VOLUME - IA

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Erection, Testing, Commissioning, Completion of facilities, PG Test & Handing Over including Handling of materials at BHEL / Client's Stores / Storage Yard and transportation to site, preparation of foundation, NDT, fixing of hangers & supports, application of lining, Insulation, Supply & Painting, Stenciling & Labelling of: -

- **Package-A: Mechanical works of FGD & Auxiliaries including FDPS of U#2 & U#3 at NTPC Barh Stage-I (3x660 MW) and,**
- **Package-B: Balance Mechanical Works of FGD & Auxiliaries including common systems and FDPS of U#4 & U#5 at NTPC Barh Stage-II (2x660 MW)**

BHARAT HEAVY ELECTRICALS LIMITED

Registered Office: BHEL House, Siri Fort, New Delhi – 110 049, India
Website: www.bhel.com

TECHNICAL CONDITIONS OF CONTRACT (TCC)
CONTENTS

1.0 Project Information:

Sl. No.	Description	Details
1	**Project Title**	U#2 & U#3 of Barh Stage-I (3x660 MW) and U#4 & U#5 of Barh Stage-II (2x660 MW)
2	**Customer**	National Thermal Power Corporation Limited (NTPC Limited)
3	**Location**	• Place: BARH • District: PATNA • State: BIHAR.
4	**Nearest Airport**	The nearest airport is Jay Prakash Narayan International Airport at Patna at about 75 Km from the project site.
5	**Nearest Railway link**	The nearest rail head Barh Railway Station (on Delhi–Kolkata main line), is approximately 07 kms from the project site.
6	**Access by Road/Major Cities**	The nearest National Highway is NH- 31. Nearest town is BARH which is approx. 4 KM from project site
7	**Temperature**	Climatological data from nearest observatory of IMD
8	**Seismic Zone**	Civil Works Seismic Design Criteria shall be as per Customer Specification
9	**Wind Speed**	Civil Works Wind Design Criteria shall be as per Customer Specifications

	INSTRUCTIONS TO BIDDERS
1.1.	The Bidder shall visit project site and acquire full knowledge and information about conditions prevailing at site and in & around the plant premises, together with site conditions, transportation routes, various distances, all the statutory, obligatory, mandatory requirements of various authorities and all information that may be necessary for preparing the bid and entering into the Contract. All costs for and associated with site visits shall be borne by the bidder.
1.2.	Other contractors would be working in this area and their structures are to be protected. The material brought and stacked for construction should not make hindrance to other contractors.
1.3.	The information given herein is for general guidance and shall not be contractually binding on BHEL/Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.
1.4.	The contractor, in the event of this work awarded to him, shall establish an office at site and keep posted an authorized, responsible officer with valid Power of Attorney for the purpose of the contract. Any order or instructions of the `Engineer' or his duly authorized representative, communicated to the contractor's representative at site office will be deemed to have been communicated to the contractor at his legal address.
1.5.	No claim will be entertained by BHEL on ground of lack of knowledge and the contractor's rates shall be deemed to have taken this into account.
1.6.	Bidders may fix up their site visit in consultation with below mentioned contact person:

Name:	Sh. P. K. Biswas	Sh. Satyajeet Roy
Designation:	Sr DGM	Sr Manager
Location:	FGD Barh Project	PSER Kolkata
Email:	biswas_pk@bhel.in	satyajeet.roy@bhel.in
Ph. No.	(+91) 922 911 5041	(+91) 964 406 4555

2.0	**Scope of Works:**
2.1.	Erection, Testing, Commissioning, Completion of facilities, PG Test & Handing Over including Handling of materials at BHEL / Client's Stores / Storage Yard and transportation to site, preparation of foundation, NDT, fixing of hangers & supports, application of lining, Insulation, Supply & Painting, Stencilling & Labelling of: - **1. <u>Package-A:</u> Mechanical works of FGD & Auxiliaries including FDPS of U#2 & U#3 at NTPC Barh Stage-I (3x660 MW) and,** **2. <u>Package-B:</u> Balance Mechanical Works of FGD & Auxiliaries including common systems and FDPS of U#4 & U#5 at NTPC Barh Stage-II (2x660 MW)**
2.2.	**Broad area of works includes, but not limited to: -** Below mentioned details are to give only general idea of FGD system/ equipment's to the Contractor. Any equipment's/systems not mentioned in this specification but which are required for the completion and smooth running of the FGD system contractor shall do the erection and commissioning of that system within the finally accepted rates / prices. **Flue Gas De-sulfurization (FGD) System:** i. FGD system mainly consists of Absorber tower along with oxidation blowers, booster fans, Lime stone grinding and slurry preparation system consist of wet ball mills, lime stone silos, slurry pumps, Gypsum dewatering system, associated piping, other auxiliaries as per followings: • Absorber system • RC Pumps • Elevator • Booster fans. • Structural steel (for absorbers, ducting etc) • Sump & sump pumps ii. The FGD system shall be based on Wet Limestone Forced Oxidation process.

iii. An independent Limestone Forced Oxidation (LSFO) type absorber system for each unit Each unit shall be provided with an independent absorber consisting of:

- An independent Limestone Forced Oxidation (LSFO) type absorber system for each unit. Each absorber system shall be complete with:
- Absorber tower complete with re-circulating slurry spray header(s) and nozzles, three stage mist eliminators, wash water nozzles, oxidation tank integral to tower, oxidation headers and nozzles, and agitators and all internal systems integral to the working of the absorber.
- 5x100% re-circulating slurry pump for each level of spray.
- Complete Ducting System from ID fan common outlet duct to absorber tower &from absorber outlet to wet stack chimney.
- 2x100% Centrifugal/ positive displacement type oxidation blowers / compressors
- 1 No. Emergency water tank for spraying water at inlet of Absorber for upset condition.
- Auxiliary Absorbent tank
- Passenger cum Goods elevator for each Absorber of minimum capacity of 1000kgs.

iv. Gas from terminal point on ID fan discharge duct shall be taken directly to the absorber through Booster Fans. In the absorber, SO2 in flue gas shall be removed by a spray of recirculating slurry, pumped by slurry recirculation pumps.

v. Booster Fan & Isolation Gates

- For each unit, two (2) nos. Booster Fans of axial type, Constant speed, variable pitch controlled each with drive motor, base plates, foundation bolts and nuts, inlet box, discharge case, coupling, coupling guard and suitable arrangement to prevent rain water entry to fan motor.
- Each Booster Fan shall be provided with bearing lubrication and hydraulic blade pitch control unit(s) consisting of:

    a. Oil pumps each with motor, coupling and coupling guard.
    b. Oil coolers.
    c. Filters, differential pressure switches, etc.

	d. Oil storage tank vi. Compressed oxidation air shall be blown through the slurry in the oxidation tank, to oxidize the Calcium sulphite to gypsum. vii. Clean gas from the absorber shall be taken to the Wet Chimney through three stage mist eliminators. viii. Limestone to the absorbers of the units shall be supplied by a wet limestone grinding system, common for the units. Limestone shall be fed to the Limestone day silos which in turn will feed the Limestone to wet ball mill through a gravimetric feeder. ix. The gypsum from the absorber(s) shall be pumped by dedicated gypsum bleed pumps to a common Gypsum Dewatering system consisting of two streams (2x100%) of primary and secondary hydrocyclone and vacuum belt filters for gypsum dewatering. The water removed from the absorber shall be recycled to the absorbers. The waste water from the system shall be collected and neutralized using lime and neutralized effluent shall be pumped at required pressure to waste water terminal point. x. The brief list of the major equipment to be erected under the FGD system but not limited to following: • Absorber System along with supporting structures • Booster Fans & isolation gates • Thermal Insulation and cladding sheets • Sump Pumps • Piping system • Misc platforms, galleries, handrails • All required structures for equipments & ducting • All shop fabricated structural steel including materials handling of the same. xi. Motorized Guillotine type gates with seal air fans shall also be provided at suction & discharge of each Booster Fan. xii. Inter connected piping, valves and fittings. Electrical actuator with accessories xiii. PIPING:

- **Slurry Piping**

  a. Piping from gypsum bleed pumps to gypsum dewatering system, along with recirculation lines (if required) necessary isolation and control valves
  b. Limestone slurry piping to each absorber, along with recirculation lines, all isolation and control valves.
  c. All connecting pipes / chutes along with necessary valves between various systems of the mill and from hydro-cyclone to common slurry storage.
  d. All slurry pipes having Material of construction carbon steel and rubber lined. End connections are bolted flanged connections.

- Oxidation Air piping
- Service Water
- Service Air & Instrument Air
- Process water piping
- Equipment Cooling water system piping
- Piping and equipment, as per requirement / drawings are to be thermally. Insulated with bonded / unbounded mineral wool /LRB mineral wool and to be covered with aluminium cladding
- All the above systems of piping include the erection of pipes, bends, elbows, valves, fittings, impulse piping and including root valves, sampling lines, drains, hangers and supports & other accessories so as to make the systems complete in all respect.

xiv. Fire protection and Detection System

Broad scope for Package-A and Package-B:

Erection, testing, commissioning, Completion of facilities, PG Test and handing over of Mechanical system of Flue gas desulphurization system (FGD) including FDPS at U#2 and U#3 of NTPC Barh Stage-I (3x660 MW) and U#4 and U#5 of NTPC Barh Stage-II (2x660 MW), Bihar. Brief detail is as below -

- **Package-A: Stage-I – Mechanical Work of U#2 & U#3 at Stage-I (3x660 MW) FGD & Aux including FDPS are in the scope of this tender.** Mechanical system of 'U#1 and common system of U#1, 2 &3' are being executed by another agency.

	• **Package-B: Stage-II –** Part Mechanical work of '***U#4&5 including common system of U#4&5***' have been erected by another agency. **'Erection of Balance quantity' and 'Testing, Commissioning, Completion of facilities, PG Test and Handing over of complete mechanical system of U#4 & U#5 including common system and FDPS of U#4 & U#5 at Stage-II (2x660 MW) FGD & Aux' are in the scope of this tender.** **Note:** 1. **Package-B: Stage-II –** It is a balance left out work which is to be carried out by the Contractor/Bidder. It consists of erection of balance quantity and complete Testing, Commissioning, Initial Operation and Handing Over of mechanical works, common system and FDPS of U#4 & 5 of Stage-II (2x660 MW) FGD. 2. Package-A & B as above shall be awarded to One (01) Agency and shall be governed as per MODE OF AWARD. All the clauses shall be applicable on both the packages separately (until otherwise explicitly mentioned). 3. LOA for each Package (A & B) shall be issued separately and each Package shall be considered as separate contract with separate contract period (as specified in Chapter-VI "Time Schedule" of TCC), separate start dates and separate contract value etc. 4. All the records of the contracts viz Measurement of work, progress monitoring, monthly review, performance evaluation etc. shall be maintained for all the contracts separately. 5. Clause of GCC Viz SD, LD, ORC, PVC, Time Extension, Retention amount, Guarantee Period, Quantity Variation, Final Bill, Breach of contract, etc. shall be applicable for each individual package/contract. 6. **Package A & B:** For each item, item rate shall be derived. Payment shall be made on actual execution of work on item rate basis.
2.3.	Erection & Commissioning of **Fire Detection and Protection system (FDPS)** of U#2 & U#3 at NTPC Barh Stage-I (3x660 MW) and U#4 & 5 of NTPC Barh Stage-II(2X660MW) is in the scope of contractor & distributed in following manner: - **Package-A & B: -** 1. **Hydrant System-** Hydrant system consists of (pipe, hydrant valves, landing valves, water monitors, hoses, branch pipes and nozzles etc).

	2. **HVW & MVW Spray System (High Velocity and Medium Velocity)** - It shall consist of water mains network, deluge valves, isolation valves, Y type strainers, spray nozzles/ projectors, spray nozzles piping network. **Terminal Point: -** • Tapping to be taken from NTPC fire Hydrant Line between existing chimney U#2 & U#3 for Stage-I. • For Stage-II: Tapping to be taken as in where basis based on actual position at site.
2.4.	**Terminal Points:** **Flue Gas Duct**: Tapping between existing ID Fan to newly erected damper before chimney. **Cooling Water, Service Water, etc**: Tapping to be taken as in where basis based on actual position at site.
2.5.	The work to be carried out at quoted / accepted rates by the Contractor under the scope of these specifications covers the complete work of handling, loading and transporting of materials from project stores sheds / storage yards to site of erection or preassembly yard and unloading at pre-assembly area/erection site, checking, pre-assembling of equipment at the preassembly yard with making all necessary arrangements, inspection, preservation, erection, levelling, and other adjustments, Lifting, laying, erection, bolt tensioning, bolt torque tightening, supporting and installation, pre and post weld heat treatment, inspection, NDT including radiography, providing assistance, approach and other necessary arrangements to other agency (deployed by BHEL) for conducting NDT/PWHT and hydrostatic tests by making all necessary arrangements (i.e. dummy plate welding, erection of temporary lines, etc. as required), water / steam flushing, air drying, nitrogen purging and other testing, cutting, edge / surface preparation, welding, grinding, radiography, LPI/MPI/UT/RT testing wherever needed, carrying out air tightness test using soap solution / kerosene, Vacuum test, hydraulic test, steam / air blowing, light up, assistance during cleaning, passivation, and inter connection of all the termination points, below and above ground piping, erection and dismantling of all temporary piping, valves, etc., and all other tests as per FQP and commissioning procedures, required for the above operations, all pre-commissioning tests, Completion of facilities, PG Test and handing over of FGD & Auxiliaries, including Fire Detection & Protection System as per packages.

2.6.	Scope covers installation of all valves including other miscellaneous in line / on line items, cleaning, pickling (if required) water / steam flushing, air drying disposal of fluids offsite, reinstatement, preservation of piping and miscellaneous items following hydro test, nitrogen purging, cleaning, painting, insulation, fabrication & installation, all associated incidentals setting and commissioning of pipe supports, guides, anchors, spring supports, temporary/permanent approach/platforms, as required.
2.7.	BHEL at its discretion may include works in other area on similar nature limited to 15% of awarded contract value, which are not mentioned in above scope of works. Contractor shall execute such works as desired and as directed by BHEL Engineer. The item rates & contract conditions shall remain unchanged for such works.
2.8.	The work under this contract shall be carried out as per BOQ Cum Rate Schedule and in compliance of tender conditions including technical specifications and approved drawings/ documents.
2.9.	**GENERAL**
2.9.1.	Further this is to be noted that the drawings and the documents furnished along with this specification are the sole property of BHEL. It must not be used directly or indirectly in any way detrimental to the interest of the company.
2.9.2.	**Erection & Commissioning of Single Girder EOTs of respective Unit is** in the scope of contractor, including associated electrical works. **Load test of EOTs (Single Girder)** shall be carried out by OEM, however required assistance for commissioning & load test (includes preparing cradle for loads) with manpower and T&P are to be provided by Contractor. Operation of EOTs are in the scope of contractor till Completion of facilities and handing over of Unit. During usage, there will be wear and tear of parts. For such incidents, materials/spares shall be provided by BHEL for replacement/maintenance. In some cases of urgency, the material may have to procured by Contractor. Cost of same shall be reimbursed with RA bill based on submission of relevant appropriate documents. However, for any damages occurred due to negligence of contractor replacement/repair/rectification shall be carried by contractor at its own cost. In case of non-compliance, BHEL shall arrange for replacement/repair/rectification and debit the same from contractor's RA bill with 5% overhead.

2.9.3.	The area of work shall be cleared of all vegetation, rubbles and other objectionable matter and materials by contractor. No separate payment for these operations shall be made for such works.
2.9.4.	All the works areas shall be adequately flood lighted to the satisfaction of the Engineer-in-Charge when the work is in progress during the night shifts.
2.9.5.	Drawings showing enough details for the construction as per the specification shall be furnished to the contractor in a phased manner as far as possible.
2.9.6.	All necessary arrangement for safety like Hard Barricading with scaffolding pipes and providing of safety net is in bidder's scope.
2.9.7.	Establish levels and coordinates at suitable intervals from existing bench marks, marking of reference (level and distance) and other identification works etc., The contractor shall provide the owner/BHEL such an assistance, instruments, machines, labour and materials as are normally required for examining, measuring and testing any work and the quality, weight or quantity of any material used.
2.9.8.	Medical/First aid centre/medicine purchased for emergency/Doctor purpose along with ambulance services with fuel and operator (round the clock) shall be arranged by BHEL for handling medical emergencies. Cost against these facilities shall be distributed / shared among the vendors working in the Project site proportionately based on contract value (**As per HSE plan**). However, Contractor shall arrange for the above facilities till the time BHEL provided common facility is operational.
2.9.9.	Any activity which is necessarily required for satisfactory execution of any item of BOQ in line with technical specifications shall be deemed to be included in BOQ item even if it is not described in the item description and no extra payment shall be made against such activity.
2.9.10.	In case of any contractor's scope pipe is routed along the path of walkways, suitable crossover has to be prepared using structural material. In case, any additional is approach/ platform required for commissioning/operation of the actuators/valves/gates/dampers is required it shall be fabricated by contractor using structural material. Payment/ payment terms of such work shall be done as per **Rate schedule identifier – 1.1a or 1.1b of Section-I of BOQ** depending upon the provision of scope of structural steel supply.

2.10.	**Tentative Technical Staff Requirement in areas of respective Packages-A & B:**
2.10.1.	• **Project Manager –** 01 Head with relevant experience in Power Plant (Boiler/FGD) Works etc. for Pkg-A/B. • **Experienced Engineers** – 04 Heads; 02 – Structure, 01 – NPP + Ducts, 01 – Yard Piping/Fire water and Fire protection System. • Experienced Supervisors – 5 heads • Planning & Billing Engineers – 01 head (01 for Planning& Billing). • Stores, Gate Pass – 1 head. • Quality Control Engineer – ▪ Quality Control Engineer – 01 head with relevant experience in NDT (Level-2 in RT, UT, LPI/MPI) • Safety Officer-2 Heads. • Safety Steward-2 Heads. • Operator, Licensed Electrician, Mechanic - As per requirement • Experienced Helpers – Lot for similar nature of work • Security Guards (Round the Clock) – As per requirement**.** **Note: Above manpower requirement is tentative only. Contractor shall augment manpower to meet the project schedule/ milestones. Deployment of manpower shall be progressive to meet the project schedule. Relevant experience is subject to decision of BHEL site in-charge.**
2.10.2.	Deputation of above man-power shall be jointly decided at site in line with construction Schedule.
2.10.3.	Engineer/ supervisor for other functions required for proper execution are to be provided as per site requirement and not considered in above list.
2.10.4.	BHEL reserves the right to reject or approve the list of personnel proposed by the contractor. The persons whose bio-data have been approved by BHEL will have to be posted at site and deviation in this regard will not be permitted unless specific & reasonable justification is made.

	Performance of their team to be review on quarterly basis & BHEL may ask for replacement of Engineer/ Supervisor based on their performance. Same to be replaced by Contractor within 30 days.
2.10.5.	The contractor shall maintain a site organization of adequate strength in respect of manpower, construction machinery and other implements at all times for smooth execution of the contract. This organizational structure shall be reinforced from time to time, as required to make up for slippage from the schedule without any commercial implication to BHEL. The site organization shall be headed by a competent construction manager having sufficient authority to take decisions at site.
2.11.	**Operator and Computer for exclusive use of BHEL:**
2.11.1.	The contractor will have to Supply & install of 1 No. PC (multimedia PC work station Pentium- Core-i5-650, 3.2 GHZ or above, 1 TB SSD (or 500 GB SSD + 500 GB HDD), 8 GB RAM, 100 /1000 MBPS LAN card) of HP / HCL / COMPAQ / LENEVO or equivalent make with window 10 or higher, 64 bit (with roll back to 32 bit O/S and required software like MS Office 2016 or higher, AutoCAD 2014 or higher, ADOBE PDF CREATOR with 1 no. Multifunction (scanner / copy / print) & 1 No. A4 Colour laser printer including all kind of consumables/license charges (except electricity charges) as per instruction of BHEL for exclusive use of BHEL. Maintenance of these IT assets shall be responsibility of Contractor. These computers / printer / Multifunction shall remain Vendors property and they will be allowed to take out the same after closing of contract. The contractor shall provide data / information etc. in prescribed formats for periodical updating of the progress reports, material management reports, updating of network pertaining to the contractor's scope of work etc. The contractor shall also provide: • Computer Operator acceptable to BHEL Site with sufficient computer knowledge (knowledge of MS office) and All statutory compliances, gate passes, food and accommodation of these manpower shall be arranged by contractor. **Payment shall be made as per BOQ item no "Section-II". Refer clause 2.12.11 of TCC.** IT facilities are to be provided within 30 days from LOI date till completion of work, without any extra cost to BHEL.

2.11.2.	In case of non-compliance of Contractor regarding deployment of IT hardware facilities, BHEL shall deduct the amount from subsequent RA bills of contractor based on actuals with 05% overheads. In case the contractor does not deploy or delays deployment of above said manpower with reference to specific instructions from BHEL, BHEL will levy penalty as per **TCC clause 2.12.11**.
2.12.	**Erection Clause:**
2.12.1.	The works to be performed under this contract consist of providing all labour, supervision, material, scaffolding, construction equipment, tools & plants, temporary works, supplies including POL, transportation and all incidental items not shown or specified but reasonably implied or necessary for the proper completion of work in all respects. Testing of all materials etc. are included on the rates of items of work. Works shall be carried out only with approved drawings. The unit rates shall include all material equipment, fixtures, labour construction plant, temporary works and everything whether of permanent or temporary nature necessary for the completion of job in all respects.
2.12.2.	The bidder should fully apprise himself of the prevailing conditions at the proposed site, climatic conditions including monsoon pattern, local conditions, soil strata and site-specific parameters and shall include for all such conditions and contingent measures in the bid, including those which may have not been specifically brought out in the specifications. Declaration already provided in Forms and Procedure.
2.12.3.	The quantities indicated in the tender specification are approximate and are liable for variation at the requirement of work/discretion of BHEL. The work executed shall be measured and priced as per the unit rate arrived at for each work area as mentioned in the relevant clauses of GCC and preamble to BOQ.
2.12.4.	It shall be specially noted that, the contractor may have to work round the clock (24x7) or may have to deploy additional manpower/resources to achieve the completion schedules / plans / targets during the entire course of erection and commissioning works, which may involve considerable payment including overtime. Hence, contractor's quoted rate shall take into consideration of all expenses that will be incurred for such arrangement of personnel including labours, engineers / supervisors, T&Ps etc. Time is the essence of contract. Night shift working is envisaged for works not hazardous in nature with due permission of BHEL like- Erection works at low heights, Material shifting, Preassembly works, welding works etc.

2.12.5.	The terminal points can be inferred from the relevant drawings and any further clarifications can be obtained/decided by BHEL at site and that **is final and binding** on the contractor for deciding the scope of work and effecting the payment for the work done up to the terminals. Carrying out work as per the specification between equipments constituting terminal points, whether the terminal equipments fall within the scope of work/specification, contractor shall carry out the terminal joints at either end. Also, wherever the piping connection to the terminal points involve flanged joints, matching of flanges, fixing gaskets, bolting and tightening as per BHEL Engineers instructions is in the scope of work. In case, piping connected to equipment, matching of flanges for achieving the parallelism and alignment at the equipment end, by suitably resorting to heat correction or other method as instructed by BHEL Engineer, is within the quoted rate.
2.12.6.	Considering the area constraint in the subject project, Contractor has to work in close co-ordination with another Erection/Civil agency at site. BHEL engineer will co-ordinate area clearance. In a project of such magnitude, it is possible that the area clearance may be less/more at a particular given time. Activities and erection program have to be planned in such a way that the project milestone events like ATT, Gas-In, etc., are achieved as per schedule/ plans. Contractor shall arrange & augment the resources accordingly.
2.12.7.	No member of the already erected structure/ platform, pipes, grills, platform, other component and auxiliaries should be cut without specific approval of BHEL engineer. In case it is necessary to cut, the contractor shall rectify / repair in a manner acceptable to BHEL / Customer without any additional cost.
2.12.8.	The storage yards are located within the plant boundary at multiple locations which shall be intimated during course of work. All other materials have to be transported from storage yard to construction area by the contractor at his own cost, using own **Pick & Carry Crane (Farrana),** crane and trailer.
2.12.9.	**Painting:** The painting works including supply of the required paints and primers and associated consumables shall be carried out as mention in the painting schedule of the respective units. **All the painting work (Refer TCC Chapter-XVIII) required for handing-over of the equipment to customer has to be carried out in this scope.**
2.12.10.	The scope of work covered under this specification is of highly sophisticated nature, requiring the best quality workmanship, engineering and construction management

	including high standard safety management (as per relevant clause of tender document) and green belt management (Project Management, HSE & Quality etc.). The contractor should ensure successful and timely completion of the work. The contractor must have adequate quantity of tools, construction aids, equipments etc., in his possession. He must also have on his payroll adequately trained, qualified and experienced supervisory staff and skilled personnel. The manpower deployment identified by contractor shall match with above scope of works. **(Refer HSE Plan)** Contractor shall execute the work as per sequence and procedure prescribed by BHEL at site. The erection manuals which are available with BHEL site office are to be referred for compliance and guidance before taking up the work. Any failure to comply with the above might lead to rework and the cost for the same shall be borne by the contractor only. BHEL engineer, depending upon the availability of materials, fronts etc., will decide the sequence of erection and methodology. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the method of erection adopted in erection of similar jobs or for any reason whatsoever.
2.12.11.	Contractor has to deploy following manpower at site/BHEL PSER office, mention in clause 2.11.1: a. Computer Operator The deployed manpower shall report to BHEL and may be deployed at any location. BHEL shall make payment on pro rata monthly basis on actual deployment as per BOQ (considering 26 working days in a month). **Payment shall be made as per BOQ item no "Section-II".** **NOTE:-** a. Monthly unit rates are based on minimum wages as per NTPC (Barh) circular at the time of NIT multiplied by **factor of 1.41**. Monthly unit rates shall be revised as when it is changed/informed by NTPC. b. Since the rates against manpower services are variable according to periodic revision, therefore ORC and PVC as per GCC shall not be applicable for providing these manpower services. Contractor has to deploy **personnel** at site, within 15 days, from the date on which requirement is mentioned in Contractor performance review (F-14). In case the contractor does not deploy or delays deployment of above said manpower with reference to specific instructions from BHEL, **BHEL will levy penalty of Rs. 500 per**

	person per service day, for such delay. Payment during the absenteeism shall not be paid.
2.12.12.	Furnishing samples of all materials required by the engineers for testing/inspection and approval for use in the works. The samples may be retained by the engineer for final incorporation in the works.
2.12.13.	Furnishing test reports for the products used or intended to be used, if called for the specifications or if so desired by the engineer.
2.12.14.	Giving all notices, paying all fees, taxes, statutory clearances, license (like T&P load test, etc), etc., in accordance with the general conditions of contract, that is required for all works including temporary works.
2.12.15.	Arranging manufacturer's supervision for items of work done as per manufacturer's specifications when so specified.
2.12.16.	The contractor shall provide the owner/BHEL such an assistance, instruments, machines, labour and materials as are normally required for examining, measuring and testing any work and the quality, weight or quantity of any material used.
2.12.17.	Providing all incidental items not shown or specified but reasonably implied or necessary for the successful completion of the work in accordance with contract.
2.12.18.	Arranging for joint checking (with BHEL / BHEL's Customer / Consultant) of all site construction activities Preparation of joint protocols for each & every activity and maintaining quality records for audit/inspection as per approved FQP by BHEL.
2.12.19.	Contractor shall set up suitable guarded storage facilities. Contractor shall ensure the Storage of only those material at site which will be erected/Pre-assembled within 10 days OR as directed by BHEL Engineer. Any wastage due to lapse in storage shall be debited from Contractor with 5% overhead.
2.12.20.	The drawings enclosed with this tender are intended to give the tenderer a general idea of the type and extent of work involved. The drawings are as such only indicative and not to be considered as the exact construction drawings. Further this is to be noted that the drawings and the documents furnished along with this specification are the sole property of BHEL. It must not be used directly or indirectly in any way detrimental to the interest of the company.

2.12.21.	The scope of work will also include such other related works although they may not be specifically mentioned above and all such incidental items not specified but reasonably imply and necessary for completion of the job as a whole all as desired and as directed by the engineer.
2.12.22.	The detail scope of work covered above is not a comprehensive list of items of work involved. The detail scope of work may vary considerably depending on the actual requirements.
2.12.23.	Adequate lighting facilities such as flood lamps, hand lamps and area lighting shall be arranged by the contractor at the site of construction, pre-assembly yard and contractor's material storage area etc. at his cost.
2.12.24.	**Adequate water-less/Bio urinals (as per HSE plan) at locations identified by BHEL site in-charge**, shall be arranged by the contractor within quoted rates, at site of construction at different level and different areas with proper disposal arrangement.
2.12.25.	Vendors have to comply requirements of HSE & Statutory requirement in line with BHEL HSE plan, NTPC Safety requirement, State/Central statutory requirement.
2.12.26.	Preparation of method statement, HIRA, Job Safety analysis, permit to work, lifting plans, and all supporting documents as required for starting & continuation of work/job is in vendor's scope.
2.12.27.	Scaffolding pipes, clamps, safety nets, floor grills for working platforms are to be made of good quality with proper certifications as per IS Codes.
2.13.	**Consumables**
2.13.1.	All the required electrodes (in Contractor scope) as approved by BHEL shall be arranged by contractor at his cost. It shall be the responsibility of the contractor to obtain prior approval of BHEL site, before procurement regarding, suppliers, type of electrodes etc. On receipt of the electrodes at site, it shall be subject to inspection and approval by BHEL. The contractor shall inform BHEL details regarding type of electrodes, batch number and date of expiry etc. C276 Welding electrode shall be provided BHEL free of cost as provided by manufacturing units.
2.13.2.	The contractor shall provide within finally accepted price / rates, all consumables like welding electrodes (including alloy steel and stainless steel), all gases (inert, Nitrogen Gas for accumulators and Gases required for welding, and cutting), soldering material, dye penetrants, radiography films, water soluble paper. Other erection consumables such as tapes, jointing compound, grease, mobile oil, M-seal,

	Sodium silicate, Araldite, petrol, CTC / other cleaning agents, grinding and cutting & buffing wheels are to be provided by the contractor. Steel, H&S, packers, shims, wooden planks, scaffolding and pre-assembly materials (**structural steel, concrete sleeper, concrete blocks etc.**) hardware items etc. required for temporary works such as supports, scaffoldings, **pre-assembly bed etc.** can be issued from BHEL at its discretion on returnable basis subject to availability with BHEL site store. In case of non-availability same has to be arranged by agency. Nitrogen cylinders required for Acid cleaning, Oil Accumulator filling & other Commissioning activities are in the scope the bidder.
2.13.3.	All the shims, gaskets and packing, which go finally as part of equipment, shall be supplied by BHEL free of cost. However, gaskets/packing required for temporary arrangements works such as hydro test of the line etc. shall be in the scope of bidder.
2.13.4.	All the required gases like Oxygen / Acetylene / argon / Nitrogen required for work shall be supplied by the Contractor at his cost. It shall be the responsibility of the contractor to plan the activities and store sufficient quantity of these gases. Non-availability of gases cannot be considered as reason for not attaining the required progress. BHEL reserves the right to reject the use of any gas in case required purity is not maintained.
2.13.5.	The contractor shall submit quarterly statement report regarding consumption of all consumables for cost analysis purposes.
2.13.6.	The contractor shall ensure safe keeping of the inflammable cylinder at a separate place away from normal habit with proper security etc.
2.13.7.	Shortage of any of the electrodes or the equivalent suggested by BHEL shall not be quoted as reason for deficiency in progress or for additional rate.
2.13.8.	Storage of electrodes shall be done in an air conditioned / humidity-controlled room as per requirement, at his own cost by the contractor.
2.13.9.	All low hydrogen electrodes shall be baked / dried in the electrode drying oven (range 375 deg. C - 425 deg. C) to the temperature and period specified by the BHEL Engineer before they are used in erection work and each welder should be provided with one portable electrode drying oven at the work spot. Electrode drying oven (Baking & holding oven) and portable drying ovens shall be provided by contractor in sufficient quantities at his cost.
2.13.10.	**In case of improper arrangement of procurement of above electrodes BHEL reserves the right to procure the same from any source and recover the cost from the contractor's subsequent bills at market value plus 5% overheads.**

2.13.11.	BHEL reserves the right to reject the use of any electrodes at any stage, if found defective because of bad quality, improper storage, date expiry, unapproved type of electrodes etc. It shall be the responsibility of the contractor to replace at his cost without loss of time.
2.13.12.	Sealing compounds and GI wires for insulation mattress binding **and Self drilling screws / Self taping screws** for sheeting works (Al Cladding sheet, Corrugated sheets and other ribbed sheet for the roof and weather protection areas) shall be provided by the agency within the quoted price/rates. However, if these are supplied by the BHEL MUs then same will be issue free of charges to contractor.
2.14.	**All Materials, including structural steel, shall be procured from the CUSTOMER approved sources only (Annexure-7).**
2.15.	**HEIRARCHY:** In case of any conflict/deviations amongst various documents of TCC, the order of precedence shall be as follows: 1. Items Description in BOQ Cum Rate Schedule. 2. Technical Conditions of Contract (TCC). 3. Technical Specifications of Customer – **Annexure-5**. 4. IS Standard. 5. BHEL's Standard Specification.

