area and removed as per requirement and instruction of BHEL engineer within the contractual value. All surplus/ unusable packing materials shall be removed and deposited at location(s) specified by BHEL within the project premises (including weightment of the same within the project premises if required).
- 39.32 Normally the consignments from BHEL manufacturing units/ their sub-suppliers are sent on freight paid basis. In case any consignment is received at any place or freight to pay basis, it will be the responsibility of the contractor to pay the freight and take delivery of such consignments. The amount of freight paid by the contractor at any point of time in such cases will be limited to Rs.5000/-. However, the freight paid by the contractor will be reimbursed by BHEL within a week's time on production of relevant receipt. In case of freight amounts exceed Rs.5000/- contractor may request BHEL well in time to issue cheque/ Draft for such additional amounts in favour of carriers towards freight charges. Receipt of payment and proof of taking delivery of consignment shall be submitted to BHEL by the contractor. Delay in issuance of cheque/ drafts as above shall not in any case be taken as a cause of delay in taking delivery of consignment resulting in wharfage / demurrage leviable by carriers.
- 39.33 In case some materials are required to be dispatched from Site to Manufacturing Units, other sites or any other place, the contractor may be asked by the engineer to get the same packed, transport it to the nearest railway station, carriers godown and get the same booked. The contractor are therefore, requested to quote their rate for this work in rate schedule. In case of material required to be booked as freight paid the freight for the consignment limited to Rs. 3000/- shall be paid by the contractor. However it shall be reimbursed by BHEL on submission of receipt within a weeks time. The funds for freight charges exceeding Rs. 3000/- shall be arranged by BHEL. Packing material required shall be provided by BHEL free of cost.

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- 39.34 In case of consignment to be dispatched on full truck/ trailer load basis, where the carriers will place their fleet inside the plant for loading the contractor may be asked to collect them from different locations of stores shed / yard and load by using his crane and labour. Tenderers are required to quote rates for the work in rate schedule.
- 39.35 For any exigencies during execution of the contract, the contractor shall have to depute his personnel for collection/ delivery of any material meant for site from/ to outstation if desired and instructed by the Engineer. The contractor will however be reimbursed expenses incurred for such work for person deputed, as below:
- a) 2<sup>nd</sup> class train fare worth reservation/ supplementary charges/ bus fare subject to furnishing details regarding ticket nos., journey details, amount of fare etc.
  - b) Local conveyance charges (Actual bus/ cycle rickshaw/ auto rickshaw fare for local journeys at outstation) as permitted by the Engineer.
  - c) Daily allowances @ Rs.100/- per day and @ Rs.250/- per day for lodging.
  - d) Postal/ telegraph/ telephone charges if any subject to production of proof of having incurred such expenditure.
  - e) Freight and other charges, if any, paid on production of actual receipts.

Payment for the above will be made by BHEL with in a month from the date of submission of bill along with details/ desired documents by the contractor subject to completion of work assigned to contractor's personnel and to the entire satisfaction of engineer.

**40.0 MATERIAL HANDLING AND STORAGE & TRANSPORTATION TO POWERHOUSE**

- 40.1 Contractor shall plan in consultation with BHEL engineer, plant/ material to be received/ delivered in powerhouse as per erection progress/ schedules and fill in the requisite formats in standard forms.
- 40.2 Contractor shall store / stack/ identify materials properly in open/ closed/ tarpaulin covered storage yard/ shed and it shall be contractors responsibility to assist BHEL in identifying material well in time for erection according to programme.
- 40.3 The contractor shall identify and deploy necessary engineer/ supervisor/ workmen for the above work in sufficient number.
- 40.4 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 any damage either to the equipment or to the floor where they are stored. The equipment from the stores shall be moved the actual location at the appropriate time so as to avoid damage of such equipment at site.
- 40.5 Contractor shall ensure that while lifting slings shall be put over the points indicated on the equipment or as indicated manufacturer drawings. Slings/

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- 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 damages. In no case piping should be dragged. In case of any damage the cost shall be recovered from the contractor.
- 40.6 Contractors shall be responsible for examining all the plant material received by them and notify the engineer immediately any damage, shortages, discrepancies etc. The contractor shall submit to the engineer every week a report detailing all the receipt during the week, however the contractor shall be solely responsible for any shortages or any damages in stores, storage yard, handling, storage at erection site and erection of equipment once received by them.
- 40.7 **As the storage & erection work can be spread in different areas/ locations of the project, contractor has to arrange sufficient numbers of watch & ward personals to avoid any pilferage of material.** In case any equipment/ material is lost/ damaged while in the custody of the contractor, the cost of repair/ replacement if any to bring back the equipment in original order shall be deducted from the contractor's bill. BHEL's decision in this regard shall be final and binding on the contractor.
- 40.8 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.
- 40.9 All the material in 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 about ground. The contractor at his cost shall arrange all covering materials and blocks and sleepers.
- 40.10 If the material belonging to the contractor are stored in area other than those earmarked for this operation the engineer will have the right to get it moved to the area earmarked for the contractor at the contractors risk and cost.
- 40.11 All electrical panels, control gear, motors and such other devices shall be dried by heating before they are installed and energized. Exposed parts those required special protection such as bearings, slip rings, commutators and other fragile items shall be protected against moisture ingress and corrosion during storage and are periodically inspected.
- 40.12 The contractor shall ensure that all the packing materials and protective devices used for various equipments during transit and storage are removed before the equipment is installed.
- 40.13 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.

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- 40.14 The contractor shall ensure that all surplus damaged scrap/ unused, packing wood/ containers/ special-transporting frames etc. are returned to BHEL at a place in project area identified by the Engineer. All account will be maintained by the contractor for all such items received and returned to BHEL. Any shortage in returning such items shall be chargeable to the contractor excepting an amount of 20% allowable against wastage for packing wood only.
- 40.15 The contractor shall hand over all parts/ materials remaining extra over the normal requirement with proper identification tags to the concerned BHEL Engineer.
- 40.16 Contractor shall also ensure that lifting heavy equipment such as generator rotor, stator, Main inlet valve, shafts etc. shall be done strictly in accordance with drawing given for the purpose and using of lifting tackles supplied for the purpose. Wherever required rubber/ leather pads shall be given between the slings and the machined parts to avoid any damages, scratches to the machined surface. Contractor shall cover bearing journals with grease and cloth as per direction of engineer to avoid damages to the surface.
- 40.17 As per the erection requirement contractor shall deliver material to powerhouse/ work site. The maximum care has to be taken during that time of loading the material at storage area, transportation and unloading at powerhouse. No untoward damage should occur to the material at that time. Any loss of item/ damages shall be to the contractors account.

### **41.0 PRESERVATION OF COMPONENTS**

- 41.1 After taking delivery from BHEL/ customer/ transporter of manufacturing units/ 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 above the ground suitably
  - b) Generator, poles,
  - c) Insulating materials, valves, electrical equipment, control equipment and instruments, rubber items etc. shall be stored indoors in warehouse provided by BHEL/ its Client. Windings shall be kept dry by use of external heat or space heaters.
  - d) Bearings and other wearing surfaces of plant materials shall be protected against corrosion and kept clean.
  - e) Insulation materials shall be stored indoors/ protected against getting wet.
- 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

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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.

### **42.0 CLEANING OF EQUIPMENT**

- 42.1 The contractor shall thoroughly clean all the components before installation of 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 procedure.
- 42.2 Contractor shall ensure that the items identified by BHEL shall be cleaned with kerosene/ petrol/ CRC before assembly and erection of the equipment. For cleaning purposes he shall use only soft cotton cloth. Contractor shall never use cotton waste for cleaning any equipment. The electrical equipment before erection shall be cleaned with dry air/ vacuum cleaner.
- 42.3 The contractor shall clean inside of all pipes and fittings from dirt, sand and loose scales, mechanically/ chemically and by air blowing before being erected. All pipe lines be thoroughly blown/ flushed. If necessary certain pipelines may have to be cleaned by acid pickling/ chemical cleaning. The procedure for the same shall be provided by BHEL. All chemicals and inhibitors shall be arranged by the contractor with in the contract. Disposal of chemical has to be carried out by the contractor at his own cost.

### **43.0 ERECTION**

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

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- 43.2 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 within the finally accepted rates.
- 43.3 No members of the 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.
- 43.4 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 & removed from work site.
- 43.5 Corrections like straightening of ladders, tube support plates adjustment/ removal of ovalities 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.
- 43.6 The contractor shall fabricate pipes, special bends, etc. threading and welding as required and carry out the chemical cleaning of fabricated piping.
- 43.7 The servicing and realignment of skid-mounted equipment if required or if directed by BHEL shall be carried out by the contractor at no extra cost to BHEL.
- 43.8 The contractor shall completely erect & test all the piping systems, covered in the specification including sampling lines up to and including sample coolers, hangers & supports, valves & accessories in accordance with the drawings furnished. This includes all necessary bolting, welding, pre-heating, stress relieving, testing, cleaning & 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 & elevation as indicated in the drawings.
- 43.9 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. Bends shall be prepared and/or fabricated at site.
- 43.10 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.
- 43.11 Certain adjustments in length may be necessary while erecting 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.

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- 43.12 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.
- 43.13 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.
- 43.14 All vents and drains for piping equipment covered in the scope whether shown in the drawings or not shall terminate in atmosphere and to pit as directed by BHEL.
- 43.15 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 of this specification.
- 43.16 Normally the 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. 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.
- 43.17 The contractor shall be responsible for correct orientation of all valves so that seats, stems & 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.
- 43.18 Suspension for piping, etc., will be supplied in running lengths, which shall be cut to suitable sizes and adjusted as required.
- 43.19 The adjustment of all supports erected for maintaining the proper slopes of piping wherever required is also in the scope of the contractor.
- 43.20 No temporary supports should be welded on the piping. In case of absolute necessity prior approval should be taken from BHEL Engineer. In such cases heat treatment if required, shall be carried out by the contractor as part of subject work.
- 43.21 All supports and anchors shall be installed as per drawing to obtain safe and reliable and complete pipe installation as per instructions of Engineer. Any additional support as called for by Engineer shall have to be fabricated and provided by the contractor. The raw materials required for fabricating such supports shall be arranged by BHEL.
- 43.22 Contractor shall install piping in such a way that no excessive or destructive expansion forces exist under any condition.

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- 43.23 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. All the torque wrenches shall be calibrated at the start of each days work and at least once during the day. The bolting work shall be carried out by the competent technicians.
- 43.24 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.
- 43.25 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 pipe lines even after completion of erection or from aesthetic point of view which should be carried out at no extra cost.
- 43.26 All the valves, including motorised valves, flap valves, 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.
- 43.27 Additional platforms and ladders of permanent nature incidental to the job for approaching different equipment/ valves as per site requirement, which may not be indicated in drawings, shall be fabricated and installed by the contractor. The materials required will be supplied by BHEL free of cost.
- 43.28 Erection and welding of necessary instrumentation tapping points, valves to be provided on equipment, auxiliaries and pipe lines covered within the scope of this specification, will also be the responsibility of the contractor and will be done as per the instructions of BHEL Engineer at no extra cost.
- 43.29 All the items will be supplied in pieces/ loose and are to be assembled bolted and welded at site. Contractor has to work as per the drawings and instruction issued at site for erection and testing purposes. Weights for handling and erection in the annexures are indicative only. **No claim will be entertained on account of variations in weights or change from conventional design e.g. from bolted to welded connections and vice versa, increase in number of pieces etc. The bidders should take care of this point while quoting lumpsum price for subject works for handling and erection works.**
- 44.0 WELDING, HEAT TREATMENT, RADIOGRAPHY (NOT APPLICABLE) AND OTHER NON-DESTRUCTIVE TESTING**
- 44.1 The equipment and piping shall be erected in conformity with the provisions of standard/ specification and as may be directed by BHEL The method of welding (arc, gas, TIG, MIG or other method) may be indicated in the detailed drawings/

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- schedules. BHEL Engineer will have the option of changing the method of welding as per site requirements.
- 44.2 Welding being a special process, all-welding shall be carried out by skilled and experienced welders holding valid certificates as per requirements of ISO 9002. The certificate shall be checked by BHEL before allowing the welders to be engaged on welding. BHEL at its own discretion may ask any or all welders to under go welder Qualification Test as per Standard Procedure in accordance with requirements of ISO 9002 and as per welding manual of BHEL. **The deployment of qualified welder and subsequent site testing of requisite numbers of welders shall be one of the prerequisite of contractor's site mobilisation completion.**
- 44.3 All welders including tack welder, structural and pipe welder shall be tested as per ASME section IX and approved by BHEL Engineer before they are actually engaged on work though they may possess the certificate. BHEL reserves the right to reject any welder if the welder's performance is not found to be satisfactory. The contractor in Performa given by BHEL Engineer shall maintain the records of qualification of welders. All the welders qualified for the work will be issued an identity card by BHEL Engineer and welder will keep the same with him at work place.
- 44.4 BHEL 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 of joints welded by a particular welder which, in the opinion of the Engineer will adversely affect the quality of the welding though the welder has earlier passed the tests prescribed by Engineer. The welders having passed qualification tests does not absolve contractor of contractual obligation to continuously check the welder's performance.
- 44.5 Faulty welds caused by the poor workmanship shall be cut and re-welded at the **contractor's expenses including cost of materials**. The Engineer prior to any repair being made shall approve the procedure for the repair of defective welds. Radiography or any other NDT on completed field welds shall be conducted as per drawings or instructions of BHEL engineer.
- 44.6 The contractor shall carry out the root run welding of all piping, valves, instrumentation, tapping points etc. by TIG/ SMAW/ MIG welding process. 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 in case of stainless steel. All arrangements required for the above shall be the responsibility of the contractor at no additional cost.
- 44.7 All charges for testing of contractor's welders including consumables for welding/ destructive and non destructive tests conducted by BHEL at site or at laboratory shall have to be borne by the contractor only. The test coupons raw material will be supplied by BHEL free of cost.

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- 44.8 The regulators used on welding machines shall be calibrated before putting these into use for work. Periodic calibration for the same shall also be arranged by the Contractor at his cost.
- 44.9 Only **BHEL/ CUSTOMER approved electrodes and filler wire** will be used. 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 will have co-relation with the lot No. /batch No given on electrode packets. No electrodes will be allowed to 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. Periodical calibration for the same shall also be arranged by the contractor within the finally accepted rates.
- 44.10 All butt / fillet welds shall be subject to dye penetration test as per drawing and document requirement and have to be carried out as per the instructions of the engineer within the quoted/ finally accepted rates for this contract .
- 44.11 The contractor shall maintain a record in the form as prescribed by BHEL of all operations carried out on each weld and 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. All site welding joints shall be subject to acceptance by BHEL Engineer.
- 44.12 All welds shall be painted with anticorrosive red oxide paint once radiography and stress relieving works are over. Necessary consumables and scaffolding etc., including paints shall be provided by contractor at his own cost.
- 44.13 The contractor shall carry out the edge preparation of weld joints at site in accordance with the details acceptable to BHEL. Wherever possible machining or automatic flame cutting will be allowed only wherever edge preparation otherwise is impractical. All slag's/ burrs shall be removed from cuts and all the hand cuts shall be ground smooth to the satisfaction of engineer.
- 44.14 Pre-heating, radiography (NOT APPLICABLE) 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 Engineer. All equipment and consumables essential for carrying out the above process shall be arranged by contractor at his cost.

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- 44.15 Contractor shall arrange all necessary stress relieving equipment with automatic recording devices. Also the contractor shall have to arrange for labour, heating elements, thermocouples, etc. insulating materials like asbestos cloth, ceramic beads, asbestos ropes etc. required for heat treatment/ stress relieving operations. 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. The contractor has to provide thermal chinks, temperature recorders, thermocouple attachment units, graphs sheets, etc. for checking within the finally accepted rates. 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 BHEL Engineer or his representative on the chart of the recorder after setting up the weld joints for heat treatment operation prior to the starting.
- 44.16 The contractor shall also be equipped for carrying out other NDT like DP/ MPI / UT etc. as required as per welding schedule/ drawings within the finally accepted price/ rates. Necessary help including surface preparation and scaffolding required for conducting all the shall be rendered by contractor at his own cost.
- 44.17 The technical particulars, specification and other general details for NDT work shall be in accordance with ASME, ISO or as specified by Drawings and Manuals of BHEL / CUSTOMER.
- 44.18 Low speed high contrast, fine grain films (D-7 or equivalent) in 10cm width only be used for weld joint radiography. Film density shall be between 2.0 to 4.0.
- 44.19 Iridium – 192/ any other approved shall be used by contractor for radiography work. The geometric un-sharpness shall not exceed 0.05 mm. Taking adequate safety precautions shall be the responsibility of the contractor while carrying out radiography. Necessary safe guards required for radiography (including personnel from BARC) shall be arranged by contractor at his own cost.
- 44.20 All radiographs shall be free from mechanical, chemical or process marks, to the extent they should not confuse the radiographic image and defect finding. Penetrameter as per ASME or ISO must be used for each exposure.
- 44.21 Lead numbers and letters are to be used (generally 6mm size) for identification of radiographs. Contract no., joint identification, source used, welder's identification and SFD are to be noted down on paper cover of radiograph.
- 44.22 Lead intensifying screens for front and back of the film should be used as per the above referred ASME specification.
- 44.23 The joint is to be marked with permanent mark A, B, C, etc. to identify the segments. For this a low stress stamp shall be used to stamp the pipe on the down stream side of the weld.

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- 44.24 For multiple exposure, an overlap of about 25 mm of film should be provided.
- 44.25 Radiography personnel with sufficient experience and certified by M/s BARC as Radiographer 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 BARC for film badge service.
- 44.26 All arrangements for carrying out radiography work including dark room with air conditioner/ blower 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.
- 44.27 The contractor shall have a dark room fully equipped with radiography equipment, film (unexposed), chemicals and any other dark room accessories such as Airconditioner/ Blower etc. There should be adequate number of radiography personnel with sufficient experience and certified by M/s BARC as Radiographer for conducting radiographic tests in accordance with safety rules laid down by Division of Radiological protection. These personnel should also be registered with BARC for film badge service.
- 44.28 Contractor shall note that 100% radiography will be done at the initial stages on all the welding joints as specified in the drawings. 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. 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.
- 44.29 All the Radiographs shall be properly preserved and shall become the property of BHEL.
- 44.30 Since radioisotopes are being used, all precautions and safety rules as prescribed by BHEL/ BARC/ Customer shall be strictly followed. BARC certificate/ permission letter to be provided before taking up the work.
- 44.31 Radiography of joints shall be so planned that it does not interfere with the ongoing erection works keeping in mind the safety of the persons due to radiation exposure. The testing of the welding joints shall also be planned in a way that it is carried out at the earliest possible so as to assess the soundness of the weld joints and performance of HP welders. If the performance of welder is unsatisfactory, he shall be replaced immediately.

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- 44.32 Wherever radiographs are not accepted, on account of bad shot, joints shall be re-radiographed and re-shots submitted for evaluation. Radiographs shall be taken on joints after carrying out repairs. However, if the defect persists after first repair, as per radiograph, carrying out 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.
- 44.33 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.
- 44.34 Heat treatment and 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.
- 44.35 The contractor shall assist BHEL Engineer in preparing complete field welding schedule/procedure 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. Such schedules shall be strictly adhered to by the contractor.

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

- 45.1 On completion of erection of equipment, the contractor shall get the equipment checked up by the CUSTOMER, BHEL, and their deputed supervisors, specialists concerned with the particular item of work. The testing of various equipments will be carried under the supervision of BHEL/ CUSTOMER with the assistance of the Contractor in the manner decided by and in the presence of the owner and other authorised supervisors concerned, and to their entire satisfaction. On completion of these preliminary checks by the equipment supplier, the contractor shall make the equipment ready for conducting the test. The contractor shall rectify all defects found during the checking/ testing as directed by the BHEL/ Consortium partner/ Owner to ensure satisfactory operation of the equipment.
- 45.2 The contractor shall carry out the required tests as instructed by BHEL using contractor's own consumables, labour and scaffoldings.
- 45.3 All the tests shall be repeated till all the equipment satisfy the requirement/ obligation of BHEL at various stages. Contractor shall also carry out repair of all the welded joints (site and suppliers) failed during testing.
- 45.4 The scope of testing activities cover installation of all necessary temporary piping, supports, valves, blanking, pumps, tanks etc. and other accessories with access platforms valves, pressure gauges, electric cables, switches, cutting of some of existing valve, placing of rubber wedges in the valves etc., required for hydro test,

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- chemical cleaning, or 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.
- 45.5 For testing of spiral casing, the necessary test pump and bulk heads shall be supplied by BHEL. Any other item which may be required additionally shall be arranged by contractor. The necessary blanks, pressure gauge, valve etc for testing of piping system including hardware shall be arranged by the contractor within his scope of work.
- 45.6 It shall be the responsibility of the contractor to provide various categories of workers in sufficient numbers along with Supervisors including necessary consumables, T&Ps, IMTEs etc., and any other assistance required during testing 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.
- 45.7 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 contractor's finally accepted rates/ price shall be inclusive of all these factors also.
- 45.8 In case, any rework is required because of contractor's faulty erection which is noticed during testing, the same has to be rectified by the contractor at his cost. If any equipment/ part is required to be inspected during testing, the contractor will dismantle /open up the equipment/ part and reassemble/ redo the work without any extra claim.
- 45.9 During testing, 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 shall also include all such work.
- 45.10 The contractor shall make all necessary arrangements including making of temporary closures on piping/ equipment for carrying out the hydro test on all piping equipment covered in the specification at no additional cost.
- 45.11 In case any defect is noticed during tests 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.
- 45.12 The contractor shall carry out cleaning and servicing of valves prior to testing of the equipment under his scope. 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 are left un-serviced. Wherever necessary as required by BHEL Engineer, the contractor shall arrange to lap / grind valve seats.

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- 45.13 Cleaning & servicing of all the filters/ strainers, toppings of oils coming in the system shall be done by the contractor within the accepted price.
- 45.14 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 extra cost.

### **46.0 PROGRESS REPORTING**

- 46.1 Contractor is required to draw mutually agreed monthly erection programmes in consultation with BHEL well in advance. Contractor shall ensure achievement of agreed programme and shall also timely arrange additional resources considered necessary at no extra cost to BHEL
- 46.2 Weekly progress review meetings will be held at site during which actual progress during the week vis-a-vis scheduled programme shall be discussed for actions to be taken for achieving targets. The programme for subsequent week shall also be presented by contractor for discussions. The contractor shall constantly update/ revise his work programme 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.
- 46.3 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.
- 46.4 The progress report shall indicate the progress achieved against planned, with reasons indicating delays, if any, and shall 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 programme and the slippage's do not accumulate and effect the overall programme.
- 46.5 The daily manpower reports shall clearly indicate the manpower deployed with specialisation, category wise specifying also the activities in which they are engaged.

### **47.0 DRAWING AND DOCUMENTS**

- 47.1 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.

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- 47.2 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.
- 47.3 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.
- 47.4 The data furnished in various annexes 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.
- 47.5 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.
- 47.6 Deviation from design dimensions should not exceed permissible limit. The contractor shall not correct or alter any dimension / details, without specific approval of BHEL.

**48.0 INCOME TAX, SALES TAX, VAT ETC.**

- 48.1 **TDS under Income Tax, Sales Tax, VAT etc**, if any, shall be deducted at prevailing rates on gross invoice value from the running bills unless Exemption Certificate from appropriate Authority / Authorities is furnished.
- 48.2 **Price quoted shall be inclusive of all taxes except service tax.** The service tax, as legally leviable & payable by the contractor under the provisions of applicable law/act, shall be paid by BHEL as per contractor's bill. However, contractor shall have to submit proof of service tax deposited by them immediately after the deposit but not later than the next bill submitted after the due date of deposit. The contractor shall furnish proof of Service Tax registration with Central Excise Division covering the services covered under this contract. Registration should also bear endorsement for the premises from where the billing shall be done by contractor on BHEL for this project. The contractor shall obtain prior approval of BHEL before billing the service tax amount.

With introduction of Cenvat credit rules 2004 which came into force w.e.f. 10.09.2004, excise duty paid on input goods including capital goods used for providing the output service and service tax paid on input service can be taken credit of against the service tax payable on output service. **As such, while offering the rates, the contractors may take into account the benefit of above provisions as the cost of input to contractors will be the cost net of excise**

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**duty and service tax and adjust their offer price accordingly to make it more competitive.**

- 48.3 In VAT applicable States, "Tax Invoice" if required under the relevant State VAT law shall be submitted alongwith other compliances as per concerned VAT Act.
- 48.4 Contractor shall get his organization registered with concerned Sales Tax/ VAT authorities within 15 days of award of this contract, if applicable. The delay on this account and delay in bringing the material shall be to contractor's account and no extension of time shall be allowed on this account. The Sales Tax/ VAT registration for this contractor shall be forwarded to BHEL within 30 days from the date of LOI. In case the contractor is already registered for Sales Tax/ VAT with Govt. Authorities he must quote his registration no, while submitting their tender.
- 48.5 Contractor has to make his own arrangement at his cost for completing the formalities, if required, with Sales Tax/ VAT Authorities, for bringing their materials, plants, and equipment at site for the execution of the work under this contract.
- 49.0 **EXTRA WORK:**
- 49.1 BHEL may consider for payment of extra works on manhour basis @ Rs. 30/- (Rupees thirty only) per manhour 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 testing/ commissioning,
  - c) Requiring fresh fabrication of components in place of rejected/ replaced components.
- 49.2 The rates indicated as above, shall include over time, if any, consumables, supervision, use of tools and tackles and other site expenses and incidentals.
- 49.3 The extra works, if any, shall be carried out by a separate gang or beyond working hours which can be identified for certification of man-hours. Logbook should be maintained and should be signed jointly by the contractor's representative and the BHEL Engineer on day to day basis. However, signing of log book 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, which 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.

## **50.0 PRICE VARIATION**

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- 50.1 The finally accepted rates for scope of work as defined in this tender are subjected to price variation provisions as per following formula. The required documents shall be submitted by contractor.

$$P1 = \frac{0.65 \times P0 (F1 - F0)}{F0} + \frac{0.10 \times P0 (D1 - D0)}{D0}$$

P1 = Increase/ decrease in billing amount (variation) for the particular month of billing.

P0 = Gross billed amount for the month as per contract provisions.

F1 = All India CPI published by Labour bureau, Simla, Govt. of India, for Industrial workers (Base 2001 =100) applicable for the month under consideration i.e. for which bill has been raised.

F0 = All India CPI published by Labour bureau, Simla, Govt. of India, for Industrial workers (Base 2001 =100) applicable for the month of opening of technical bid.

D1= Rate of diesel as applicable at site for the month under consideration i.e. for which the bill has been raised.

D0= Rate of diesel at site applicable for the month of opening of technical bid.

- 50.2 The contractor will be required to raise the bills for price variation payments on a monthly basis irrespective of the facts whether any increase or decrease in CPI. Price variation as per above formula will be calculated and paid/ deducted on the total contract value on month-to-month basis from the date of award. BHEL however reserves the rights to freeze variation for that much of duration of delays, from time to time, which are entirely attributable to the contractor. Average of applicable index of PVC paid shall be taken as index for PVC FOR final 5% amount.
- 50.3 With the provision of price variation as above **NO CLAIM/ COMPENSATION** on account of any increase whatsoever, (irrespective of whether variation are steep/ unanticipated or not compensated by the above escalation provisions in full towards minimum wages, consumables, electrodes, gases or any other item/ reason) will be payable during the entire period of execution including extended period, if any.

### 51.0 RATE SCHEDULE

- 51.1 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.

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51.2 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.

**52.0 INSTRUCTIONS TO TENDERER**

52.1 Offers received without data/ information required to be submitted under tender clauses-11.1 to 11.11 are liable to be rejected. Documentary evidences should duly support all these data/ information.