3.0 Facilities in the scope of Contractor/BHEL:

Sl. No	Description PART I	Scope		Remarks (for details refer relevant clause of tender document)
		BHEL	Bidder	
3.1	**Establishment:**			
3.1.1	**For Construction Purpose:**			
A	Open space for office (as per availability within project premises)	Yes		Location will be finalized after joint survey with owner.
B	Open space for storage (as per availability within project premises)	Yes		Location will be finalized after joint survey with owner.
C	Open space for fabrication/pre-assembly (as per availability within project premises)	Yes		Location will be finalized after joint survey with owner.
D	Construction of bidder's office, fabrication yard, canteen and storage building including supply of materials and other services		Yes	
E	Bidder's all office equipment, office / store / canteen consumables		Yes	
F	Canteen facilities for the bidder's staff, supervisors and engineers etc.		Yes	
G	Firefighting equipment like buckets, extinguishers etc.		Yes	
H	Cordoning-off of storage area, office, canteen etc. of the bidder		Yes	
3.1.2	**For living purpose of the bidder:**			

Sl. No	Description PART I	Scope		Remarks (for details refer relevant clause of tender document)
		BHEL	Bidder	
A	Open space for labour colony		Yes	Contractor has to make his own arrangements for shelter and transportation of labours as per requirement.
B	Labour Colony with internal roads, sanitation, complying with statutory requirements		Yes	Construction Plan shall be approved by BHEL
3.2	**Electricity:**			
3.2.1	**Electricity for construction purposes (for Site/Project works only) 3 Phase 415/440 V** within project premises			
A	Single point source	**Yes**		**Free of cost basis.** Connection will be provided at One (01) point near the site at a distance of approx. 500 meter.
b	Further distribution including all materials, Protection devices and its service		Yes	
c	Duties and deposits including statutory clearances, if applicable		Yes	
3.2.2	**Electricity for office, stores, canteen etc. of the bidder within project premises**			

Sl. No	Description PART I	Scope		Remarks (for details refer relevant clause of tender document)
		BHEL	Bidder	
A	Single point source	**Yes**		Connection will be provided at single point as per TCC Clause **3.2.1;** However, it will be **Chargeable** at prevailing **tariff on project site.**
b	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
c	Duties and deposits including statutory clearances, if applicable		Yes	
3.2.3	**Electricity for living accommodation of the bidder's staff, engineers, supervisors, labour Hutment etc.**			**Contractor has to make his own arrangements**
A	Single point source		Yes	
b	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
c	Payment/Duties and deposits including statutory clearances if applicable		Yes	
3.3	**Water Supply:**			
3.3.1	**For construction purposes:**			**Contractor has to make his own arrangements**
A	Making the water available at single point (Free of charge)	**Yes**		

Sl. No	Description PART I	Scope		Remarks (for details refer relevant clause of tender document)
		BHEL	Bidder	
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	
3.3.2	**Water supply for bidder's office, stores, canteen etc.**			**Contractor has to make his own arrangements**
A	Making the water available at single point	Yes	Yes	BHEL will provide single point supply for drinking water inside the project premises for office free of cost.
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	
3.3.3	**Water supply for Living Purpose**			**Contractor has to make his own arrangement**
A	Making the water available at single point		Yes	
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	

Sl. No	Description PART I	Scope		Remarks (for details refer relevant clause of tender document)
		BHEL	Bidder	
3.4	**Lighting**			General area lighting through high mast and other fixtures shall be in the scope of BHEL. However, localized area lighting for bidder's construction site/ storage yard/pre-assembly yard/ material handling location, etc. shall be in scope of contractor.
A	For construction work (supply of all the necessary materials) 1. At office/storage area 2. At the preassembly area 3. At the construction site /area 4. At the Fabrication yard		Yes	
b	For construction work (execution of the lighting work/ arrangements) 1. At office/storage area 2. At the preassembly area 3. At the construction site /area 4. At the Fabrication yard		Yes	
c	Providing the necessary consumables like bulbs, switches, etc. during the course of project work		Yes	
d	Lighting for the living purposes of the bidder at the colony / quarters		Yes	
3.5	**Communication facilities for site operations of the bidder**			

Sl. No	Description PART I	Scope		Remarks (for details refer relevant clause of tender document)
		BHEL	Bidder	
A	Telephone, fax, internet, intranet, e-mail etc.		Yes	
3.6	**Compressed air wherever required for the work**			
A	Supply of Compressor and all other equipments required for compressor & compressed air system including pipes, valves, storage systems etc.		Yes	
b	Installation of above system and operation & maintenance of the same		Yes	
c	Supply of the all the consumables for the above system during the contract period		Yes	
3.7.1	**Demobilization of all the above facilities**		Yes	
3.7.2	**Transportation**			
A	For site personnel of the bidder		Yes	
b	For bidder's equipment and consumables (T&P, Consumables etc.)		Yes	
3.7.3	**Erection Facilities**			
3.7.3.1	Engineering works for construction:			
A	Providing the erection/constructions drawings for all the equipment covered under this scope.	Yes		**Shall be provided progressively.**
b	Drawings for construction methods	Yes	Yes	In consultation with BHEL

Sl. No	Description PART I	Scope		Remarks (for details refer relevant clause of tender document)
		BHEL	Bidder	
c	As-built drawings wherever deviations observed and executed and also based on the decisions taken at site		Yes	Changes are to be marked in drawing & handover to BHEL on completion of work.
d	Shipping lists etc. for reference and planning the activities	Yes		
E	Preparation of erection schedules and other input requirements asper Form-14.		Yes	In consultation with BHEL
F	Review of performance and revision of site fabrication and erection schedules in order to achieve the end dates and other commitments	Yes	Yes	In consultation with BHEL
G	Weekly erection schedules based on Sl. No. e		Yes	In consultation with BHEL
h	Daily erection / work plan based on Sl. No. g		Yes	In consultation with BHEL
i	Periodic visit of the senior official of the bidder to site to review the progress so that works is completed as per schedule. It is suggested this review by the senior official of the bidder should be done once in every two months.		Yes	

Sl. No	Description PART I	Scope		Remarks (for details refer relevant clause of tender document)
		BHEL	Bidder	
j	Preparation of pre-assembly bay		Yes	Materials required for pre-assembly bay/fabrication yard shall be in agency scope. However, if available, BHEL may provide such material on free returnable basis, which shall be returned without any damage.
K	Laying of tracks, erection, commissioning for gantry crane, if provided by BHEL or brought by the contractor /bidder himself.		Yes	

3.8.	**Land/Open Space:** Availability of land within plant boundary is very limited and the contractor has to plan and use the existing land considering the use of land by other Civil /mechanical/ electrical contractors and the storage of plant machineries and materials. The existing land shall be shared by all erection agencies. BHEL shall provide free of charge limited open space for office, storage shed and laydown area as and where made available by Customer. It is the responsibility of the contractor to construct facilities such as sheds, fabrication/Preassembly yard, provide all utilities and dismantle and clear the site after completion of work or as and when required, as a part of his scope of work.
3.9.	**Labour and Staff Colony:** **Following are in the Bidder's scope of work for labour & staff colony:**
3.9.1.	Labour colony is to be developed by bidder for all the labours required to be deployed for the works. All labour colony set-up is to be developed as per statutory requirements.

	Contractor shall ensure establishment & maintenance of workmen/labour colony in line with BHEL layout drawings & Guidelines **(As per BHEL - Standard Guidelines for Worker's Accommodation / Establishments at BHEL-Project Sites, Annexure-11)** for which no separate payment shall be made by BHEL. Modifications, if any proposed, in the Hutment shall be in consent with BHEL/Customer. Any other facilities required for scope of work shall be arranged by the contractor at his own cost. Ownership of the labour hutment shall be of the contractor and contractor shall keep BHEL indemnified from any statutory obligations/ legal compliances w.r.t. labour hutment establishment during as well as after the completion of contract.
3.9.2.	In case labour hutment is not completed as per the drawings and specification and any penalty is imposed by Customer, same shall be recovered from contract's RA Bill. Rectification and Corrections in labour hutment as pointed out by BHEL/Customer shall be bidder's responsibility and any cost incurred by BHEL to complete the works, in case of non-compliance of the instructions, same shall be recovered from his RA Bills along with 5% overheads.
3.9.3.	Land for labor colony shall be arranged by Contractor at their own cost as per availability outside project area within 5Km, Necessary levelling/dressing of land shall be done by the contractor. All arrangement for electricity and drinking/service water for labour colony to be arranged by the contractor within his quoted price.
3.9.4.	Development of Bidder's temporary staff colony and labour colony having adequate no. of rest rooms along with toilets & fencing etc. (**Drawing enclosed as Annexure-3**).
3.9.5.	All Civil and Structural work associated with drinking and service water for Bidder's labour and other personnel at the work site/colony/offices including pump houses, pipes, overhead tank, tube wells etc.
3.9.6.	Providing and maintaining facilities for safety, welfare, drinking water and sanitation, hygiene, biennial health check-up etc. for construction workers at their workplaces as well as at labour & staff colonies.
3.9.7.	Development and maintenance of above facilities for construction workers deployed by the Contractor shall solely rest with the Contractor.

3.9.8.	**Installation of necessary amenities and temporary infrastructure for construction activities at Project site locations.** Following are the minimum amenities to be provided by the bidder within the quoted price including removal/disposal of the same in environment friendly manner after its intended use/completion of scope of work: i. Labour rest sheds near work spot. (Minimum 01 Nos. Rest shed shall be constructed by contractor as per approved drawings within 03 months from the date of start of work). ii. Canteen facility creation. iii. Drinking water facility. iv. Labour Bio toilets near work spot in sufficient nos. with regular cleaning & maintenance arrangement. Exclusive arrangement of Bio toilets to be made at site for ladies v. Labour colony should have all hygienic condition, dining hall, toilets, proper sewerage system, good drinking water arrangements. vi. Regular fogging in the work place and labour colony to avoid mosquitoes.
3.10.	**Construction Power:**
3.10.1.	Construction power (Three phase, 415 V/ 440 V) shall be provided by BHEL on **free of cost** basis within 01 month from the date of start of work, refer clause 3.2 of TCC. Further, distribution shall be arranged by the contractor at his own cost and services. However, contractor has to deploy DG Sets to meet power requirement in case of delay in availability of single source or any kind of power interruptions during the course of the project at no extra cost to BHEL. If any other voltage level (other than normally available) is required, the same shall be arranged by the contractor from power supply as above. Contractor shall be responsible for fulfilment of all requirements including statutory requirements in this regard.

3.10.2.	Contractor shall deploy and install required energy meter (wherever applicable), cables, fuses, distribution boards, switchboards, bus bars, earthing arrangements, protection devices and any other installation as specified by statutory authority/act. Contractor shall provide at his own cost necessary calibrated energy meters (tamper proof, suitably housed in a weather proof box with lock & key arrangement) at point of power supply along with calibration certificate from authorized/ accredited agency for working out the power consumption. In case of recalibration required for any reason the necessary charges including replacement by calibrated meters is to be borne by the contractor. Contractor is advised to maintain the calibrated energy measuring instruments. Contractor shall also obtain approvals of appropriate authority and pay necessary fees, levies etc. towards the clearance of such installations, prior to use.
3.10.3.	Sufficient power factor compensation equipment like capacitor shall be provided by contractor for reactive loads like welding machines etc. In case of any fine/penalty on account of low power factor, same shall be shared by contractor proportionately according to power consumption.
3.10.4.	Contractor shall make necessary arrangements for onward distribution of construction power taking due care of surrounding construction activities like movement of cranes & vehicles, civil work, fabrication/construction/assembly/ erection etc. and safety of personnel. It may become necessary to relocate some of the installations to facilitate work by other agencies or by him.
3.10.5.	It shall be the responsibility of the Contractor to provide, maintain the complete installation on the load side of the supply with due regard to the safety requirements at site. All cabling and installations shall comply in all respects with the appropriate statutory requirements. The installation and maintenance of this shall be done by licensed and experienced electrician.
3.10.6.	While reasonable efforts will be made to ensure continuous electric power supply, interruptions cannot be ruled out and no claim from the Contractor shall be entertained on this account such as idle labour, extension of time etc. The Contractor shall adjust his working shift accordingly and deploy additional manpower, if necessary, so as to achieve the target.
3.10.7.	Contractor to note that till construction power is made available by BHEL, contractor shall make his own arrangement like DG set etc. The contractor shall also take the approval/ permission of statutory authorities for his DG set installation. The Contractor has to make

	his own arrangement for the same as required to carry out the job under the scope of work within the quoted rate. Nothing extra shall be paid on this account of DG set up and running for construction and office maintenance etc.
3.10.8.	Contractor shall be well equipped with back-up power supply arrangement like DG set and diesel operated welding machine etc. to tackle situations arising due to failure of supplied power, so as to ensure continuity and completion of critical processes that are underway at the time of power failure or important activities planned in immediate future.
3.10.9.	BHEL is not responsible for any loss or damage to the Contractor's equipment as a result of variations in voltage or frequency or interruptions in power supply.
3.10.10.	The bidder will have to procure & install general mobile illumination system during construction right from start of his work. This system will include temporary pole lighting, within the quoted price. The illumination should be such that minimum illumination requirement as specified by Indian standards for general illumination is maintained.
3.10.11.	Supply of electricity shall be governed by Indian Electricity Act and Installation Rules and other Rules and Regulation as applicable. The contractor shall ensure usage of electricity in an efficient manner and the same may be audited by BHEL time to time. In case of any major deviation from normally accepted norms is observed, BHEL will reserve the right to impose penalty as deemed fit for such cases.
3.11.	**Construction water:**
3.11.1.	BHEL shall provide water supply free of cost (at single point source) for construction purpose as and when made available by customer within 3 months from date of start of work for construction purpose. Contractor has to make arrangement of further distribution. However, contractor shall make alternate arrangement of construction water till the same is made available by BHEL.
3.11.2.	The Contractor should make arrangements for storage of sufficient quantity of water required for work.
3.11.3.	Contractor to satisfy himself that the water drawn by him is fit for construction / consumption and adequately treat such water at his cost when it is not found fit for the said purposes.

4.0 **Tools and Plants:** Number of T&Ps to be deployed at site shall be decided w.r.t. monthly plan and review format (F-14) based on site requirement.

4.1. **Major T&P**: The following **Major Tools & Plants** (T&P) shall be arranged by the Contractor with certified operator for execution of work as per Technical Conditions of Contract of this tender within the quoted rate.

S.N.	DESCRIPTION OF MAJOR T&Ps	CAPACITY	QUANTITY	REMARKS
1.	Crawler Crane	150 MT	01 No.	**For Package-A** Crane to be made available within 15days from BHEL's intimation/ instruction.
2.	Crawler Crane	150 MT	01 No.	**For Package-B** Crane to be made available within 15days from BHEL's intimation/ instruction.

Note for clause 4.1:

1. Contractor shall mobilise aforementioned cranes/T&Ps at site, in case stated capacity crane could not be made available, for any reason what so ever, a higher capacity crane shall be mobilised by the contractor without any extra cost.
2. Agency shall Mobilize / de-mobilize/ re-mobilise the Major T&Ps as per BHEL instruction without any extra cost to BHEL.

4.2. **Other T&Ps:** The following **Other Tools & Plants** (T&P) shall be arranged by the Contractor for execution of work under **Package A & B** as per Technical Conditions of Contract of this tender within the quoted rate. Below given Quantities are tentative for planning purposes by the bidder.

For Package A and Package B (Common):

SN	DESCRIPTION OF OTHER T&Ps	CAPACITY (MINIMUM)	QUANTITY	REMARKS
1	Tyre mounted mobile crane (Telescopic boom, hydraulically operated with turret function)	50 MT	03 nos.	As per requirement
2	Pick & carry type tyre mounted mobile Farana crane. (FX or TRX/ NextGen series of 'ESCORT' or equivalent make)	12/14/18 MT	04 nos.	As per requirement
3	Trailer with prime mover	40 MT	03 nos.	As per requirement
4	Trailer with prime mover	20 MT	As per requirement	As per requirement
5	Truck	Adequate Capacity	As per requirement	As per requirement
6	Slings, 'D'-Shackles, Max Puller.	01 MT TO 10MT	As per requirement	As per requirement
7	Slings, 'D'-Shackles, Max Puller, Pulley Blocks, Hydraulic Jacks, Etc Above 10 Mt.	As per requirement	As per requirement	As per requirement
8	Tube expander	As per requirement	01 No.	As per requirement
9	Man lifter	min. 40mtr height capacity	01 no.	As per requirement
10	Torque calibrator	As per requirement	As per requirement	As per requirement
11	Bolt Tension Calibrator	As per requirement	As per requirement	As per requirement
12	Pre-heating, post-heating and post-weld stress relieving equipment with automatic recording devices and chartless recorder / IIOT sensors duly password protected with a connectivity to remote server /Cloud along with heating control panel, cables, heating elements, thermocouples,	As per requirement	As per requirement	As per requirement

SN	DESCRIPTION OF OTHER T&Ps	CAPACITY (MINIMUM)	QUANTITY	REMARKS
	thermo-chalks, temperature recorders, thermocouple attachment units, graphs, sheets insulating materials like asbestos cloth, ceramic beads, asbestos ropes etc. required for heat treatment / stress-relieving operations.			
13	Electrical torque wrench	As per requirement	As per requirement	As per requirement
14	Impact wrench	As per requirement	As per requirement	As per requirement
15	Torque wrench	As per requirement	As per requirement	As per requirement
16	Steel tape	As per requirement	As per requirement	As per requirement
17	Steel ruler	As per requirement	As per requirement	As per requirement
18	DG SET – 250 KVA	As per requirement	01 set	For continuous/ uninterrupted back up power
19	Portable DG Set	As per requirement	02 set	For CW & Raw water PH works
20	Air compressor/blower (electric/diesel operated)	210 CFM, 7 KG/CM2	02 Nos	As per requirement
21	Air Leak Test equipment with all auxiliaries.	As per requirement	02 Set	For leakage test
22	TIG welding set	As per requirement	As per requirement	As per requirement
23	Oxy Acetylene Gas cutting Machine	As per requirement	As per requirement	As per requirement
24	GTAW Machine: HF Welding Machine & SMAW machine: Inverter based welding machine	As per requirement	As per requirement	As per requirement

SN	DESCRIPTION OF OTHER T&Ps	CAPACITY (MINIMUM)	QUANTITY	REMARKS
25	DC arc welding machine & Submerged ARC welding M/C	As per requirement	As per requirement	As per requirement
26	3-phase distribution board with complete set up for drawl of construction power	As per requirement	As per requirement	As per requirement
27	Power cable for drawl of construction power	As per requirement	As per requirement	As per requirement
28	**Self-drilling cum tapping machine for screws**	As per requirement	As per requirement	Prior to start of sheeting works.
29	Radiography arrangement with radioactive isotope source	As per requirement	As per requirement	As per requirement
30	Radiography film viewer	As per requirement	As per requirement	As per requirement
31	Theodolite of required accuracy (To ensure verticality of structural columns.)	As per requirement	As per requirement	As per requirement
32	Welding rectifiers / MIG Welding (electrical)	As per requirement	As per requirement	As per requirement
33	Welding generator (diesel operated)	As per requirement	As per requirement	As per requirement
34	Pipe/Tube cutting/ bevelling /chamfering machine	As per requirement	As per requirement	During Pre-assembly & erection
35	Electro/hydraulic pipe bending machine	Up to 2.5” nb and 12 mm thick pipes	As per requirement	During Trim piping erection work.
36	Hydraulic pipe bending machine (Manual)	For bending of pipes up to 50 mm nb size	As per requirement	As per requirement
37	Baking oven with thermostat and temperature gauge for welding electrodes	As per requirement	As per requirement	Required Since start of work
38	Holding oven with thermostat and temperature gauge for welding electrodes	As per requirement	As per requirement	Required Since start of work

SN	DESCRIPTION OF OTHER T&Ps	CAPACITY (MINIMUM)	QUANTITY	REMARKS
39	Portable oven for welding electrodes	As per requirement	As per requirement	Required Since start of work
40	Chain pulley blocks	As per requirement	As per requirement	As per requirement
41	Electric winch	2/3/5/10/15 MT capacity	As per requirement	As per requirement
42	Hand winch	0.5 ton/1.0 MT capacity	As per requirement	As per requirement
43	Battery Driven emergency light	As per requirement	As per requirement	As per requirement
44	Scaffolding materials with clamps for erection, insulation, painting etc works	As per requirement	As per requirement	As per requirement
45	Profile making m/c	For aluminium sheet cladding work	As per requirement	As per requirement
46	Nibbling m/c	As per requirement	As per requirement	As per requirement
47	Shearing m/c	As per requirement	As per requirement	As per requirement
48	Portable grinding m/c	As per requirement	As per requirement	As per requirement
49	Portable drilling m/c	As per requirement	As per requirement	As per requirement
50	Hoisting and pulley devices/pulleys	As per requirement	As per requirement	As per requirement
51	Spanners / Eye Bolts (of All Sizes)	As per requirement	As per requirement	As per requirement
52	Magnetic particle testing equipment – DRY &WET Type	As per requirement	As per requirement	As per requirement
53	Hydraulic Jacks	10/20/50/100 MT	As per requirement	As per requirement
54	Submersible Dewatering pumps (Electrical operated)	As per requirement	As per requirement	As per requirement

SN	DESCRIPTION OF OTHER T&Ps	CAPACITY (MINIMUM)	QUANTITY	REMARKS
55	Dewatering pumps (Diesel engine operated)	As per requirement	As per requirement	As per requirement
56	Various sizes of clamps/ fixtures for assembling	As per requirement	As per requirement	As per requirement
57	Hand Operated Megger 500 / 1000 V	As per requirement	As per requirement	As per requirement
58	Tong Tester 10, 20 Or 50 Amp + / - 3 % Accuracy	As per requirement	As per requirement	As per requirement
59	Digital and Analogue Multimetres	As per requirement	As per requirement	As per requirement
60	U Tube Manometer 0-2000 mm Water Column	As per requirement	As per requirement	As per requirement
61	Inclined Manometer 0-50 mm Water Column	As per requirement	As per requirement	As per requirement
62	Special Slings for Erection of HPT, Valves, LPT & other heavy components	As per requirement	As per requirement	As per requirement
63	Concrete Blocks	As per requirement	As per requirement	For making bed of steel structure for checking dimensional accuracy, configuration and minor rectification.
64	Wooden/Concrete sleeper 1.5-2.0 Mtr length	As per requirement	As per requirement	As per requirement
65	PORTABLE MAGNETIC STRUCTURESCOPE	As per requirement	01 no.	As per requirement
66	PMI (Positive Material Identification)	As per requirement	01 no.	As per requirement
67	Painting equipment sets complete with compressor, hopper, screen, blasting hose pipe, nozzle airless / conventional spray (within CGI temporary cover shed)	As per requirement	As per requirement	As per requirement

SN	DESCRIPTION OF OTHER T&Ps	CAPACITY (MINIMUM)	QUANTITY	REMARKS
68	Digital Elcometer for paint thickness checking	As per requirement	As per requirement	As per requirement
69	Sufficient quantity of steel ladders for approach up to the top of each erected column to be required during erection of actuators, valves, etc.	As per requirement	As per requirement	As per requirement
70	Hydraulic test/ pressurizing pump (Along with Suitable/ different ranges of calibrated Pr. gauges)	Up to 600 Kg per cm2 -02 Nos	As per requirement	For Piping and other areas Incl. installation, electrical connection, Erection and dismantling, temporary pipelines, fittings, etc. shall be carried out by the contractor as part of this work.
71	Hand operated pressurising pump (capacity Up to 400 KG/Cm2)		02 No	For Hydrotest of hydraulic oil lines/ impulse lines of various system.
72	Vacuum M/c with Accessories		As per site requirement.	For inspection of welding leakage inspection of bottom plates of tanks.

4.3.	List of suggestive safety Equipments /PPEs to be brought by Contractor for Package A and Package B:	
1.	Safety Net (Conforming IS 11057:1984) Safety Net (Net Size: 10m x 5m, Mesh Size: 25 mm, Mesh Rope: 2mm double cord, Border/Tie Cord: 12mm diameter polypropylene rope (tested as per IS: 5175). Two meters length shall be provided at all four corners.	As per requirement
2.	Fall Arrester 'Rope grab fall arrester' & anchorage line. Anchorage Line: 14mm- 16 mm diameter, three strand twisted Polyamide rope. Rope Grab fall arrester: Openable & Guided type Fall Arrestor (on flexible line) conforming EN 353-2 & works on 14-16 mm diameter polyamide rope. Material: Nickel Chrome plated Steel.	As per requirement,

	Connector: Karbiner conforming to EN 362 (Minimum Strength 22 KN), material: Steel	
3.	**Horizontal life line** Stainless Steel Wire rope of 8mm diameter. Minimum six nos. of steel U-bolt clips are required for clamping each wire rope to a rigid support (03 nos. of U-bolt clips at each end).	As per requirement
4.	**Ladders on column** The minimum design live load on metallic ladder shall be a single concentrated load of 100 kilo grams. All rungs shall have a minimum diameter of 1.9 cm and minimum clear length of rungs shall be 40.6 centimetres. The distance between rungs shall not exceed 30.5 centimetres. Each ladder shall have maximum height of 9.0 metre. The ladder shall have proper fastenings for attaching it to a column using positive means such as bolt, weld or other type of fasteners.	As per requirement
5.	Full body safety harness double lanyard with shock absorber	As per requirement
6.	Industrial Safety Helmet	As per requirement.
7.	Industrial Safety Shoes	As per requirement

4.4.	**List of suggestive safety Equipments /PPEs to be included in List of minimum T&P for Package A and Package B:**	
1.	Height Rescue Kit and Confined space rescue kit	1 No each
2.	Lux Meter & Breathe Analyser	2 Nos each
3.	Multi Gas Meter	1 No
4.	ELCB & RCCB Tester	1 No
5.	Earth Resistance meter	1 No
6.	Scaffolding materials as per EN 74 for hard barricading	As per requirement
7.	Axial Fan with exhaust hood for confined space working and DC Light Unit	Min 2 Nos each
8.	Oxygen Meter	1 No
9.	Fire Blanket	Min 100 Mtr
10.	**Fire resistant tarpaulins**	As per requirement
11.	**Safety Posters as per BHEL Guidelines**	As per requirement and instruction of BHEL
12.	**Fire Extinguishers:** ABC – 6 Kg: 4Nos, Co2 – 4.5 Kg: 03 Nos, Foam – 9 Kg: 02 Nos	

13.	Rubber Mat as per IS 15652	Min 50 Sqm
14.	Electrical rubber gloves	As per requirement
15.	Water Sprinkling tanker for dust suppression	BHEL shall provide on sharing basis

Note:

- **Above list of T&Ps (TCC Clause 4.2, 4.3, 4.4) are common and sharable among Package-A & B.**
- **Above list (TCC Clause 4.2, 4.3, 4.4) is tentative and any items required in quantity, more than mentioned above, has to be arranged by Contractor at its own cost.**

4.5.	**Measuring and Monitoring Equipment (MMEs):** To be finalized as per site requirement.
4.6.	**All above T&Ps are to be deployed by contractor as and when required as per instruction of BHEL engineer. If works gets delayed due to non-availability of above T&Ps, BHEL reserves the right to deploy the same and recover the charges thereof from the contractor as per TCC Clause 4.21.**
4.7.	**Any Heavy Equipment (cranes, winch machine, etc.) manufactured less than 15 Years from the current Year shall be only allowed to be used at project Site. Pre-safety Inspection of the equipment by safety deptt. shall be done before mobilizing the equipment at our project site.**
4.8.	**Hydras are not permitted for the scope of work. Contractor shall deploy and use pick & carry crane of TRX or equivalent type only for the above purpose.**
4.9.	**Tandem operation towards material handling is also not permitted in the project premises.**
4.10.	Necessary electrical / water / air connection required for operation of any of the tools & tackles shall be to Contractor's account.
4.11.	Contractor has to submit the Calibration certificates of all the precision equipment to BHEL. BHEL may ask for recalibration of the MMEs /precision equipments for ensuring quality of work. Contractor must re-ascertain/ recheck range and accuracy of each IMTE from BHEL Engineer well in advance before arranging calibration/ deployment.
4.12.	All Measuring and Monitoring Devices (MMD) used for the work in scope of these tender specifications shall be calibrated by the accredited agencies that are approved by BHEL or calibration tractability is established up to National Physical Laboratory.
4.13.	Contractor has to arrange slings of all sizes for completing the works covered under these specifications.
4.14.	In the event of need of change of type of any of major T&Ps, approval shall be taken from BHEL Engineer in-charge prior to mobilization. The decision of Number of T&P required

	due to replacing the enlisted T&P as per above table, shall be taken after analysing the production capacity and suitability of both the T&Ps.
4.15.	The contractor shall submit the valid test certificate/calibration certificates for all the T&Ps before put into actual use at site. The certificates shall be renewed time to time as instructed by BHEL Engineer.
4.16.	Crane operators deployed by the contractor shall be offered for testing by BHEL before they are allowed to operate the cranes.
4.17.	The above list as mentioned in S.No. 4.2 (Other than mentioned in S.No. 4.1 Major T&Ps) is only indicative and these T&Ps may not be required for entire contract period but contractor shall ensure the availability of the T&Ps as per work requirement and T&P Deployment schedule. T&P Deployment schedule shall be finalized at site in consultation with BHEL Engineer based on the work fronts/work requirement. BHEL decision shall be final and binding regarding the T&P deployment schedule. Contractor shall mobilize / maintain the T&P's as per the deployment schedule notified time to time by BHEL Engineer.
4.18.	APR (As per Requirement)- Contractor has to deploy T&P, MMD, IMTE as per requirement of site and as decided by BHEL Engineer.
4.19.	Apart from above mentioned T&P, any additional item required in addition to above mentioned T&P for proper execution of scope of work, contractor has to arrange such T&P within quoted rate on the instruction of BHEL in writing in a reasonable period within two weeks from the written instruction from BHEL.
4.20.	If the work related to T & Ps mentioned above is completed then, BHEL can release that T&P during contract period / extended period (if any). However, written permission shall be taken by contractor from BHEL Construction Manager and gate pass formalities shall be followed by the contractor for releasing the T&P.
4.21.	In the eventuality of contractor not deploying / abnormal down time of T&P/cranes in his scope during the period specified above, and BHEL arranges for the same [BHEL's own cranes], prevailing BHEL Corporate Crane hire charges (which may vary from time to time) shall be recovered from the contractor's running bills. Corresponding pages of Corporate Crane hire charges are enclosed as part of tender document as file titled "**Annexure-1-BHEL T&P Hire Charges"**. (*Please note that these charges are as valid up to Aug'2027 and may get revised further*). In case BHEL arrange the T&P/Crane through hiring, actual hiring charges with 5% over head shall be recovered from the contractor's running bills.
4.22.	The loading, unloading and transportation of contractors T&Ps shall be in the scope of contractor. All necessary items such as Trailers, Cranes, Winches, welding generators, slings, jacks, sleepers, rails etc., are to be arranged by the contractor at his own cost.