52.2 No deviations to the tender conditions will normally be accepted.

52.3 The tenderers are advised to actually visit the site and fully acquaint themselves with site conditions, location of stores, transportation routes, Local taxes, toll charges and levies, local labour minimum wages & prevailing wage agreements at site, quantum of work etc. before quoting their rates for this work. BHEL shall not be responsible in any way for non-familiarisation of site conditions. Once the tenderer has quoted for the work, it is implied that he has ascertained various site condition and NO CLAIM whatsoever will be entertained by BHEL on any such account.

52.4 The contractor in the event of this work awarded to him, shall establish a site office at site and keep posted an authorised responsible officer who should hold a valid power of attorney for the purpose of the contract. Any or order or instruction of the Engineer or his duly authorised representative shall be communicated to the contractor's representative at site office and the same will be deemed to have been communicated to the contractor at his legal address.

52.5 Contractor has to insure his T&P against all risks. In addition to Insurance under workman compensation act, all statutory insurances including employers liability insurance has to be arranged by the contractor.

3X33.3 MW UHL HEP  
SPECIAL CONDITIONS OF CONTRACT

SECTION III-B

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**Clause Description**

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SPECIAL CONDITIONS OF CONTRACT**

**SECTION III-B**

**53.0 SCOPE OF WORK:**

53.1 Scope of these specifications cover complete work of

**(A) Material handling:**

Complete material handling at site which includes unloading of all the incoming material of all packages including packages not in erection scope of PSNR but in scope of Bhopal, ISG and TBM groups of BHEL/their vendors, by truck/ trailer/ carriers, reporting damages, providing necessary helps in insurance claim lodging, shifting of material to open/ closed storage yards, proper storing and stacking, material verification and shortage reporting, material preservation as per instructions, On receipt of demand for material from erection site, loading of material on truck/ trailer/ carriers, transporting the same to powerhouse/ erection place. The total material to be handled shall be approximately **2,575 MT** but the contractor shall have no extra claim in the event of reduction of quantity of material. The details of total materials to be handled shall be as per **Annexure-I**. Accordingly the bidders are required to quote their rates against item No. 2 of rate schedule. **(Some material/equipment shall be unloaded near stores /service bay by EOT crane/ Mobile cranes. However Preservation and record keeping of same shall be in this scope of work)**

<b>• Brief Description of Equipment for material handling</b>
<ul style="list-style-type: none"><li>• Embedded Parts including embedded pipelines,</li><li>• Stay ring and Spiral Casing</li><li>• Francis Turbine &amp; accessories</li><li>• Governing System &amp; accessories</li><li>• Main Inlet valves (Spherical) &amp; Accessories</li><li>• Generator, &amp; Accessories</li><li>• Plant and unit auxiliaries of Power House</li><li>• Digital Excitation system. &amp; DVR &amp; accessories.</li><li>• 11 KV SP Bus Duct including CTs &amp; PTs, LAVT&amp; NG cubicles</li><li>• Protection System</li><li>• Cooling Water system including Pipings</li></ul>

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- Drainage & Dewatering systems including Pipings
- Centralised Grease Lubrication system.
- Water Sprinkler type Fire fighting system for generator..
- HP compressed air system for Turbine & HP compressed air system for MIV
- LP compressed air system (synchronous condenser operation)
- 41 MVA three phase generator transformers.
- 500KVA unit aux. transformers (DTT)
- 1000kva Station Aux. Transformers (DTT)
- 6.3 MVA Station Transformer
- Dry type cast resin Excitation transformer.
- Control & Monitoring system
- 24VDC battery system
- Cables & cable carrier system, power & control cables including cable trays & accessories.
- Optical fibre cable.
- 132 KV CTs & PTs for switchyard
- EOT crane 120/20T.
- Starter Panels for auxiliaries

HPSEB have given land and closed sheds to BHEL near their project office and BHEL shall develop the plot area approx. 4,100 Sq. m. fenced from all sides with entrance, closed storage shed and open storage yard. More open area approx. 3,000 Sq. m has been provided by HPSEB near to the above area. Both these locations shall be used for storage of materials.

### **(B) Erection & commissioning:**

Pre-erection assembly, erection, testing (including hydraulic, NDT, electrical, stage & final HV including dry out etc of relevant equipments at various stages during erection), pre-commissioning and commissioning including trial run, handing over to customer HPSEB of the following equipments for three units of 3X33.3 MW UHL HEP high head (Rated net head of 264 metres) 500 RPM clockwise vertical Francis type hydro turbines, main inlet valve (Spherical type), suspended type hydro generators with wound stators in three sectors each and rim type rotors, connected to three phase 41 MVA generator transformers through segregated phase 11 kV bus ducts.

Brief Description of Equipment for erection & commissioning
<ul style="list-style-type: none"> <li>• Embedded Parts including embedded pipelines,</li> <li>• Stay ring and Spiral Casing</li> <li>• Francis Turbine &amp; accessories</li> <li>• Governing System &amp; accessories</li> <li>• Main Inlet valves (Spherical) &amp; Accessories</li> <li>• Generator, &amp; Accessories</li> <li>• Plant and unit auxiliaries of Power House</li> <li>• Digital Excitation system. &amp; DVR &amp; accessories.</li> <li>• 11 KV SP Bus Duct including CTs &amp; PTs, LAVT&amp; NG cubicles</li> <li>• Protection System</li> <li>• Cooling Water system including Pipings</li> <li>• Drainage &amp; Dewatering systems including Pipings</li> <li>• Centralised Grease Lubrication system</li> <li>• Water Sprinkler type Fire fighting system for generator.</li> <li>• HP compressed air system for Turbine and HP compressed air system for MIV.</li> <li>• LP compressed air system (synchronous condenser operation)</li> <li>• 41 MVA three phase generator transformers.</li> <li>• 500KVA unit aux. transformers (DTT)</li> <li>• 1000kva Station Aux. Transformers (DTT)</li> <li>• 6.3 MVA Station Transformer</li> <li>• Dry type cast resin Excitation transformer.</li> <li>• Control &amp; Monitoring system</li> <li>• 24VDC battery system</li> <li>• Cables &amp; cable carrier system, power &amp; control cables including cable trays &amp; accessories.</li> <li>• Optical fibre cable</li> <li>• Starter Panels for auxiliaries</li> </ul>

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Detailed scope of work is as given below.

1. Each turbine comprising mainly of
  - Embedded parts namely, draft tube elbow liner supplied in single piece, draft tube upper and lower cones both in single piece, primary embedded piping etc,
  - Foundation parts namely foundation ring in two halves, stay ring in single piece with spiral casing in about 4 segments, inlet pipe, secondary embedded piping, pit liners etc. The spiral shall be kept pressurized during concreting.
  - Set of guide apparatus & servomotors, guide bearing, shaft sealing, runner, shaft, cabling works and other standard assemblies etc,
  - Set of chequered plates, handrail etc,
  - Along with associated equipment.
2. Main inlet valve: 1,400 mm diameter Spherical valve including inlet pipe with taper piece, outlet pipe SS with dismantling joint, Service seal (main seal) on D/S side, levers, Servomotors, Bypass valve, Air release valve. The mainbody is in two halves bolted together. The valve door shall be of cast- fabricated construction with trunnions on both sides.
3. Digital Governors comprising of hydro mechanical cabinet, micro processed based EHGC, duplicating instruments, joint control panel, hydraulic over speed device, oil Pumping units, Pressure accumulators, oil leakage units, moisture detectors, oil level relays, pressure instruments, emergency slide valve, Electromagnetic type flow meter, Temperature scanner, oil level indicator & controller, Head/ tail race measuring equipment, ultrasonic type turbine discharge measuring equipment, MIV control panel, and feedback mechanism along with piping and associated equipment.
4. Each generator comprising mainly of
  - Wound Stator in three segments, jointing to be done at site, air coolers, anti-condensation pit heaters and control panels. **HV test on complete stator shall be done at site**
  - Rim type rotor to be assembled at site around the spider having 12 no. poles, slip rings, brush gear,
  - Assy of moulded air guides while maintaining proper gaps with fans to suit the assembly at site.
  - thrust bearing, lower and upper guide bearings, plug in type oil coolers,
  - brake & jack system, HS lubrication system, carbon dust collection system for slip rings, brake dust collection system consisting of extraction unit, hoppers, hoses etc
  - upper and lower brackets, upper and lower air baffles, generator covering sheets, turbine pit cover sealing,

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- cooling water system with starter panels, flow, pressure, temperature monitoring and necessary regulating/ check valves etc,
  - Water Sprinkler type fire extinguishing system for each unit,
  - various indicating & measuring instruments and devices like over speed, vibration monitoring, temperature, partial discharge monitoring, SSG, moisture detectors in oil, limit switches, air gap monitoring, shaft current monitor etc,
  - various foundation plates, foundation bolts, barrel access door, lighting arrangement for barrel, dome and turbine pit areas, various instruments/control devices etc,
  - Blue matching of bearing pads with shafts and of load components of thrust bearing thrust bolt, thrust block etc with corresponding parts shall be carried out,
  - along with associated equipment.
5. Digital Excitation systems and DVRs consisting of excitation transformers, DVRs, rectifier system, power supply units, field flashing equipment including transformers, field breakers, digital control and metering equipment, JB's and its wiring etc along with associated equipment.
6. Segregated phase 11 KV Bus ducts mainly comprising of 3 sets each of main bus duct, tap off bus duct for LAVT & NG, tap off bus duct for SST, 1 set each of LAVT, VT, NG cubicles, galvanized steel structures, earthing switches etc along with various rubber bellows, seal off bushings, CTs, VTs and other associated equipment. Field tests during erection/ commissioning current carrying capacity, voltage withstand test etc. Connection and disconnection of various shorting links etc during pre-commissioning and commissioning is included in this contract.
7. Generator transformers 41 MVA, 11 kV/ 132 kV three phase along with set of valves, piping, hangers, hardware, CW system consisting of radiators & coolers etc, oil r , rails and other associated equipment. All routine tests except HV test shall be conducted at site. The connection on HV side to the 132 kV overhead lines shall be done by other contractor and not in the scope of this work
8. The total Control & Monitoring system is divided into following two parts for the lower and upper level of controls.
- i. Control & Monitoring at lower level for unit and other auxiliaries from individual local control stations to be located in the machine hall nearby the generating units, control bay etc.
  - ii. Overall control & monitoring of the power plant at the upper level from operator work station in the central control room

Control & Monitoring system comprising of MAX DNA DCS based system, local control boards and computers for various locations, VDUs, printers, power supply system, mobile operator station, operator work station, CCS and MMI, HMI, mosaic mimic board, control master clock system, CAD station, UPS system, 24V DC Battery system, Remote processing unit, and RTU panels, optic fibre cable including central alarm & annunciation panels synchronizing panels, automatic

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- energy metering system with panel in central control room, instruments, relays, loose power and control cables for all above equipments along with associated equipment. Commissioning of all this system shall be carried out by BHEL engineers. However erection associated cabling works and all assistance for Pre commissioning and commissioning the same shall be provided under the scope of this work.
9. Protection system for turbine, generators transformers, 132 KV switchgear, 132KV feeders, station Aux. transformer and various relay panels.
  10. Power, control and instrumentation cables complete with cable terminals, accessories, trays/ support structures, cabling/-wiring, proper dressing, identification tags, clamping of cables on trays for all the hydro generating equipment, MIV transformers, bus ducts, along with associated items & auxiliaries BUT excluding the cabling for switchyard & transmission line, few BOPs namely EOT cranes.
  11. Auxiliary Transformers as below,
    - 2 nos 1000 KVA Station Aux. Transformers 3 phase cast resin dry type with all fittings & accessories.
    - 3 nos 500 KVA Unit Aux. transformers cast resin dry type with fittings & accessories.
    - 1 no 6300 KVA Station transformers with fittings & accessories
  12. Centralised Grease lubricating system (CGL)

CGL system of sufficient capacity has been provided for supplying grease to moving parts of turbine and Main inlet valve. Each set shall comprise of grease reservoir, pump motor set with starter, four way magnetic valve, pressure relay, control panel, dose feeders, piping and fittings
  13. Cooling water system for turbine, generator and transformer of each unit comprising of raw water system (two centrifugal pump, self cleaning duplex filter, motorized valves, heat exchangers, instruments, piping, fittings etc), closed water system (two centrifugal pump, fine mesh strainer, motorized valves, valves, instruments, piping, fittings etc), and shaft seal cooling water circuit (line filters, cyclone separators, centrifugal booster pump, instruments, piping, fittings etc.)
  14. Drainage water systems along with piping, valves, fittings, starter panels, water tight manhole doors and associated equipment for drainage of power house. The drainage water shall be pumped out to tail race above the maximum tail water level.
  15. Dewatering system comprising of pumps/ motors along with piping, indicating & measuring instrumentation, level gauges, watertight doors, starter panels and other associated equipment for dewatering of turbine and draft tube passages.

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16. One set of LP Compressed air system for synchronous condenser operation comprising mainly of compressors, dryers, air receivers, pressure reducing valves, fittings, instruments, valves, piping, starter panels along with piping and other associated equipment.
- 16A. One set of HP Compressed air system for turbine comprising of reciprocating compressors, dryers, air receivers, pressure reducing valves, fittings, instruments, valves, piping, starter panels along with piping and other associated equipment.
- 16B. One set of HP Compressed air system for MIV comprising of reciprocating compressors, dryers, air receivers, pressure reducing valves, fittings, instruments, valves, piping, starter panels along with piping and other associated equipment
17. Erection of 1<sup>st</sup> stage embedded, 2<sup>nd</sup> stage embedded and surface/ exposed air, oil, water or any other pipelines for all above systems including fabricating/ making site bends, cleaning, clamping, flushing, hydraulic testing as per drawing requirements and standard practices etc. Pipes shall in general be supplied in straight lengths and to be bent at site as per requirement. **For medium and large size pipes, regular bends may not be supplied and therefore bends shall have to be fabricated at site.**

The ends of the pipelines shall be kept covered during concreting and/ or other civil works. Thermal insulation of the pipelines as per requirements given in the relevant drawings of different systems shall be done at site.

18. Finish painting of equipment as per drawing requirements. Paints shall be supplied by BHEL. Painting may also be required on embedded/ foundation parts prior to concreting etc.
  19. Some of the main tests apart from the routine tests during erection, pre commissioning and commissioning shall include HV, SCC, OCC, load rejection tests upto 110%, emergency stop tests, over speed tests, turbine & generator output tests, vibration measurement & balancing, etc on all units and field efficiency test and type test on one unit. Inspection of the units shall be carried out after load throw off tests and re-tightening of wedges, fasteners etc if required shall be carried out.
  20. Any other works required to be carried out which have not been explicitly mentioned above but are essentially required to be carried out to complete the individual assemblies and the unit/ units as a whole including pre commissioning and commissioning.
- 53.2 The equipment and piping shall be erected in conformity with the provision of standard/ specification and as may be directed by BHEL. The method of welding (Arc, gas, TIG, MIG/ MAG or other method) may be indicated in the detailed drawing/ schedules. BHEL engineer will have option of changing the method of welding as per site requirements.

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- 53.3 On the discretion of BHEL site engineer, some of the material can be directly unloaded in the powerhouse/work site. Contractor shall keep record of the same. For such works contractor shall be paid under Material-handling package.
- 53.4 EOT cranes are being installed by BHEL Bhopal/Vendor.. The EOT cranes shall be provided free of hire charges and on sharing basis. BHEL Bhopal/Vendor shall carry the AMC of the cranes. The day-to-day routine maintenance shall be in the scope of the present contractor for the period of crane being used for his scope of erection works. The said contractor shall also deploy the requisite number of crane operators (one or two nos. operator simultaneously) as per the instructions of BHEL engineer for operation of the crane for his scope of work in connection with Electromechanical works of BHEL. The crane operator may have to work in overtime also depending upon the work conditions for which no extra charge shall be payable to the contractor. The contractor will also provide the EOT crane services (including the operators) to the other contractors working in the powerhouse for civil and mechanical works.
- 53.5 Construction drawings and documents shall be provided at site to the successful bidder for erection of work:
- 53.6 Most of the items/ consignments will be despatched directly to site by road. However some consignments mainly small parcels may also be received at Mandi/ Baijnath town through road/ rail. The contractor may have to handle such consignments also. These items shall be paid as per the **optional rates** indicated at rate schedule.
- 53.7 Details with weights & Dimensions of Major equipment supplied by BHEL under this scope are given in **Annexure-I. However, changes in design may occur as is usual for which no compensation will be payable and contractor shall complete the entire work as detailed in the tender specifications within finally accepted rates/ prices.**
- 53.8 The EOT crane shall not be available for the erection of first stage embedment/ piping. The contractor has to carry out the works by mobile/ hydra crane provided by BHEL with the condition that operator and diesel/lubricants have to be provided by the contractor..

### 54.0 FINISH PAINTING

- 54.1 Primer painting wherever peeled off or damaged or if required is to be carried out after thoroughly cleaning of all dirt, rust, scales, grease, oils and other foreign materials by wire brushing, scrapping, any other method as per requirement of BHEL and the same being inspected and approved by the engineer before painting. Bare surfaces/ unpainted surfaces shall be provided with two coats of suitable primer. The gas cut stubs/ weld seams would require to be cleaned/

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ground before painting. After applying the primer paints all the equipments/ items shall be finished with two coats of enamel paint or any other paint as issued by BHEL. The exterior surface may have to be cement/ coal tar painted as directed by BHEL

- 54.2 As the equipment/ items are to be spray painted, the contractor shall make arrangements of the required equipment for spray painting. Spray painting at the job/ site shall be permitted only items approved by the owner/ Engineer.
- 54.3 While the primers and paints will be issued by BHEL as free issue item, all tools and other consumables including scaffolding materials required for finish painting shall be supplied by contractor within their quoted rate.

### **55.0 FACILITIES TO BE PROVIDED BY BHEL/ CUSTOMER**

- 55.1 BHEL/ CUSTOMER shall provide limited open space for site office and store free of rental charge. It is the responsibility of the contractor to construct temporary sheds for his use, and to dismantle and clear the site after completion of work or as and when required, as a part of his scope of work.
- 55.2 BHEL/ CUSTOMER shall provide space for labour colony. Contractor shall have to arrange accommodation for his workmen/ staff on his own within the awarded rates. Contractor shall be responsible for providing all necessary facilities to staff and workmen like construction of residential accommodation with electricity & water inside the rooms, proper sanitation, transport, medical facilities etc. at his own cost as required under various labour laws and statutory rules and regulations.
- 55.3 The contractor shall submit to BHEL his electrical power requirements. BHEL/ CUSTOMER shall provide supply of construction power at 415V at one point in Power House to enable smooth execution of works on chargeable basis. **Electricity for the purpose of Erection & Commissioning and in stores shall be chargeable to the Contractor.** Contractor at his cost shall do further distribution. All wiring must comply with local regulations and will be subject to Engineer's inspection and approval before connecting supply. One DG set provided by BHEL shall be installed, Operated and maintained by the contractor at his own cost.
- 55.4 Water for construction and drinkable water of suitable quality shall have to be arranged by the contractor at his own cost. There are also few natural water springs which can be tapped for drinkable water after seeking permission from Irrigation & Public Health department of the State Govt./ Local Panchayat. Contractor shall lay network of pipelines at his cost to various work spots requiring construction water.  
For shortage of water, Contractor will be responsible for alternative arrangements.
- 55.5 Provision of distribution lines of electrical power from the central points to the required place with proper distribution boards observing the safety rules laid down

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by the electrical 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 shifts/ hours accordingly and deploy additional manpower if necessary so as to achieve the targets.

- 55.6 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.
- 55.7 Adequate lighting arrangement such as flood lights, hand lamps and area lighting shall be arranged by the contractor at the site of construction, storage area etc within finally accepted rates.
- 55.8. On completion of work or as and when required by BHEL, all the temporary buildings, structures, pipe lines, cables etc. shall be dismantled and levelled 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, the Engineer will be done it and expenses incurred shall be recovered from the contractor along with prevailing overhead. The decision of BHEL Engineer in this regard shall be final.

### **55 TIME SCHEDULE**

- 56.1 The contractor is required to commence the work within 15 days from the date of issue of letter of intent unless BHEL decides to fix any other later date. However, BHEL Engineer will certify the actual date of start of work after adequate mobilisation of manpower, T&P and other pre-requisites as stated in the contract. However, it may be noted that the scope of work consists of material handling of all items dispatched from BHEL Manufacturing units, and their vendors as detailed in clause 53.1A AND erection of 1<sup>st</sup> stage embedments & embedded parts and erection of II stage embedments & foundation parts and subsequent erection, testing of Francis type turbine and generator and auxiliaries as detailed in clause 53.1B. While material handling work is expected to commence immediately, work of erection of embedment and foundation parts, erection of II stage and subsequent erection, testing of Francis type turbine and generator and auxiliaries will be taken up in phases depending on availability of fronts from customer. Bidders are advised to note this and quote accordingly. No additional charges/compensation will be paid by BHEL on this account.
- 56.2 Entire work as detailed in the tender specifications shall be completed within 26 months from the date of start of work.**
- 56.3 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.

**57 OVER RUN**

- 57.1 In case due to reasons not attributable to the contractor, the work gets delayed and scheduled completion gets extended, the contractor shall not be entitled for any over run compensation for a period of **three months** after the contractual completion date. In case the scheduled completion time gets extended beyond **three months** as stated above, the contractor shall be considered for payment of fixed over run charges **@ Rs. 1,00,000/- PM (Rupees One Lac per month Only)** on receipt of advance notice intending to claim over run & on fulfilment of following condition:-
- a) The reasons for delay in completion of work are not attributable to contractor but however subject to the provisions of clause – 31.
  - b) The targets fixed during the over run period are achieved by contractor.
- 57.2 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.
- 57.3 The contractor shall maintain sufficient work force and other resources required for completion of the job expeditiously for the entire contractual period including total extended period.

**58 INSURANCE**

- 58.1 All equipment will be insured by M/s BHEL/ Customer up to the time of completion of their erection, testing and commissioning within the comprehensive MCE policy. The MCE policy so taken shall have provisions for deductible franchise of 5% of the claim amount with a minimum value of Rs. 15,000/- during erection and Rs. 40,000 during testing. Subject to provisions of GCC clause No. 29.0 the deductible franchise shall be borne by contractor. The Contractor shall take an insurance policy for all the workmen employed by him against accidents and injuries as per the statutory requirements.

**59 TERMS OF PAYMENT**

- 59.1 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.
- 59.2 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.
- 59.3 Shortage/ damage reports to be submitted on BHEL standard materials management forms. No payment shall be released till the contractor submits these reports and are verified by the Engineer.

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59.4 Subject to any deduction which BHEL may be authorised to make under the contract, the contractor on the certificate of the Engineer at site be entitled for payment as explained hereunder:

**(A) ITEM 1 OF THE RATE SCHEDULE**

92% of contract rate of item No. 1 of rate schedule shall be payable as detailed in Annexure A enclosed

NOTE: Further break-up and/or minor changes in the Annexure A referred above, if required depending upon the site conditions, can be done at site entirely at the discretion of BHEL.

**(B) ITEM 2 OF THE RATE SCHEDULE**

(i) **52%** of the rate shall be payable on prorata basis for material handling after the materials are safely unloaded and recorded in stocks as per BHEL practices such as GR/ LWB/ loading advice/ box packing slip subject to furnishing of following information along with the bills as per above clause

- Proof of claim lodged with Railways/ Transporters in respect of shortage/open delivery.
- Material Management forms duly filled/ Records generated in stocks (Stock registers and computers) and certified by Engineer.

(ii) **40%** of the rate shall be payable on prorata basis after safekeeping/ stacking, proper verification in line with documents and records and proper preservation as per BHEL standards is ensured. Opening of cases/ repacking, wherever necessary (with contractors own T&P and labour), submission of information as per Material management forms by contractor immediately after verification of materials as certified by Engineer. Required Performa would be supplied by site.

**(C) ITEM 3A & 3B OF RATE SCHEDULE**

**92%** of the rate shall be payable on prorata basis after materials are loaded in trucks/ trailers from stacked area, transported and unloaded at requisite place (a) with his own arrangements (b) with EOT crane and proper handing over to erection group.

**(D) ITEM 4 OF RATE SCHEDULE**

(i) **52%** of the rate shall be payable on prorata basis for material handling after the materials are safely unloaded directly in the Power House using his own labour and T&P and using the EOT crane of the Power house and recorded in

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stocks as per BHEL practices such as GR/ LWB/ loading advice/box packing slip subject to furnishing of following information along with the bills as per above clause

- Proof of claim lodged with Railways/ Transporters in respect of shortage/ open delivery.
- Material Management forms duly/ Records generated in stocks (Stock registers and computers) and certified by Engineer.

(ii) **40%** of the rate shall be payable on prorata basis after proper safekeeping/stacking, proper verification in line with documents and records and proper preservation as per BHEL standards is ensured. Opening of cases/ repacking, wherever necessary (with contractors own T&P and labour), submission of information as per Material management forms by contractor immediately after verification of materials as certified by Engineer. Required Performa would be supplied by site.

- (E) 1) An amount limited to **1.7% of** the awarded contract value shall be payable in **one or more instalments**, solely at the discretion of Construction Manager/ BHEL at different stages of the contract execution to facilitate resource augmentation or to meet any exigency of work. In case of its non-utilization 'OR' its part utilization, the entire/ balance payment against this category shall be released along with commissioning of HTG.
- 2) An amount limited to **1.3% of** the awarded contract value shall be payable in **26 instalments @ 0.05% per month**, solely at the discretion of Construction Manager/ BHEL on account of maintaining cleanliness at work places and following safety norms.

(F) **FOR OPTIONAL ITEMS NOS 5, 6, 7, 8 OF RATE SCHEDULE**

95% of the unit rate shall be paid on completion of particular item.

(G) **Balance 5% of the value shall be payable as under.**

- i) 2.5% of the contract value as executed, shall be payable on completion of all pending works, which includes settlement of all outstanding issues, reconciliation of material wherever required, area cleaning etc.
- ii) The balance 2.5% of the contract value as executed will be payable after 3 months on contractors discharging his responsibilities as stipulated in this contract and on passing of final bill. The certificate of Engineer regarding such approval and passing of sums shall be final and conclusive against the contractor.

**Note:** Above payment shall be released after adjustment of the contract value based on actual work carried out.

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**No payment shall be made for handling of items issued from BHEL stores for storing, stacking of materials and their return.**

## **60. RATE SCHEDULE**

- 60.1 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/ price. **The bidders are requested to carefully go through the note under clause 53.1 (B) 4 of the special conditions of the contract before quoting their price.**
- 60.2 The tenderer shall quote the rates/ Price 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.
- 60.3 Contractor's total quoted price as per rate schedule will be taken as tentative only. The contractor undertakes to handle actual quantities as per advice of BHEL Engineer and accordingly the final contract price shall be worked out on the basis of quantities actually handled at site and payments will also be regulated for the same. Quantities mentioned in the rate schedules are approximating only and liable for variation due to change of scope of work / variation in schedule of quantities, changes in design etc. The quantities indicated against each item may vary to any extent and no compensation will be payable in variation of Individual quantity. **However in case of over all variation in Contract value (as indicted in LOI), beyond minus 30%, the contractor will be eligible for compensation as per the following provision:**
- “The total executed value shall be raised by 10 % subject to the condition that the total value of work executed plus increase as above shall be limited to 70 % of the awarded contract value”**
- Contractors are requested to take above into account while quoting. The contractor confirms that unit rates quoted above takes care of such variation during execution stage.
- 60.4 The tenderer is also required to quote for all OPTIONAL items of the rate schedule as the same may be operated according to site conditions and entirely at the discretion of BHEL during the execution of contract. No compensation for non-operation of these OPTIONAL items and getting work done through other agency for optional items, shall be payable to the contractor.
- 60.5 Rates for optional items shall not be considered for evaluation of tender.

**61 INSTRUCTIONS TO TENDERER**

- 61.1 The tenderer are advised to actually visit the site and fully acquaint themselves with site conditions, transportation routes, various distances, facilities etc., before quoting their rates for this work. BHEL shall not be responsible in any way for non-familiarization of site conditions.
- 61.2 Once the tenderer has quoted for the work, it is implied that he has ascertained various site conditions, transportation routes and distances etc. as per above clause. No claim whatsoever will be entertained by BHEL on any such account.
- 61.3 The contractor in the event of this work 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.
- 61.4 Any order or instruction of the Engineer or his duly authorized representative shall be communicated to the contractor's representative at site office and the same will be deemed to have been communicated to the contractor at his legal address

**62 PERFORMANCE GUARANTEE:**

Irrespective of provisions in tender else where, in view of nature of work, performance guarantee is required under this contract.