4.23.	All the T&Ps required for this scope of work, except the Tools & Plants mentioned in **Chapter V of TCC: T&Ps to be provided by BHEL,** are to be arranged by the contractor with in the quoted rates.
4.24.	All operators (for crane, winch etc.) deployed by contractor shall have valid licence from applicable authority (which ever applicable).
4.25.	The contractor has to furnish a list of Tools and plants including cranes/ tractors/trailers/trucks etc. which he has proposed to deploy for this work.
4.26.	T&Ps shown in the above in **S. No. 4.2** mentioned list is suggestive requirement. However, mobilization schedule as mutually agreed at site for T&Ps, have to be adhered to. Numbers/time of requirement will be reviewed from time to time at site and contractor will provide required T&Ps/equipment to ensure completion of entire work within schedule/target date of completion without any additional financial implication to BHEL.
4.27.	Contractor will give advance intimation & certification regarding capacity etc. prior to dispatch of heavy equipment. Also, on completion of the respective activity, demobilization of T&Ps in total or in part can be done with the due approval of Engineer-In-Charge. Retaining of the T&Ps during the contract period will be mutually agreed in line with construction requirement.
4.28.	The contractor shall arrange operator, diesel, petrol and other consumables including electrical / water / air connections required for the tools and plants, equipment such as crane, winch, temporary Jhoola, Sky Climber etc. Preventive and routine maintenance of T & P are also to be arranged by the contractor at his cost without any delay. Required number of experienced mechanics and helpers for routine maintenance of the above T&Ps shall be provided by the contractor within his quoted rate.
4.29.	Filling pump, for hydro test shall be arranged by the contractor, if required. For testing of LP lines, necessary hydraulic test pumps/ hand pumps are to be arranged by the contractor.
4.30.	Such of those consumables as indicated as consumables provided by BHEL alone will be provided to the contractor by BHEL free of charge for erection activities. Other required consumables like electrodes, all gases, and other materials for this scope of work are to be arranged by the contractor at their cost.
4.31.	C276 Welding electrode shall be provided BHEL free of cost as provided by manufacturing units. All other electrodes / TIG welding wires including stainless steel electrodes required for shall be arranged by the contractor at his cost. However, BHEL will provide imported

	electrodes as provided by manufacturing units. The bidder shall use the Customer approved quality welding electrodes only. The utilization of the TIG welding wires issued by BHEL shall be duly accounted for exercising maximum care and ensuring economical usage for minimum wastage. If during erection, it is found that the consumption of filler wire is more than the actual requirement due to improper usage, the cost for the additional quantity so consumed shall be recovered from the contractor.
4.32.	Gaskets, gland packing, wooden sleepers, for temporary work, required for completion of work except those which are specifically supplied by manufacturing unit are also to be arranged by contractor.
4.33.	**LIFTING OPERATIONS FOR CRANE** The Contractor shall prepare a lifting plan, checked and submit for authorization by contractor's competent authorized persons prior to any lifting operation and formally communicated to all persons undertaking the work. All persons preparing, issuing lifting plans and all persons involved in lifting operations must be subject to formal competence checks by the contractor to ensure necessary training, experience and qualification prior to commencing work. The Subcontractor must ensure that their nominated Lifting Leader has appropriate qualifications. **Contractor lifting plans include:** • The lifting methodology, step by step, • The risk analysis of the operation including consideration for weather conditions and work environments (e.g.: proximity of hazards and obstructions to the load, consideration for overturning, load integrity) where appropriate and consideration for simultaneous operations and the measures taken to avoid conflicting tasks in the lifting area. • The identification of the designated lifting area, the fall zone and the control measures to prevent access such as barriers, signs, etc. • The description of the type, weight, size, shape and center of gravity of the load and the method used for slinging, attaching and detaching the load with the availability of approved lifting points on load when necessary. • The list of the certified and inspected equipment and lifting accessories to be used.

	• The composition of the team required to perform the task (crane driver, rigger, etc.) with the needed qualifications and description of their roles and responsibilities including the intended communication method. • Any Heavy equipment (crane, winch machine, etc.) manufactured less than 15 years from the current year shall be only allowed to be used at project Site's. Pre-safety Inspection of the equipment by safety deptt. shall be done before mobilizing the equipment at our project site. The contractor must ensure that a competent operational leader is formally appointed to supervise each lifting operation. All lifting plans must clearly define the specific roles and responsibilities for each person involved (e.g.: crane drivers, lifting coordinators and riggers) and must be checked and issued prior to lifting operation. Clear communication channels must be formally established and maintained between everyone involved in a lift with only authorized person giving instruction to the operator. Special permission needs to be taken from Customer for tandem lifting and for any non-routine lifting operations must strictly adhere to the guidelines described in corresponding Standard / Procedures / Directive. No employee of the contractor shall be positioned under a suspended load or between a suspended load and fixed objects. All lifting equipment and accessories must have valid manufacturers certificates or thorough examination records and be uniquely identified, marked with the safe working load, listed in a register and subject to formal regular inspection as per EHS requirements and shall have valid certificates from a competent authority. Inspection before use by the operator is mandatory. All lifting hooks must have latch. All cranes shall be fitted with Automatic Safe Load Indicator (ASLI) and Anemo Meter. The contractor shall operate and maintain cranes and hoisting equipment in accordance with manufacturers' specifications and limitations and the safety Requirements. All defective, non-inspected or unidentified (safe working load / identification number) lifting equipment or accessories must be either removed from site or physically prevented from use.
4.34.	**Penalty due to non-availability of T&Ps:** In order to meeting the site requirement and in line with monthly plan and review format (F-14), Contractor has to mobilise their T&Ps and made available at site for required activities.

	For Major T&Ps, if contractor fails due to, either of the case, mentioned hereunder, BHEL shall be entitled to impose penalty on Contractor till any alternate arrangement is made by 'Contractor' OR 'BHEL (on cost recovery basis)'. **Case 1:** Contractor fails to mobilise the same within the mobilisation period of 30 days from the date of intimation. OR **Case 2:** After mobilisation of T&P at site, the work is getting hampered due to non-availability of T&P for more than 05 days from the date of such intimation, Penal rate for Major T&Ps is mentioned hereunder: a. 150 MT Crane – Rs. 24,650/day

5.0 LIST OF T&P TO BE PROVIDED BY BHEL FREE OF HIRE CHARGES ON SHARING BASIS:

5.1. BHEL shall provide following T&Ps on sharing basis for both packages:

SL NO	DESCRIPTION & CAPACITY OF T&P	QUANTITY	REMARKS
1	Crawler Crane – 250 MT	01	Will be provided by BHEL on sharing basis based on requirement as decided by BHEL Engineer in-charge.
2	Crawler Crane – 100 MT/80 MT	01	

5.2.	All the T&Ps mentioned in **TCC clause 5.1** above shall be given to contractor on sharable basis and the allotment is made by BHEL on need basis. Contractor shall plan activities well in advance and inform BHEL Engineer in charge/ Construction Manager the date of actual use. The decision of BHEL Engineer in-charge/CM on this will be final and binding.
5.3.	Contractor shall provide assistance to transport from BHEL stores, install, operate, carry out maintenance, dismantle after use and return to BHEL stores all T&Ps mentioned in Cl. no 5.1 for his use.
5.4.	Cranes provided by BHEL are only for erection purpose and shall not be available for material handling or transportation purpose. Contractor shall make their own arrangements for material transportation to erection site.
5.5.	All the distribution boards, connecting cables, hoses etc., and temporary connection work including electrical connections for the BHEL issued T&Ps shall have to be arranged by the contractor at his cost.
5.6.	The contractor at his cost shall arrange for grouting of anchor points of T&Ps issued to agency. Necessary grout materials are to be arranged by the contractor at his cost.
5.7.	The day-to-day and routine maintenance including replacement of spares for the BHEL T&Ps will be carried out by the contractor at his own cost. However, BHEL shall supply spare parts free of charges for normal wear and tear only.
5.8.	Any loss/damage of tools by the contractor shall have to be replaced or otherwise cost thereof shall be recovered from the contractor.
5.9.	T&Ps provided by BHEL will be on sharing basis with other agencies / contractors of BHEL. The allocation of T&Ps shall be the discretion of BHEL engineer, which shall be binding on the contractor. T&Ps will be deployed at appropriate time as decided by BHEL for suitable duration and intended purpose. Augmentation of BHEL T&P under special circumstances shall be discretion of BHEL.

5.10.	HL-HR crane is to be used for erection of boiler ceiling structures and equipment/ components above Boiler ceiling structure, etc that require services of this crane as decided by BHEL. This crane will accordingly be deployed at appropriate time as decided by BHEL for suitable duration and intended purpose.
Note:	**For BHEL Owned or hired Crane:**
	1. The cranes may be BHEL owned or may be obtained on hiring basis including operating and maintenance crew.
	2. Operator and O&M for BHEL Owned/Hired crane will be provided by BHEL (including extended hours), free of charge.
	3. Contractor shall provide the fuel for BHEL provided cranes (Hired/owned) for his use.
	4. Contractor shall make necessary arrangements like laying of special sleeper beds and steel plates (**Plates for BHEL owned/ hired cranes shall be provided by the BHEL**), assembly and dismantling of heavy attachment, boom, jib etc. for movement and operation of the crane. Contractor shall provide necessary manpower assistance for initial and final assembly & dismantling and for subsequent operations of boom extension and reduction during execution of work. Levelled & reasonably compacted area will be provided by BHEL/customer for the movement of BHEL cranes. Further Consolidation of the ground with hard-crusting of Area required for movement of crane (including civil work with material) for placing crane for operation shall be facilitated by BHEL. Necessary plates required for marching operation shall be provided by the BHEL only for BHEL owned cranes.

6.0 TIME SCHEDULE & MOBILIZATION

6.1.	**Time Schedule and Mobilization:**
6.1.1.	**Initial Mobilization and Time Schedule:**
	After issue of LOA (though Fax/courier/email) the contractor shall report to the Construction Manager/Site In-Charge of BHEL at site within Two weeks (14 days) from date of LOA for Kick-off meeting regarding mobilization of manpower, T&Ps and date of start of work and detailed completion program etc. The contractor has to subsequently augment his resources in such a manner that the project milestones are completed on specified schedules and entire work completed within the entire contract period, as specified in the following clause from the date of start of work, in a manner required by BHEL to match with the project schedule.
6.1.2.	**COMMENCEMENT OF CONTRACT PERIOD**
	BHEL Engineer will certify the actual date of start of work after adequate mobilization of manpower, major equipment and another T&P by the contractor. The date of start of contract period shall be the mutually agreed date between the bidder and BHEL engineer to start the work. In case of discrepancy, the decision of BHEL shall be considered to be final and binding to contractor. Based on the availability of civil foundations, drawings and material from BHEL, contractor may have to advance the erection activity after getting clearance from Construction Manager, or the erection activity may get delayed due to site conditions. The contractor shall complete all the works in the scope of this contract within the contract period. Pending points identified by the customer/BHEL during the execution of the contract are to be liquidated during the contract period itself.
6.2.	**Schedule of Completion:**
	The contract period for completion of entire work under scope shall be as mentioned hereunder, from the "**COMMENCEMENT OF CONTRACT PERIOD**" as specified earlier for completion of the entire work in respective Package.

	S.No.	Package	Contractual Schedule (Month)
	1.	**Package-A:** Mechanical works of FGD & Auxiliaries including FDPS of U#2 & U#3 at NTPC Barh Stage-I (3x660 MW)	15 Months
	3.	**Package-B:** Balance Mechanical Works of FGD & Auxiliaries including common systems and FDPS of U#4 & U#5 at NTPC Barh Stage-II (2x660 MW)	12 Months

6.3. The schedule of important milestones is as follows:

6.3.1.1. FGD & Auxiliaries including FDPS of U#2 & U#3 for Package A

SL No.	Milestones	Tentative Schedule w.r.t date of start of work	
		U#2	U#3
1.	Start of erection	1st Month	1st Month
2.	Air tightness test of complete ducting	08th Month	10th Month
3.	Completion of erection work of FGD system	09th Month	11th Month
4.	Commissioning of FGD	10th Month	13th Month
5.	Completion of Facilities (COF) FGD	12th Month	15th Month

6.3.1.2. Balance work of FGD & Auxiliaries including common systems and FDPS of U#4 & U#5 for Package B

SL No.	Milestones	Tentative Schedule w.r.t date of start of work	
		U#4	U#5
1.	Start of erection	1st Month	1st Month
2.	Air tightness test of complete ducting	4th Month	7th Month
3.	Completion of erection work of FGD system	06th Month	09th Month
4.	Commissioning of FGD	07th Month	10th Month
5.	Completion of Facilities (COF) FGD	09th Month	12th Month

6.3.2.	The above schedule is only tentative. The above schedule shall be advanced, if there are requirements to advance the project to meet the project requirement. No extra payment whatsoever shall be paid on this account.	
6.3.3.	In order to meet the above schedule in general, and any other intermediate targets set, to meet customer/ project schedule requirements, Contractor shall arrange & augment all necessary resources from time to time on the instructions of BHEL Engineer w.r.t. monthly plan and review format (F-14).	
6.4.	**Intermediate milestones:**	
6.4.1.	Two Major Intermediate Milestones are identified as M1 and M2 above.	
	Milestones for Package A	**Tentative Schedule**
M1	Air tightness test of complete ducting Unit#3	10^{th} Month
M2	Commissioning of FGD U#3	13^{th} Month
	Milestones for Package B	**Tentative Schedule**
M1	Air tightness test of complete ducting Unit#5	7^{th} Month
M2	Commissioning of FGD U#5	10^{th} Month
6.4.2.	**Provision of Penalty in case of slippage of Intermediate Milestones:**	
	In case of slippage of Two Major Intermediate Milestones, mentioned as M1 & M2 above, delay Analysis shall be carried out on achievement of each of these two Intermediate Milestones in reference to F-14.	
6.4.3.	In case delay in achieving M1 Milestone is solely attributable to the contractor, 0.5% per week of executable contract value*****, limited to maximum 2% of executable contract value, will be withheld.	
6.4.4.	In case delay in achieving M2 Milestone is solely attributable to the contractor, 0.5% per week of executable contract value*****, limited to maximum 3% of executable contract value, will be withheld.	
6.4.5.	Amount already withheld, if any against slippage of M1 milestone, shall be released only if there is no delay attributable to contractor in achievement of M2 Milestone.	
6.4.6.	Amount required to be withheld on account of slippage of identified intermediate milestone(s) shall be withheld out of respective milestone payment (corresponding RA Bill) and balance amount (if any) shall be withheld @10% of RA Bill amount from subsequent RA bills.	

6.4.7.	Final deduction towards LD (if applicable), on account of delay attributable to contractor shall be based on final delay analysis on completion/ closure of contract. Withheld amount, if any due to slippage of identified intermediate milestone(s) shall be adjusted against LD or released as the case may be.
6.4.8.	In case of termination of contract due to any reason attributable to contractor before completion of work, the amount already withheld against slippage of intermediate milestones shall not be released and be converted into recovery.
6.4.9.	Contractor shall make all possible efforts to expedite the activities, in case of delay of any intermediate milestone, to maintain overall project completion schedule.
6.4.10.	***Executable Contract Value –** Value of work for which inputs/fronts were made available to contractor and were scheduled for execution till the date of achievement of that milestone.
6.5.	**COMPLETION OF WORK AND COMMENCEMENT OF GUARANTEE PERIOD**
6.5.1.	The works shall be completed to the entire satisfaction of the Engineer and in accordance with the completion schedule as specified in the Contract, and all unused stores and materials, tools, plant, equipment, temporary buildings, site office, labour hutments and other things shall be removed and the site and work cleared of rubbish and all waste materials and delivered up clean and tidy to the satisfaction of the Engineer at the Contractor's expenses.
6.5.2.	BHEL shall have power to take over from the Contractor from time to time such sections of the work as have been completed to the satisfaction of the Engineer. Such work however shall not be treated as have been completed until the remaining / pending works are executed to the satisfaction of Engineer.
6.5.3.	Commencement of performance guarantee shall be as per clause no.2.24 (Performance Guarantee for Workmanship) of General Conditions of Contract. **The commencement of guarantee period for the quality of the workmanship shall start from the date of completion of facilities OR Handing Over to the customer, whichever is earlier**.
6.6.	The contractor shall submit and a detailed area/structure wise L3 schedule within 15 days from date of LOA, in consultation with BHEL, based on the tentative schedule provided as above. The detailed L3 schedule shall be approved by BHEL and same shall be implemented. Bidder shall submit L3 schedule in MS Projects and excel to meet the agreed project schedule covering various mile stone activities and their split-up details such as mobilization, procurement of materials & erection activities. This schedule shall also clearly indicate the interface facilities / inputs applicable in each package. Bidders shall submit Resource

	deployment plan Area wise with detail program in line with above schedule in the form of Bar Chart/ MS project planner along with their offer.
6.7.	The under mentioned Records/ Log-books/ Registers applicable to be maintained.
	1. Hindrance Register.
	2. Site Order Book.
	3. Test Check of measurements.
	4. Records of Test reports of Field tests.
	5. Records of manufacture's test certificates.
	6. Records of disposal of scraps generated during and after the work completion.
6.8.	**Control and monitoring of progress of work**
6.8.1.	Refer forms F -14 to F-15 of volume I D (Forms & Procedure). Plan and review will be done as per the formats.
6.8.2.	The progress reports shall indicate the progress achieved against plan, indicating reasons for delays, if any. The report shall also give remedial actions which the contractor intends to make good the slippage or lost time so that further works can proceed as per the original plan the slippages do not accumulate and affect the overall programme.
6.8.3.	It is the responsibility of the contractor to provide all relevant information on a regular basis regarding progress of work, labour availability, equipment deployment, testing, etc.
6.8.4.	Contractor is required to draw mutually agreed monthly work programs in consultation with BHEL well in advance. Contractor shall ensure achievement of agreed program and shall also timely arrange additional resources considered necessary at no extra cost to BHEL.
6.8.5.	Progress review meetings will be held at site during which actual progress during the week vis-a-vis scheduled program shall be discussed for actions to be taken for achieving targets. Contractor shall also present the program for subsequent week. The contractor shall constantly update / revise his work program to meet the overall requirement. All quality problems shall also be discussed during above review meetings. Necessary preventive and corrective action shall be discussed and decided upon in such review meetings and shall be implemented by the contractor in time bound manner so as to eliminate the cause of nonconformities.
6.8.6.	The contractor shall submit quarterly progress reports, manpower reports, materials reports, consumables (gases / electrodes) report, cranes availability report and other reports as per Performa considered necessary by the Engineer. The periodicity of the reports will be decided by BHEL Engineer at site.
6.8.7.	The contractor shall submit quarterly statement report regarding consumption of all consumables for cost analysis purposes.

6.8.8.	The contractor shall submit a report of any damage, shortage, discrepancy etc., every week detailing in this regard. Non-submission of report would be considered as no shortage of materials.
6.8.9.	The manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.
6.9.	**The monthly report as a booklet shall be submitted at the end of every month and shall contain the following details: -**
a	Progress photographs in colour.
b	Erection progress in terms of tonnage, welding joints, radiography, stress relieving, etc., completed as relevant to the respective work areas against planned.
c	Site Organization chart of engineers & supervisors as on the last day of the month with further mobilization plan.
d	Category- wise man hours engaged during the previous month under the categories of fitters, welders, riggers, khalasis, grinder-men, gas cutters, electricians, crane operators and helpers. Data shall be split up under the work areas like TG, Boiler (pressure parts, structures), Piping, Rotating machines, etc.
e	Consumables report giving consumption of all types of gases and electrodes during the previous month.
f	Availability report of cranes.
g	Safety implementation report in the format.
h	Pending material and any other inputs required from BHEL for activities planned during the subsequent month.
6.10.	**Site Data Digitalisation:** Daily Activity Log, M-Book and Subcontracting Billing Module: -
a	Refer Vendor Portal System with links: for ref. https://pshq.bhel.in/sddvp/
b	Login ID and Password shall be provided by respective package manager.
c	Contractor by clicking 'Daily Work Photos', shall upload area wise photos on daily basis.
d	Contractor by clicking 'Daily Activity Log', shall update site activities on daily basis.
e	Contractor by clicking 'Measurement Book', shall enter Measurement Book in Format and BOQ.
f	**Contractor shall raise their RA Bills along with supporting documents (such as Quality and HR Document – Vetted by Customer Etc.) and checklist through SDD portal only.**
g	Contractor shall comply the system requirement.
h	Refer Vendor Manual for further details.
	Note: The contractor shall be required to provide all facilities including manpower for the aforementioned activities, without any cost implications to the BHEL.

6.11.	Agency shall extend all support towards inputs for IPMS system for project monitoring and control.

7.0 Terms of payment

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

Payment Terms for both the Packages: Payment shall be regulated progressively as mentioned in Table 7.1, 7.2 & 7.3 below:

7.1 Progressive Payment for FGD & Auxiliaries including FDPS against monthly running bills will be made upto **85 %** of the value of the erected Pro-rata as per the following table for **Section-I**:

Sl No	Activity	For item No: 1.1 (Str. & Duct / Dampers)	For item No 1.1a* (Procurement of raw material, fabrication, etc)	For item No 1.1b* (Fabrication, etc)	For item No: 1.2 (Tanks under FGD system)	For item No: 1.3 (Rotating Machines)	For item No: 1.4 (1.4.1, 1.4.2, 1.4.3) (Insulation)	For item No: 1.5.1, 1.5.2, 1.5.3 (Piping System)	For item No: 1.6 (Misc Equip & Structural steel)
1	Completion of Preassembly, (if not applicable this portion shall be clubbed with Placement in position)	20%	---	---	20%	20%	---	20%	20%
2	Procurement & Supply of Raw Steel	---	55%	---	---	---	---	---	---
3	Completion of Fabrication & Pre-assembly including painting		30%	85%					
4	Placement in position	25%	---	---	20%	20%	50%	20%	25%
5	Alignment	20%	---	---	10%	20%	---	10%	20%

Sl No	Activity	For item No: 1.1 (Str. & Duct / Dampers)	For item No 1.1a* (Procurement of raw material, fabrication, etc)	For item No 1.1b* (Fabrication, etc)	For item No: 1.2 (Tanks under FGD system)	For item No: 1.3 (Rotating Machines)	For item No: 1.4 (1.4.1, 1.4.2, 1.4.3) (Insulation)	For item No: 1.5.1, 1.5.2, 1.5.3 (Piping System)	For item No: 1.6 (Misc Equip & Structural steel)
6	Welding/Bolting/Fixing as required.	15%	---	---	20%	20%	35%	15%	15%
7	Completion of Non-Destructive Examination & Stress relieving /heat treatment, (if not applicable, then this portion to be paid along with welding)	5%	---	---	10%	5%	---	10%	5%
8	NDT Examination (Holiday Test)	---	---	---	---	---	---	---	---
9	H&S wherever applicable as per drawing	---	---	---	---	---	---	5%	---
10	Hydro Test of Piping/Water Fill Test/ Vacuum Box test of Tanks/Holiday test (as applicable)	---	---	---	5%	---	---	5%	---
	TOTAL FOR PRORATA PAYMENTS (7.1)	**85%**	**85%**	**85%**	**85%**	**85%**	**85%**	**85%**	**85%**

Note- (*) – Payment for erection of these items shall be paid as per rate of BOQ item 1.1a.

7.2 Further **15%** payment for FGD & Auxiliaries including FDPS will be made on pro-rata basis common to all shall be released on achievement of the following stage / milestones events as per the following table for the executable contract value:

Sl. No.	Stage/Milestones	% Payable
1	Completion of tightness test of Ducts	1.50%
2	Completion of Trial Run of Slurry Pumps	1.00%
3	Trial Run of Stg-I: Oxidation Blower / Stg-II: Wet Ball Mills	3.00%
4	Trial Run of Booster Fans	1.50%
5	Trial Run of FGD System	3.00%
6	Completion of Painting (wherever applicable)	2.00%
7	Area Cleaning, Temporary Structures Cutting/Removal and return of Scrap	1.00%
8	Liquidation of Pending Points	1.00%
9	Completion of all Contractual Obligation and demobilization of site office.	1.00%
	TOTAL FOR STAGE/MILSTONES PAYMENT (7.2)	**15%**
	TOTAL (7.1) + TOTAL (7.2)	**100%**

7.3 Progressive Payment for **PG Test of each unit, which is to be certified by the BHEL, ITEM NO. 1.7 OF RATE SCHEDULE (Section-I) shall be released on Pro-rata basis as 4x25% of Item no. 1.7 of Section-I.**

7.4 BHEL-Site, at their discretion, may further split up above percentages and effect payment to suit the site condition, cash flow requirement and according to the progress of work. The billing break-up is drawn for progressive payment and shall not be construed as the value/ price of corresponding item, unless otherwise decided by BHEL.

7.5	**Progressive Payment/ Final Payment:** The payments for works under the scope of this contract for both the packages shall be as per clause no 2.6; 2.22; 2.23 of General Conditions of Contract and Volume-IB, Chapter-X of SCC.
7.5.1	**Documents required for RA Bill:**
	GST Complied Invoice of the work done as per approved BBU.
	WAM -6 for RA Bill.
	Jointly signed Measurement sheet.
	Power of Attorney before submission of Bill.
	Validity of Bank Guarantees as applicable under the contract.
	Monthly HSE Compliance Certificate certified by BHEL- Safety
	Material reconciliation statement alongwith RA Bill (Monthly basis).
	HR/IR compliance documents:
	i. Wages payment sheet as per applicable minimum wages.
	ii. Proof of PF contribution submission.
	iii. Proof of ESI/ WC contribution submission
	iv. Proof of Bonus payment as per Bonus Act if applicable.
	v. Proof of EL payment if applicable.
	vi. Any other statutory document if applicable.
7.5.2	**Documents required for Final Bill:**
	The final bill is drawn as soon as the entire work is completed. From the final amount due, all amounts already claimed up to the previous running account bill will be deducted. It should be ensured that in the final bill the following additional particulars have been provided:
	• Final Bill in WAM-7 Format. • 'No claim' certificate from the contractor. • Clearance certificates where ever applicable viz. Clearance Certificates from Customer, various Statutory Authorities like Labour department, PF Authorities, Commercial Tax Department etc. • Final Material re-conciliation statement duly approved by BHEL.

	• Indemnity Bond as per prescribed format. • Deviation statement showing the difference between the actuals and as per the contract. • Final Delay Analysis.
7.5.3	The payment for running bills will be released after submission of running bill complete in all respects with all documents. It is the responsibility of the contractor to make his own arrangements for making timely payments towards labour wages, statutory payments, outstanding dues etc. and other dues in the meanwhile. No interest shall be payable for the delayed payment (if any).
	Few points of consideration are as below:
	i. The measurements sheets of work done in a month shall be submitted in triplicate duly agreed/signed by BHEL Engineer. The contractor shall extend all necessary assistance for verification of measurements of works without any extra cost.
	ii. Material reconciliation shall be complied on monthly basis.
	iii. The RA bill payments are interim payments and bills shall be submitted in prescribed formats.
	iv. Recoveries on account of electricity, water, statutory deductions etc. shall be made as per terms of contract.
	v. BHEL will release payment through Electronic Fund Transfer (EFT)/RTGS.
	vi. Final bill shall be submitted after completion of works and upon material reconciliation along with all prescribed formats.
	Quoted Rates are inclusive of all labour, contractor's equipment, temporary works, consumables and all matters and things of whatsoever nature, charges for Safety Aspects/Compliance to Safety Rules including operations and maintenance services (if applicable) etc., and other services, as identified in the tender Documents, as necessary for the proper execution of the subject work.
7.6	**SECURED RECOVERABLE ADVANCES:**
	Interest Free Secured Mobilization Advance as per GCC Clause No. 2.13.1 will be payable under exceptional circumstances on certification of BHEL Construction Manager at Site. Interest Free Mobilization Advance shall be disbursed in specifically mentioned stages of major respective resource mobilization as specified hereunder:
	For Package-A/B 1. For Mobilization of **01 no. of Crane of 150 MT capacity in Package A/B - 2.0%** of Contract value of respective package (**A/B**). 2. For Mobilization of balance **required T&Ps and resources at site to start the work of FGD & Aux in Package A/B as finalised with BHEL Engineer In-Charge - 2%** of Contract value of respective package (**A/B**).

	3. For Installation and Erection of **Site Infrastructure by contractor i.e. site office stores, etc. - 01%** of Contract value of respective package (**A/B**). **Note:** 1. BHEL Site-CM/PD shall be the deciding authority for assessing the admissibility of advance payment to contractor. 2. In case contractor do not fulfil the agreed conditions of payment of earlier mobilization advance, BHEL Construction Manager will have the authority to not allow the subsequent mobilization advance to contractor.