**63.0 LIQUIDATED DAMAGES (LD)**

- 63.1 **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.**

**64.0 SECURITY DEPOSIT**

- 64.1 The contractor shall submit Security Deposit within 15 days from the date of issue of LOI as per clause no. 16.2 of the General Conditions of Contract (GCC). 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 on Page No. 34(a) of the GCC;

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

**65.0 OTHERS**

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- 65.1 In case of any contradiction between General Conditions of Contract (GCC) and Special Conditions of Contract (SCC), the latter shall prevail.
- 65.2 The tenderer shall specifically confirm that he has inspected the site of work and acquired full knowledge and information about the site conditions, wage structure, Industrial climate, total work involved and will not raise claim of any nature due to lack of knowledge of site condition. He will also confirm that local taxation laws at the site have been clearly understood by him.
- 65.3 **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 bids and acceptance of customer. 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.**

**UHL STAGE - III (3 X 33.33 MW)****FRANCIS TURBINE****PACKAGE WEIGHTS & DIMENSIONS**

S.NO.	DESCRIPTION	NO. OF PACKAGES	PACKAGE DIMENSIONS (EACH)			WT.OF EACH PACKAGE	WEIGHT PER UNIT	TOTAL WT. FOR 3 UNITS	SUM
			L	W	H	(T)	(T)	(T)	(T)
			(m)	(m)	(m)				
<b>A)</b>	<b>TURBINE (each)</b>								
1.00	Runner	1.00	2.10	2.10	0.75	6.00	6.00	18.00	
2.00	Shaft	1.00	4.20	1.40	1.40	6.20	6.20	18.60	
3.00	Draft tube cone (upper) single piece	1.00	2.10	2.40	1.10	3.10	3.10	9.30	
4.00	Draft tube cone (Lower)single piece	1.00	2.30	2.30	1.60	3.50	3.50	10.50	
5.00	Regulating Ring(in halves)	2.00	3.90	1.95	0.60	1.70	3.40	10.20	
6.00	Guide Vanes (20 nos)	1.00	1.85	0.65	1.65	1.70	1.70	5.10	
7.00	Guide vanes sevometer	2.00	0.72	0.72	1.30	0.70	1.40	4.20	
8.00	Guide bearing	1.00	1.70	1.70	1.25	2.00	2.00	6.00	
9.00	Shaft seal	1.00	1.60	1.60	0.70	0.80	0.80	2.40	
10.00	Draft Tube Liner (single piece)	1.00	3.00	3.50	2.50	3.00	3.00	9.00	
11.00	Stay Ring(full ring)	1.00	5.00	3.80	1.40	12.30	12.30	36.90	
12.00	Spiral Casing (Four Pieces)		.-----In suitable no. of transportable segment -----				7.50	22.50	
13.00	Inlet pipe	1.00	3.20	2.30	2.30	5.20	5.20	15.60	
14.00	Upper Pit Liner (Two pieces)		4.00	2.50	4.00		7.10	21.30	
15.00	Lower Pit Liner (Single Piece)		.-----In suitable no. of transportable segment -----				4.80	14.40	
16.00	Top cover	2.00	3.00	1.50	0.70	5.00	10.00	30.00	
17.00	Pivot ring	2.00	3.10	1.55	0.60	2.55	5.10	15.30	
18.00	Other misc. assemblies, piping & Components		.-----In suitable no. of transportable segment -----				40.00	120.00	
<b>B)</b>	<b>MAIN INLET VALVE (each)</b>								
1.00	Spherical valve assembly	1.00	3.00	2.20	2.80	33.50	33.50	100.50	
2.00	Upstream pipe	1.00	1.80	1.80	1.10	2.00	2.00	6.00	
3.00	Dismantling joint	1.00	1.80	1.80	0.50	0.70	0.70	2.10	
4.00	MIV servomotor	2.00	1.00	1.00	2.00	4.20	8.40	25.20	
5.00	Other Misc. assemblies & components		.-----In suitable no. of transportable segments-----				26.50	79.50	
<b>C)</b>	<b>AUXILIARIES (one set for complete power house)</b>								
1.00	HP Compressor motor set(Turbine+MIV)	4.00	-	-	-	1.00	4.00	4.00	
2.00	LP compressor motor set	2.00	-	-	-	1.00	2.00	2.00	
3.00	HP Air Receiver	2.00	-	-	-	1.40	2.80	2.80	
4.00	LP Air receiver	2.00	-	-	-	2.00	4.00	4.00	
5.00	Dewatering Pump motor set	4.00	-	-	-	1.00	4.00	4.00	
6.00	Drainage Pump motor set	4.00	-	-	-	0.80	3.20	3.20	
7.00	Centrifugal pump motor sets(raw water circuit)	6.00	-	-	-	1.80	10.80	10.80	
8.00	Centrifugal pump motor sets(secondary water circuit)	6.00	-	-	-	1.80	10.80	10.80	
9.00	Heat exchanger	3.00	-	-	-	1.00	3.00	3.00	
10.00	Expansion tank	3.00	-	-	-	1.00	3.00	3.00	
11.00	Duplex strainer(raw water circuit)	3.00	-	-	-	1.25	3.75	3.75	
12.00	Strainer(Secondary circuit)	6.00	-	-	-	1.00	6.00	6.00	
13.00	Strainer(other applications)	12.00	-	-	-	0.50	6.00	6.00	
14.00	Misc. piping, valves, fittings for all above station auxiliaries		.-----In suitable no. of transportable segment -----				55.00	55.00	
<b>D)</b>	<b>SPARES (one set for complete power house)</b>							0.00	
1.00	Runner	1.00	2.10	2.10	0.75	6.00	6.00	6.00	
2.00	Guide vanes(20)	1.00	1.85	0.65	1.65	1.70	1.70	1.70	
3.00	Other spares of turbine		.-----In suitable no. of transportable segment -----				6.00	6.00	
4.00	Spares for MIV		.-----In suitable no. of transportable segment -----				2.00	2.00	
5.00	One set for turbine, MIV & auxiliaries		.-----In suitable no. of transportable segments-----				10.00	10.00	
								726.65	726.65

HYDROGENERATOR CONSIGNMENTS(TENTATIVE)									
PACKAGE WEIGHTS & DIMENSIONS									
S.NO.	NAME OF COMPONENT	CASE PER M/C	PACKAGE DIMENSIONS (EACH)			TOTAL CASES	PACKAGE WT. (T)	TOTAL PACKAGE (T)	
			L (m)	W (m)	H (m)				
1.00	Wound Stator Sector	3.00	5.50	3.20	2.50	9.00	30.00	270.00	
2.00	Poles	12.00	1.60	0.90	0.70	36.00	2.20	79.20	
3.00	Rim Punching	19.00	1.60	1.00	0.50	57.00	2.60	148.20	
4.00	Shaft	1.00	6.60	1.00	1.40	3.00	18.00	54.00	
6.00	Thrush Collar	1.00	1.50	1.50	1.20	3.00	4.50	13.50	
7.00	Spider	1.00	1.90	1.90	2.00	3.00	8.50	25.50	
8.00	Top Bracket Housing	1.00	3.00	3.00	1.40	3.00	14.00	42.00	
9.00	Top Bracket Arm	6.00	1.40	0.60	1.40	18.00	1.50	27.00	
10.00	Bottom Bracket Housing	1.00	3.20	3.20	1.00	3.00	5.00	15.00	
12.00	Air Coolers	6.00	2.00	1.50	0.60	18.00	1.40	25.20	
13.00	Plug in Type Oil Coolers for upper Bearing	5.00	1.10	0.90	0.80	15.00	0.40	6.00	
14.00	Plug in Type Oil Coolers for Lower Bearing	2.00	0.80	0.90	0.70	6.00	0.30	1.80	
<b>MISC PACKAGES</b>									
15.00	Large Packages	8.00	3.00	1.50	1.20	24.00	1.00	24.00	
16.00	Medium Packages	12.00	2.00	1.00	1.00	36.00	0.75	27.00	
17.00	Small Packages	16.00	1.20	0.80	0.80	48.00	0.50	24.00	
								782.40	782.40
<b>HSE (Electrical)/(Mechanical)</b>									
<b>TENTATIVE PACKAGE WEIGHTS &amp; DIMENSIONS</b>									
S.NO.	DESCRIPTION	NO. OF PACKAGES	PACKAGE DIMENSIONS (EACH)			WT.OF EACH PACKAGE (T)	TOTAL WT. OF PACKAGE (T)		
			W (m)	D (m)	H (m)				
1.00	Sprinkler type fire fighting system for generator						60.00		
2.00	Starter for Turbine & Gen. auxiliaries						40.00		
							100.00	100.00	
<b>SCHEDULE OF PANELS FOR STATIC EXCITATION SYSTEM</b>									
<b>PACKAGE WEIGHTS &amp; DIMENSIONS</b>									
S.NO.	SCOPE OF SUPPLY	NO. OF PANELS PER SET	NO. OF SETS	DIMENSION			WIGHT OF EACH SET(T)	TOTAL WT.(KGS)	
				W (m)	D (m)	H (m)			
1.00	Regulation Panel with AVR	1.00	3.00	1.15	1.25	2.32	1.00	3.00	
2.00	Thyristor converter Panel	2.00	3.00	0.68	1.25	2.32	0.70	2.10	
3.00	Field Suppression Panel	1.00	3.00	1.50	1.25	2.32	1.20	3.60	
5.00	Excitation Transformer with enclosure	1.00	3.00	1.80	1.25	2.50	3.00	9.00	
								17.70	17.70
<b>GENERATOR RELAY PANEL &amp; 132 KV RELAY PANEL</b>									
<b>PACKAGE WEIGHTS &amp; DIMENSIONS</b>									

S.NO.	DESCRIPTION	NO. OF BOXES	PACKAGE DIMENSIONS (EACH)			WT.OF EACH BOX	TOTAL WT.		
			L	W	H				
			(m)	(m)	(m)	(T)	(T)		
1.00	Generator Relay Panel		2.30	suit. Width	1.00		10.00		
2.00	Switchyard Relay Panel						5.00		
3.00	Protection Panel						4.00		
							19.00		19.00
<b>MAJOR ITEMS OF GOVERNING GROUP</b>									
<b>PACKAGE WEIGHTS &amp; DIMENSIONS</b>									
S.NO.	DESCRIPTION	NO. OF PACKAGES	PACKAGE DIMENSIONS (EACH)			WT.OF EACH PACKAGE	TOTAL WT. OF PACKAGE		
			(m)	(m)	(m)	Kg	kg		
1.00	HYDRO MECHANICAL CABINET (HMC)	3.00	2.80(H)	1.400(W)	1.300(D)	1.50	4.50		
2.00	MICROPROCESSOR BASED DIGITAL GOVERNOR (EHGC)	3.00	2.320(H)	1.000(W)	0.800(D)	0.80	2.40		
3.00	OIL SUMP TANK FOR GOV. (0.6 M. Cu)	3.00				1.50	4.50		
4.00	OIL PRESSURE RECEIVER FOR GOV. (0.6 M. Cu)	3.00				1.45	4.35		
5.00	OIL SUMP TANK FOR MIV. (2.5 M. Cu)	3.00				8.00	24.00		
6.00	OIL PRESSURE RECEIVER FOR MIV. (2.5 M. Cu)	3.00				10.00	30.00		
7.00	HYDRAULIC CONTROL PANEL FOR MIV.	3.00				0.25	0.75		
							70.50		70.50
<b>SCHEDULE OF PANEL/DESK FOR CONTROL &amp; MONITORING SYSTEM</b>									
S.NO.	DESCRIPTION	NO. OF SETS	NO. OF PANELS/SUITES/DESKS PER	Size of each panel/suite/desk			WEIGHT OF PANEL	TOTAL WT.	
				W	D	H			
				mm	mm	mm	(T)	(T)	
1.00	<b>LOCAL CONTROL BOARDS</b>								
1.10	<b>Unit Control Board (UCB)</b>								
1.1.1	Control & Monitoring Panel	3.00	1 suite	(750+750+750+750)	800.00	2320.00	2.00	6.00	
1.1.2	Temp. msmt. Panel	3.00	1.00	950.00	800.00	2320.00	0.50	1.50	
1.1.3	Ins. & Guage Panel	3.00	1.00	950.00	800.00	2320.00	0.50	1.50	
1.20	<b>Local Control Board(LCB) for Common, Station Service &amp; Dam Monitoring</b>								0.00
1.2.1	Control & Monitoring Panel	1.00	1suite	(750+750+750+750)	800.00	2320.00	2.00	2.00	
									0.00
1.30	<b>Local Control Board(LCB) for 132 kV Switchyard</b>								0.00
1.3.1	Control, Monitoring Panel	1.00	1suite	(750+750+750)	800.00	2320.00	2.00	2.00	
2.00	<b>Computerized system in Central Control Room</b>								0.00
2.10	Operator Work Stations	2.00	2 desk	3600.00	800.00	1100.00	1.00	2.00	
2.20	Fixed Engineer's Station	1.00	1 table	900.00	800.00	1100.00	0.10	0.10	
2.30	Lap top based engineering Station	1.00	1 table	900.00	800.00	1100.00	0.10	0.10	
2.40	Pentium IV based max LINC PC	1.00	1 table	900.00	800.00	1100.00	0.10	0.10	
2.50	Pentium IV based maxSTORIAN PC	1.00	2 tables	900.00	800.00	1100.00	0.10	0.20	
2.60	Plotter	1.00	1 table	900.00	800.00	1100.00	0.10	0.10	
2.70	132 column DM Printers	2.00	2 tables	2000.00	750.00	1000.00	0.10	0.20	
3.00	<b>A3 size, colour, Laser Printer</b>	1.00	1 table	2000.00	750.00	1000.00	0.10	0.10	
4.00	<b>Network Interface Panel</b>	1.00	1panel	750.00	750.00	2250.00	0.10	0.10	
5.00	<b>230 V, 1-Phase, UPS</b>	1.00	1.00	Later			0.00	0.00	
									16.00
									16.00
<b>TRANSFORMER</b>									

<b>PACKAGE WEIGHTS &amp; DIMENSIONS</b>										
S.NO.	DESCRIPTION	NO. OF TRANSFORMER	TOTAL QTY.	DIMENSION, MM			WEIGHT PER TRANSFORMER (T)	TOTAL WT. (T)		
				L	B	H				
1.00	41 MVA 3 PH Gen. TRANSFORMER (filled with oil)	3.00					58.50	175.50		
2.00	6.3 MVA STATION TRANSFER (filled with oil)	1.00					31.50	31.50		
3.00	500 KVA unit aux. transformer (DTT)	3.00					3.40	10.20		
4.00	1000 kVA station aux. transformer	2.00					5.20	10.40		
5.00	132 kV PT for switchyard	1 LOT					0.60	0.60		
6.00	132 kV CT for switchyard	1 LOT					0.60	0.60		
								228.80	228.80	
<b>MISCELLANEOUS</b>										
<b>PACKAGE WEIGHTS &amp; DIMENSIONS</b>										
S.NO.	DESCRIPTION	NO. OF QTY./SETS	PACKAGE DIMENSIONS (EACH)			UNIT WEIGHT (T)	TOTAL WT. (T)			
			(m)	(m)	(m)					
1.00	11kV SP BUS DUCT, LAVT & NG Cubicles	3.00				10.00	30.00			
2.00	EOT Crane 120/20 tonnes	1.00					84.00			
3.00	Cables & cable carrier system, power & control cables including optic fibre cable, cable trays & accessories						500.00			
							614.00			614.00
								TOTAL=		2575.05

- NOTE 1. Above details are tentative and are liable to change on account of design considerations  
2. Erection being activity oriented, the lumpsum price has been asked. No additional price increase will be considered due to change in weights indicated.

**LIST OF T&P BEING PROVIDED BY BHEL FOR USE OF CONTRACTOR FREE OF HIRE CHARGES ON SHARING BASIS**

S.NO.	EQUIPMENT	CAPACITY	QTY
1.	HYDRA CRANE	14/20 T	01
2.	TYRE MOUNTED CRANE	55 T	01

**NOTE:**

1. THE ABOVE MENTIONED SUITABLE CAPACITY CRANE WITHOUT SLINGS & LIFTING TACKLES WILL BE PROVIDED BY BHEL ON SHARING BASIS. THE OPERATION AND MAINTENANCE OF CRANE SHALL BE THE RESPONSIBILITY OF CONTRACTOR. THE FUEL SHALL BE ALSO GIVEN BY CONTRACTOR. ALL OTHER TERMS & CONDITIONS SHALL BE AS PER TENDER CLAUSE NO. 35
2. EOT CRANES IN THE POWER HOUSE WILL BE ERECTED/ COMMISSIONED BY ANOTHER AGENCY OF BHEL AND MAY BECOME OPERATIONAL ANY TIME DURING THE PERIOD OF SUBJECT WORK. THESE EOT CRANES WILL ALSO BE PROVIDED BY BHEL FREE OF HIRE CHARGES & ON SHARING BASIS FOR SUBJECT WORK WITH EXCLUSIONS AS ADVISED. THE MAJOR MAINTENANCE OF EOT CRANE WILL BE CARRIED OUT BY HPSEB. ROUTINE MAINTENANCE SHALL BE TAKEN CARE BY THE CONTRACTOR UNDER THIS SCOPE OF WORK. HOWEVER, CONTRACTOR WILL NOT BE ENTITLED FOR ANY COMPENSATION DUE TO NON-AVAILABILITY OF EOT CRANE.

**TENDER NO. BHEL/NR/SCT/UHL/MATL. HAND. & ETC/576**  
ANNEXURE-III

**INDICATIVE LIST OF MAJOR T&P TO BE PROVIDED BY CONTRACTOR FOR EXECUTION  
OF TENDERED WORKS FOR MOST DURATION OF THE CONTRACT**

S.NO.	EQUIPMENT	CAPACITY	QTY
1.	TRUCK	10 T	01 NO ALWAYS AT SITE ADDL 1-2 NOS AS PER REQMT.
2.	TRAILOR WITH PULLING UNIT	20 T	01
3.	TRAILOR WITH PULLING UNIT	60/70 T	.AS PER REQUIREMENT
4.	GENERAL PURPOSE MATERIAL HANDLING T&P (WINCHES 3T MECHANICAL OPERATED, SLINGS, CARPENTOR TOOLS, D SHACKLES, EYE BOLTS, FITTERS TOOLS, ELECTRICIANS KIT ETC)		- AS PER REQUIREMENT
5	WOODEN/ CONCRETE SLEEPERS		AS PER REQUIREMENT
6	CONSUMABLES FOR ABOVE & GENERAL PRESERVATIVES		AS PER REQUIREMENT
7	FORK LIFT	3 T	01
8	SET OF MEASURING TOOLS		AS PER REQUIREMENT
9	COMPUTER WITH PERIPHERALS		02 SETS
10	FIRE EXTINGUISHERS 10KG ABC DRY POWDER TYPE		MINIMUM 15 NOS

**NOTE:**

- The above list specifies only major T&P (may not be complete) to be deployed by the contractor and is based on minimum requirement. All additional/ other tools and plants including suitable capacity 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.
- Consignments which can not be handled by above cranes of contractor/ BHEL, has to be unloaded/ handled by sleeper jack method. Alternatively suitable capacity crane is to be arranged by contractor for handling such consignments. The bidders are required to take note of it while submitting their offer.
- Suitable capacity crane 55/75T and 14/20T capacity without slings & lifting tackles will be provided by BHEL on sharing basis. All other terms & conditions shall be as per tender clause no. 35.
- Other terms and conditions regarding above shall be as per the special condition of the contract clause of section III A (Tools & Plants, IMTEs)

**TENDER NO. BHEL/NR/SCT/UHL/MATL. HAND. & ETC/576**

Annexure IVA

**INDICATIVE TENTATIVE LIST OF GENARAL TOOLS & PLANT MATERIAL HANDLING (TO BE ARRANGED BY THE CONTRACTOR AT HIS OWN COST)**

S.NO.	ITEM	QTY.(Nos.)	REMARKS
1	Slings (10, 16, 25, 32, 40, 50 mm )	As per requirement	
2	Pulling & Lifting machines 5T	2 no	
3	Chain Pulley blocks (2T, 5T, 10T)	1 each	
4	D-Shackles & Eye Bolt	Assorted up to 20T	
5	Hydraulic Jacks (10, 20, 50 100 Tons)	2 each	
6	Wire Ropes	As per requirement	
11	Manila Ropes	As per requirement	
12	Turn buckles & chain shackles	Assorted	
13	Set of Carpenter tools	1 set	
14	Crow Bar (0.5, 1.0, 1.5 meter)	2 each	
15	Set of preservatives	As per requirement	
16	Torque Spanners/ Wrenches	As per requirement	
17	All general purpose T&P	As per requirement	

**Note:**

1) The above list specifies only major T & P (may not be complete) to be deployed by the contractor. All additional/ other tools and plants required for timely and satisfactory completion of works/ testing etc. shall also be deployed by the contractor with in the finally accepted rates/ prices.

2) Other terms and conditions regarding above shall be as per the special condition of the contract clause of section III A (Tools & Plants, IMTEs)

3) The T&P marked BHEL in the remarks column shall be arranged by BHEL

**TENDER NO. BHEL/NR/SCT/UHL/MATL. HAND. & ETC/576**

**Annexure IVB**

**INDICATIVE LIST OF TOOLS AND PLANTS FOR ERECTION TO BE ARRANGED BY THE CONTRACTOR AT HIS OWN COST**

<b>S.NO.</b>	<b>ITEM/ DESCRIPTION</b>	<b>QTY.(Nos.)</b>	<b>REMARKS</b>
1	Double end spanners upto 60mm	2 No. each	
2	Ring spanners upto 60mm	2 No. each	
3	Hammer 500 gm, 1 Kg, 2Kg, 4 Kg,8 Kg	2 No. each	
4	Nylon/ Wooden Hammer	As required	
5	Box spanner set upto 60 mm	1 No. each	
6	Set of Slogging spanner upto 60 mm	1 No. each	
7	Torque Wrenches upto 2000 NM	1 set	
8	Impact Wrench (Pneumatic) upto 2400 NM		
9	Chiesel 14mm, 22mm	1 No. each	
10	Hacksaw 400 mm with blades	2 nos	
11	Electrician Tool Kit	As required	
12	Soldering iron (35/ 125 Watts)	As required	
13	Plier 1", 1 1/2"	1No. Each	
14	Screw driver set	1No. Each	
15	Letter punch A-Z (10mm)	1 set	
16	Number punch 0-9 (10mm)	1 set	
17	Chain pulley block 1T, 3M	2 nos	
18	Chain pulley block 5T, 3M	2 nos	
19	Pull lift 5 T	2 nos	
20	Turn Buckle ( 2 T, 5 T)	4 each	
21	Mechanical Jacks (5, 10, 20, 35 T)	4 each	
22	Hydraulic Jacks (5, 10, 20T)	4 each)	
23	Gas cutting set (Acetyline Cylinder, Oxygen Cylinder cutting set with hose & regulator.	As required	
24	Brazing torch set (With oxygen, acetylene cylinder)	As required	
25	Compressed air spray painting Unit	1 No.	
26	Air hose 16mm dia.	As required	
27	Aluminium ladder 4 M length	2 nos	
28	Welding generator (300/ 600 A) with cable & holder	As required	
29	Air Arc Gouging Arrangement	1 no.	
30	Electrode Oven	4 nos	
31	Wire Brush	As required	
32	Flat/ round/ triangular/ square/ needle file (assorted)	1 set	
33	Oil stone / oil can	As required	
34	Allen key set (MM/ BA/ Inch size - assorted)	1 set each	
35	Crow bar (1.5M, 2.1M)	2 Each	
36	Scissor	2 nos	
37	Leather gloves / Rubber glouses/Cotton gloves	As required	
38	Goggles green	As required	
39	Mobile power boards	6 nos.	
40	Set of carpentat tools	1 set	
41	Plumb-with line dori	1 no.	
42	MIG/ TIG Welding machine with accessories	As required	
43	Angle grinder (AG7, AG9) machine	4 nos each	

**TENDER NO. BHEL/NR/SCT/UHL/MATL. HAND. & ETC/576**

44	Sander (HS7)	4 nos	
45	Straight grinder (GQ4, GQ 6)	4 nos	
46	Pneumatic straight grinders(use upto 100 mm dia )	4 nos	
47	Pneumatic Angle grinders(use upto 100 mm dia )		
48	Flexible shaft grinder (FF2)	3 nos	
49	Portable pneumatic drill machine ( upto 40 mm)	1 set	
50	Portable electric dril machine (upto 40 mm)	1 set	
51	Fire fighting equipment for A,B,C class of fires	Adequate Qty	
52	Hydraulic test pump (100 Kg/cm2)with pressure gauge	1 no	
53	Pipe bending machine for pipe upto 50 mm	1 no	
54	Bench Vice	2 nos	
55	Pipe Vice	2 nos	
56	Scraper (Flat/ triangular/ half round)	2 each	
57	First Aid Box with medicine	2 sets	
58	Centre punch	4 nos	
59	Hole Punch (assorted size)	2 nos each size	
60	Portable drilling Machine (concrete upto 40 mm)	As required	
61	Air Compressor	As required	
62	Hydraulic pump hand operated.	1 no	
Note:			
1) The above list specifies only major T & P (may not be complete in items or numbers) to be deployed by the contractor. All additional/ other tools and plants required for timely and satisfactory completion of works/ testing etc. shall also be deployed by the contractor with in the finally accepted rates/ prices.			
2) Other terms and conditions regarding above shall be as per the special condition of the contract clause of section III A (Tools & Plants, IMTEs)			
3) The T&P marked BHEL in the remarks column shall be arrange by BHEL			

**TENDER NO. BHEL/NR/SCT/UHL/MATL. HAND. & ETC/576**

<b>Annexure V</b>			
<b>LIST OF T&amp;P AND IMTE FOR TRANSFORMER ERECTION/ COMMISSIONING TO BE ARRANGED BY THE CONTRACTOR AT HIS OWN COST</b>			
<b>S.NO.</b>	<b>ITEM/ DESCRIPTION</b>	<b>QTY.(Nos.)</b>	<b>REMARKS</b>
1	High vacuum filter machine (2000 L P H )	1	
2	Vacuum pump for evacuation of transformer tank.	1	
3	Hydraulic Jacks 10 Tons	5	
4	Wooden sleepers	10	
5	Tarpauline for covering (3M x 6M)	4	
6	Hand tools (spanners, screwdrivers, hammers etc)	2 sets	
7	Slings, ropes, manila rope, D-shackles, spanners (upto 36 mm size) & other fitter / electrician hand tools.)	2 sets	
8	Pully 3/5 tonnes	2 each	
9	Chain Pulley blocks( 3T, 5T)	2 each	
10	Welding machine set.	1 set	
11	Gas cutting set with gas & cutting set.	1 set	
12	Winch 10 Tons capacity	1 no.	
13	Multimeter	1 set	
14	Megger Hand operated 500V / 1000V	1 set	
15	Megger Motorised 2500v / 5000v	1 set	
16	Transformer turn ratio meter	1 set	
17	single phase variac 0-260 V, 8 Amps.	1 set	
18	Oil BDV Test Kit 0-100 KV	1 set	
19	Tong tester 0-30-60 Amps.	1 set	
Note:			
1) The above list specifies only major T & P (may not be complete) to be deployed by the contractor. All additional/ other tools and plants required for timely and satisfactory completion of works/ testing etc. shall also be deployed by the contractor with in the finally accepted rates/ prices.			
2) Other terms and conditions regarding above shall be as per the special condition of the contract clause no. 38 of section III A (Tools & Plants, IMTEs)			
3) The T&P, IMTEs marked BHEL in the remarks column shall be arranged by BHEL			