7.7 For the BOQ item number-1.1a – Payment shall be done for finished erection weight.

8.0	**TAXES & DUTIES**
8.1	The contractor shall pay all (save the specific exclusions as enumerated in this clause) taxes, fees, license, charges, deposits, duties, tools, royalty, commissions, other charges, etc. which may be levied on the input goods & services consumed and output goods & services delivered in course of his operations in executing the contract. In case BHEL is forced to pay any of such taxes/duties, BHEL shall have the right to recover the same from his bills or otherwise as deemed fit. However, provisions regarding **GST** on output supply (goods/service) and TDS/TCS as per Income Tax Act shall be as per following clauses.
8.2	**GST (Goods and Services Tax)**
8.2.1	GST as applicable on output supply (goods/services) are excluded from contractor's scope; therefore, contractor's price/rates shall be **exclusive** of GST. Reimbursement of GST is subject to compliance of following terms and conditions. BHEL shall have the right to deny payment of GST and to recover any loss to BHEL on account of tax, interest, penalty etc. for non-compliance of any of the following condition.
8.2.2	The admissibility of GST, taxes and duties referred in this chapter or elsewhere in the contract shall be limited to direct transactions between BHEL & its Contractor. BHEL shall not consider GST on any transaction other than the direct transaction between BHEL & its Contractor.
8.2.3	Contractor shall obtain prior written consent of BHEL before billing the amount towards such taxes. Where the GST laws permit more than one option or methodology for discharging the liability of tax/levy/duty, BHEL shall have the right to adopt the appropriate one considering the amount of tax liability on BHEL/Client as well as procedural simplicity with regard to assessment of the liability. The option chosen by BHEL shall be binding on the Contractor for discharging the obligation of BHEL in respect of the tax liability to the Contractor.
8.2.4	Contractor has to submit GST registration certificate of the concerned state. Contractor also needs to ensure that the submitted GST registration certificate should be in active status during the entire contract period.
8.2.5	Contractor/Vendor has to issue Invoice/Debit Note/Credit Note indicating HSN/SAC code, Description, Value, Rate, applicable tax and other particulars in compliance with the provisions of relevant GST Act and Rules made thereunder.

8.2.6	Vendor has to submit GST compliant invoice within the due date of invoice as per GST Law. In case of delay, BHEL reserves the right of denial of GST payment if there occurs any hardship to BHEL in claiming the input thereof. In case of goods, vendor has to provide scan copy of invoice & GR/LR/RR to BHEL before movement of goods starts to enable BHEL to meet its GST related compliances. Special care should be taken in case of month end transactions.
8.2.7	Vendor has to ensure that invoice in respect of such services which have been provided/completed on or before end of the month should not bear the date later than last working day of the month in which services are performed.
8.2.8	Subject to other provisions of the contract, GST amount claimed in the invoice shall be released on fulfilment of all the following conditions by the Contractor: - a. Supply of goods and/or services have been received by BHEL. b. Original Tax Invoice has been submitted to BHEL. c. Contractor/ Vendor has submitted all the documents required for processing of bill as per contract/ purchase order/ work order. d. In cases where e-invoicing provision is applicable, vendor/contractor is required to submit invoice in compliance with e-invoicing provisions of GST Act and Rules made thereunder. e. Contractor has filed all the relevant GST return (e.g. GSTR-1, GSTR-3B, etc.) pertaining to the invoice submitted and submit the proof of such return along with immediate subsequent invoice. In case of final invoice/ bill, contractor has to submit proof of such return within fifteen days from the due date of relevant return. f. Respective invoice has appeared in BHEL's GSTR - 2A for the month corresponding to the month of invoice and in GSTR-2B of the month in which such invoices has been reported by the contractor along with status of ITC availability as "YES" in GSTR-2B. Alternatively, BG of appropriate value may be furnished which shall be valid at least one month beyond the due date of confirmation of relevant payment of GST on GSTN portal or sufficient security is available to adjust the financial impact in case of any default by the contractor. g. Contractor has to submit an undertaking confirming the payment of all due GST in respect of invoices pertaining to BHEL.

8.2.9	Any financial loss arises to BHEL on account of failure or delay in submission of any document as per contract/purchase order/work order at the time of submission of Tax invoice to BHEL, shall be deducted from contractor's bill or otherwise as deemed fit.
8.2.10	TDS as applicable under GST law shall be deducted from contractor's bill.
8.2.11	Contractor shall comply with the provisions of e-way bill wherever applicable. Further wherever provisions of GST Act permits, all the e-way bills , road permits etc. required for transportation of goods needs to be arranged by the contractor.
8.2.12	Contractor shall be solely responsible for discharging his GST liability according to the provisions of GST Law and BHEL will not entertain any claim of GST/interest/penalty or any other liability on account of failure of contractor in complying the provisions of GST Law or discharging the GST liability in a manner laid down thereunder.
8.2.13	In case declaration of any invoice is delayed by the vendor in his GST return or any invoice is subsequently amended/altered/deleted on GSTN portal which results in any adverse financial implication on BHEL, the financial impact thereof including interest/penalty shall be recovered from the Contactor's due payment.
8.2.14	Any denial of input credit to BHEL or arising of any tax liability on BHEL due to non-compliance of GST Law by the Contractor in any manner, will be recovered along with liability on account of interest and penalty (if any) from the payments due to the Contactor.
8.2.15	In the event of any ambiguity in GST law with respect to availability of input credit of GST charged on the invoice raised by the contractor or with respect to any other matter having impact on BHEL, BHEL's decision shall be final and binding on the contractor.
8.2.16	**<u>Variation in Taxes & Duties:</u>** Any upward variation in GST shall be considered for reimbursement provided supply of goods and services are made within schedule date stipulated in the contract or approved extended schedule for the reason solely attributable to BHEL. However downward variation shall be subject to adjustment as per actual GST applicability. In case the Government imposes any new levy/tax on the output service/goods after price bid opening, the same shall be reimbursed by BHEL at actual. The reimbursement under this clause is restricted to the direct transaction between BHEL and its contactor only and within the contractual delivery period only.

	In case any new tax/levy/duty etc. becomes applicable after the date of Bidder's offer but before opening of the price Bid, the Bidder/Contractor must convey its impact on his price duly substantiated by documentary evidence in support of the same before opening of price bid. Claim for any such impact after opening the price bid will not be considered by BHEL for reimbursement of tax or reassessment of offer.
8.3	**Income Tax:** **TDS/TCS** as applicable under Income Tax Act, 1961 or rules made thereunder shall be deducted/collected from contractor's bill.

8.4 BOCW Act & Cess Act

8.4.1 BOCW Cess is not to be borne by contractor. Refer Annexure-I for BOCW Act & Cess Act.

	Annexure-I:
Bidder may please note that the sub-contractor/bidder of BHEL engaging building or construction worker in connection with building or other construction work, are required to follow the procedures enumerated below:	
1.	It shall be the sole responsibility of the contractor as employer to ensure compliance of all the statutory obligations under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder.
2.	It shall be sole responsibility of the contractor engaging Building Workers in connection with the building or other construction works in the capacity of employer to apply and obtain registration certificate specifying the scope of work under the relevant provisions of the Building and Other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 from the appropriate Authorities.
3.	It shall be responsibility of the contractor to furnish a copy of such Registration Certificate within a period of one month from the date of commencement of Work.
4.	It is responsibility of the contractor to register under the Building and other Construction Workers' Welfare Cess Act, 1996 and deposit the required Cess for the purposes of the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 at such rate as the Central Government may, by notification in the Official Gazette, from time to time specify. However, before registering and deposit of Cess under the Building and other

	Construction Workers' Welfare Cess Act, 1996, the contractor will seek written prior approval from the Construction Manager.
5.	It shall be sole responsibility of the contractor as employer to get registered every Building Worker, who is between the age of 18 to 60 years of age and who has been engaged in any building or other construction work for not less than ninety days during the preceding twelve months as Beneficiary under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996.
6.	It shall be sole responsibility of the contractor as employer to maintain all the registers, records, notices and submit returns under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder.
7.	It shall be sole responsibility of the contractor as employer to provide notice of poisoning or occupation notifiable diseases, to report of accident and dangerous occurrences to the concerned authorities under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the rules made thereunder and to make payment of all statutory payments & compensation under the Employees' Compensation Act, 1923.
8.	It shall be the responsibility of the sub-contractor as employer to make payment/deposit of applicable cess amount on the extent of work involving building or construction workers engaged by the sub-contractor within a period of one month from the receipt of payment. It shall also be responsibility of the Contractor to furnish BHEL on monthly basis, Receipts/ Challans towards Deposit of the Cess under the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder along with following statistics: i) Number of Building Workers employed during preceding one month. ii) Number of Building workers registered as Beneficiary during preceding one month. iii) Disbursement of Wages made to the Building Workers for preceding wage month. iv) Remittance of Contribution of Beneficiaries made during the preceding month
9.	**BHEL shall reimburse the contractor the Cess amount deposited for the purposes of the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 under the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder.** However, BHEL shall not reimburse the Fee paid towards the registration of establishment, fees paid towards registration of Beneficiaries and Contribution of Beneficiaries remitted.

10.	It shall be responsibility of the Building Worker engaged by the Contractor and registered as a beneficiary under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 to contribute to the Fund at such rate per mensem as may be specified by the State government by notification in the Official Gazette. Where such beneficiary authorizes the contractor being his employer to deduct his contribution from his monthly wages and to remit the same, the contractor shall remit such contribution to the Building and other construction Workers' Welfare Board in such manner as may be directed by the Board , within the fifteen days from such deduction.
11.	**Bidders may please note that though the quoted price is exclusive of BOCW (which will be reimbursed by BHEL as per sub-clause 9 above) , however, If at any point of time during the contract period, non-compliance of the provisions of the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder is observed, BHEL reserves the right to deduct the applicable cess (1%) on the contract value and penalty (if any, imposed by Cess Authorities) from the payables on account of non-compliance.**
12.	The contractor shall declare to undertake any liability or claim arising out of employment of building workers and shall indemnify BHEL from all consequences / liabilities / penalties in case of non-compliance of the provisions of the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder.

BILL OF QUANTITY/WEIGHT SHCEDULE

8.0 Summary of Weight of BOQ for the scope of work mentioned in the tender: -

S. No.	Description of Items	UOM	PKG-A	PKG-B	TOTAL
1.1	Structure, Duct and dampers etc as per tender specifications	MT	10801.69	7704.70	18506.39
	Procurement of raw materials & fabrication of auxiliary support, small beam, inserts, shear keys etc. (as per requirement.)	MT	100.00	100.00	200.00
1.1a	**STRUCTURAL WORKS: Structural steel works including all labour, material (unless otherwise specified in BOQ/contract specification), equipments unless otherwise specified, transportation, handling etc. at all level as per specification, drawings and as directed by engineer - in - charge for the following:** Supply, fabrication (Non Galvanised fabricated Structures as per specification), transportation, from work shop to site etc. of structural steel with mild steel (E250) rolled section / built up section / combination of both will be welded type and field connections will generally be bolted type (unless otherwise specified) conforming to IS:2062 and technical specification, pipes conforming to IS:1161/ IS:1239, chequered plate conforming to IS: 3052, mild steel rounds, monorails, stays, safety chains, ladders, MS grating etc. in columns, beams, gantry girders, bunkers, silos, hoppers, roof trusses, portals, laced purlins, space frames, hangers, struts, monorails, galleries, stiffeners, wall beams, sheeting runners, brackets, stub columns, bracings, cleats, trestles, base plates, splice plates, chequered plate flooring, decking and seal plates, steel frame grid over false ceiling, walkway platforms, ladders, stairs, stringers, treads, landings, hand-rails etc as applicable, including blast cleaning, application of primer, intermediate & finish paint as mentioned below and as given in specification, fabrication, straightening, cutting, bending, rolling, grinding, machining, drilling, welding, electrodes and other consumables, alignment (weight of welds not payable), assembly, edge preparation, preheating (min preheat and interpass temperature of 20o C for welding over 20				

S. No.	Description of Items	UOM	PKG-A	PKG-B	TOTAL
	mm and upto 40 mm & 66o C for welding over 40 mm and upto 63 mm & 110o C for thickness over 63 mm & use of low hydrogen / radiogenic electrodes), post heating, testing of welders, inspection of welds, visual inspection, non destructive and special testing, rectification and correction of defective welding works, production test plate, inspection and testing, erection scheme, protection against damage in transit, stability of structures, installation of temporary structures, setting column bases, rectification, dismantling and removal of all temporary structures (weight of temporary structures not payable), etc all complete as per technical specification. **- Providing, nuts, washers, fasteners as per 8.8 grade (weight of erection bolts, nuts, washers, fasteners and welds not payable)** **- Blast cleaning for making surface conforming to Sa 2 ½ finish of ISO 8501-1 with surface profile 40-60 Micron and providing with two component moisture curing zinc (ethyl) silicate primer coat (having minimum 80% of metallic Zinc content in dry film, solid by volume minimum 60% ±2%) of minimum 70 micron DFT, including other associate works etc all complete. The primer coat shall be applied in shop immediately after blast cleaning by airless spray technique. Zinc dust composition and properties shall be Type-II as per ASTM D520-00.** **-Providing and applying Intermediate coat of two component polyamide cured epoxy with MIO Content (containing lamellar MIO minimum 30% on pigment, solid by volume minimum 80% ±2%) of minimum 100 micron DFT. This coat shall be applied in shop after an interval of minimum 24 hours (from the application of primer coat) by airless spray technique including protection and cleaning, scoffolding etc. all complete as per specification.**				

S. No.	Description of Items	UOM	PKG-A	PKG-B	TOTAL
	-Providing and applying Finish Coat of two pack aliphatic Isocyanate cured acrylic finish paint (solid by volume minimum 55% ±2%) with Gloss retention (SSPC Paint Spec No 36, ASTM D 4587, D 2244, D 523) of Level 2 (after minimum 1000 hours exposure, Gloss loss less than 30 and colour change less than 2.0 ΔE) and minimum 70 micron DFT including protection and cleaning, scaff-holding, touchup painting etc. all complete as per specification. This coat shall be applied at shop after an interval of minimum 10 hours and within six (6) months (from the completion of Intermediate coat), Colour and shade of the coat shall be as approved by the BHEL / NTPC. **All Materials shall be procured from the CUSTOMER approved sources only**				
1.1b	**Fabrication of Structures including Preparation of detailed drawing (based on input drawing provided by BHEL), review and approval of fabrication drgs, in consultation with BHEL through detailing agency & reviewing agency, approved by BHEL (Material shall be issued by BHEL free of cost).** **- Blast cleaning for making surface conforming to Sa 2 ½ finish of ISO 8501-1 with surface profile 40-60 Micron and providing with two component moisture curing zinc (ethyl) silicate primer coat (having minimum 80% of metallic Zinc content in dry film, solid by volume minimum 60% ±2%) of minimum 70 micron DFT, including other associate works etc all complete. The primer coat shall be applied in shop immediately after blast cleaning by airless spray technique. Zinc dust composition and properties shall be Type-II as per ASTM D520-00.** **-Providing and applying Intermediate coat of two component polyamide cured epoxy with MIO Content (containing lamellar MIO minimum 30% on pigment, solid by volume minimum 80% ±2%) of minimum 100 micron DFT. This coat shall be applied in shop after an interval of minimum 24 hours (from the**	MT	100.00	250.00	**350.00**

S. No.	Description of Items	UOM	PKG-A	PKG-B	TOTAL
	application of primer coat) by airless spray technique including protection and cleaning, scoffolding etc. all complete as per specification. **-Providing and applying Finish Coat of two pack aliphatic Isocyanate cured acrylic finish paint (solid by volume minimum 55% ±2%) with Gloss retention (SSPC Paint Spec No 36, ASTM D 4587, D 2244, D 523) of Level 2 (after minimum 1000 hours exposure, Gloss loss less than 30 and colour change less than 2.0 ΔE) and minimum 70 micron DFT including protection and cleaning, scaff-holding, touchup painting etc. all complete as per specification. This coat shall be applied at shop after an interval of minimum 10 hours and within six (6) months (from the completion of Intermediate coat), Colour and shade of the coat shall be as approved by the BHEL / NTPC.**				
1.2	**Tanks under FGD system etc as per tender specifications**	MT	47.14	45.73	**92.87**
1.3	**Rotating Machines etc as per tender specifications**	MT	743.46	740.73	**1484.19**
1.4	**Insulation and sheeting, etc. for FGD system as per specifications.**				
1.4.1	INSULATION- MINERAL WOOL	MT	228.53	733.08	**961.61**
1.4.2	INSULATION- FIXING COMPONENTS	MT	136.66	264.10	**400.76**
1.4.3	INSULATION- SHEETING	MT	22.55	169.02	**191.56**
1.5	**Piping systems (including valves, flanges, fittings , H&S etc.) as per tender specifications**				
1.5.1	SS Piping	MT	50.00	55.68	**105.68**
1.5.2	Carbon steel piping including fire protection piping	MT	988.68	829.05	**1817.73**
1.5.3	Carbon steel Buried piping including Supply and Application of Wrapping and Coating	MT	50.00	47.00	**97.00**
1.6	**Erection of Misc. Equpt./Str steel/ etc.**	MT	69.92	70.43	**140.35**
1.7	**Providing PG test assistance for Unit#2, Unit#3, U#4 & U#5**	LS	**2**	**2**	**4**

Note to weight schedule:	
1	The PGMAs/Weights/Quantities/dimensions mentioned above are approximate and liable to vary as per design consideration. There will be change in weight, description etc. However,

	payments will be made for the tonnage actually erected at the quoted rate. Quantity Variation will be dealt as per clause 2.14 of General Conditions of Contract (Volume I BCD).
2	A material breakup under mentioned categories are indicated in the relevant chapter of this tender specification, but the contractor is required to erect actual tonnage which may be necessary to complete the work in all respects as detailed in the tender specifications, for which payments shall be released based on agreed rates. The weights and dimensions of material shown are approximate and are liable to vary.
3	Besides PG / PGMA indicated in the weight schedule, there is likely hood of addition product groups integral to the system. The quoted rate shall be applicable for such product groups also. There may be variation or addition of PGMAs, description, weights etc., and any additional scope of work supplied under the above package shall be erected by the contractor and payment will be made as per the quoted / accepted rate in the respective category at the discretion of BHEL. Decision of BHEL Engineer shall be final and binding to the contractor in this regard.
5	Rate Schedule Identified are based on envisaged material specification. Payment shall be made on the basis of material specification of actual material received and erected at site irrespective of PGMA allocation in the weight schedule. BHEL's decision in this regard shall be final.
6	The erection & dismantling of temporary piping, pumps, dummy plates & blanks, valves, pressure gauges and other miscellaneous equipment required for the test for pre-commissioning and commissioning activities like hydraulic test, acid cleaning, etc. are covered in this contract and shall be carried out as a part of work. Payment will be made at the rate applicable. Weight for the same will be based on jointly measured quantity and corresponding standard weights, except contractor scope materials/equipment. No payment will be made for the equipment brought by the Contractor such as pumps etc and foundations made by the Contractor for temporary systems. Dismantling of temporary piping, edge preparation and return to BHEL stores, area cleaning is in the scope of contractor. All thermo well points are to be seal welded, with plug in position. All Temperature Element points are to be provided with blanks and welded. No Extra Payment shall be made for the same.
7	**Fixing components for insulation:** The scope of works covers welding of all attachment on the ducts, pipe, etc for fixing insulation & refractory.
8	The Erection of HT/LT MOTORS are covered in this scope of contract. However, dry out, testing and commissioning is not in the scope of this contract.

9	The erection and dismantling of air blowers and connecting pipes and ducts, providing blanks / dummies at the required locations and conducting gas tightness test is in the scope of the contractor and shall be carried out within the quoted rate.
10	Payment for additional CONTROL VALVES / STEAM TRAPS/ FLOW NOZZLES / ORIFICES & OTHER VALVES AND FITTINGS (except temporary system valves) will be made as per the quoted / accepted tonnage rate of respective piping category in which these materials is installed.
11	**Extra work rates for welding:** The quantum of welding joints indicated in Welding schedule shall be tentative and liable for variation in PG, description, size, materials, NDT requirements etc. The joints will be grouped into category of carbon steel (inclusive of SA106GrC or equivalent) and Alloy steel (inclusive of T91/T92/P91/P92) and convert them in to equivated joints (Dia 63.5x6.3mm) as per the formula below: No. of equivalent Joints = Dia X Thickness / (63.5 x 6.3) = Dia X Thickness / 400.05 If the total no of equivalent joints in each category exceeds 25% of the total equivalent joints in that category contractor will be paid extra as per the rate indicated below: a) One extra Equivalent joints of Carbon Steel (CS) = Rs 254/- b) One extra Equivalent Joints of Alloy Steel (AS) = Rs 561/-

9.1 Detailed (PGMA wise) weight of BOQ for:

Package A: Unit # 2 & 3 of Stage-I

Sl. No.	MU	PG	MA	NS	SUB-SYSTEM	Description	UOM	Unit-2	Unit-3	Cat
1	RANIPET	55	081	1	STRUCTURE	BUF FIX MATERIAL	MT	2.929	2.929	**1.1**
2	RANIPET	55	082	1	STRUCTURE	BUF STAIR AND HND RAIL	MT	1.577	1.577	**1.1**
3	RANIPET	55	084	1	ROTARY	BUF C AND S AIR FAN	MT	3	3	**1.3**
4	RANIPET	55	089	1	STRUCTURE	BUF MOTOR CANOPY	MT	1.322	1.322	**1.1**
5	RANIPET	55	091	1	ROTARY	FIRST FILL LUBRICANT	LTR	0.5	0.5	**1.3**
6	RANIPET	55	287	1	ROTARY	1 STG BUF ROTOR	MT	20.773	20.773	**1.3**
7	RANIPET	55	587	1	ROTARY	1 STG BUF HOUSING	MT	82.3	82.3	**1.3**
8	RANIPET	55	880	1	ROTARY	BUF CPLNG	MT	2.431	2.431	**1.3**
9	RANIPET	55	980	1	ROTARY	BUF LUBE OIL SYS	MT	4.421	4.421	**1.3**
10	RANIPET	55	983	1	ROTARY	BUF ACTUATOR	MT	0.046	0.046	**1.3**
11	RANIPET	57	141	1	DUCT	SEAL AIR PIPING	MT	8.912	13.269	**1.1**

Sl. No.	MU	PG	MA	NS	SUB-SYSTEM	Description	UOM	Unit-2	Unit-3	Cat
12	RANIPET	57	491	1	ROTARY	BLOWER WITH MOTOR	MT	3.86	4.08	**1.3**
13	RANIPET	57	540	1	STRUCTURE	GATE-FGD BOOSTER FAN INLET	MT	50.83	50.83	**1.1**
14	RANIPET	57	550	1	STRUCTURE	GATE-FGD BOOSTER FAN OUTLET	MT	51.146	51.146	**1.1**
15	RANIPET	57	566	1	STRUCTURE	PLATFORMS AND LADDERS-FGD GD	MT	18.044	21.476	**1.1**
16	RANIPET	57	570	1	STRUCTURE	GATE-FGD OUTLET	MT	35.527	42.997	**1.1**
17	RANIPET	57	570	2	STRUCTURE	GATE-FGD OUTLET	MT	1.252	0	**1.1**
18	RANIPET	57	577	1	STRUCTURE	ELECT ACTUATOR FOR GATE,DAMPER	MT	10.146	11.406	**1.1**
19	RANIPET	57	578	1	STRUCTURE	ELECTRICAL ITEMS FOR GATE,DAMP	MT	3.6	5.8	**1.1**
20	RANIPET	57	583	1	STRUCTURE	DAMPER FGD BYPASS	MT	42.997	43.39	**1.1**
21	RANIPET	57	992	1	STRUCTURE	SPL MATL ELECTRODES	MT	0.0026	0.0026	**1.1**
22	RANIPET	FW	132	1	DUCT	DUCT SUP BYP & BUF/GGH	MT	95.704	122.54	**1.1**
23	RANIPET	FW	133	1	DUCT	DUCT SUPPORT BUF/GGH & ABS	MT	100.121	0	**1.1**
24	RANIPET	FW	134	1	DUCT	DUCT SUP ABS & STACK/BYP	MT	0	60.844	**1.1**
25	RANIPET	FW	136	1	STRUCTURE	STRUCTURES FOR RC PUMP HOUSE	MT	35.769	7.912	**1.1**
26	RANIPET	FW	152	1	DUCT	DUCT BYP-BUF/GGH/ABS	MT	283.272	291.699	**1.1**
27	RANIPET	FW	153	1	DUCT	DUCT BUF/GGH & ABS	MT	162.478	0	**1.1**
28	RANIPET	FW	154	1	DUCT	DUCT ABS & BYP/STA	MT	0	292.691	**1.1**
29	RANIPET	FW	169	1	INSULATION - MINERAL WOOL	INSULATION MATERIALS	MT	10.97	28.89	**1.4.1**
30	RANIPET	FW	170	1	INSULATION - ALUMINIUM CLADDING SHEETS	FIXING COMPONENTS & CLADDING SHE	MT	5.275	17.271	**1.4.3**
31	RANIPET	FW	182	1	DUCT	DUCT STR BYP & BUF	MT	201.308	524.469	**1.1**
32	RANIPET	FW	183	1	DUCT	DUCT STR BUF/GGH&ABS	MT	157.018	0	**1.1**
33	RANIPET	FW	201	1	STRUCTURE	ABSORB. RC PUMP NOZZLE	MT	4.902	4.902	**1.1**
34	RANIPET	FW	202	1	STRUCTURE	ABS NOZL NB 300 AND ABOVE	MT	0.194	0.194	**1.1**
35	RANIPET	FW	207	1	DUCT	OUTLET GUIDE VANE	MT	7.5	7.5	**1.1**
36	RANIPET	FW	209	1	STRUCTURE	MAN HOLE DOOR FOR ABSORBER	MT	3.731	3.731	**1.1**
37	RANIPET	FW	212		ROTARY	SLURRY RECIRCULATION PUMP SYST	MT	160.000	160.000	**1.3**
38	RANIPET	FW	213	1	STRUCTURE	ABSORBER SYSTEM INTERNALS	MT	26.200	26.200	**1.1**

Sl. No.	MU	PG	MA	NS	SUB-SYSTEM	Description	UOM	Unit-2	Unit-3	Cat
39	RANIPET	FW	214	1	STRUCTURE	ABS BAFFLE GRATING	MT	0.668	0.668	**1.1**
40	RANIPET	FW	215		STRUCTURE	MIST ELIMINATOR and ACCESSORIES	MT	16.024	16.024	**1.1**
41	RANIPET	FW	216	1	STRUCTURE	ABS BAFFLE GRATING SUPP	MT	17.335	17.335	**1.1**
42	RANIPET	FW	217	1	STRUCTURE	ABS ME SUPPORT	MT	54.428	54.428	**1.1**
43	RANIPET	FW	218	1	STRUCTURE	ABS SPRAY PIPE SUPP	MT	33.388	33.388	**1.1**
44	RANIPET	FW	219	1	STRUCTURE	ABSORBER SYSTEM-BASE	MT	25.124	24.915	**1.1**
45	RANIPET	FW	220		STRUCTURE	ABSORBER SYSTEM-STRUCTURES	MT	104.668	104.668	**1.1**
46	RANIPET	FW	221	1	STRUCTURE	ABSORBER SYSTEM-CASING BOTTOM	MT	90.778	91.196	**1.1**
47	RANIPET	FW	222	1	STRUCTURE	ABSORBER SYSTEM-CASING TOP	MT	86.140	86.140	**1.1**
48	RANIPET	FW	223	1	STRUCTURE	ABSORBER SYSTEM ACCESSORIES	MT	2.847	2.847	**1.1**
49	RANIPET	FW	224	1	STRUCTURE	ABSORBER SYSTEM-LINING-C276	MT	3.002	3.002	**1.1**
50	RANIPET	FW	226	1	TANK	EMERGENCY QUENCH WATER TANK	MT	15.041	15.041	**1.2**
51	RANIPET	FW	227	1	TANK	EMERGENCY QUENCH SYSTEM	MT	2.915	2.915	**1.2**
52	RANIPET	FW	228	1	STRUCTURE	ABSORBER-W/D INTERFACE	MT	35.801	35.801	**1.1**
53	RANIPET	FW	229	1	STRUCTURE	W/D WASH SYSTEM	MT	0.886	0.886	**1.1**
54	RANIPET	FW	230	1	ROTARY	OXIDATION BLOWER AND ACC	MT	29.290	29.290	**1.3**
55	RANIPET	FW	231	1	STRUCTURE	ABSORBER SHEAR PLATE	MT	6.227	6.227	**1.1**
56	RANIPET	FW	232	1	DUCT	DUCT SUP BYP AND BUF/GGH	MT	132.634	85.458	**1.1**
57	RANIPET	FW	233	1	DUCT	DUCT SUPPORT BUF/GGH AND ABS	MT	49.557	53.274	**1.1**
58	RANIPET	FW	234	1	DUCT	DUCT SUP ABS AND STACK/BYP	MT	30.544	140.244	**1.1**
59	RANIPET	FW	235	1	STRUCTURE	SPECIAL FASTNERS	MT	0.812	0.812	**1.1**
60	RANIPET	FW	236	1	DUCT	STRUCTURES FOR RC PUMP HOUSE	MT	125.422	125.422	**1.1**
61	RANIPET	FW	237	1	STRUCTURE	GALLERIES AND RAILING FOR STAIR	MT	32.528	32.528	**1.1**
62	RANIPET	FW	238	1	DUCT	HOOK UP DUCT WITH STRUCTURE	MT	19.574	19.574	**1.1**
63	RANIPET	FW	239	1	DUCT	VIEWING PORTS	MT	0.131	0.131	**1.1**
64	RANIPET	FW	249	1	ROTARY	HANDLING EQUIP- RC PUMP	MT	5.000	5.000	**1.3**
65	RANIPET	FW	251	1	DUCT	EXPNSN JNT METALLIC	MT	51.377	45.352	**1.1**
66	RANIPET	FW	252	1	DUCT	EXPNSN JNT NON METALLIC	MT	22.333	22.333	**1.1**
67	RANIPET	FW	255	1	DUCT	DUCT BYP AND BUF/GGH/ABS	MT	15.186	15.186	**1.1**