**TENDER NO. BHEL/NR/SCT/UHL/MATL. HAND. & ETC/576**

<b>Annexure-VI</b>			
<b>INDICATIVE LIST OF IMTE`S (ELECTRICAL) TO BE ARRANGED BY THE CONTRACTOR AT HIS OWN COST</b>			
<b>S.NO.</b>	<b>ITEM</b>	<b>QTY.(Nos.)</b>	<b>REMARKS</b>
1	Analog multimeter voltage AC/DC 2.5-2500V/current AC /DC-100Ma to 10A, Resistance upto 200 Mohm	As per requirement	
2	Digital Multimeter	As per requirement	
3	Megger hand operated 500V / 1000V 200 Mohms	As per requirement	
4	Megger motorized 2500V / 500V 2500 00 Mohms	As per requirement	
5	Phase sequence indicator 110-450V	As per requirement	
6	Frequency meter 0-115-230-440 0-300-600A	As per requirement	
7	Tong tester	As per requirement	
8	Single phase variac 0-220 V, 8/15A	As per requirement	
9	Three phase variac 0-415, 8/15A	As per requirement	
10	Milli volt meter 600-60 mv D.C	As per requirement	
11	Rheostat 0-250 ohms 2A, 0-8 Ohms 15A, 0-8 Ohms 15A, 0-26 Ohms 5A, 0-165 ohms 2 Amps	As per requirement	
12	Hand tachometer(Digital) 0-15000 r.pm	As per requirement	
13	Function Generator - Input/ output 220V AC/ 30 V DC, 20 VA	As per requirement	
14	A.C. Voltmeter 0-75-150-300-600V	As per requirement	
15	D.C. Voltmeter 0-75-150-700-600	As per requirement	
16	A.C. Ammeter 0-5-10 Amps.	As per requirement	
17	D.C. Ammeter 0-1-2.5-5 Amp.	As per requirement	
18	Dual channel, double beam Oscilloscope 20 M HZ	As per requirement	
19	secondary injection Kit 0 to 5 Amp	As per requirement	
20	Digital micro Ohm meter	As per requirement	
21	A.C. H.V.Test Kit 0-40 KV, 400 KVA	As per requirement	
22	Vibration Measurement equipment	As per requirement	
23	Dead weight Tester for calibration of pressure gauge.	As per requirement	
24	Wheatstone bridge.	As per requirement	
25	Kelvin's double bridge	As per requirement	
26	Partial discharge monitoring	As per requirement	
27	U.V. Recorder	As per requirement	
28	C.T.'s 50/100/200/500 by 5A	As per requirement	
29	P.T's 3.3/6.6/11/13.8by 110 V	As per requirement	
30	D.C. Shunt 2000A / 10 Mv		BHEL
31	Stop watch		
32	Precision Thermometer		
33	Sound level meter		BHEL

**TENDER NO. BHEL/NR/SCT/UHL/MATL. HAND. & ETC/576**

	150 db.		
34	Temperature measurement system with RTD Measuring stator.		BHEL
35	<p>Precision tools (IMT) TENTATIVE QUANTITY</p> <ol style="list-style-type: none"> <li>1. 0.02 accuracy block level-2 nos</li> <li>2. Dumpy level with accessories- 1 no</li> <li>3. Inside micrometer – as per requirement</li> <li>4. Outside micrometer-0-25, 25/50, 50-75, 75-100, 100-150</li> <li>5. Vernier callipers150, 300 – 2 each</li> <li>6. Telescopic gauge- 2 sets</li> <li>7. Slip gauge- 1 set</li> <li>8. Feeler gauges- as per requirement</li> <li>9. Dial gauge with magnetic stand- 12 nos</li> </ol>		
Note:			
<p>1) The above list specifies only major IMTE – Electrical (may not be complete) to be deployed by the contractor. All additional/ other IMTEs required for timely and satisfactory completion of works/ testing etc. shall also be deployed by the contractor with in the finally accepted rates/ prices.</p>			
<p>2) Other terms and conditions regarding above shall be as per the special condition of the contract clause no. 38 of section III A (Tools &amp; Plants, IMTEs)</p>			
<p>3) The IMTEs marked BHEL in the remarks column shall be arrange by BHEL</p>			

**CERTIFICATE OF DECLARATION FOR CONFIRMING THE KNOWLEDGE OF SITE CONDITIONS (Please refer Clause 57.0)**

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 and 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 conditions.

Tenderers Name and Address

Place:

(Signature of the Tenderers  
with stamp)

Date:

**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..... )

**TENDER NO. BHEL/NR/SCT/UHL/MATL. HAND. & ETC/576**  
**Annexure - IX**

**FORMAT OF UNDERTAKING**  
**(To be submitted in the bidder's letter head)**

REF:

Dt.

**Bharat Heavy Electricals Limited**  
**Power Sector – Northren Region,**  
**Plot No. 25 , Sector - 16A ,**  
**Distt. Gautam Budh Nagar,**  
**NOIDA – 201 301. INDIA**

**Sub.:** Material Handling and Erection, Testing & Commissioning of 3X33.3 MW UHL Stage III HEP, Chullah, Distt. Mandi, HP.

Dear Sirs,

With reference to above, this is to confirm that as per tender conditions, we have visited UHL 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)

**TENDER NO. BHEL/NR/SCT/UHL/MATL. HAND. & ETC/576**  
**Annexure-X**

**FORMAT FOR NO DEVIATION CERTIFICATE**  
**(To be submitted in the bidder's letter head)**

**REF:**

**Dt.**

**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 Material Handling and Erection, Testing & Commissioning of 3X33.3 MW UHL Stage III HEP, Chullah, Distt. Mandi, HP.

**TENDER NO. BHEL/NR/SCT/UHL/MATL. HAND. & ETC/576**

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)

**FORMAT FOR E-PAYMENT DETAILS: - BHEL-PSNR-NOIDA**

(To be given in Company letterhead)

Beneficiary Name :  
Bank Name & Branch :  
MICR Code (9 Digits) :  
IFSC CODE :  
(VALID FOR NEFT)  
Beneficiary Account No. :  
Beneficiary E-mail ID :  
(for payment confirmation)

**GENERAL TERMS AND CONDITIONS OF REVERSE AUCTION (RA)**

Against this NIT for the subject work, **tender shall be processed through Reverse Auction mode i.e., ON LINE BIDDING ON INTERNET. The General Terms and Conditions of the RA shall be as follows:**

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 to the vendor in writing, in case of reverse auction along with the details of Service Provider to enable them to contact & 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 format (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), which will help to arrive at "Total Cost to BHEL".
7. Reverse auction will be conducted on scheduled 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. During Reverse Auction, if no bid is received within the specified time, BHEL at its discretion, may decide to revise opening price/ scrap the reverse auction process/ proceed with conventional mode of tendering.
11. **Sealed bid Reverse Auction:** The opening bid (In the initial auction) of the bidders shall be same as that quoted in their Final Sealed price submitted to BHEL. **The bidders shall confirm in writing to BHEL that their opening bid (In both cases) shall be same as that quoted in their final sealed price bids submitted to BHEL against this NIT along with Technical Bid (Part-I).**
12. BHEL reserves the right to cancel Reverse Auction (RA) without assigning any reasons and resort to considering the sealed bids submitted by vendor for processing and finalizing the tender.
13. Any variation between the on-line bid value and the signed document will be considered as sabotaging the tender process and will invite disqualification of vendor to conduct business with BHEL as per prevailing procedure.
14. 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's standard practice.
15. Bids-given by the bidders during the Reverse Auction process will be taken as an offer to execute the work. Bids once made by the bidder, cannot be cancelled/ withdrawn and bidders shall be bound to execute the work as mentioned above at the final bid price. Should be bidder (Lowest) back out and not execute the contract as per the rates quoted, BHEL shall take action as appropriate.

BILLING BREAK UP FOR SUB CONTRACTOR FOR UHL ETC TENDER							
Sr no.	ACTIVITY		UNIT NO.			COMMON	TOTAL
			I	II	III		
<b>1</b>	<b>TURBINE</b>	<b>28.5</b>					
i)	Embedded parts comprising , primary embedded piping, DT elbow liner etc		0.3	0.3	0.3		0.9
ii)	Foundation parts comprising stayring, spiral csing including hydraulic testing, secondary embedded piping, inlet pipe etc		1.75	1.75	1.75		5.25
iii)	Runner and shaft assembly		0.1	0.1	0.1		0.3
iv)	Guide apparatus trial and final assembly		2.1	2.1	2.1		6.3
v)	Main Inlet Valve (spherical) & accessories including Servomotor		0.6	0.6	0.6		1.8
vi)	Guide bearing including pad scraping		0.7	0.7	0.7		2.1
vii)	Shaft sealing		0.2	0.2	0.2		0.6
viii)	OPU, pressure accumulator, governor etc		0.2	0.2	0.2		0.6
ix)	OPU adjustment, Dry stroking and time adjustment of Guide Apparatus		0.25	0.25	0.25		0.75
x)	Oil, air, water piping etc		0.8	0.8	0.8		2.4
xi)	Instrumentation and box up for readiness for spinning		1	1	1		3
xii)	Pre commissioning checks		1.5	1.5	1.5		4.5
							28.5
<b>2</b>	<b>GENERATOR</b>	<b>30</b>					
i)	Dressing of foundations		0.05	0.05	0.05		0.15
ii)	Stator assembly, winding, HV etc		1.5	1.5	1.5		4.5
iii)	Stator shifting to pit and its alignment, levelling etc		0.1	0.1	0.1		0.3
iv)	Rotor assembly in service bay, HV etc		2.88	2.88	2.88		8.64
v)	Rotor lowering in pit		0.15	0.15	0.15		0.45
vi)	Lower bracket assembly in service bay		0.06	0.06	0.06		0.18
vii)	Instt of lower brkt in pit, alignment etc		0.15	0.15	0.15		0.45
viii)	Assembly brake, jack system, HS lub system		0.2	0.2	0.2		0.6
ix)	Upper bracket assembly including flooring sheets in service bay		0.3	0.3	0.3		0.9
x)	Instt of upper brkt in pit, alignment etc		0.15	0.15	0.15		0.45
xi)	Blue matching of bearing pads and thrust bearing components		0.25	0.25	0.25		0.75
xii)	Shaft and thrust bearing assembly in service bay		0.3	0.3	0.3		0.9
xiii)	Shifting thrust bearing, shaft assembly to pit incl final installation		0.06	0.06	0.06		0.18
xiv)	Installation of stator air coolers.		0.3	0.3	0.3		0.9
xv)	Fire fighting system of generator.		0.2	0.2	0.2		0.6
xvi)	Generator instrumentation, gauge panel including calibration		0.3	0.3	0.3		0.9
xvii)	Rotor/ turbine/generator shaft coupling including any correction for alignment		0.4	0.4	0.4		1.2
xviii)	Extension shaft, slip ring, brush gear, CCL etc		0.75	0.75	0.75		2.25
xix)	Unit axis alignment		0.4	0.4	0.4		1.2
xx)	Box up of bearings, air baffles, generator		1	1	1		3
xxi)	Pre commissioning checks		0.5	0.5	0.5		1.5
							30
3	Digital Exc sys with DVR, accessoriies etc	1.8	0.6	0.6	0.6		1.8
4	11 kV SP bus duct isolated type, terminal cubicles etc	6	2	2	2		6
5	41MVA Step up transformer 3 phase with associated eqpt	4.5	1.5	1.5	1.5		4.5
6	Control & Monitoring sys incl computers, VDU's, printers, optic fibre cable incl uding Alarm & annunc.,sync panels, instruments, relays, automatic energv metering system etc	3	1	1	1		3
7	Protection system for gen and transformers with wiring & cubicles	1.5	0.5	0.5	0.5		1.5
8	Power, control & instrumentation cabling, cable trays, support structures,	2.1	0.7	0.7	0.7		2.1
10	Unit stn service, aux, other transf with 415 V switchgear	1.5	0.5	0.5	0.5		1.5
12	CW system	3.25	0.75	0.75	0.75	1	3.25
13	Drainage water pumps and piping etc for PH	1.5				1.5	1.5
14	Dewatering system pumps and piping etc	1.5				1.5	1.5
15	LP comp air system with compressors, accessories, piping etc	0.8	0.1	0.1	0.1	0.5	0.8
16	HP comp air system with compressors, accessories, piping etc	1	0.1	0.1	0.1	0.7	1
17	Painting of equipment	0.9	0.3	0.3	0.3		0.9
18	Spining and bearing run of unit	0.75	0.25	0.25	0.25		0.75
19	Synchronising including commissioning tests prior to synchronising	1.5	0.5	0.5	0.5		1.5
20	Load throw off tests and unit inspection	0.9	0.3	0.3	0.3		0.9
21	Turbine acceptance test & generator field acceptance test including preperatory works	1				1	1
	<b>TOTAL</b>	<b>92</b>					<b>92</b>
22	As per clause No. 59.4 E	3					3
23	On completion of trial run and handing over the units to AHPCL OR 3 months after the contractor has discharged his responsibilities as per contract, whichever is earlier.	2.5					2.5
24	2% of the contract value shall be payable on completion of all pending works, which includes settlement of all outstanding issues, reconciliation of material wherever required, area cleaning and handing over surplus materials and spares to AHPCL/ BHEL and submission of final bill.	2.5					2.5
		<b>100</b>					
	<b>TOTAL</b>	<b>100</b>					

## BRIEF DESCRIPTION OF TURBINE

**Embedded parts:** The embedded parts comprise mainly of draft tube knee lining, draft tube upper and lower cones and embedded pipelines in primary concreting.

The draft tube knee lining weighing approx 2.9 tonnes with inlet diameter 1,891 mm and rectangular outlet section 4,505 mm wide & 1085mm high is fabricated from 10mm thick plate and is supplied in single piece. 22 no holes of  $\Phi$ 200 mm have been done in the lower portion of the lining for concreting which are to be plugged at site. After concreting, grouting holes, wherever required, shall have to be done at site and plugged after grouting. All plugs shall be checked by 100 % dye penetration during erection. 8 no. foundation plates have been foreseen for pedestals of draft tube knee lining.

The draft tube cone comprises upper and lower cones. Upper cone is supplied in single piece and weighs app 4.3 tonne. On the top, upper cone is bolted to extended pivot ring and at bottom, it is bolted with lower cone. Lower cone is supplied single piece. Top and bottom diameters of upper and lower cones are 1545 and 1882 mm respectively.

The embedded pipelines weighing total about 2.7 tonnes for all units have been foreseen in primary concreting which mainly comprise penstock drain, draft tube drain, sleeve for drainage valves, air supply line, pressure relieving pipe from top cover etc.,. The drainage boxes of draft tube and penstock drain are to be welded at site. All welding shall be checked by DP at site.

The embedded tubes for field efficiency test of turbine weighing 13 T approx for all the units has been foreseen. Major portion of this piping will be embedded in first stage concreting, rest is exposed piping.

**Foundation parts:** The foundation parts comprise mainly stay ring, spiral casing, inlet pipe, lower and upper pit liner and embedded pipes in secondary concreting.

The stay ring with over all diameter 3270 mm, throat height of 202 mm and weighing approx 12.25 tonnes is supplied in single piece with portion of spiral casing welded on it. Center line of the stay ring is at EL 596.0 mtrs. It is provided with a set of 48 holes M 56 for bolting of turbine top cover and 48 no. M 56 holes for pivot ring.

The spiral casing is approx 7.5 tonne in weight with inlet dimension of 1382 mm. The spiral casing is supplied in about 4 segments with plate thickness varying from 21 to 32 mm which are to be finally matched, assembled, and welded at site with the stay ring. NDT shall be carried out on stay ring and spiral casing as per drawing requirements.

Two makeup pieces have been provided with erection allowance to be matched at site. Edge preparation in few sections may have to be done at site. The weld quality shall have to be X- ray/ ultrasonic tested as per drawing requirement.

The assembled stay ring & spiral casing shall be hydraulically tested at site to check for soundness of weld joints. The central test plug bolted type is in single piece and bolted to stay ring. The test cone shall be installed at spiral inlet end for pressure testing. The spiral casing shall be kept pressurized during the process of concreting.

#### **Inlet Pipe/outlet pipe with dismantling joint**

The inlet pipe 32 mm thick weighs approx 5.23 tonnes. The length of the pipe is approximately 3150 mm with inlet diameter 1382 mm.

#### **Lower and upper pit liner**

Lower pit liner is approx. 4.62 tonnes in weight and is made of 12 thick plate. Inner radius of pit liner is 2000mm. It has lower cylinder segment (three pieces), cone segment (in six pieces) and upper cylinder segments (in six pieces) to be assembled and welded together at site. All site welds to be DP tested 100%. The lower pit liner has a opening for runner removal.

Upper pit liner is approx. 7 tones in weight and is in two halves which is to be assembled and welded together at site. All site weld to be DP tested 100% at site. The plate of thickness of upper pit liner is 12mm. the inner radius of pit liner is 1900 mm and the height is 3600 mm.

**Embedded pipe lines in secondary stage foundation** for various functions for all 3 units have been provided. Necessary cutting in pit liner etc. wherever required for the embedded pipelines, pickling etc. shall have to be done at site. Pipes shall in general be supplied in straight lengths and to be bent at site as per requirement. **For medium and large size pipes, regular bends may not be supplied and therefore bends shall have to be fabricated at site.** The pipes are to be layed and welded at site as per drawing. All welds are to be 100% DP tested. All pipes are to be hydraulically tested at site after welding

**Guide apparatus** 20 guide vanes of feather height approx 200 mm are located at PCD of 2746 mm. Regulating ring is located out side the guide vane PCD. Top cover and bottom pivot ring are in single piece. Two servomotors are mounted on base plates to be installed/ leveled at site.

#### **Runner & shaft assembly**

The Francis type runner assembly with OD 2000 mm and height 732 mm is in single piece weighting approximately 4.53 tonnes. The runner cone is to assembled at the bottom of the runner. The stoppers/ plugs of runner cone shall be welded at site after tightening of the bolts.

The turbine shaft 3570 mm long is flanged type at both ends with guide bearing journal of diameter 750 mm. This is bolted to runner at turbine end with M72 fitted bolt and to generator shaft at upper end.

#### **Turbine guide bearing**

Self pumping lubrication pivoted segment type guide bearing with 6 segments has been foreseen. Plug in coolers are mounted inside the guide bearing housing. Other

essential instrumentation for temperature, level sensing etc have been provided. The joints are to be applied with loctite to be arranged by the erection contactor. The dowelling at bearing housing with top cover shall be done at site after centering of bearing housing.

### **Turbine sealing**

Rubber type sealing has been provided which is assembled on a bracket to be mounted on the top cover. Inflated type maintenance seal has also been provided. The rubber ring shall be sealing against the rotating sleeve to be fixed on the turbine shaft flange.

### **Other standard assemblies**

Various assemblies like feedback system, top cover drain pumps, oil pumping system, oil air receives, oil leakage unit as generally provided in any hydro unit are all foreseen which shall be erected at site.

### **Feedback mechanism**

It comprises of a mechanism to transmit the guide apparatus movement signal to the hydro mechanical cabinet (HMC) of governor. This is achieved through a wire rope with necessary brackets and versatile rollers connected from regulating ring to master switch and in turn to HMC.

### **Installation of metering instruments**

Pressure and temperature measuring instruments are installed on this metering panel to measure the pressures of different points like spiral casing, draft tube, sealing air & water pressures, servomotor closing & opening pressures etc. The pipelines shall be hydraulically tested to required pressures.

### **Monorail assy.**

Monorail assembly has been provided in the turbine pit to handle various components of guide apparatus and guide bearing etc.

### **Platform in turbine pit**

Chequered plate platform has been foreseen for easy movement in the pit. Plates are fixed over the angle frame for which matching holes are to be done at site.

### **Oil, water, air pipelines**

Pipelines after erection shall be tested at required pressures as per drawing requirement. Pipes shall be cleaned, properly clamped, painted at site.

### **Main inlet valve:**

1400 mm diameter spherical valve with rubber sealing arrangement has been provided as the main inlet valve before the turbine. The main body is fabricated/ machined and is bolted together in two halves. It has service seal (Main seal) on D/S side and SS Maintenance seal on U/S side, Levers, Servomotors By pass valve, Air release valve. The valve door is casting which will be bolted together with trunnion on both sides. The complete assembly is to be pressure tested at site before installation.

#### **Inlet pipe with taper piece of MIV:**

The inlet pipe 32 mm is in one piece of diameter 1432 mm. This shall be welded on upstream side to penstock at site. It shall be subjected to 100% ultrasonically tested.

### **BRIEF DESCRIPTION OF GENERATOR**

#### **GENERAL:**

The generator is of vertical shaft suspended type construction with closed air circuit ventilation and suitable for coupling to a Francis turbine. Static excitation system is provided for energizing the field winding of rotor. This supply is fed through slip rings located above the generator rotor on an extension shaft.

The generator thrust bearing and a guide bearing is positioned above the rotor in upper bracket and a guide bearing below the rotor in lower bracket. The bearings are of self-lubricating type and immersed in oil bath in which plug-in type oil coolers are provided. Thrust bearing is provided with high-pressure oil injection (HS Lubrication) system. Air operated brakes are mounted on lower bracket arms. These are also used for lifting the rotor for maintenance purposes. For trapping and subsequent evacuation of the brake dust generated during braking operation, brake dust collection equipment has also been provided.

Air coolers are directly mounted on the outer steel casing of stator. Water sprinkler type fire extinguishing system is provided for each unit. For monitoring the air gap in between generator stator-rotor & vibrations on the bearings of the machine, an on-line (continuous) monitoring system has been provided. Creep running of the machine is detected through a creep detector. Partial discharge measurement and shaft current monitor is also provided.

#### **GENERAL DESCRIPTION OF VARIOUS ASSEMBLIES.**

**STATOR:** The wound stator shall be dispatched to site in three segments. The joint-winding shall be made at site. The stator frame A/F is 5700 MM. The stator core outside/ inside diameter is 4,400/ 3,450 mm and height is 1200mm. HV test is to be carried out on complete stator at site after jointing three segment.

**MAIN GENERATOR SHAFT & THRUST COLLAR:** The shaft is having integral lower guide bearing. The thrust collar is separate which is to be pressed/ assembled at site. The bottom surface of the collar is polished in fine limits to act as runner surface.

**GENERATOR EXTENSION SHAFT:** The slip ring and brush gear assembly is assembled on generator extension shaft.

**SPIDER:** Rotor spider is a fabricated structure in single piece and to be assembled on generator shaft before rotor rim building at site. It has six arms.

**ROTOR RIM:** The rotor rim, which is assembled around rotor spider at site, along with shaft is built up from sheet steel laminations. The laminations are pressed between steel end plates during assembly and clamped by means of tight fitted studs. The rim segments do not have equal weight due to variation in thickness. Therefore, all the laminations are required to be degreased, cleaned, de-burring if any, segregated in groups of equal thickness by weight measurement and accordingly assembled. The rim is secured tangentially to the rectangular bars of the spider with sets of 5 part keys having a master key, so as to allow the rim to float freely during operation. As such, no hot wedging shall be required to be carried out. Broaching of the rim shall have to be done at site as is usual in rim type rotors.

**POLES WITH FIELD WINDINGS:** There are 12 poles each having 2 no. 'T' shaped tails to engage with corresponding 'T' shaped slots in rotor rim. Damper connections have also been foreseen.

**SLIP RINGS & BRUSH GEAR:** The slip rings are mounted on the extension shaft during erection. The brush-gear collector shall be mounted on the upper bracket.

**CARBON DUST COLLECTION SYSTEM:** Necessary arrangement is provided to prevent mixing of carbon dust with closed air ventilation system of generator. A small centrifugal fan is provided on extension shaft under the slip rings assembly. The carbon dust is collected in the cleanable filters mounted on the brush gear casing.

#### **BEARINGS:**

**THRUST BEARING:** Thrust bearing is positioned above the rotor in top bracket. Thrust bearing is of pivoted segmental pad type consisting of a set of 12nos. babbitted segmental pads. The bearing is of self-lubricating type and immersed in oil bath in which plug-in type of oil coolers are provided.

**GUIDE BEARINGS:** Two nos. segmental pad type of guide bearings are provided for generator; one positioned above the rotor along with thrust bearing housed in upper bracket and second below the rotor housed in lower bracket. The guide bearings are of pivoted pad type consisting of a row of white metal pads.

**HYDROSTATIC LUBRICATION SYSTEM:** A high-pressure oil system is provided for the thrust bearing in order to create a positive oil film over the pads at low speeds. The components consist of a positive displacement pump with its motor, filters, valves etc. mounted on a steel base.

#### **VENTILATION:**

The generator has closed circuit system of ventilation. Air coolers are to be assembled to the outer periphery of the stator frame.

**UPPER BRACKET:**

The upper bracket consists of a fabricated steel structure having a central part and 6 nos. radial arms. The arms are to be bolted and finally welded to the central part at site. It supports the weights of the stationary parts of brush gear, upper air baffles, generator covers, mechanical over speed device, creep detector, speed signaling generator (S.S.G) etc.

**LOWER BRACKET:**

The lower bracket consists of a fabricated steel structure having a central part and 4 nos. radial arms. The arms are to be bolted and finally welded to the central part at site. The lower guide bearing is housed in it along with oil coolers. Brake-cum-jack units are also mounted on the bracket for rotor braking.

**BRACKING AND JACKING SYSTEM:** has been provided for the braking of the unit during stopping and jacking whenever required.

**BRAKE DUST COLLECTION EQUIPMENT:** The brake dust collection equipment consists of two extraction units for each hydro generator, hoppers around brake assembly for trapping the brake dust and flexible hoses for connecting hoppers to extraction unit.

**COOLING WATER SYSTEM:**

Cooling water pipe lines along with pressure gauge and flow monitoring instruments are provided to supply cooling water to air coolers and oil coolers.

**MAJOR INSTRUMENTS & DEVICES:**

- Mechanical over speed device.
- On line condition monitoring system for vibration & air gap.
- Creep detector system.
- Speed signaling generator

**WATER SPRINKLER TYPE FIRE EXTINGUISHING SYSTEM:**

Water sprinkler type fire extinguishing system independent for each unit has been foreseen. Smoke detectors and a control panel is provided in each of the four generators.

**General:**

-Special welding electrodes for main assemblies like draft tube, spiral casing, inlet pipe, Spherical valve and its inlet pipe etc shall be provided by BHEL manufacturing units. Any additional requirements resulting due to reasons namely but not limited to avoidable wastages, mis-handling, poor storage, high rate of rejections due to poor quality of welding or deployment of insufficiently experienced welders etc shall be arranged by contractor at his own cost. General purpose welding rods shall be arranged by contractor at his own cost.

-Insulating materials for stator winding shall be provided by BHEL.

-Operators for 1 no. EOT cranes 120/ 20 tonne to be provided by the contractor free of cost

-First filling of oil with 10% extra for turbine and generator bearings, OPU system, and transformers shall be supplied by BHEL. Any undue wastage of oil due to mis-handling, poor quality of piping and/or other works resulting into leakages or spillages shall have to be arranged by contractor at his cost or recoverable from him.

-In order to save time of assembly/erection of spiral casing, the welding shall be carried out by MIG process as far as possible. Two shifts or preferably three shifts working with deployment of sufficient number of certified welders, fitters etc shall be adopted to ensure completion of stay ring and spiral casing assembly in maximum of two months period.

-Since the subsequent units shall have to be erected/ commissioned with a gap of 2 months from the previous unit, the contractor shall have to complete the rotor assembly in around 2 months by working round the clock in this area. Moreover, two-shift working shall have to be adopted by the contractor to meet the erection schedule.

-In view of the tight erection schedule, limited area in service bay and rotor assembly being in critical path, whatever pre-erection preparatory works can be carried out in BHEL store area shall have to be planned accordingly. In particular, the cleaning, de-burring, de-greasing and segregation of rim punching by weight shall definitely be planned and carried out in store area.

**NDT:**

Stay ring, Spiral, MIV, Inlet pipe of spiral casing, Inlet pipe of MIV welding to be tested 100% UT & MPI as per drawing requirements.