Sl. No.	MU	PG	MA	NS	SUB-SYSTEM	Description	UOM	Unit-2	Unit-3	Cat
68	RANIPET	FW	255	1	DUCT	DUCT BYP AND BUF/GGH/ABS	MT	616.039	469.727	**1.1**
69	RANIPET	FW	256	1	DUCT	DUCT BUF/GGH and ABS	MT	270.298	293.71	**1.1**
70	RANIPET	FW	257	1	DUCT	DUCT ABS AND BYP/STACK	MT	172.585	634.437	**1.1**
71	RANIPET	FW	260	1	DUCT	DUCT STR BYP AND BUF/GGH/ABS	MT	303.151	469.928	**1.1**
72	RANIPET	FW	261	1	DUCT	DUCT STR BUF/GGH and ABS	MT	188.172	205.963	**1.1**
73	RANIPET	FW	262	1	DUCT	DUCT STR ABS AND BYP/STACK	MT	116.405	235.201	**1.1**
74	RANIPET	FW	267	1	INSULATION - MINERAL WOOL	INSULATION MATERIALS FOR DUCT	MT	94.333	94.333	**1.4.1**
75	RANIPET	FW	268	1	INSULATION - FIXING COMPONENTS	FIXING COMP FOR DUCT	MT	65.516	71.14	**1.4.2**
76	RANIPET	FW	269	1	DUCT	CLADDING SHEET FOR DUCT	MT	40.064	44.989	**1.1**
77	RANIPET	FW	280	1	DUCT	FOUNDATION MATL FOR DUCT STRUC	MT	25.103	31.213	**1.1**
78	RANIPET	FW	281	1	STRUCTURE	FOUNDATION MATL FOR ABS	MT	5.143	5.143	**1.1**
79	RANIPET	FW	282	1	STRUCTURE	FOUNDATION MATL FOR ELEVATOR	MT	3.874	3.874	**1.1**
80	RANIPET	FW	283	1	STRUCTURE	FOUNDATION MATL RC PUMP SHED	MT	2.291	2.291	**1.1**
81	RANIPET	FW	285	1	TANK	SUPRTING STR FOR EMERGENCY QWT	MT	5.613	5.613	**1.2**
82	RANIPET	FW	292	1	ELEVATOR	STRUCTURES FOR ELEVATOR	MT	102.37	102.37	**1.1**
83	RANIPET	FW	293	1	ELEVATOR	ELEVATOR AND ACCESSORIES	MT			**1.1**
84	RANIPET	FW	297	1	DUCT	PLATFORM FOR DUCT	MT	15.071	20.33	**1.1**
85	RANIPET	FW	298	1	DUCT	PLATFORM FOR GATE AND DAMPER	MT	7.949	43.311	**1.1**
86	RANIPET	FW	301	1	STRUCTURE	ABSORBER BEAMS AND BRACINGS	MT	193.907	193.907	**1.1**
87	RANIPET	FW	302	1	STRUCTURE	ABSORBER LOWER FLOORS	MT	12.944	12.944	**1.1**
88	RANIPET	FW	303	1	STRUCTURE	ABSORBER UPPER FLOORS	MT	11.069	10.948	**1.1**
89	RANIPET	FW	304	1	STRUCTURE	ABSORBER FLOOR GRILLS	MT	47.282	47.282	**1.1**
90	RANIPET	FW	305	1	STRUCTURE	ABSORBER STAIRS AND HANDRAILS	MT	26.627	26.627	**1.1**
91	RANIPET	FW	306	1	STRUCTURE	ABSORBER HSFG FASTNERS	MT	11.246	11.246	**1.1**
92	RANIPET	FW	307	1	STRUCTURE	ABSORBER MISCELLANEOUS	MT	2.400	2.400	**1.1**
93	RANIPET	FW	310	1	STRUCTURE	STRU FOR BOOSTER FAN HANDLING	MT	119.876	103.314	**1.1**

Sl. No.	MU	PG	MA	NS	SUB-SYSTEM	Description	UOM	Unit-2	Unit-3	Cat
94	RANIPET	FW	322	2	STRUCTURE	ABSORBER SYSTEM-CASING INTERM	MT	91.11	91.11	**1.1**
95	RANIPET	FW	324	1	STRUCTURE	HOOD OVER ABSORBER	MT	98.679	98.679	**1.1**
96	RANIPET	FW	328	1	STRUCTURE	W/D INTERFACE (CARBON STEEL)	MT	41.692	41.692	**1.1**
97	RANIPET	FW	373	1	PIPE RACK	HSFG BOLT-PIPE RACK	MT	14.634	19.668	**1.1**
98	RANIPET	FW	385	1	ELEVATOR	ELEVATOR M/C ROOM AND GUIDE	MT	2.407	1.504	**1.1**
99	RANIPET	FW	386	1	ELEVATOR	INTER-CONNECTING PLTF TO ABS	MT	22.179	6.108	**1.1**
100	RANIPET	FW	390	1	STRUCTURE	C276- SPL- WELD ELECTRODE P-1	MT	0.5	0.5	**1.1**
101	RANIPET	FW	391	1	STRUCTURE	C276- SPL- WELD ELECTRODE P-2	MT	0.5	0.5	**1.1**
102	RANIPET	FW	392	1	STRUCTURE	TI- SPL WELD ELECTRODE P-1	MT	0.05	0.018	**1.1**
103	RANIPET	FW	393	1	STRUCTURE	TI- SPL WELD ELECTRODE P-2	MT	0.05	0.018	**1.1**
104	RANIPET	FW	610	1	STRUCTURE	GALLARIES AND RAIL FOR ABSORBER	MT	1.478	1.478	**1.1**
105	RANIPET	FW	612	1	STRUCTURE	GALLARIES AND RAILINGS FOR DAM	MT	31.459	34.72	**1.1**
106	RANIPET	FW	613	1	STRUCTURE	GALLARIES AND RAILINGS FOR DUC	MT	30.187	35.189	**1.1**
107	RANIPET	57	497	1	CS PIPING	KGV AND CHECK VALVE	MT	1.93	2.41	**1.5.2**
108	RANIPET	FW	208	1	Misc. Equpt./Str steel/ etc.	RC PUMP OB SUPPORT	MT	11.992	10.507	1.6
109	RANIPET	FW	815	1	CS PIPING	RC PUMP INLT and OUTLT VALVE	MT	50	50	1.5.2
110	RANIPET	FW	861	1	CS PIPING	CSRL PIPE-1 (GS,LS)	MT	37.623	37.623	1.5.2
111	RANIPET	FW	862	1	CS PIPING	CSRL PIPE-2 (GS,LS)	MT	99.546	99.546	1.5.2
112	RANIPET	FW	866	1	Misc. Equpt./Str steel/ etc.	FASTENERS CS & SS	MT	14.861	14	1.6
113	RANIPET	FW	867	1	Misc. Equpt./Str steel/ etc.	RUBBER GASKET, SHEET	MT	0.65	0.65	1.6
114	RANIPET	FW	868	1	Misc. Equpt./Str steel/ etc.	U-BOLTS	MT	8	9.264	1.6
115	RANIPET	FW	873	1	CS PIPING	CSRL PIPE-1 (GS,LS)	MT	36.667	36.667	**1.5.2**
116	RANIPET	FW	874	1	CS PIPING	CSRL PIPE-2 (GS,LS)	MT	103.333	103.333	**1.5.2**
117	RANIPET	FW	876	1	CS PIPING	CSRL PIPIE-1 (LOT-2)	MT	5.000	5.000	**1.5.2**
118	TRY-PC/PEM	80	463	1	SS PIPING	TG AUX COOLING WATER (DMCW/ECW)	MT	25	25	**1.5.1**

Sl. No.	MU	PG	MA	NS	SUB-SYSTEM	Description	UOM	Unit-2	Unit-3	Cat
119	TRY-PC/PEM	80	463	1	CS PIPING	TG AUX COOLING WATER (DMCW/ECW)	MT	95	95	**1.5.2**
120	TRY-PC/PEM	-	-	-	CS PIPING	CS PIPING (PW,CW,SW, IA, DW)	MT	5	5	**1.5.2**
121	PE&SD	-	-	-	CS PIPING	FIRE FIGHTING SYSTEM	MT	100	0	**1.5.2**
122	PE&SD	-	-	-	CS PIPING - BURIED	FIRE FIGHTING SYSTEM - BURIED PIPING	MT	50	0	**1.5.3**
123	TRY-PC/PEM & Ranipet				CS PIPING	MISC VALVES	MT	10	10	**1.5.2**
124	BHOPAL	-	-	-	MOTOR	MOTOR	MT	60	60	**1.3**
						Total	**MT**	**6118.574**	**7020.050**	
						Total Pkg:A Stg-I(U#2 & 3)	**MT**	**13,138.62**		

Package B: Unit # 4 & 5 Stage-II

Sl. No.	MU	PG	MA	SUB-SYSTEM	Description	UOM	Unit-4	Unit-5	Cat
1	RANIPET	55	84	ROTARY	AXIAL BOOSTER COOLING/SEAL FAN	MT	3	0	**1.3**
2	RANIPET	55	87	ROTARY	BOOSTER FAN C& I ITEMS	MT	0.04	0.04	**1.3**
3	RANIPET	55	91	ROTARY	FIRST FILL LUBRICANTS	MT	2.31	2.31	**1.3**
4	RANIPET	55	980	ROTARY	BOOSTER FAN LOS WITH LUBRICANT	MT	4.461	4.461	**1.3**
5	RANIPET	55	983	ROTARY	BOOSTER FAN ACTUATOR	MT	0.1	0.1	**1.3**
6	RANIPET	57	540	STRUCTURE	BUF INLET GATE	MT	50.323	0	**1.1**
7	RANIPET	FW	208	**Misc. Equpt./Str steel/ etc.**	RC PUMP OB SUPPORT	MT	12	11	**1.6**
8	RANIPET	FW	815	CS PIPING	RC PUMP OUTLT VALVE	MT	25	25	**1.5.2**
9	RANIPET	FW	212	ROTARY	SLURRY RECIRCULATION PUMP SYST	MT	320	0	**1.3**
10	RANIPET	FW	227	STRUCTURE	Emergency Quench System	MT	2.915	2.915	**1.1**
11	RANIPET	FW	229	STRUCTURE	W/D Wash System	MT	0.886	0.886	**1.1**
12	RANIPET	FW	232	STRUCTURE	DUCT SUPPORT	MT	300.56	296.971	**1.1**
13	RANIPET	FW	234	STRUCTURE	DUCT SUPPORT	MT	33.049	33.057	**1.1**

Sl. No.	MU	PG	MA	SUB-SYSTEM	Description	UOM	Unit-4	Unit-5	Cat
14	RANIPET	FW	235	STRUCTURE	C276 M10x70 Hexscrew+2nut+2wasr	MT	0.812	0.812	**1.1**
15	RANIPET	FW	236	STRUCTURE	STRUCTURES FOR RC PUMP HOUSE	MT	**31.781**	0	**1.1**
16	RANIPET	FW	237	STRUCTURE	GALLERIES / RAILING FOR STAIR	MT	27.986	30.955	**1.1**
17	RANIPET	FW	239	STRUCTURE	Rect.Gaskt-350nb5x75x2600 Absn19	MT	0.131	0.131	**1.1**
18	RANIPET	FW	241	STRUCTURE	Absorber Agitator	MT	4.4	4.4	**1.1**
19	RANIPET	FW	251	STRUCTURE	EXPANSION JOINT	MT	34.881	48.64	**1.1**
20	RANIPET	FW	255 355	STRUCTURE	DUCT	MT	899	996	**1.1**
21	RANIPET	FW	257	STRUCTURE	DUCT	MT	137.865	167.473	**1.1**
22	RANIPET	FW	260 286 287 360	STRUCTURE	DUCT	MT	560.002	1177.087	**1.1**
23	RANIPET	FW	262	STRUCTURE	DUCT STRUCTURE	MT	78.445	116.114	**1.1**
24	RANIPET	FW	267	INSULATION - MINERAL WOOL	INSULATION MATERIALS FOR DUCT	MT	339.867	393.216	**1.4.1**
25	RANIPET	FW	268	INSULATION - FIXING COMPONENTS	FIXING COMPONENTS FOR DUCT	MT	121.765	142.339	**1.4.2**
26	RANIPET	FW	269	INSULATION - ALUMINIUM CLADDING SHEETS	ALSH0.711 FOR DUCTING AND FAN	MT	78.386	90.629	**1.4.3**
27	RANIPET	FW	292	STRUCTURE	Elevator Column	MT	58.695	43.439	**1.1**
28	RANIPET	FW	293	STRUCTURE	ELEVATOR AND ACCESSORIES	MT	12	12	**1.1**
29	RANIPET	FW	305	STRUCTURE	ABSORBER STAIR & HANDRAILS	MT	24.739	22.663	**1.1**
30	RANIPET	FW	307	STRUCTURE	Absorber Miscellaneous	MT	2.363	2.363	**1.1**
31	RANIPET	FW	385	STRUCTURE	Elevator M/c room & Guide	MT	1.504	1.504	**1.1**
32	RANIPET	FW	386	STRUCTURE	Inter-connecting pltf to Abs	MT	3.584	3.585	**1.1**
33	RANIPET	FW	701	ROTARY	Tank Pumps	MT	28.16	0	**1.3**
34	RANIPET	FW	705	ROTARY	Pumps & Motor Acc	MT	9.02	0	**1.3**
35	RANIPET	FW	720	ROTARY	Agitators	MT	36.724	0	**1.3**

Sl. No.	MU	PG	MA	SUB-SYSTEM	Description	UOM	Unit-4	Unit-5	Cat
36	RANIPET	FW	734	ROTARY	WET BALL MILL	MT	**210**	0	**1.3**
37	RANIPET	FW	748	TANK	Process water tank	MT	22.793	0	**1.2**
38	RANIPET	FW	761	STRUCTURE	Structure (column) for pipe rack 3PR1/2 to 3PR7/8, 5PR1/2 to 5PR5/6, 7PR7/8 to 7PR11/12, 9PR1/2 to 9PR11/12	MT	100.53	0	**1.1**
39	RANIPET	FW	767	STRUCTURE	PLATFORM FOR SUB PIPE RACK	MT	5	0	**1.1**
40	RANIPET	FW	769	STRUCTURE	TRESTLE FOR SUB PIPE RACKS (Trestle (Gallery) for sub pipe rack 3PR1/2 to 3PR7/8, 5PR1/2 to 5PR5/6, 7PR7/8 to 7PR11/12, 9PR1/2 to 9PR11/12	MT	61.993	0	**1.1**
41	RANIPET	FW	785	TANK	Belt filter wash tank	MT	9.427	0	**1.2**
42	RANIPET	FW	791	STRUCTURE	TRESTLE FOR MAIN PIPE RACK- STRETCH II (Gallery for main pipe rack-strech II 9PR1/2 to 9PR13/14)	MT	120.565	0	**1.1**
43	RANIPET	FW	800	TANK	Clarifier water tank	MT	9.512	0	**1.2**
44	RANIPET	FW	802	TANK	Lime Neutralisation tank	MT	4	0	**1.2**
45	RANIPET	FW	863	CS PIPING	CS PIPING (PW,CW,SW)	MT	142.911	0	**1.5.2**
46	RANIPET	FW	864	SS PIPING	SS PIPING (W/D)	MT	5.681	0	**1.5.1**
47	RANIPET	FW	865	CS PIPING	GI PIPING (IA, DW)	MT	42.16	0	**1.5.2**
48	RANIPET	FW	867	Misc. Equpt./Str steel/ etc.	RUBBER GASKET, SHEET	MT	0.65	0.65	**1.6**
49	RANIPET	FW	868	Misc. Equpt./Str steel/ etc.	U-BOLTS	MT	8	9.264	**1.6**
50	RANIPET	FW	873	CS PIPING	CSRL PIPE-1 (GS,LS)	MT	68.287	0	**1.5.2**
51	RANIPET	FW	874	CS PIPING	CSRL PIPE-2 (GS,LS)	MT	176.301	0	**1.5.2**
52	RANIPET	FW	877	CS PIPING	CS PIPING (LOT-2)	MT	19.851	0	**1.5.2**
53	RANIPET	FW	879	CS PIPING	GI PIPING (LOT-2)	MT	7.538	0	**1.5.2**
54	RANIPET	-	-	CS PIPING	MISC VALVES	MT	20	0	**1.5.2**
55	RANIPET	-	-	STRUCTURE	WET BALL MILL BUILDING	MT	35	0	**1.1**
56	RANIPET	BOLT & NUT		STRUCTURE	BOLT & NUT	MT	31.666	0.032	**1.1**
57	RANIPET	FW		Misc. Equpt./Str steel/ etc.	FASTENERS CS and SS	MT	14.861	14	**1.6**

Sl. No.	MU	PG	MA	SUB-SYSTEM	Description	UOM	Unit-4	Unit-5	Cat
58	TRY-PC/PEM	80	463	SS PIPING	TG AUX COOLING WATER (DMCW/ECW) - SS	MT	50	0	**1.5.1**
59	TRY-PC/PEM	80	463	CS PIPING	TG AUX COOLING WATER (DMCW/ECW) - CS	MT	207	0	**1.5.2**
60	PE&SD	-	-	CS PIPING - BURIED	FIRE FIGHTING SYSTEM - BURIED PIPING	MT	47	0	**1.5.3**
61	PE&SD	-		CS PIPING	FIRE FIGHTING SYSTEM	MT	95	0	**1.5.2**
62	BHOPAL			ROTARY	MOTOR	MT	60	60	**1.3**
					Total	**MT**	**4822.48**	**3714.036**	

Sl. No.	MU	PG	MA	SUB-SYSTEM	DESCRIPTION	UOM	COMMON SYSTEM U#4 & 5	Cat
1	PSER			STRUCTURES	SHOP FABRICATED STRUCTURES	MT	**2123**	**1.1**
					Total Pkg:B Stg-II (U#4 & 5)	**MT**	**10,659.52**	

9.2 BOQ for Mobilisation of special resources (Part of Package A & B): -

ST NO	Item Description	Unit	Quantity Per Package
	Deployment of Requisite Manpower as mentioned below at site, within 15 days, as and when intimated by BHEL. This deployment shall be over and above the requirement as per Contractual clause. The deployed manpower shall report to BHEL and may be deployed at any location. BHEL shall make payment on pro rata monthly basis on actual deployment (considering 26 working days in a month). In case the contractor does not deploy or delays deployment of above said manpower with reference to specific instructions from BHEL, BHEL will levy penalty of Rs. 100 per service day, for such delay		
1.0	Computer operator (Skilled)	**Manmonth**	15
	Execution/Mobilisation of special resources (PVC & ORC shall not be applicable on Section-II)		

THE SCOPE OF THE WORK WILL COMPRISE OF BUT NOT LIMITED TO THE FOLLOWING:

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

10.0 GENERAL

10.1 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 method, equipment or material necessary for the proper and efficient services towards installation of the plant shall not relieve the contractor of the responsibility of providing such services/ facilities to complete the work or portion of work awarded to him. The quoted/ accepted rates/ lump sum price shall deem to be inclusive of all such contingencies.

10.2 It is not the intent to specify herein all details of all material. Any item related this work not covered by this but necessary to complete the system will be deemed to have been included in the scope of the work.

10.3 **Site Visit by the Bidder: -** The bidder shall, prior to submitting his tender for the work, visit and examine the site of works and its surroundings at his own expense, and obtain and ascertain for himself on his own responsibility all information that may be necessary for preparing his tender and entering into a contract, and take the same into account in the quoted contract price for the work.

10.3.1 The bidder shall satisfy themselves about the following factors:

i) Site conditions including access to the site, existing and required roads and other means of transport/communication for use by him in connection with the work including diverting and re-routing of services.

ii) Requirement and availability of land and other facilities of his enabling works, establishment of his office, stores etc.

iii) Ground conditions including those bearing upon transportation, disposal, handling and storage of materials required for the work or obtained there-from.

iv) Source and extent of availability of suitable materials, including water etc., and labour (skilled and unskilled) required for work, and laws and regulations governing their use and employment.

v) Geological, meteorological, topographical and other general features of the site and its surroundings as are pertaining to and needed for the performance of the work.

vi) The limit and extent of surface and subsurface water to be encountered during the performance of the work, and the requirement of drainage and pumping.

vii) The type of equipment and facilities needed, for and in the performance of the work.

viii) The extent of lead and lift required for the work in complete form over the entire duration of the contract, and All other information pertaining to and needed for the work including information as to the risks, contingencies and other circumstances which may influence or affect the work or the cost thereof under this contract.

10.4 The contractor is strictly prohibited from using BHEL's regular components like angles, channels, beams, plates, pipe / tubes, and handrails etc. for any temporary supporting or approach platforms or scaffolding works or as bed for pre-assembly works. Contractor shall arrange himself all such materials. The Contractor shall make all fixtures, temporary supports, steel structures required for jigs & fixtures, anchors for load and guide pulleys required for the work. Contractor shall arrange necessary steel (angles, channels, beams, plates etc) for such usage as normal scope of work without any cost implication on BHEL. In case of such misuse of BHEL materials, a sum as determined by BHEL engineer will be recovered from the contractor's bill. The decision of BHEL engineer is final and binding on the contractor. However, if available with BHEL (in form of scrap/good steel), vendor may be allowed to use on returnable basis on discretion of BHEL.

10.5 Contractors shall ensure that all their Staff / Employees are exposed to periodical training programme conducted by qualified agencies / personnel on ISO 9001 – latest Standards.

10.6 Contractor has to clear the front, expeditiously and promptly as instructed by BHEL Engineer for other agencies, like Civil, Electrical, instrumentation, BOP, etc., to commence their work from / on the equipments coming under this scope. Sometimes, more than one agency may have to work in same location. Sometimes it may be required to re-schedule the activities to enable other agencies to commence / continue the work so as to keep the overall project schedule.

10.7 For the purpose of planning, contractor shall furnish the estimated requirement of power (month wise) for execution of work in terms of maximum KW demand.

10.8 The FGD & its auxiliaries including FDPS shall be erected as per relevant provisions of latest relevant Regulations and amendments/addendums thereof, if any.

10.9 Based on the applicability, Contractor should obtain the formal statutory clearance from Chief Inspector of Boilers to carry out erection & Welding of piping (Power cycle piping, special tanks, IBD Tanks, CBD tanks any other tanks as applicable) under IBR purview. Arrangement for the visit of Boiler inspector for field inspection, hydraulic test etc., is in the scope of contractor, and necessary drawing / details only will be given by BHEL. If applicable/required, all boiler, piping layout drawings received from BHEL for pipeline erection to be submitted to Boiler Inspector for approval. After approval of the above drawing, Erection of pressure parts, pipe line to be started

10.10 All necessary certificates and licenses, permits & clearances to carry out this work from the respective IBR authorities/statutory/ local authorities/ etc are to be arranged by the Contractor, if required, at his cost in time to ensure smooth progress of work and render all assistance, service required in this regard.

10.11 All registration and statutory inspection fees, if any, in respect of his work pursuant to this Contract shall be to the account of the Contractor. However, any registration, statutory inspection fees lawfully pay-able under the provisions of the Indian Boiler Regulations and any other statutory laws and its amendments from time to time during erection in respect of the plant equipment ultimately to be owned by the customer, shall be to the account of the customer. Should any such inspection or registration need to be re-arranged due to the fault of the Contractor, the additional fees for such inspection and/or registration shall be borne by the Contractor. Inspection fee and registration fee as mentioned in Chapter VIII of Special Conditions of contract (Volume-IB in (Vol I BCD)) shall be paid by BHEL.

10.12 The contractor must obtain the signature and permission of the security personnel of the customer for bringing any of their materials inside the site premises. Without the Entry Gate Pass these materials will not be allowed to be taken outside.

10.13 During the course of erection, if the progress is found unsatisfactory, or if the target dates fixed from time to time for every milestone are to be advanced, or in the opinion of BHEL, if it is found that the skilled workmen like fitters, operators, technicians employed are not sufficient BHEL will induct required additional workmen to improve the progress and recover all charges incurred on this account including all expenses together with BHEL overheads (5%) from contractor's bills.

10.14 The intent of specification is to provide services according to the most modern and proven techniques and codes. The omission of specific reference to any method, equipment or material necessary for proper and efficient execution of this work shall not relieve the Contractor of the responsibility of providing such facilities to complete the work without any extra compensation.

10.15 Contractor shall erect and commission all the equipments and auxiliaries as per the sequence & methodology prescribed by BHEL depending upon the technical requirements. Availability of materials and fronts will decide this. BHEL Engineer's decision regarding correctness of the work and method of working shall be final and binding on the Contractor. No claims for extra payment from the Contractor will be entertained on the ground of deviation from the methods / sequence adopted in erection of similar sets elsewhere.

10.16 The Contractor shall perform any services, tests etc. which may not be specified but nevertheless, required for the completion of work within quoted rates.

10.17 The Contractor shall execute the work in the most substantial and workman like manner. The stores shall be handled with care and diligence.

10.18 BHEL reserves right to recover from the Contractor any loss which arises out of undue delay / discrepancy / shortage / damage or any other causes due to Contractor's lapse during any stage of work. Any loss to BHEL due to Contractor's lapse shall have to be made good by the Contractor as per GCC.

10.19 All works such as cleaning, levelling, aligning, trial assembly, dismantling of certain equipments / components for checking and cleaning, surface preparation as per general engineering practice and as per BHEL Engineer's instructions at site, cutting, gouging, weld depositing, grinding, straightening, chamfering, filing, chipping, drilling, reaming, scrapping, lapping, fitting up etc. as may be applicable in such erection works and which are treated incidental to the erection works and necessary to complete the work satisfactorily, shall be carried out by the Contractor as part of the work within the quoted rates.

10.20 The Contractor shall take delivery of the components, equipments, chemicals, and lubricants etc. from the BHEL stores/ storage area after getting the approval of BHEL Engineer on standard indent forms of BHEL. Complete and detailed account of the materials and equipments after usage shall be submitted to the BHEL and reconciled periodically.

10.21 Plant materials should not be used for any temporary supports / scaffolding/ preparing pre-assembly bed etc. The details of equipments to be erected under this contract are generally as per the schedule given in relevant appendices. These details are approximate and meant only to give a general idea to the tenderer about the magnitude of the work involved. Actual quantum and type of equipments will be based on the relevant erection documents which will be furnished to the Contractor in due course of erection and the weight and quantity as per the relevant engineering documents will only be admissible for the billing purpose.

10.22 Spring suspension / constant load hangers may have to be pre-assembled for required load and erection carried out as per instructions of BHEL. Adjustments, removal of temporary arrests/locks, cutting of excess thread length of hanger tie-rod etc have to be carried out as and when required. Load setting of spring hangers, as per BHEL's documents/instructions, during various stages of erection & testing and after floating of piping/ducting during cold and hot condition will have to be done as part of work. This exercise may have to be repeated till satisfactory results are achieved.

10.23 Layout of field routed, fine fittings, boiler trim piping, oil system and other small-bore piping have to be routed according to site conditions and hence shall be done only in position as per the site requirement. As such, layout of small-bore piping in boiler and oil system shall be done as per the site requirement. Necessary sketch for routing these lines shall be prepared and got

approved from BHEL by the contractor. There is a possibility of slight change in routing the above pipelines when after completion, to suit the site conditions. The contractor should absorb this cost in his quoted rate.

10.24 Fixing and seal welding of thermowells & plugs before Hydro test/ steam blowing of equipment or other piping system is within the scope of work. Contractor shall also remove the seal welded plugs by process of grinding and fix and seal weld thermowells after hydro test/steam blowing of lines as part of work.

10.25 In installation of various equipments it may become necessary to install these on temporary supports/ hanger due to various reasons including non-availability of suspension materials. Contractor shall install such temporary suspensions/hangers and later on shift the relevant equipments to their respective permanent hangers/ suspensions/ supports as incidental to work. Requisite materials for such temporary arrangements will be provided by BHEL on free - returnable basis which shall be returned to BHEL after the use.

10.26 Interconnection/ hook-up, if any, with the existing system shall form part of work. Such interconnections, hook-ups may require shut down of running plant and the relevant work have to be completed within such planned shutdowns. This may call for working with enhanced resources and on extended hours. Contractor's offer shall cover all such contingencies.

10.27 Contractor shall regulate flow of material to and from site in such a manner and sequence that material accumulation at site does not lead to congestion at site. In case it is necessary to shift and restack the materials kept at work areas / site to enable other agencies to carry out their work or further any other reason, it shall be done by the Contractor most expeditiously. No claim for extra payment for such work will be entertained.

10.28 It may so happen that certain components like manhole doors, hanger etc may be supplied in loose items. They need to be assembled as per relevant drawings or as per advice of BHEL engineer prior to erection. This forms the part of the scope of work.

10.29 The Contractor shall have total responsibility for all equipment and materials in his custody at Contractor’s stores, loose, semi-assembled, assembled or erected by him at site. He shall effectively protect the finished works from action of weather and from damages or defacement and shall also cover the finished parts immediately on completion of work as per BHEL engineer’s instructions. The machine surfaces/finished surfaces should be greased and covered.

10.30 BHEL is operating web based computerized E-store system that includes, inter-alia, issue of materials, daily progress reporting, Contractor’s running monthly billing and material reconciliation through a computerized data management system. Contractor shall install necessary hardware to hook-up with the BHEL’s system and use the same for his scope of work.

10.31 In the event the computerized E-store/SOMS is inoperative for any reasons, the Contractor shall take delivery of materials from the storage area/sheds of BHEL/customer after getting the approval of the engineer/customer on standard indent forms to be specified by BHEL/customer. All these records however shall be updated in the E-store/SOMS as and when the E-store/SOMS is reactivated/ normalized.

10.32 Gases like argon, oxygen, acetylene etc that are required for erection related activities shall be arranged by the Contractor at his cost. For T-91 material site weld joints argon as per grade-3 of is 5760: 1998 with oxygen and water vapour restricted to max 6 ppm each and with argon purity level of minimum 99.99% shall be arranged and used by the Contractor. The supply should accompany test certificate for the batch indicating individual element 'ppm' level and overall purity level. Contractor should arrange to verify the purity of argon at site as required by BHEL/Customer

10.33 **Contractor shall arrange necessary connector, nipple, regulator, header and piping for usage of such gas from cylinders. However, Nitrogen gas required for the initial charging of Fuel/Lube/Working oil accumulators shall be in the scope of the contractor.**

10.34 **All lubricants and chemicals required for testing, preservation, chemical cleaning / acid cleaning/pickling, oil flushing, and the lubricants for trial runs of the equipments and commissioning of the unit will be supplied by BHEL free of charges.**

10.35 Site testing wherever required shall be carried out for all items / materials installed by the contractor to ensure proper installation and functioning in accordance with drawings, specifications and manufacturer's recommendations.

10.36 The work shall be executed under the usual conditions without affecting power plant construction / operation and in conjunction with other operations and contracting agencies at site. The contractor and his personnel shall co-operate with the personnel of other agencies, co-ordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.

10.37 Wherever Construction sequences are furnished by BHEL, the contractor shall follow the same sequence.

10.38 Contractor shall, transport all materials to site and unload at site / working area for inspection and checking. All material handling equipment required shall be arranged by the contractor.

10.39 Contractor shall retain all T&P / Testing instrument / Material handling equipment's etc. at site as per advice of BHEL engineer and same shall be taken out from site only after getting the clearances from engineer in charge. The contractor at his cost shall arrange necessary security measures for adequate protection of his machinery, equipment, tools, materials etc. BHEL shall not be responsible for any loss or damage to the contractor's construction equipment and

materials. The contractor may consult the Engineer-in-Charge on the arrangements made for general site security for protection of his machinery equipment tools etc.

10.40 The consumables (welding electrodes, special T&Ps etc), commissioning spares and erection material spares released in PG-MA XX-991, XX-992, XX-993, XX-988, XX-997 and other similar items are not billable. However, certain spare items when actually erected as a part of permanent equipment shall be paid as per agreed payment terms as applicable. The decision of BHEL Engineer in this regard shall be final and binding on contractor.

10.41 Dismantling of temporary piping & Cleaning of the area, erected by bidder, is in the scope of contractor.

10.42 Contractor shall remove all scrap materials periodically generated from his working area and collect the same at one place earmarked for the same. Load of scraps is to be shifted to a place earmarked by BHEL. Failure to collect the scrap is likely to lead to accidents and as such BHEL reserves the right to collect and remove the scrap at contractor's cost with applicable overheads if there is any failure on the part of contractor in this respect.

10.43 The contractor shall ensure that his premises are always kept clean and tidy to the extent possible. Any untidiness noted on the part of the contractor shall be brought to the attention of the contractor's site representative who shall take immediate action to clean the surroundings to the satisfaction of the Engineer in- Charge.

10.44 Completion of work, all the temporary buildings, structures, pipe lines, cable 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 expenditure towards clearance of the same will be recovered from the contractor with 5% overhead. The decision of BHEL Engineer in this regard is final.

10.45 The contractor's work shall not hinder other work, either underground or over ground, such as electrical, phone lines, water or sewage lines, etc. In areas of overlap, the contractor shall work in coordination with other related contractors.

10.46 Any damage of the landscape by contractor's team to such utilities will be penalized and contractor shall be responsible for cost/making good for such damages.

10.47 Contractor at his cost shall lay all necessary temporary piping including cutting and edge preparation, install the pumps, blanks, valves, Pressure gauges etc. required for the test. Required pipes, valves, plates etc., will be given by BHEL.

10.48 SITE INSPECTION

10.48.1 The owner / employer or his authorized agents may inspect various stages of work during the currency of the contract awarded to him. The contractor shall make necessary arrangements for such inspection and carry out the rectification pointed out by the owner / employer without any extra cost to the owner / employer. No cost whatsoever such duplication of inspection of work be entertained.

10.48.2 BHEL / Customer will have full power and authority to inspect the works at any time, either on the site or at the contractor's premises. The contractor shall arrange every facility and assistance to carry out such inspection. On no account will the contractor be allowed to proceed with work of any type unless such work has been inspected and entries are made in the site inspection register by customer / BHEL.

10.48.3 Wherever the performance of work by the contractor is not satisfactory in respect of workmanship, deployment of sufficient labour or equipment, delay in execution of work or any other matter, BHEL shall have the right to engage labour at normal ruling rates and get the work executed through other agency and debit the cost to the contractor with 5% overhead, and the contractor shall have no right to claim compensation thereof. In such a case, BHEL shall have the right to utilize the materials and tools brought by the contractors for the same work.

10.49 UTILITY POINTS

10.49.1 Number of utility points (Service / plant air, service / plant water, service / washing steam, inert gas (N2) etc., shall be indicated in the P & I diagram. Contractor to locate the utility points as advised by site engineer and shall route the piping to these points as per site conditions, and shall submit as built layout with 'BILL OF MATERIAL' to BHEL for approval.

10.49.2 The utility points shall be located at convenient point to handle and to be terminated with brass / bronze valve with suitable connection for hose pipe.

10.50 DOCUMENTATION

10.50.1 Contractor has to maintain documents regarding erection, alignment, welding, joints, NDT and other erection data as per the FQP (min 05 Copies). These shall be required at different stages of erection and commissioning for statutory clearances as well as during handing over to Customer.

10.51 AS BUILT DRAWING:

After successful completion, testing and commissioning of installation work, Purchaser's drawings / documents shall be updated in line with the actual work carried out and as built drawings / documents shall be submitted by the contractor as agreed for the project. Contractor shall be supplied with one extra copies of the layout & isometrics drawings. Contractor to incorporate in one of the copies with red ink all the changes / deviations / alterations etc., Carried out at site due to various reasons, with site engineer's endorsement. Marked up drawings shall be submitted to BHEL for approval.

10.52 Statutory approval

10.52.1 Necessary approval for drawings, documents, Load Testing, license of hoists, lifts, Misc cranes of different equipment erected by bidders has to be arranged for getting statutory fitness certificates, drawings/documents from Statutory agency/Third party inspectors without any extra commercial implication on BHEL treating as normal scope of work.

10.52.2 Contractor has to provide assistance during commissioning & Load test of EOTs with manpower, load shifting, etc. Load shall be provided by BHEL on returnable basis.

10.52.3 Contractor has to arrange sufficient manpower (fitters, electricians with supporting helpers) and T&P /other resources with sufficient testing instruments, IMTE/MMD for erection and commissioning of these systems without any extra commercial implication on BHEL treating as normal scope of work.

10.52.4 It shall be the responsibility of the Contractor to obtain the all necessary approvals/permits from the inspection/regulatory authorities etc. on behalf of the Employer, as may be required for erection, testing and commissioning etc. As called for under the statutes, regulations and the safety codes, all such documentation submission and taking necessary approval shall be the responsibility of contractors. Necessary approval is required from statutory authorities for the entire work.

10.53 Support for Handing Over of T&P, spares to BHEL/Customer, diversion to other BHEL Sites/Units

Vendor will assist in handing over of Special T&Ps/Spares for Erection/commissioning, which were issued to them free of charge, for returning to BHEL /Customer store in good working condition. Any damage caused to these Special T&Ps/Spares by Contractor has to be made good by the contractor only. In case of non-compliance, BHEL shall recover the cost of repair/replacement with 5% overhead. Decision of BHEL Engineer shall be final in such case.

10.54 Dewatering

Dewatering of Low Lying areas like Duct. Absorber, Tanks, Gypsum handling, Lime stone handling, fans, pumps and other working areas, other low lying areas (as per scope applicability), till handing over to customer, is in contractor's scope for which contractor has to arrange and maintain adequate no. of Diesel & electrical pumps of suitable capacities, operators, necessary manpower with sufficient quantity of suction & discharges hoses, pipes, Clamps, cables, Electrical panels/starters, diesel, consumables without any extra commercial implication on BHEL treating as normal scope of work. Dewatering pumps will be required to run to ensure job progress is not hampered &, if required, pumps are to be run on round the clock basis on working days & holidays and even on Sundays.

10.55 Housekeeping/Area Cleaning

The contractor has to do area cleaning on every date on daily basis. Non-compliance of the above cleaning shall call for penal recovery limited to **Rs.2,000.00 on each instance** and at the same time, cleaning of the area shall be done by BHEL at Cost recovery basis with **10%** overheads. No excuses on this above account shall be entertained by BHEL on whatsoever account.

Contractor shall engage separate gangs throughout the contract period, exclusively for proper housekeeping of the site. The contractor has to make necessary arrangements for collection and for bringing down the scrap from all locations and taking them away from the erection areas to various locations as indicated by BHEL Engineer. The house keeping must be a routine and continuous activity. in the various work fronts.

10.56 Approach platforms, fixtures

10.56.1 Erection of Platforms (with grating, railing, toe-guards and stairs) for safe approach and operation of auxiliaries and valves, as per BHEL and customer requirement etc is to be carried out by contractor. Payment/ payment terms of such work shall be done as per **Rate schedule identifier – 1.1a or 1.1b of Section-I of BOQ** depending upon the provision of scope of structural steel supply.

10.56.2 Steel items like angles, scaffoldings, Tie beams required for erection of items which are temporary in nature are to be arranged by vendor for structural erection treating it as normal scope of work without any cost implication on BHEL.

10.57 Assistance during commissioning of panels, Equipment, system, actuators for valves (motor operated/pneumatic), gates, dampers

Agency has to give assistance for commissioning during initial period and subsequently during unit operation during stabilization period/trial run/PG Test. For this purpose, for the items

erected by agency has to provide manpower, other resources, diesel, other consumables, scaffoldings, Other T&Ps as required from time to time. These types activities will be repetitive in natures for number of times and in cases dismantling, reinstallation of items/parts has also to be done till handing over of unit to customer. During case of dismantling /reinstallation logistic supports like Tyre mounted crane/Crawler Crane/crane/truck/trailers as applicable including manpower are to be arranged by vendor. These types of activity are treated as vendor's normal scope of work without any extra commercial implication on BHEL.

10.58 Sky Climber

Agency has to supply, erection, commissioning, maintenance, shifting, resifting of sky climbers as per site requirement. Taking statutory fitness certificates from Statutory Authorities/Third Party Inspectors as per requirement from time to time lies with boiler vendor. Contractor shall take back the sky climber after completion of works as per instruction of BHEL Engineer.

10.59 Agency has to supply Anchor Faster for various support works for permanent/temporary supports related to his scope of job.

10.60 All relevant provisions/responsibilities of contractors as mentioned in any of the chapter of this specification (same or different chapter) shall also be applicable, mutatis-mutandis, to any other chapter of this specification.

11.0 Following points may be noted with respected to the Welding schedule

Erection/Final Welding Schedule of subject Project shall be made available during Erection.

The scope of the work will comprise of but not limited to the following:

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

12.0 PREPARATION OF FOUNDATIONS AND GROUTING

12.1 Building foundations and other necessary civil works for supporting structures, equipments etc will be provided by BHEL / Customer. The checking of dimensional accuracy, axes, elevation, levels etc, with reference to bench marks of foundations and anchor bolt pits have to be checked and logged by the Contractor. The permanent benchmark / reference marks will have to be transferred to new locations with sufficient care to maintain the accuracy and protected / preserved with adequate care (to enable rechecking at later dates) as per BHEL instruction.

12.2 Minor adjustment of foundation level, dressing and chipping of foundation surfaces and blue-matching (wherever required) for of all equipments as per BHEL Engineers instructions, should be done by the Contractor as part of the work. Contractor/BHEL shall prepare protocols before taking over the foundations. All minor adjustments of foundation level, dressing and chipping of foundations up-to **+/- 50 mm**, enlarging the pockets in foundations, cleaning using compressed air, etc., for achieving proper levels & erection of equipment/ plants, will be within the scope of work/specification.

12.3 It shall be contractor's responsibility to check the various equipment foundations for their correctness with respect to level, orientation, dimensions etc., and ascertained dimensions shall be measured and submitted to BHEL for approval before erection.

12.4 Foundation pockets are to be cleaned thoroughly before placing the supports / columns / equipments. Verticality of foundation bolts to be checked along with correctness of the threads and freeness of the nut's movement. If required cleaning of the threads to be done with proper dies.

12.5 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 packer plates as per requirements provided BHEL Engineer allows it. When required by manufacturers, the embedded sub-sole plates shall be scraped and checked with Prussian blue to get the required contact with frames. The required packer plates shall be provided by BHEL free of cost. Certain packer plates and shims over and above the quantity received as a part of supplies from manufacturing units of BHEL will have to be cut out from steel plates / steel sheets at site to meet site requirement. Contractor shall cut

and prepare **packers and shims by gas cutting / chiseling / grinding and de-burr the same. However, machining of the packers wherever necessary, shall be arranged by contractor.**

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

12.7 All temporary foundations and anchor points required for installing erection Equipments and winches, foundations for pumps, tanks etc (until otherwise explicitly mentioned in the tender) are in the scope of Contractor. All building materials like cement, steel including re-enforcement bars, grits cements etc for such temporary foundations shall have to be arranged by the Contractor within the quoted rates. All such foundations shall be demolished and normal ground conditions restored after the usage by Contractor.

12.8 The surface of foundations shall be dressed to bring the surface of the foundations to the required level and smoothness prior to placement of equipments / equipments based on the foundations including shear lug provisions / openings.

12.9 Contractor shall carry out scrapping and blue matching of embedded plates/ packers of rotating equipments. Chipping and the levelling of concrete surfaces, fine dressing up to the extent required to obtain contact between packer and concrete, is also covered in the scope of this work. Scrapping, chipping and matching shall be done so as to achieve prescribed percentage of contact between the two surfaces.

12.10 Complete grouting of structures, equipments, including anchor/ foundation bolts, beneath base, base hollows etc, as may be applicable, is **INCLUDED** in the scope of Contractor. Arranging all labour, building materials including cement, ordinary portland as well as quick setting – free flow - non-shrink grout mix (e.g. conbextra GP-1/GP-2/GP-3), form work, shuttering, and any other requirements is in the Contractor's scope. Contractor shall obtain approval of BHEL for cement (Ordinary Portland as-well-as quick setting – free flow- non-shrink grout mix) prior to use. While grouting the contractor has to ensure that all the matching joints which are not to be grouted shall be kept free from the grouting mixture by applying tape or any other alternative method approved by Engineer. If required, decoupling of equipment's has to be done for conducting the verification. In case any disturbance is noticed the cause, if any, shall be removed and re-alignment done as part of work**.** Cleaning of foundation surfaces, pocket holes and anchor bolt pits and de-watering

and making them free of oil, grease, sand and other foreign materials by soda washing, water washing, compressed air and other approved methods are within the scope of this specification/ work.

12.11 After the grouting has finally set and cured, alignment of structure, equipment, alignment of shafts of rotating machines, the slopes of all bearing pedestals, centring of rotors with respect to their sealing bores, coupling etc involved shall be checked again to verify for any disturbance or any other reason. If required, de-coupling of equipments has to be done for conducting the verification. In case any disturbance is noticed the cause, if any, shall be removed and re-alignment done as part of work.

12.12 The concrete foundation, surfaces shall be properly prepared by chipping, as required to bring the top of such foundation to the required level to provide the necessary roughness for bondage and to ensure enough bearing strength. All laitance and surface film shall be removed and cleaned and the packers placed with suitable mortar prior to erection of the equipment. Packer plates should not only be blue matched with foundation but also inter-packer contact surfaces between the packers and foundation frame etc., shall also be blue matched by Prussian Blue match checks and required percentage contact shall be achieved by chipping and scrapping as per BHEL Engineer's instructions.

12.13 Total grouting of the columns / equipment including pocket grouting, grouting at the gap between foundation, base plates top surface of column / equipment, anchor/ foundation bolts, beneath base, base hollows, etc is in the scope of the contractor. All the grouting should be carried out by non-shrink cement like conbextra GP-1 / Conbextra GP-2 / GP-3 Shrinkkomp or its equivalent etc. This special non-shrink cement shall be arranged by the contractor at his cost. The quoted rate shall be inclusive of the same.

12.14 All equipment bases and structural steel bases and foundations pockets shall be grouted and finished as per these specifications after surface preparation unless otherwise recommended by the equipment manufacturers. The surface preparation includes soda washing of the foundations to remove oil, grease etc. to ensure proper grouting.

12.15 The certificates of the grout are to be submitted to BHEL. If necessary, test cubes are to be made and tested at site to ensure the quality of the grout as per relevant IS standards. In case grouting with Portland cement is approved, necessary cement, sand etc. to be arranged by the contractor including the fine aggregates.

12.16 All the materials required for grouting including special cements as approved by BHEL and other materials like Portland cement, sand chips, gravel etc., are to be arranged by the contractor at his cost. It shall be the responsibility of the contractor to obtain prior approval of BHEL, regarding suppliers, type of grouting cements before procurement of grouting cements.

12.17 **PROCEDURE FOR GROUTING:** Contractor has to carry out the grouting as per the work instructions for grouting available at site or the grouting is to be carried out as per the supplier's recommendation / IS standard. Copy of those recommendations is to be submitted to BHEL for records.

The scope of the work will comprise of but not limited to the following:

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

13.0 Material Handling, Transportation and Site Storage

13.1 Loading at BHEL / Customer stores and storage yard, transport to site, unloading at site / working area of equipment, placement on respective foundation / location, pre-assembly bay or at working area are in the scope of work. The scope includes taking materials / Equipments from customer stores / storage yard also. Contractors Quoted / Accepted rate shall be inclusive of the same. Required cranes, tractors, trailer or trucks/ slings/ tools and tackles / labour including operators, fuel, lubricants etc. for loading & unloading of materials will be in the scope of contractor.

13.2 The storage yard is located within the Main Plant Boundary.

13.3 Transportation of all items including ODC items from BHEL Store/Yard to Erection site shall be in the contractor's scope. However, in some cases, consignments including ODC may be unloaded near erection site as per space availability and site requirements.

13.4 Loading at storage yard and transporting to site, unloading at site / pre-assembly area or at working area, is in the scope of work. Required cranes for loading & unloading of materials, trailer shall be in the scope of contractor. The contractor shall provide any fixtures, concrete blocks & wooden sleepers, sandbags which are required for temporary supporting of the components at site.

13.5 The equipments / materials from the storage yard shall be moved in sequence to the actual site of erection / location at the appropriate time as per the direction of BHEL Engineer so as to avoid damage / loss of such equipment at site.

13.6 The contractor shall satisfy himself of the quality and quantity of the materials at the time of taking delivery from BHEL stores. No claims whatsoever will be entertained by BHEL because of quality or quantity after the materials are taken by the contractor from BHEL stores.

13.7 Sometimes it may become necessary for the contractor to handle certain unrequited components in order to take out the required materials. The contractor has to take this contingency also into account. No extra payment is payable for such contingencies.

13.8 Contractor shall plan and transport equipments, components from storage yard to erection site in such a manner and sequence that material accumulation at site does not lead to congestion at site of work. However, in specific cases "**as a special case to expedite the job**" the consignment received at BHEL stores can directly be diverted to the work site, as decided by BHEL, following issuance procedure of BHEL. Such direct issues shall be as per the Challan/dispatch document/LR received with the consignment. In such cases, contractor shall do unloading of materials from trucks/lorry/trailers at their own cost.

13.9 All materials issued by BHEL shall be stacked neatly, preserved, stored in the contractor's shed / work area above ground level by use of concrete or wooden sleepers. No materials shall remain on ground at any time. All concrete or wooden sleepers required for stacking the materials shall be arranged by contractor at his own cost within the quoted rates. In case it is necessary to shift and re-stack the materials kept at work area / site to enable other agencies to carry out their work, same shall be done by the contractor at no extra cost. Contractor shall maintain register/diary for location and quantity of materials transported from BHEL/Customer Store/Yard and unloaded at site/ pre-assembly area.

13.10 All pipe and tube ends shall be covered with plastic caps or will be closed with wooden plugs as the case may be.

13.11 The contractor shall take necessary measures to see that all the machined surfaces are preserved and covered. Contractor has to arrange required fire proof tarpaulins to protect the machined components / assembled parts drawn from BHEL store before and after erection as required at their cost.

13.12 The contractor shall take all such measures as may be reasonably necessary to ensure that its arrangements and those of its sub-contractors with respect to the transport of Goods, Materials and Labour to the site do not interfere with local traffic in the vicinity of the site and where such interference is unavoidable shall make such special arrangements as may be reasonably required to minimize the effect of such interference.

13.13 The contractor shall solely be responsible for the safety & security of material after it is handed over and issued to contractor by the BHEL. BHEL reserves the right to recover from the contractor any loss arising out of damage/ theft or any other causes or during verification/stacking or at any time under the custody of the contractor.

13.14 Open land for storage purposes shall be provided by BHEL on free of cost/as available basis for storage of materials issued to contractor (if required). Temporary barbed wire fencing (if required), of the open storage yard is to be done by the contractor and is included under the scope of his work. Contractor shall also remove grass, bushes, trees etc wherever required off the land provided to agency and shall make proper continuous up keeping of the open yard /land by removing grass, bushes trees etc and same is included under the scope of his work & No extra payment shall be made to the contractor in this regard. The bidder shall make complete arrangement of necessary security personnel to safeguard all such materials in his custody. The contractor shall take care of material issued by BHEL and shall protect the same from theft, damage and weathering. In case, loss of any materials for whatsoever reasons attributable to the contractor, then cost of such materials shall be recovered from the running bill payment with 5% overhead.

13.15 All surplus materials shall be returned to BHEL store. All wastage / scrap (including melting scrap, wastage, and unusable scrap) shall be returned to the stores on weighment basis in consultation with BHEL Engineer and a receipt obtained for material accounting purposes. Scrap materials shall be sorted section-wise and returned separately at a place directed by BHEL Engineer within the project area. Return of such materials will not be entitled for any handling and incidental charges.

13.16 All lifting tackles including wire ropes, slings, shackles etc. used by the contractor shall be got approved by BHEL Engineer at site before they are actually put on the work. It will be the responsibility of the contractor to ensure safe lifting of the equipment taking due precautions to avoid any accidents and damage to other equipment and personnel. All equipment/structure shall be adequately supported and protected to prevent damage during handling and erection. The history cards for major equipment to be maintained by the contractor.

The scope of the work will comprise of but not limited to the following:

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

14.0 Erection

14.1 Brief list of System / sub-system to be erected by the contractor & approximate weight of individual structure, equipment, PGMA's and number of welding joints mentioned in this Tender Specification are meant for giving general idea to the tenderer only about magnitude of the work involved. This is tentative and should not be taken for billing or any other claims. All weights for such purposes will have to be taken from design documents only (shipping list). This section also gives general idea about various components to be erected with expected accuracy level. However, the contractor shall get the correct details from the engineer to avoid mistakes and rework.

14.2 All normal erection and assembly techniques necessary for completion of works under this specification and magnitude have to be carried out. It is not possible to specifically list out of all of them. Absence of any specific reference will not absolve the contractor of his responsibility for the particular operation. These would include equipment for checking, cleaning, servicing and site fabrication. Following among others shall form part of contract in contractor's scope:

a) Scaffolding and rigging operations,

b) Machine/ flame/ electric cutting, grinding, welding, radiography and stress relieving & wrap inspection by Holiday detector.

c) Fitting, Fettling, Filing, Straightening, Chamfering, Chipping, Scrapping, Reaming, cleaning, checking, levelling, blue matching, aligning and assembly

d) Machining, Surface grinding, drilling, doweling, shaping

e) Temporary erections for alignment, dismantling of certain equipment for checking, cleaning, servicing and site fabrication

f) Insulation and painting

14.3 The contractor will have to follow the instructions provided in the technical manuals, drawings, and specifications provided by BHEL, to the contractor from time to time. In case of ambiguity or deviation the decision/clarification of BHEL engineer will have to be followed.

14.4 The contractor will be responsible for the safe custody and proper accounting of all materials in connection with the work. If the contractor has drawn materials in excess of design requirements, recoveries will be affected for such excess drawls at the rate prescribed by manufacturing units.

14.5 The temporary structures/ items welded to permanent members/pipes are to be cut and removed without any damage. Any damage so to permanent members/ pipes to be made good by the contractor at his cost.

14.6 Approach road in the vicinity of erection area are to be maintained by Contractor.

14.7 In the case of structural members / ducts in certain cases, the raw material will be supplied in random lengths and the contractor will have to make up the length / prepare the edges to suit the matching profiles, weld / bolt connects the joints at no extra cost.

14.8 All piping items including pipes, valves, flanges, fittings etc. shall be supplied as commercially available. Hence Fit-ups, edge preparation including welding of stubs, shall be included in the contractor's scope. No separate payment will be made for the edge preparation of pipes, Standard fittings such as bends, Tees etc

14.9 Pipes above 2" diameter have to be cleaned by means of wire brush as per the instruction of BHEL Engineer and subsequently flushed with air before lifting them into position. For pipes below 2" diameter, shall be sponge cleaned with air flushing. After cleaning is over, the end caps shall be put back in tube openings till such time they are welded to other tubes. Required compressors shall be arranged by the contractor at his cost.

14.10 Wherever elbows of 45 deg. or any other angle are required, the same shall be cut from 90 deg. elbow supplied and used as per BHEL engineer instruction. No extra cost shall be paid.

14.11 Welding of all thermo wells, draft, pressure and temperature instrumentation points and all other instrumentation points on piping and auxiliaries and welding of thermocouple pads for permanent system as well as for performance guarantee test is in the scope of work.

14.12 Plate / Pipe shoes for piping supports shall be fabricated at site by the contractor at no extra cost. Other supports namely Hangers, U-clamps etc., shall be supplied by BHEL duly bent and threaded. Assembly and necessary cutting work etc., shall be carried out at site by contractor within the quoted rate.

14.13 Wherever hanger and support materials are not received from manufacturing unit in time to suit the erection schedule, contractor shall erect the system on temporary supports to ensure the progress of work. The required structural steel materials will be issued on free of charges by

BHEL, either from scrap/spare materials. The same shall be removed and returned to BHEL store after erection of permanent supports.

14.14 Contractor has to carryout fabrication works such as welding of stubs / nipples, attachments etc., preparation of surface for rust preventive coating and application of rust preventive is within the quoted / accepted rate.

14.15 All the equipments /material to be taken inside the plant building shall be cleaned thoroughly before taking them inside. The contractor shall clean, wherever necessary and paint inside surfaces of the equipments like coolers, oil tanks, Rubber expansion joints and other components as per instruction of BHEL Engineer during erection within the quoted rate.

14.16 The contractor shall take all reasonable care to protect the materials and equipment during erection. Touch up painting required to be done on any equipment or part during the course of erection will have to be done by the contractor.

14.17 Any fixtures, scaffolding materials, approach ladders, concrete block supports, steel structures required for temporary supporting, pre-assembly, checking, welding, lifting & handling during pre-assembly and erection and during application of insulations shall be arranged by the contractor at his cost.

14.18 **Field Quality Assurance Formats: -** It is the responsibility of the contractor to collect and fill up the relevant FQA log sheets of BHEL and present the same to BHEL after carrying out the necessary checks as per the log sheets and obtaining the signature of BHEL and customer as token of their acceptance. Payment to the contractor will be linked with the submission of these FQA log sheets.

14.19 BRIEF FEATURE OF FLUE GAS DE-SULFURIZATION & AUXILIARIES

14.19.1 Erection, alignment, welding, bolting, grouting and painting as applicable for the BHEL Supplied materials of Absorber, Gypsum Dewatering System, CS and rubber lining piping, Lime Dosing System and another associated auxiliary as per BOQ/PGMA item list.

14.19.2 In case of any class of work for which there is no such specifications as laid down in the contract such as blue matching, welding of stainless-steel parts etc., the work shall be carried out in accordance with instructions and requirements of the BHEL engineer at the quoted rates only.

14.19.3 Brief list of System / sub-system to be erected by the contractor & approximate weight of individual PGMA's & items are given in this tender elsewhere and are meant for giving general idea to the tender only about magnitude of the work involved. This should not be taken for

billing or any other claims. All weights for such purposes will have to be taken from design documents only (shipping list). This section also gives general idea about various components to be erected with expected accuracy level. However, the contractor is requested to get the correct details from the engineer to avoid mistakes and rework.

14.19.4 All the works such as cleaning, checking, levelling, blue matching, aligning, assembling, temporary erection for alignment, opening, dismantling of certain equipment's for checking and cleaning, surface preparation, edge preparation, fabrication of tubes and pipes as per general engineering practices at site, cutting, grinding, straightening, chamfering, filing, chipping, and rectification of foundation up to 30 mm, drilling, reaming, scrapping, shaping, fitting up etc. as may be applicable in such erection works are to be treated as incidental to erection and necessary to complete the work satisfactorily shall be carried out by the contractor as part of the work and at his quoted rates.

14.19.5 ABSORBER SYSTEM

I. Each unit shall be provided with an independent absorber with Supporting Structure. Absorber system complete with internals Spray Pipes, Spray Nozzles, Jet Air Sparger (JAS), Agitator and Mist eliminator.

II. Complete Ducting System from ID fans to absorber tower, from absorber tower to Chimney

III. Bypass duct and connecting duct to chimney.

IV. Absorber Slurry Recirculation System including the Slurry recirculation pumps, suction & discharge valves, agitators and related piping.

V. Gates-Motorized isolation gates at Absorber gas inlet, Absorber gas outlet and FGD bypass in the main duct to Chimney along with 2x100 seal air fans for each gate and 2x100 heaters for absorber outlet gate & bypass gate. A bi-plane bypass damper along with 2x100 seal air & 2x100 heaters shall also be provided in the bypass duct (actual shall be as per drawings released by BHEL after finalization of design and engineering)

VI. Compressed Oxidation Air System- 2X100% Oxidation Blowers.

VII. Mist Eliminator- Clean gas from the absorber shall be taken to the Chimney through three stage mist eliminators. Treated flue gas from the absorber shall be discharged through a stack.

VIII. One number of Passengers cum Goods Elevator of adequate capacity shall be provided with adequate landings for absorber. The erection and commissioning of the Elevator is in Elevator Vendor Scope. Lift Structure, sheeting and other supporting structure is included in the scope of this contract.

IX. Fabricated Emergency cooling tank.

X. Gypsum bleed pumps, Emergency transfer pump

XI. Duct/piping system complete with supports, structures, trestles, absorber platforms.

XII. Piping from gypsum bleed pumps to gypsum dewatering system, along with recirculation lines (if required) necessary isolation and control valves.

XIII. Erection of monorail beams as per drawing.

XIV. Installation, erection and commissioning of Electric Hoist including receipt at site, installation of Supporting and Main Structure of the Hoist, Erection and Commissioning of the Hoists at the locations identified in the drawing.

XV. Erection of Agitators.

XVI. Fabrication and Erection of Tanks is included from the scope however, piping and other interconnection between the tanks and related auxiliaries etc from the outlet flanges of the tanks is included in the scope of vendor.

XVII. Absorber is supplied in C276-line panels which are required for welded for erection. Surface preparation of these weld joints is in the scope of contractor before application of lining over it by another agency.

14.19.6 GYPSUM DEWATERING SYSTEM:

The gypsum dewatering system is common for the two units in Stage-II & three units in Stage-I. Only Work of gypsum dewatering system in Stage-II is balance. The common dewatering system shall receive the gypsum slurry from each absorber through slurry feed pipes and shall comprise of two sets of dewatering equipment**.**

I. Each set (suitable for handling /dewatering of both units) of dewatering equipment (01working set + 01 standby set) shall comprise of the following items as a minimum requirement:

i. One set of primary hydro-cyclones

ii. One set of vacuum belt filter

iii. One set of vacuum receiver

iv. One set of vacuum pump

v. One set of secondary hydro-cyclones

vi. Complete piping and valves for the system along with wash water line.

II. Common Filtrate Water Tank.

III. 2X100% Filtrate Water Pumps.

IV. Vacuum Belt Filters complete with Accessories including discharge chute, Drivers (VFD and LCP) and driving motors (IE3) with inverter panel, cloth spray nozzles, rubber belt etc

V. Vent fan including enclosure and its arrangement and Vacuum receivers with anchor bolts, nuts and washer etc.

VI. Belt Filter Washing Tank and Belt Filter Washing Pumps.

VII. All interconnecting piping (slurry, air and water pipes) which includes the requisite pipe support materials, fittings, gasket, flange materials, bolting along with valves for the entire Gypsum Dewatering System and the expansion Joints at the suction and discharge of each pump.

VIII. Neutralizing Tank.

IX. Erection of Agitators.

X. Erection of the Elevator Structure of Gypsum Dewatering Building and FGD Control Room.

14.19.7 PROCESS WATER & COOLING WATER STORAGE & PUMPING SYSTEM

I. 2 nos of Booster Water Pumps along with all necessary piping, valves, control & instrumentation to feed the tank

II. 2x100% Process Water Pumps for each unit connected to each of the Process water Storage tanks (total 4 nos. of pumps for 2x800 MW) along with all necessary piping, valves, control & instrumentation.

III. 2x100% Mist Eliminator Wash Water Pump for each unit connected to each of the Process water Storage tanks (total 4 nos. of pumps for 2x800 MW) along with all necessary piping, valves, control & instrumentation.

IV. Any other pump or storage system not specified but required to meet the system requirement.

V. Interconnection between the tanks and piping from tanks to the area as provided in the drawing.

VI. All drains & overflow lines from the tanks shall be terminated to the nearest trench/drain.

14.19.8 The **Lime dosing system** is common for the two units in Stage-II & three units in Stage-I and shall be erected by contractor.

14.19.9 **Wet Ball Milling System** is common for the two units in Stage-II & three units in Stage-I. Only work of wet ball mill in Stage-II is balance.

14.19.10 GALVANISED STEEL PIPING

a) Galvanized pipe shall be joined by screwing in to socket and screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before joining. The exposed threaded portion on either side of the socket joint shall be applied with Zinc Silicate Paste or as specified in relevant procedures/documents. All these consumables are in the scope of contractor and shall carry out within the quoted rate.

b) GI pipe with flanged joints shall have screwed flanges. Flanged joints face shall be painted with red lead and bolting up evenly on all sides with compressed asbestos gaskets in between two flanges.

c) Teflon tapes shall be used to seal out screwed joints and shall be applied to the male threads only. Threaded parts shall be wiped clean of oil or grease with appropriate solvent if necessary and allowing proper time for drying before applying the sealant. Pipe ends shall be attached by screwing the pipe through the flange and pipe and flange shall be refaced accurately.

d) Required threading should be done by the contractor at site as specified in the drawing. The pipes shall be cut only by Hacksaw / Machining.

e) Required Teflon tapes are to be arranged by the contractor within the quoted rate.

f) ALL THE SCREWED JOINTS ARE TO BE SEAL WELDED IF REQUIRED BY CUSTOMER, SUITABLE ELECTRODES FOR FULL SEAL WELDING ARE TO BE ARRANGED BY THE CONTRACTOR AT HIS COST.

14.19.11 Preparation of preassembly bed is arranged wherever required for preassembly of FGD components on consolidated ground. The preassembled component should be supported to avoid sagging. No separate payment will be made.

14.19.12 Ducts / expansion pieces are dispatched to site in loose walls / plates and these are to be assembled at site before erection. (Walls with stiffeners in welded condition will be provided).

14.19.13 All the dampers, valves, lifting equipments, power cylinders, etc., shall be serviced and lubricated to the satisfaction of BHEL engineer before erecting the same and also during pre-commissioning. The bearings of dampers shall be properly cleaned, serviced and lubricated before commissioning at no extra cost. Even after commissioning the equipments, if there are problems in the operation they have to be attended by the contractor during the tenure of the contract. (for the limited nos. (2-3) of incidents on same equipment/defect and reasons not attributable to the Vendor after commissioning and operation of the equipments/ system).

14.19.14 In case of any class of work for which there is no such specifications as laid down in the contract such us blue matching, welding of stainless-steel parts etc., the work shall be carried out in accordance with instructions and requirements of the BHEL engineer at the quoted rates only.

14.19.15 Spring suspensions / constant load hangers have to be preassembled and adjusted for the required loading and erected as per instructions, of BHEL Engineer. Any adjustments, removal of temporary arrestors / lockers, etc., have to be carried out as and when required at no extra cost to BHEL Contractors has to adjust the cold and hot values of CLH/VLH as per the drawings and document in cold condition as well as in unit operation condition observing all necessary safety measures/ safety permit/ etc.

14.19.16 The contractor shall carry out necessary preservative painting, periodic application of preservations on Rotating parts and other equipments during erection / after erection until completion of work. Necessary preservatives / paints, other consumables are to be arranged by the contractor at his cost

14.19.17 Contractor shall provide necessary crew with all items like wire brushes, paint brushes, emery paper, cotton waste, scaffolding materials etc., at his cost.

14.19.18 All hangers, supports and anchors (including concreting or welding) shall be installed as per drawing to obtain a reliable and complete pipe installation as per instructions of BHEL Engineer. Normally supports are issued in running meters. Any additional supports as called for by BHEL Engineer shall be fabricated by the contractor. Payment/ payment terms of such work shall be done as per **Rate schedule identifier – 1.1a or 1.1b of Section-I of BOQ** depending upon the provision of scope of structural steel supply. (Any machining or threading is involved will only be done by BHEL).

14.19.19 Fabricated pipes are sent in standard length and will be cut to suit the site conditions and the layouts. Tubes or pipes wherever deemed to be convenient will be sent in running lengths with sufficient bends. Bends up to NB 65 mm will have to be fabricated at site adopting specified heat treatment procedures, wherever required at no extra cost.

14.19.20 In the case of structural members / ducts in certain cases, the raw material will be supplied in random lengths and the contractor will have to make up the length / prepare the edges to suit the matching profiles, weld / bolt, connect the joints at no extra cost. Normally, the machine profile will be cut out for the structural members but the contractor will have to carry out suitable alteration / adjustments at site, without any extra payment in case it becomes necessary.

14.19.21 Erection & welding of necessary instrumentation tapping points, thermocouple pads, root valves, condensing vessels, flow nozzles and control valves etc., both for regular measurements and performance testing to be provided are covered with in scope of this tender, will also be the responsibility of the contractor and the same will be done as per the instructions of BHEL Engineer. The erection and welding of all above items will be contractor's responsibility even if, (a) Product group under which these items are released are not covered in the scope of this tender, (b) Items are supplied by an agency other than BHEL if they are integral to the scope envisaged under this package. Payment will be regulated as per the settled terms and conditions.

14.19.22 The contractor shall fabricate piping, install lube oil systems and carry out the acid cleaning of fabricated piping. The contractor shall also service the lube oil system, carry out the pressure test of oil coolers. etc.

14.19.23 All the tubes and pipes shall be cleaned and blown with compressed air and shown to the Engineer before lifting. Bigger size pipes should be cleaned with flexible wire brush, wherever

necessary. After cleaning is over, the end caps shall be put back in tube openings till such time they are welded to other tubes. Required compressors shall be arranged by the contractor at his cost.

14.19.24 It is the responsibility of the contractor to do the alignment, checking, etc., if necessary, repeatedly to satisfy BHEL Engineer / customer Engineers with all the necessary tools and tackles manpower, etc., without any extra cost. The alignment will be complete only when jointly certified so, by the BHEL Engineer & customer. Also, the contractor should ensure that the alignment is not disturbed afterwards.

14.19.25 Fine fittings, trim piping, oil system and other small-bore piping have to be routed according to site conditions and hence shall be done only in position. Necessary sketch for routing these lines should be got approved from BHEL by the contractor. There is a possibility of slight change in routing the above pipelines when after completion, to suit the site conditions. The contractor should absorb this cost in his quoted rate.

14.19.26 Additional platforms for approaching different equipments as per the site requirement, which may not be indicated in drawings, shall be fabricated, assembled and erected by contractor. However, the contractor shall be paid for this work on accepted tonnage rate for erection of structure. Works of major nature not covered under this clause. Payment/ payment terms of such work shall be done as per **Rate schedule identifier – 1.1a or 1.1b of Section-I of BOQ** depending upon the provision of scope of structural steel supply.

14.19.27 Work such as minor rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin, etc. are covered in the scope of work.

14.19.28 Certain extra lengths of various tubes/pipes and fabricated ducts are provided as erection allowance and the same have to be cut/adjusted to suit the site conditions and layouts or certain small lengths may have to be added for adjustments to suit the site conditions. For any mismatch while matching the joints in tubes, the cutting, adjusting, re-welding, addition spool pieces should be done by the contractor to match site conditions without any extra payment.

14.19.29 Assistance for “calibrating / testing the power cylinders / valves, gauges, instruments, etc. and setting of actuators” shall be provided by contractor within the quoted rates.

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

14.19.31 The HT Electric motor bearings shall be blue matched at site and checked for bearing clearance. Scrapping of bearing housing, if required to any extent shall be carried out by the contractor. No extra claim for blue matching of any two surfaces will be entertained. The HT Electric motors will also be checked for air gap and adjustment of stator / rotor to magnetic centre shall be carried out as part of erection.

14.19.32 The contractor shall fabricate piping, install lube oil systems and carry out the acid cleaning of fabricated piping. The contractor shall also service the lube oil system, carry out the hydraulic test of oil coolers. etc., if applicable

14.19.33 The contractor shall take all reasonable care to protect the materials and equipment during erection. Touch up painting required to be done on any equipment or part during the course of erection will have to be done by the contractor.

14.19.34 Contractor shall engage separate gangs throughout the contract period, exclusively for proper housekeeping of the site. The contractor has to make necessary arrangements for collection and for bringing down the scrap from, all locations and taking them away from the erection areas to various locations as indicated by BHEL Engineer. The house keeping must be a routine and continuous activity. If the contractor does not do this job satisfactorily, BHEL will arrange for the same at the cost of the contractor. Periodical payments to the contractor for the work done will be considered only if the housekeeping is certified as satisfactory by the customer.

14.20 ERECTION OF LP PIPING AND FIRE PROTECTION PIPING

14.20.1 The scope includes LP Piping, IA/SA Piping and Fire Detection and Protection piping system of respective units and common systems.

14.20.2 Handling at site stores / storage yard, transporting to site, inspection, fabrication, pre-assembly, erection, alignment, welding, NDT, fixing of hangers & supports, assistance during chemical cleaning / pickling, oil flushing, water flushing, hydro testing & steam blowing, surface finish, supply & application of primer & finish paints including labelling & flow direction on the piping over insulation & hangers and supports, pre-commissioning, commissioning, Completion of facilities & handing over to customer of LP piping, IA/SA Piping and Equipment, Fire Detection & Protection System piping and its associated items / systems, hangers & supports, valves and miscellaneous equipment and structures.

14.20.3 All above piping erection has to be done with associated surface finishing, supply, and application of primer, wrapping coating, finish/anti-corrosive/steam wash paints, etc. as applicable as per paining schedule.

14.20.4 Brief list of system / sub system, approximate weight of pipes and accessories to be erected by the contractor mentioned in the Bill of Quantity of this tender specification are meant for giving general idea only about magnitude of the work involved. The piping components are sent in parts for convenient transportation / layout requirements. They are to be cleaned, pre-assembled/fabricated in stage by stage, welded, erected and aligned as per the drawing dimensions / tolerance and instructions of BHEL Engineers.

14.20.5 All the works such as cleaning, levelling, aligning, trial assembly, dismantling of certain components for checking and cleaning, surface preparation, fabrication of sheets, tubes and pipes as per general engineering practice and as per BHEL Engineer's instructions at site, cutting, weld depositing, grinding straightening chamfering, filing, chipping, drilling, reaming, scrapping, lapping, fitting-up, inspection, edge preparation if required, etc., as may be applicable in such erection works and are necessary to complete the work satisfactorily, shall be carried out by the contractor as part of the work within the quoted rate. Major machining work, which is only to be carried out in workshops, will be arranged by BHEL.

14.20.6 Erection of all items comprising piping systems such as valves, filters / strainers, expansion bellows, flow elements, hangers and supports, tanks, pumps, associated skids are also a part of the scope. Pipes/ Structural steels are to be supplied in commercial length only with plain end. Necessary welding for pipes and fittings as well as threading for small bore pipe shall be done by vendor at site. Hence Erection activities like cutting/ threading/welding etc. of conduit/pipe/ISMC/ISA shall be carried out at site as per requirement.

14.20.7 Erection of all the systems supplied by BHEL MUs and BOIs Supplied under this package, including auxiliaries covered in this contract, is to be erected by the contractor as per the accepted tonnage rate.

14.20.8 All operating/ Approach Platforms, cross over, canopies, ladders etc. along with their supporting structures, for the equipment/valves/filters etc shall be erected by the contractor as per instructions of BHEL. Contractor will have to install them to suit to site requirements. Payment/ payment terms of such work shall be done as per **Rate schedule identifier – 1.1a or 1.1b of Section-I of BOQ** depending upon the provision of scope of structural steel supply.

14.20.9 The pipe supports for fire protection system piping shall be provided by BHEL at site and shall be paid as per accepted tonnage rates.

14.20.10 If the provision of creep measurement is envisaged in the drawings, stubs erection and welding as per drawing shall be done by the contractor within the quoted rate.

14.20.11 The work on piping system will include Wrapping & Coating, laying, edge preparation, fixing and welding of the elbows / fittings / valves etc., welded on the lines, NDE, fixing and adjustment of supports / hangers / shock absorbers and carrying out all other activities / works to complete the erection and also carrying out all pre-commissioning / commissioning operations mentioned in the specification as per BHEL Engineer's instructions and/or as per approved drawings / documents.

14.20.12 Contractor shall arrange the necessary clearance from any other statutory authorities as required for installation of the plant and equipment and render all assistance, service required in this regard. Inspection fee, if any will be paid by BHEL.

14.20.13 Obtaining statutory approvals from Electrical Inspector or any other Governing Agencies shall be in Vendor scope. Documentation required like Layouts, Schemes shall be furnished by BHEL.

14.20.14 The contractor shall arrange necessary statutory inspections and obtain certificate for installation work at their cost. Any Expenditure related to documentation shall be borne by the contractor. Contractor shall pay all fees relates to TAC/Electrical inspectorate or any other Governing Agency approval. However, BHEL shall reimburse all statutory govt legal fees on production of receipts (FEES FOR VISITS, INSPECTION FEES, REGISTRATION FEES and any other statutory fees).

14.20.15 Any modification work required by inspector shall be attended by the contractor. Modifications which had raised due to execution deficiencies are at the cost of contractor. Whereas modifications which are due design change shall be treated as extra work.

14.20.16 Fittings like bends, tees, elbow / bends, reducers, flanges etc., will be supplied as loose items. Fittings shall be supplied with standard dimensions. Edge preparation, matching inner diameter of pipes for welding as per the drawing dimensions shall be part of erection works. No separate payment will be made for the correction of pipes, edge preparation of standard fittings such as bends, Tees etc.,

14.20.17 Normally weld neck valves will have prepared edges for welding. It may be occasionally necessary to prepare new edges or recondition the edges by grinding or chamfering to match the corresponding tubes and pipes. All fittings like tees, weld neck flanges, reducers, elbows, flanges, inserts etc., shall be suitably edge prepared and matched with pipes for welding. No extra cost shall be paid for this.

14.20.18 During connection & floating of any decks, etc., before and after pipe connections, adding tentative loads, readjusting of spring to the required level is covered in this scope of work.

14.20.19 Carrying out erection of piping as per the specification between equipment constituting terminal points, whether the terminal equipment fall within the scope of work / specification, contractor shall carry out the terminal joints at either end. Also, where the piping connection to the terminal points involve flanged joints, matching of flanges, fixing gaskets, bolting and tightening as per BHEL Engineers instructions is in the scope of work. Piping connected to equipment, matching of flanges for achieving the parallelism and alignment at the equipment end by suitably resorting to heat correction or other method as instructed by BHEL Engineer, is in the scope of contractor with in the quoted rate.

14.20.20 Contractor has to carryout fabrication works such as welding of stubs / nipples, attachments etc., preparation of surface for rust preventive coating and application of rust preventive within the quoted / accepted rate.

14.20.21 Attachment, welding of necessary instrumentation tapping points, thermocouple pads, root valves, condensing vessels, flow nozzles and control valves etc., shall be the responsibility of the contractor and the same shall be done as per the instructions of BHEL Engineer. The erection and welding of all above items will be contractor's responsibility even if the items are supplied by an agency other than BHEL if they are integral to the scope envisaged under this package.

14.20.22 All the valves will have to be checked, cleaned, lapped or overhauled in full or in parts before erection, after chemical cleaning and during commissioning. The contractor, at his own cost, shall arrange experienced technicians for the above work, including required consumables.

14.20.23 Contractor shall study the layout of LP Piping, IA/SA Piping and FDPS Hydrant & Spray piping, and other site routed piping well before the start of work. Final routing shall be decided after approval from Site. Erection Engineer for site routed pipe in such a way that it does not foul with other equipment and piping etc.

14.20.24 For Thermo-Well welding with Carbon steel / alloy steel welding applicable combination electrodes shall be arranged by the contractor within the quoted rate.

14.20.25 Immediately after erecting electrically operated valves, Valve Tag Nos shall be painted or stickering shall be done for ease of identification.

14.20.26 The Portable Fire Extinguisher System includes the positioning of the Fire Extinguishers in the designated places as per the discretion of BHEL and customer. There may be a possibility that the vendor has to relocate the Extinguishers based on revision of drawings or at customers will (if any). No Extra payment will be made for relocation of the cylinders.

14.20.27 All the valve packing has to be lubricated as per BHEL Engineer instruction till handing over. Necessary gland packing will be supplied by BHEL.

14.20.28 All the lifting equipments, actuators / power cylinders, valves / dampers, etc., shall be serviced and lubricated to the satisfaction of BHEL engineer before erecting the same and also during pre-commissioning. The required cleaning, servicing and lubrication of bearings to be carried out before commissioning at no extra cost.

14.20.29 All the tubes and pipes shall be cleaned and blown with compressed air and shown to the Engineer before lifting. Pipes above 2" diameter have to be cleaned by means of wire brush as per the instruction of BHEL Engineer and subsequently flushed with air before lifting them into position. Pipes below 2" diameter, shall be sponge cleaned with air flushing. After cleaning is over, the end caps shall be put back in tube openings till such time they are welded to other tubes. Required compressors shall be arranged by the contractor at his cost.

14.20.30 All the equipments / material to be taken inside the plant building shall be cleaned thoroughly before taking them inside and erect. The contractor shall clean, wherever necessary and paint inside surfaces of the equipments like coolers, oil tanks, Rubber expansion joints assembly and other components as per instruction of BHEL Engineer during erection at the quoted rate. The necessary compressor for air cleaning is to be arranged by contractor at his cost.

14.20.31 Fine fittings and other small-bore piping have to be routed according to site conditions and hence shall be done only in position as per the site requirement. Necessary sketch for routing these lines should be got approved from BHEL by the contractor. In case any minor modifications are required in these pipelines after completion to meet the system requirements, the same shall be carried out by the contractor within the quoted rate. The contractor should absorb this cost in his quoted rate.

14.20.32 Work such as minor rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin, etc. are covered in the scope of work.

14.20.33 Assistance for calibrating / testing the power cylinders/ actuators / valves, etc. and setting to actuators shall be provided by contractor within the quoted rates.

14.20.34 Before erecting the valves and other mountings, check for the tag for correct rating with valve schedule. Ensure correct flow direction. Ensure easy accessibility for operation and maintenance of valves.

14.20.35 All the drain lines should have sufficient slope towards drain. Slope of 1:500 shall be maintained towards drain point unless otherwise specified. Expansion loops shall be provided in all the vents and drains than carries steam and water having temperature above 50 Deg Cel. as per the drawings.

14.20.36 Wherever pipes / bends / equipments are supplied in pre-fabricated / assembled packages, there may be necessity to make minor changes, including strengthening by additional welds. This shall be treated as part of the contractor's scope. Complete fabrication is included in the scope of the contractor for the raw material supplied.

14.20.37 All the oil & gas piping flanges, wherever provided are to be blue matched using surface plates for at least 80% contact area to attain leak proof of joints.

14.20.38 Wherever drawings indicate site routing and site fabrication, such pipes (in general equal to and less than 2" Dia) will be issued in running meters as straight length. These are to be cut to required length at site to suit layout as given in the erection drawing and edge prepared as per the standards / drawings and as per the instruction of BHEL Engineer. In some cases, attachments like lugs, stoppers, cleats etc., will be supplied as loose items and to be cut and welded to the pipes at site as per erection drawing necessary drilling of holes on main pipe for welding stubs shall also be done at site by the contractor. The contractor shall weld the joints of site routing piping as per site requirement.

14.20.39 Certain extra lengths of portions / parts of various site fabricated components / parts / bellows / piping etc. are provided as erection allowance and they shall have to be cut to suit site conditions and layout. Certain small length of portions / components / bellows / piping casing etc., may have to be added to suit conditions and layouts. Preparing edges afresh and adopting specified heat treatment procedure as applicable, are in the scope of work. No extra payment will be admitted for such works.

14.20.40 Some extra lengths in various fabricated pipes given as erection allowance shall have to be cut and edges prepared to suit the site conditions at no extra cost. The contractor shall carry out the edge preparation of weld joints at site in accordance with the details acceptable to BHEL Engineer. Wherever possible machining or automatic flame cutting should be done. Gas cutting will be allowed only wherever edge preparation otherwise is impractical. All slag / burrs shall be removed from the edge and all the hand cuts shall be ground smooth to the satisfaction of engineer. Prepared edges to be preserved / applied with weldable primer.

14.20.41 Minor adjustment like removal of ovalities in pipes and opening or closing of the fabricated bends by process of heat correction or any other method approved by BHEL Engineer to suit

the layout, with specified heat treatment procedure shall be carried out by the contractor within the quoted rate.

14.20.42 For pipes nominal bore size 2" and below routing shall not be shown in piping layouts or in isometrics and the same to be routed/ connected as shown in schematics. For the above sizes if the routing is shown in layouts it is only for guidance and the same shall be routed and supported as per site requirement / convenience as per site engineer's advice.

14.20.43 For piping of nominal bore size 2" and below, valves, flanges, fittings etc. shall be supplied as commercially available. Hence fit-ups, edge preparation including welding of stubs, shall be included in the contractor's scope.

14.20.44 Contractor should fabricate bends of </=2' diameter size at site from running meters of piping for the above and cut, edge prepare and lay the piping as per BHEL Engineer's instruction.

14.20.45 Contractor shall use only bolted clamps for achieving alignment of piping. Wherever "L" shaped stoppers and wedges are to be used for aligning piping and equipment, the same shall be subject to the approval of BHEL Engineer. Contractor shall remove the bridge, stopper etc., by grinding / gouging and not by hammering. Any burrs left on the equipment / piping, after welding, shall be ground off or any scar or cavity made good by welding and grinding. NDT tests shall be carried out if necessary to detect surface and sub-surface cracks in these ground areas.

14.20.46 Flame cutting of piping and other equipment shall be strictly done as per BHEL Engineer's Instructions and in his presence only.

14.20.47 All the weld joints on equipment and piping shall be ground or filed after completion of welding and before radiography as per instructions of BHEL Engineer so as to achieve smooth surface to avoid of ripples, undulations etc.,

14.20.48 Wherever elbows of 45 deg or any other angle are required, the same shall be cut from 90 deg. elbow supplied and used as per the instructions of BHEL engineer. No extra cost shall be paid.

14.20.49 Flow nozzles, orifice, spray nozzles etc., shall be mounted / erected after chemical cleaning / flushing / or steam blowing at site.

14.20.50 Erection of Flow nozzles, flow orifices, flow switches, filters, flow meters, flow indicators, other metering elements, spray nozzles, steam traps, flow orifices, flow indicators, control valves, aux. control valves, filters, suction strainers, NRVs, etc. forming part of the system (under this scope of work) irrespective of the suppliers is also to be carried out by the agency without any

extra cost after chemical and / or steam blowing / oil flushing at site. This will include collecting from BHEL/ Customers Store, transport to site, suitably cutting the erection piping, cleaning, erection, welding, radiography, NDE and stress relieving and commissioning.

14.20.51 Certain instruments like pressure switches, gauges, air sets, regulators, filters, junction boxes, power cylinders, dial gauges, thermometers, flow meters, valve actuators, flow indicators etc., are received in assembled conditions as integral part of equipments. Contractor shall dismount such instruments and re-erect whenever required prior to commissioning. Sometime this may have to be handed over to store or instrumentation contractor.

14.20.52 Fixing of stubs, root valves & welding of thermowells shall be within the scope of contractor.

14.20.53 Contractor shall also weld small length of piping with root valve to the pressure, flow and level tapping points on piping or flow nozzles / orifices / metering elements fixed on piping as per the instructions of BHEL Engineer.

14.20.54 Welding of all thermowells, draft, pressure and temperature instrumentation points and all other instrumentation points on piping and auxiliaries and welding of thermocouple pads for permanent system as well as for performance guarantee test is in the scope of work.

14.20.55 It shall be the responsibility of the contractor to provide ladders on column for initial works till such time stairways are completed. For this the ladder should not be welded on the column and should be prefabricated clamping type ladders. No temporary welding on any structural member is permitted except under special circumstances with the approval of BHEL.

14.20.56 All piping items including pipes, valves, flanges, fittings etc. shall be supplied as commercially available. Hence Fit-ups, edge preparation including welding of stubs, shall be included in the contractor's scope.

14.20.57 Before lifting the heavy components, soft materials like gunny bags to be used while lashing the rope to avoid dents, rubbing marks etc.

14.20.58 The contractor shall also weld all thermowells, small length of pipes to all pressure, flow and level tapping points, isolating valves and root valves on all equipment under scope of erection of this contract. All embedded temperature measuring elements provided in the bearings will have to be terminated at the junction box by the contractor. Thermowells tapping point connections incorporated shall be plugged during the pressure testing and steam blow out of piping systems. Upon completion of blow out operation all thermowells and flow elements with branch pipes be installed and welded.

14.20.59 The hangers and supports for pipelines and pressure parts may be supplied in dismantled / knocked down condition. It is the responsibility of the contractor to assemble them as per approved drawings and install them in position as per site engineer instructions.

14.20.60 For hangers and supports the instruction given in the drawings and documents must be followed for handling, erection and setting of cold / hot values and locking etc.

14.20.61 Where the flange comes welded to the equipment, erection of counter flange, Hydrotesting and Normalisation of the line is under the scope of this contract. Where both the flange and counter flange come as loose items and need to be welded, the entire welding of flange and counter flange, Hydrotesting and Normalisation of the line are under the scope of this contract.

14.20.62 Wherever hangers and support materials of piping are not received from manufacturing unit in time to suit the erection schedule, contractor shall erect the piping system on temporary supports to ensure the progress of work within quoted rate. The required structural steel materials will be issued on free of charges by BHEL, either from scrap / spare materials. The same shall be removed and returned to BHEL store after erection of permanent supports.

14.20.63 Plate / Pipe shoes for piping supports shall be fabricated at site by the contractor at no extra cost. Other supports namely Hangers, U-clamps etc., shall be supplied by BHEL duly bent and threaded. Assembly and necessary cutting work etc. shall be carried out at site by contractor within the quoted rate.

14.20.64 Contractor has to fabricate and erect temporary spool pieces wherever required due to non-receipt of valves in time and after receipt of valves the spool pieces are to be replaced with regular valves at free of cost. For spool pieces materials will be supplied free of cost by BHEL.

14.20.65 Welding, non-destructive testing and heat-treatment as prescribed in BHEL Welding / Heat treatment manual is to be carried out by the contractor. The contractor shall conduct non-destructive tests like radiography, ultrasonic test for weld defects etc., ultrasonic test for finding thickness, dye penetrant tests, magnetic particle test etc. on weld joints, castings, valve bodies and other equipment etc. as per BHEL Engineer's instructions within the quoted rates.

14.20.66 Cutting and removal of dummies for all the shop welded stubs (irrespective of the equipment supplier for the above) for all the terminal points and preparation of edge where the piping is to be terminated is also in the scope of the contractor without any extra payment.

14.20.67 The contractor shall fabricate piping, install lube oil systems, if any and carry out the acid cleaning of fabricated piping. The contractor shall also service the lube oil system, carry out the hydraulic test of oil coolers. etc.,

14.20.68 For skid mounted equipment, the checking and re-alignment required at site is in the scope of work.

14.20.69 HSFG Bolts are to be tightened by turn of nut method / Torque Wrench, as per the instruction of BHEL Engineer. The bolted joints shall be jointly checked by BHEL/Customer and contractors' personnel for the required tightness and retightened wherever necessary. The tightened bolts shall be identified by color paints. Facility for random checking with calibrated Torque Wrench shall also be provided by contractor.

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

14.20.71 All the bearings, gearboxes etc., of the equipment / actuators and electrical motors to be erected are provided with protective greases only. Contractor shall arrange as and when required by the engineer for cleaning the bearing / gear boxes etc., with kerosene or some other agent if necessary by dismantling some of the parts of the equipment during erection and shall arrange for re-greasing / lubricating them with recommended lubricants and assembling back. Lubricants will however be supplied by BHEL at free of cost.

14.20.72 All motors / pumps shall be stripped opened, thoroughly serviced with proper care and re-assembled properly before erection by the contractor. During servicing, pre-commissioning & commissioning, if any deficiency is observed the same should be taken up with BHEL Engineer at site and rectified at site without any delay.

14.20.73 The actuators / motors of valves may be supplied in loose parts, contractor shall have to match / assemble and align at site as per instructions of BHEL Engineer including placement on foundation.

14.20.74 Pipelines shall be cleaned off welding slag and burrs by hand files, wire brushes and flexible grinders wherever required and using cloth.

14.20.75 Platforms, ladders crossovers and canopies shall be fabricated and erected by contractor at site as per site engineer's advice. Platforms shall also be provided at places where it has not

been shown in drawings but if felt necessary by site engineer. Canopies shall be provided for all out-door pumps and motors.

14.20.76 Galvanized pipe shall be joined by screwing in to socket and screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before joining. The exposed threaded portion on either side of the socket joint shall be applied with Zinc Silicate Paste. All these consumables are in the scope of contractor and shall carry out within the quoted rate.

14.20.77 GI pipe with flanged joints shall have screwed flanges. Flanged joints face shall be painted with red lead and bolting up evenly on all sides with compressed asbestos gaskets in between two flanges.

14.20.78 Teflon tapes shall be used to seal out screwed joints and shall be applied to the male threads only. Threaded parts shall be wiped clean of oil or grease with appropriate solvent if necessary and allowing proper time for drying before applying the sealant. Pipe ends shall be attached by screwing the pipe through the flange and pipe and flange shall be refaced accurately. Required Teflon tapes are to be arranged by the contractor at his cost.

14.20.79 Required threading should be done by the contractor at site as specified in the drawing. The pipes shall be cut only by Hacksaw / Machining. Required Teflon tapes are to be arranged by the contractor within the quoted rate.

14.20.80 All the screwed joints are to be seal welded if required by Customer, suitable electrodes for full seal welding are to be arranged by the contractor at his own cost.

14.20.81 The Buried pipe in general shall be laid with the top of the pipe minimum 2.0 /1.5 metre below finished general ground level or as specified in the drawing. Anti-corrosive treatment for all buried pipes as specified in the drawings including supply & application of anti-corrosive treatment, required consumables are in the scope of contractor and shall carry out as per drawing within the quoted rate.

14.20.82 Buried GI pipes shall not have flanged joints. All the joints shall be screwed with socket. Screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before joining. Threaded portion on either side of the socket joint shall be applied with Zinc Silicate Paste. All these consumables are in the scope of contractor and shall carry out within the quoted rate.

14.20.83 The civil works like excavation, compaction, sand filling & etc. for the buried piping identified in this contract are excluded in the scope of work.

14.20.84 Free access is to be provided for the welding of the circumferential joints by increasing the width and depth of the trench at these points. There should be no obstruction to the welder from any side so that good welded joint is obtained. This type of incidental works is to be carried out by the contractor within quoted rates.

14.20.85 Prior to lowering and laying pipe in any trench, the contractor shall ensure for the backfill and compact the bottom of the trench or excavation in accordance with IS 5822 / as per drawing to provide an acceptable bed for placing the pipe.

14.20.86 Preparation of pipe surface as per customer/ consultant specifications by sand/grit blasting (if required) for wrapping and coating is included in the scope of this tender. All fittings like elbows, tees, reducers, flanges, inserts etc., valves flow nozzles, etc shall be matched with pipes for welding which may require re-edge preparation, grinding etc., if found necessary.

14.20.87 All dimensions / elevations refer to centreline of pipe unless otherwise specified, the pipe routing shall be carried out as per the drawing. Wherever the dimensions are not specified / shown as approximate the same may be routed as per site requirement / convenience as per Engineers' advice.

14.20.88 Contractor shall arrange all the equipment, alignment bolts, tools, consumables like welding electrodes (all type), TIG wires (Other than the supplied TIG wires from BHEL, if any) and argon gas cylinders etc., for welding of pipes at his cost. Consumables like jute, cotton waste, hacksaw blades, petrol, Kerosene oil etc are in the scope of contractor.

14.20.89 Bidders to exercise utmost care while doing execution and commissioning work for this package so that no damage is caused to the existing plant at site. Any such damage will be back charged to bidder.

14.20.90 Protection of pipeline against floatation during the contract/extended period shall be the responsibility of the contractors. Should any section of the pipe line float due to their negligence etc. the entire cost of laying it again to the correct line and level shall be to the contractor's account.

14.20.91 Contractor has to take care for the Buoyancy effect which may arise in due course of erection of the Pipeline. Proper care to minimize the Buoyancy effects has to be ensured by the

contractor during the erection of the pipelines. Any mitigation measures to be adopted for minimizing the buoyancy effects has to be arranged by the contractor within the quoted rates.

14.20.92 **TARIFF ADIVSORY COMMITTEE APPROVAL FOR FIRE PROTECTION SYSTEM-** BHEL Will make arrangement of TAC approved agency for accreditation of work. The contractor has to facilitate TAC for getting approval. As per TAC any modification or any rerouting of the lines, re erection of equipment should be done and same should be carried by contractor with in quoted rates. There is no extra payment will be paid. However, contractor is responsible for availing the TAC approval for Fire protection system in total. Also responsible for getting any necessary approval from statutory and regulatory body of TAC if any needed. All the reports from concerned statutory departments obtaining is the responsible by contractor. All these activities should be carried with in the quoted rates.

14.20.93 Also refer clause Chapter XX, in Volume IA Part I of TCC titled “Coating and Wrapping”. **ARRANGING PAINTS, WRAPPING AND COATING MATERIALS, PRIMERS FOR PAINTING (AS APPLICABLE) AS PER TENDER SPECIFICATION FOR ALL ERECTED MATERIALS IS IN THE SCOPE OF CONTRACTOR.**

14.20.94 In case of any class of work for which there is no such specifications as laid down in the contract such us blue matching, welding of stainless-steel parts etc., the work shall be carried out in accordance with instructions and requirements of the BHEL engineer at the quoted rates only.

14.20.95 Contractor has to arrange required fire retardant covering materials (tarpaulins) to protect the machined components / assembled parts drawn from BHEL before and after erection at their cost.

14.20.96 The contractor shall erect scaffolding / temporary platforms for erection as per the guidelines of relevant IS codes. These should be of adequate capacity and shall never be over loaded. These should be replaced when not found suitable during erection work and dismantled on work completion and removed from work site. Only steel scaffolding materials with proper clamps should be used. Use of bamboo / casuarinas shall not be permitted.

14.20.97 Contractor shall remove all scrap materials periodically generated from his working area and collect the same at one place earmarked for the same. Load of scraps is to be shifted to a place earmarked by BHEL. BHEL reserves the right to collect and remove the scrap at contractor's risk and cost if there is any failure on the part of contractor in this respect. All the packaging materials, including special transporting frames, etc. shall be returned to the BHEL stores / customer's stores by the contractor and maintain records.

14.20.98 Any faulty erection shall be removed and re-erected promptly to comply with the design requirements to the satisfaction of Site Engineer.

14.20.99 Prior to erection of any components, inspection to be done for any foreign materials and damages and they are to be removed / attended as per instructions of BHEL engineer.

14.20.100 The temporary structures / items welded to permanent members / pipes are to be cut and removed without any damage. Any damage so to permanent members / pipes to be made good by the contractor at his cost.

14.20.101 Upon completion of daily work, the contractor shall remove from the vicinity of work all scrap packing materials rubbish, unused and other materials and deposit them in places to be specified by BHEL Engineer.

14.20.102 Delay in clearance of fronts like equipments, piping, buildings is unlikely to happen. However, if any delay occurs, the contractor shall not claim anything extra, like idle charges.

14.21 Rubber Lined Piping: All the rubber – lined pipes are flange joined and the flanges are also rubber lined. No welding is allowed on these pipes. If any damages occurred / notices in the above pipe lines during erection / transportation / commissioning of rubber lined pipes, the same has to be rectified by the contractor at his cost.

14.22 Reconciliation of Material issued by BHEL (free of cost):

14.22.1 All materials as specified in relevant BOQ shall be issued free of cost by BHEL for use in the work covered in this contract from BHEL stores/storage yard. The contractor shall collect these materials from BHEL stores/storage yard at specified places at his own cost and store the same at his stores as per standard norms. Materials issued will be used only for construction of permanent works.

14.22.2 The contractor shall in no case be entitled for any compensation (other than explicitly mentioned in the tender conditions) on account of any delay in supply or non-supply thereof for all or any such materials. However, in case of non-availability of any specific section(s) which delays the completion of work, such cases shall be recorded separately in monthly planning format (F 14) and shall be considered for time extension of contract in line with GCC.

14.22.3 Contractor will have to make his own arrangement at his own cost for procurement of any other materials except as mentioned above/ BOQ, as required for the works and of such quality as acceptable to BHEL.

14.22.4 The contractor shall maintain proper store account for all the BHEL issued materials and shall give **Three (03) copies of monthly-computerized reconciliation statement** of such account showing total receipt, consumption and balance at site to the BHEL. BHEL Engineer's certification for the reconciliation of steel shall be final. The detailed reconciliation (dia. Wise or Wt. wise or as required) shall be done **at least once in three months (03) or before submission of final bill which comes earlier**.

14.22.5 Contractor shall also carryout in complete association with BHEL, the material management functions and execution like day-to-day update of materials, issued to contractor, accounting for surplus/scrap material returned etc. These functions shall also be carried out through computerized system utilizing suitable software. Contractor shall engage experienced software personnel to associate on dedicated basis for efficient discharge of the same in time.

14.22.6 BHEL issued materials, shall not be under any circumstances whatsoever, and shall be taken out of the project site unless otherwise permitted by BHEL for outside job.

14.23 Scrap/Surplus material left out from the portion bought & supplied by Vendor, shall be taken out of the project site, after completion of work, only after due permission from BHEL.

The scope of the work will comprise of but not limited to the following:

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

15.0 WELDING, HEAT TREATMENT & RADIOGRAPHY AND NON-DESTRUCTIVE TESTING

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

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

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

15.4 The contractor shall carry out the root run welding of all PP, HP / LP piping, valves by TIG welding method only (or as specified in applicable procedure/manual issued by BHEL during execution). 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.

15.5 All expenses for testing of contractor's welders including destructive and Non- destructive tests conducted by BHEL at site or at laboratory shall have to be borne by the contractor only. Limited quantity of tube and pipe material required for making test pieces will be supplied by BHEL free of cost.

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

15.7 **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 should have a co-relation with the lot number / batch number given on electrode packets. No electrodes will be used in the absence of above requirement. The thermostat and thermometer of electrode drying oven will be also calibrated and test certificate from Govt. approved / accredited test house traceable to National / International standards will be submitted to BHEL before putting the oven in use. The contractor shall also arrange periodical calibration for the same. Separate ovens shall be used for baking and holding.

15.8 All butt / fillet welds shall be subject to Non–Destructive testing as per the Drawing/Procedures/Welding Schedules/Documents at no additional cost. 100% RT will be applicable to all the circuits however applicable percentage of RT shall be guided by the field welding schedule.

15.9 **Non-Destructive Testing such as RT, CRT, UT, MPI, PAUT, hardness test, SR etc. wherever applicable shall be in Contractor scope. In case of any delay (i.e. 2 days from the date of completion of joint/intimation) in execution of NDT, BHEL shall be entitled to execute the work at cost recovery basis.**

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

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

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

15.13 Pre-heating, radiography and other NDT tests, post heating and stress relieving after welding of tubes, pipes, Non-Pressure Parts, including attachment welding wherever necessary, are parts

of erection work and shall be carried out by the contractor in accordance with the instructions of the Engineer. Contractor at his cost shall arrange all equipment and consumables essential for carrying out the above process.

15.14 The contractor shall also be equipped for carrying out other NDT like LPI / MPI / Hardness test etc. as required as per welding schedules / drawings within the finally accepted price / rates. Ultrasonic testing, wherever required, will be arranged by contractor within the quoted rate.

15.15 The technical particulars, specification and other general details for radiography work shall be in accordance with ASME, IBR or ISO as specified by BHEL through its manuals/procedures etc.

15.16 The contractor for radiography work shall use Iridium-192; the geometric un-sharpness shall not exceed 1.5 mm. The contractor should take adequate safety precautions while radiography is being carried out. Contractor at his cost shall arrange necessary safe guards required for radiography (including personnel from BARC).

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

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

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

15.20 Lead intensifying screens for front and back of the film should be used as per the above-referred ASME specification. The joint is to be marked with permanent mark A, B, C to identify the segments. For this a low stress stamp shall be used to stamp the pipe on the down streamside of the weld. For multiple exposures on pipes, an overlap of about 25-mm of film should be provided.

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

15.22 The contractor shall be fully equipped with radiography equipments, films, chemicals and other dark room facilities. There must be a number of radiographic personnel with sufficient

experience and certified by BARC for field radiographic inspection. Further, the contractor must follow strictly the safety rules laid down by BARC, from time to time, contractor's radiographers shall also be registered with BARC for film badge service.

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

15.24 The contractor shall have a dark room & pit room fully equipped with radiography equipment, film (un-exposed), chemicals and any other dark room accessories. All radiography films shall be developed in the dark room at site.

15.25 In case of radiography of less than 100%, the joints identified by BHEL at random shall be radiographed.

15.26 Radiography inspection of welds shall be performed in accordance with requirement and recommendation of BHEL Engineer. The quantum of radiographic inspection shall be as per provision of ASME /BHEL/CUSTOMER approved documents. However, minimum percentage of joints to be radiographed shall not be less than the requirement of BHEL welding schedule / IBR / Customer's requirements. The percentage may be increased depending upon the quality of joints and at the discretion of BHEL.

15.27 Radiography on LP piping joints is not envisaged. However, other NDT test(s) as called for in the FQP including LPI, MPI and HT will have to be carried out. Since, radioisotopes are being used, all precautions and safety rules as prescribed by BHEL/BARC/ Customer shall be strictly followed. BARC / DRP certificate to be provided before taking up the work. Subsequently radiographic inspection will be done on the basis of quality of welding. However minimum percentage of joints to be radio graphed shall not be less than the requirement of BHEL welding schedule / IBR / Customer's requirements.

15.28 The percentage may be increased depending upon the quality of joints and at the discretion of BHEL.

15.29 All the Radiographs shall be properly preserved in AC room and shall become the property of BHEL. They are to be reconciled with the work done, joints radio graphed and submitted to BHEL / Customer.

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

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

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

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

15.34 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 and cost for the same shall be debited from Contractor’s bill(s) with 05% overhead.

15.35 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 the work as per directions of BHEL.

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

15.37 All welded joints shall be subjected to acceptance by BHEL Engineer.

15.38 Check slots as per requirement BHEL/ Customer will be taken at contractor’s cost.

15.39 The technical particulars, specifications and other general details of work shall be in accordance with BHEL welding, Heat treatment and NDE manuals or equivalent as decided by BHEL Engineer.

15.40 Contractor shall carryout Radiography as per welding Manual booklet applicable as per IBR, enclosed. However, percentage radiography shown in the respective drawings shall be final and binding on the contractors.

15.41 The field joints are to be radiographed and preheating and post weld heat treatment shall be done as per BHEL procedure and manuals.

15.42 The percentage of Radiography are tentative, which may be increased depending upon the quality of joints at the discretion of BHEL.

15.43 Penetrometer as per ASME/ISO shall be used for all exposures.

15.44 Contractor shall provide all skilled, unskilled work men required for the job, which will include Engineers, supervisors, operators, as required for timely and satisfactory execution of radiography work.

15.45 The defects as pointed out by the Engineer shall be rectified immediately to the satisfaction of Engineer and Re-radio graphed. The decision of Engineer regarding acceptance or otherwise of the joint shall be final and binding on the contractor.

15.46 The contractor shall also be equipped for carrying out other NDT like liquid penetrant inspection, magnetic particle inspection, etc. as and when required in the interest of work within the quoted rates.

15.47 For carrying out ultrasonic testing of welded joints of large size tubes and pipes, it will be necessary to prepare the surface by grinding to a smooth finish and contour as desired by BHEL Engineer. The contractor's scope of work includes such preparation and no extra charges are payable for this.

15.48 It may also become necessary to adopt inter layer radiography / MPT / UT depending upon the site/technical requirement necessitating interruptions in continuity of the work and making necessary arrangements for carrying out the above work. The contractor shall take all this into account and quote the price inclusive of all such work and radiography.

15.49 The welded surface irrespective of place of welding shall be cleaned of slag and painted at the centre with primer paint to prevent corrosion at no extra cost towards this.

15.50 All welders shall be tested and approved by BHEL Engineer before they are actually engaged on work though they may possess the required certificate. BHEL reserves the right to reject any welders without assigning any reason. The welder Identification code as approved by the BHEL Engineer shall be stamped by the welder on each joint done by them. The contractor will be responsible for the periodic renewal, retesting of the welders as demanded by BHEL.

15.51 BHEL Engineer is entitled to stop any Welder from the work if his work is unsatisfactory for any technical reasons or there is a high percentage of rejection of joints welded by him, which in

opinion of the BHEL Engineer will adversely affect the quality of the welding though the Welders, has earlier passed the tests prescribed by BHEL Engineers. The welders having passed qualification tests do not relieve the contractor of a contractual obligation to check the welder's performance.

15.52 All charges towards testing of Welders for destructive and non-destructive test, testing and approval of welders for engaging in the erection work shall be borne by the contractor.

15.53 The welding process, weld joint details, joint configuration and material specification may change to suit the design requirements. The contractors quoted rates shall be inclusive of each contingency. All welds involved in the erection of temporary pipe lines for hydraulic test, chemical cleaning, steam blowing etc., as applicable, to be carried out within the quoted rates. The number of joints to be welded as mentioned in the welding schedule consists of butt welds. All other welds viz. attachment welds on pressure parts/non-pressure parts, fillet welds in non-pressure parts welding in the boiler and Rotating Machines has to be carried out by the bidder within quoted rates.

15.54 For uniform heating and better closed loop control, pre-heating, post heating, controlled rate of heating & cooling and post weld heat treatment cycles for tube specifications SA213T91 & SA213T92 should be carried out using flexible ceramic pads with suitable heating machine.

15.55 MPI must be done on joints, those are undergone ultrasonic testing.

15.56 Preheating, inter-pass heating, post weld heating and stress relieving after welding are part of erection work and shall be performed by the Contractor in accordance with BHEL engineer's instructions. Where the electric resistance heating method is adopted, Contractor shall make all arrangement including heating equipment with automatic recording devices, all heating elements, thermocouples and attachment units, graph sheets, thermal chalks, & insulating materials like mineral wool, asbestos cloth, ceramic beads, asbestos ropes etc, required for all heating and stress relieving works.

15.57 List of Penalties on Violations on Quality Provisions

Sr no	Violation	Penalty in Rs
1	Mother oven not working	500 per day & ban on its use

2	Slackness in control over baking of welding electrodes (Doc.)	200 per incident
3	Holding oven not working/plugged in	500 per incident/day & ban its use
4	Portable oven not working/Plugged in	100 per incident & welder to be sent home
5	Use of cold electrodes (Except E6013)	1000 per incident & welder to be sent home
6	Unauthorized welder on job	5000 per incident & welder to be sent home
7	Delay in NDT Agency deployment w.r.t jointly agreed Ere. Prog	500 per incident
8	Failure to monitor Welder's Performance (RT, SR, Penalty Joint etc.)	5000 per week
9	Improper acts w.r.t maintain SR Charts	10000 per incident
10	Site Welding/QLY Engineer not deployed w.r.t mutually agreed Ere. Plan	500 per day
11	Delay in (RT, SR, UT) report submission & customer acceptance Log sheets esp. for Billed qty. from dt. of Billing (Vendor)	10,000 per week
12	Lack of safe approach Scaffolds/Platform for inspection & non-availability of calibrated MMDs –	1000 per incident.

15.57.1 RECEIPT INSPECTION OF WELDING ELECTRODES / FILLER WIRES

1. All electrodes / filler wires received at site stores shall be segregated for type and size of electrode.

2. Ensure that electrode packets received are free from physical damage.

3. Where electrodes are damaged, the same shall be removed from use.

4. Only electrodes identified in the "Rationalized List of Electrodes" are to be accepted.

5. Where filler metals are supplied by manufacturing unit, inspect for damages, if any.

6. Ensure availability of relevant test certificates. Refer tables of chemical compositions and mechanical properties for acceptance.

7. Endorse acceptance / rejection on the test certificate.

15.57.2 STORAGE & IDENTIFICATION OF WELDING ELECTRODES / FILLER WIRES

1. **Scope**

1.1 This procedure is applicable for storage of welding electrodes / filler wires used at sites.

2**. Procedure:**

2.1 Only materials accepted (based on receipt inspection) shall be taken into account for storage.

2.2 Storage Facility:

2.2.1 The storage facility shall be identified.

2.2.2 Access shall be restricted to authorized personnel.

2.2.3 The storage area shall be clean and dry.

2.2.4 Steel racks may be used for storage.

2.2.5 Avoid storing wood inside the storage room.

2.2.6 Maintain the temperature of the storage facility above the ambient temperature.

2.2.7 This can be achieved by the use of appropriate heating arrangement .

2.3 The electrodes / filler wire shall be segregated and identified for

1. Type of electrode e.g. E7018.

2. Size of electrode e.g. Dia 3.15 mm.

2.4 Colour coding for filler wires:

2.4.1 On receipt of GTAW filler wires, codify the filter wires as per table I below . Both ends shall be coloured.

Table - 1

Specification	Brand Name*	Colour Code
RT 1/ 2 Mo (ER80s-D2)	TGSM	Green
RT 1 Cr 1 / 2 Mo (ER80S-B2)	TGS 1CM	Silver grey/White
RT 2 1/ 4 Cr 1 Mo (ER90S-B3)	TGS 2CM	Brown / Red
RT 347 (ER 347	TGS – 347	Blue

(* or other approved equivalents)

2.4.2 Where another set of colour code is followed, maintain a record of coding used

2.4.3 Where the filter wire is cut, apply the appropriate colour code at both ends of the piece.

2.4.4 For other filler wires, a suitable colour distinct from table 1 shall be applied

15.57.3 BAKING AND HOLDING OF WELDING ELECTRODES

A. Purpose:

This section details activities regarding baking and holding of welding electrodes used at sites.

B. Procedure:

1. While handling, avoid contact of oil, grease with electrodes. Do not use oily or wet gloves.
2. It is recommended that not more than two days requirements are baked.

C. GTAW Filler Wires:

1. These wires do not require any baking.

D. Covered Electrodes:

I. Baking and holding

II. Identify baking oven and holding oven.

III. They shall have a temperature control facility upto 350 °C for baking oven and 200 Deg. C for holding oven.

IV. A calibrated thermometer shall be provided for monitoring temperature.

V. On opening a packet of electrodes, segregate and place them in the baking oven. Avoid mix up.

VI. After loading, raise the baking oven temperature to the desired range as per Table below.

VII. Note the time when the temperature reaches the desired range. Maintain this temperature for the duration required as per Table below.

VIII. On completion of baking, transfer the electrodes to holding oven, maintain a minimum temperature of 100°C till issue.

IX. The electrode shall not be subjected to more than two cycles of baking. Maintain a register containing following details:

a. Brand name (e.g. Supratherme)
b. Size (e.g Dia 4.0 mm)
c. Quantity (e.g. 110 pieces)
d. Time at required temperature ie. Above 250^0C
e. Time of Transfer to holding oven. Activities a, b, c to be recorded before loading into the oven.

15.58 NDT and PWHT of all areas shall be guided by the site erection welding schedule.

15.59 Chapter on Quality Assurance from CUSTOMER Contract (Annexure-6) has been enclosed with this specification for general understanding of minimum requirement and applicable provisions with respect to Field/Site works may be referred to. All NDE/SR to be carried out at site as per prevailing manual/procedure issued by BHEL during execution of contract within quoted price.

The scope of the work will comprise of but not limited to the following:

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified)

16.1 All piping systems shall be subjected to hydraulic test as per Customer specification / BHEL. Customers' specification forms the part of this tender specification. The contractor shall supply necessary labour and other services and make necessary arrangements to carry out the required tests as per the instructions and directions of the BHEL Engineers.

16.2 Soundness of the welds shall be tested hydraulically under the supervision of the BHEL Engineer and Customer, to the pressure indicated in the drawing. Prior to the test, the piping system shall be inspected by the BHEL Engineer to the extent necessary to ensure compliance with clearance for the test, which will be obtained by the contractor from the Engineer.

16.3 As far as the hydraulic pressure test is concerned, the same shall be conducted at various stages to the satisfaction of BHEL / Customer Engineers. Any rectifications required shall have to be done / redone by the contractor at his cost. The contractor shall carry out all the required tests and pre-commissioning and commissioning activities required for successful and reliable operation.

16.4 Test records shall be made for pressure testing of above piping system. These records shall contain the following information:

a) Date of test
b) Identification of piping tested
c) Test fluid
d) Test pressure
e) Approval of the Engineer

16.5 Contractor has to arrange required pumps with sufficient capacity for filling water in the tubes and pipes for conducting Hydraulic testing of LP lines. Contractor has to arrange Hydraulic Test pump / Hand Pump at his cost for Hydraulic testing of LP lines.

16.6 Contractor shall lay all necessary electric cables and switches etc. required for the hydraulic tests and other tests, flushing etc., and maintain the system till the tests are completed satisfactorily.

16.7 In certain places blanking has to be resorted prior to Hydraulic test and spool pieces have to be erected in place of control valves, orifices and other fittings and these spool pieces have to be subsequently replaced with the regular valves/ fittings by the contractor at no extra cost.

16.8 For conducting Hydro test / steam blowing internals of valves and NRVs are to be removed, Hydro Test devices are to be fixed and after Hydro Test the internals are to be re-assembled by the contractor as instructed by BHEL without any additional cost.

16.9 The contractor shall make all necessary arrangements including making of temporary closures / dummy on piping / equipment for carrying out the hydro-static testing on all piping, equipment covered in the specification at no extra cost. Necessary blanks will be provided by BHEL.

16.10 The contractor shall see that the water shall not be allowed to accumulate in open trenches where work is in incomplete stage, precautionary works such as blank flanging the open ends of the pipe line and filling the pipe line with water etc. shall be taken as directed by the engineer. Such works shall be to the contractor's account and no separate payment will be made for the same.

16.11 The contractor shall carryout the required test on the pipelines such as Hydraulic Test of various piping systems, Ultrasonic Test for weld defects and finding thickness, Dye penetrant test, Magnetic particles test for Weld defects and materials defects etc. All facilities (manpower, materials, equipment, consumables etc.) including proper approaches wherever required shall be provided by the contractor for satisfactory conduction of above tests. Special equipment such as magnetic particle tester, ultrasonic test kit and engineers required for these tests shall be arranged by the contractor along with Qualified technician within finally accepted rates.

16.12 In general, Hydraulic testing of piping shall be performed after all eventual pipe branches have been completed and valves installed. Should it be required to hasten erection work, pressure tests may be performed by sections. For this scope of work, the erected pipe lines shall be hydraulically tested as per site requirement in segments. For conducting hydraulic test, both ends of pipe lines shall be blanked by welding of plates. Only one or two set of plates and structural materials for blanking required for one segment will be provided by BHEL free of charge. After completion of hydraulic test in one segment, the same plates are to be cut and removed and utilized / welded on the other segment of the pipe lines, to carry out the hydraulic test for the respective segments. No separate plates for blanking for each segment will be provided. After completion of Hydraulic test, the required edge preparations shall be carried out on the end of pipe lines and to be welded with the respective pipe lines. In such cases joint

connection shall be checked during a final and additional test, if required. The contractor shall note this aspect and quote accordingly.

16.13 During hydraulic test, the pipes being tested shall be isolated from the equipments to which they are connected.

16.14 Openings on piping for pressure / temperature impulse connections shall be fully closed during the test to prevent dust or foreign matter entering into the instrument piping inadvertently.

16.15 The following specifications shall also be completed with during hydrostatic test.

a. Vent nozzles with valves shall be provided at the highest point of the runs, to eliminate air pockets. At the lowest point drain nozzles, with valves shall be provided to drain water from pipes. The nozzles and valves shall be of the same materials as the pipe.

b. The lowest part of the pipe shall always be filled first with water.

c. Pressure shall be slowly increased (without shocks) to the stipulated value and maintained as long as required to visually check all joints.

d. Following the control specified above the pressure shall be slowly decreased to the design pressure after which the pipe shall be subjected to the peening test, applying knocks every 150 mm approx. especially in the welded joint areas, with a 0.5 – 1.5 kg. Hammer (depending on the pipe wall thickness). The hammer used shall be a round headed one.

e. Following the peening test, the pressure shall be increased to the stipulated value and all welded joints shall be visually inspected.

f. Following these tests, the pipe shall be drained or pumped out to the other section to be hydro test using the drain out pump to be provided by Contractor and wherever necessary shall be flushed with air for all pipes.

g. The pressure test is considered satisfactory if no cracks, unjustified pressure reductions, leakages, seepages etc., appear.

h. Should defects be found, these shall be repaired in the same manner as these during radiographic examination. Hydraulic test shall be repeated after defects have been repaired.

The scope of the work will comprise of but not limited to the following:

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

17.0 TESTING, PRE – COMMISSIONING & COMMISSIONING AND POST COMMISSIONING

17.1 The Contactor shall carry out all the required tests, pre-commissioning, commissioning, activities required for successful and reliable operation of FGD system. These would include Air/ Gas tightness test of ducts, Hydraulic test of piping, Water fill test/ vacuum box test of tanks, trial run of pumps/ blowers/ ball mills/ feeders/ vacuum belt filter/ hydro cyclones, etc. as instructed by BHEL using contractors own consumables, labour and scaffoldings etc. Specific omission of any test which is required for the successfully commissioning all the equipment's covered under scope does not absolve the contractor of its responsibilities of performing of that test.

17.2 All required tests (Mechanical and electrical) indicated by BHEL and their clients for successful commissioning are included in the scope of these specifications though some of the tests / activities are not listed in these specifications. HT and LT electrical testing of motors and megger/IR value checking is also part of scope.

17.3 After completion of erection of ducts, the contractor shall conduct the air/gas tightness of the inlet duct from ID fan outlet to booster fan to absorber inlet and outlet duct from absorber outlet up to wet stack chimney. Erection etc. of blowers and blanks and putty required for conducting air tightness test shall be carried out as part of work (putty to be procured by the contractor without any extra cost of work)

17.4 The scope of pre-commissioning, commissioning and post commissioning 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 all 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 offsite disposal of effluents (if any) of the tests under the scope of this contract as per instruction of BHEL Engineer.

17.5 The contractor shall make all necessary arrangements including making of temporary closures on piping/ equipment for carrying out the hydro-static testing on piping equipment covered as per the scope at no additional cost. The contractor shall carryout the required test on the pipelines such as Hydraulic Test (as per FQP/IBR requirement/ instruction of BHEL), of piping systems as per the scope, Ultrasonic Test for weld defects and finding thickness, Dye penetrant test, Magnetic particles test for Weld defects and materials defects etc. All facilities (manpower, materials, equipment, consumables etc.) including proper approaches wherever required shall be provided

by the contractor for satisfactory conduction of above tests. Special equipment such as magnetic particle tester, ultrasonic test kit and engineers required for these tests shall be arranged by the contractor along with qualified technician within finally accepted rates.

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

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

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

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

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

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

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

that no valves and valve actuators are left un-serviced. Wherever necessary as required by BHEL Engineer, the contractor shall arrange to lap / grind valve seats.

17.13 Cleaning and servicing of all the filters / strainers, in the system shall be done by the contractor within the accepted price. All oils and greases to be filled in the main equipments as first fill and subsequent topping up's will be furnished by BHEL.

17.14 At the time of each inspection, the contractor shall take note of the decisions / changes proposed by the BHEL Engineer and incorporate the same at no additional cost.

17.15 The valves, dampers, actuators etc. will have to be checked cleaned and overhauled in full or in part before erection, after acid cleaning, steam blowing and during commissioning as may be necessary.

17.16 Welding and stress relieving of temporary blanks or suitably fixing temporary blank flanges with gaskets and fasteners and welding and providing suitable deaeration / venting / draining points with valves as per BHEL Engineer's instructions, for performing hydro-test of piping and other equipments is within the scope of work. Gaskets, valves, fasteners will be provided free of cost by BHEL. Contractor shall cut steel blanks from steel provided within quoted rate. After completion of hydraulic test, welded blanks shall be cut and removed and weld burrs ground finished and cavities / scars of cutting weld filled and ground as per BHEL Engineer's instructions. Seal welding of thermo-wells and blanks of Temperature Element are to be removed by grinding only after steam blowing.

17.17 The hydraulic testing of the equipment and piping, covered under this scope of work has to be carried out by the contractor as per instructions of BHEL Engineer. The contractor shall provide all facilities required for hydraulic testing. Before hydraulic test, all the hangers are to be locked by locking pin / plate or temporary support. After completion of Hydraulic test, these are to be removed and all hangers are to be readjusted if required, to the desired value within quoted value.

17.18 All the tests shall be repeated till equipments satisfy the requirements / obligation of BHEL to their customer at various stages. As far as the hydraulic pressure test is concerned, the same shall be conducted at various stages to the satisfaction of BHEL / Boiler Inspector / Customer Engineers. Any rectifications required shall have to be done / redone by the contractor at his cost.

17.19 Transportation of oil drums from customer/ BHEL's stores, filling of lubricants and filling of oil for flushing and first filling and subsequent topping up during commissioning and post commissioning is included in the scope of this contract. The contractor shall have to return all the empty drums to the customer / BHEL stores. Similarly transport of chemicals for various pre-commissioning

activities / processes mentioned in the above clauses and returning of remaining and / or the empty containers of the chemicals to customer / BHEL stores is the responsibility of the contractor.

17.20 Replacing / cleaning of filters of the erected equipments, piping system etc. during pre-commissioning / commissioning stage are within the scope of work.

17.21 Contractor shall lay the temporary pipelines with fittings, accessories and erection / commission pumps, valves, fittings, hangers and supports and other installations as instructed by BHEL, Engineer for the purpose of cleaning / flushing / blowing / washing /bursting etc. of piping and other equipments are in the scope of work. Necessary, structural steel materials for blanking this will be provided by BHEL. Weight for the same will be based on jointly measured quantity and corresponding standard weights. No payment will be made for the equipments brought by the Contractor such as pumps etc and foundations made by the Contractor for temporary systems. Overhauling / cleaning / servicing of valves, pumps, fittings in temporary system, etc prior to the above operations / activities will also be carried out by the contractor at his cost.

17.22 During the initial stages of work, trenches for draining water may not be available for alkali flushing or mass flushing for discharging and draining the system and piping. Necessary low point drains and temporary piping for this will have to be erected by contractor from materials provided by BHEL.

17.23 After the cleaning/flushing/HT has been successfully completed, removing all temporary piping, fittings of tanks etc. checking all the valves for any accumulation of foreign materials, welding the valves, pipes which were cut and cleaning, re-fixing, edge preparation and return to BHEL stores, area cleaning as per BHEL Engineer's instructions is within the scope of work/specification. The contractor, at his own cost, shall arrange experienced technicians for the above work, including required consumables.

17.24 The contractor as per BHEL requirements will suitably make preservation of cleaned surfaces.

17.25 Contractor may have to replace old/damaged gaskets / packing etc. for equipments and the same shall be carried out by contractor as per requirement. Materials will be given by BHEL.

17.26 In case any erection defect is detected during various tests / operations / trial runs as detailed above such as loose components undue noises or vibration strain on connected equipment steam or oil or water leakage etc. the contractor shall immediately attend these defects and take necessary corrective measures. The parts to be replaced shall be provided by BHEL free of cost. If the insulation is to be removed to attend any of the defects the cost of removal and reapplication of insulation should be borne by the contractor.

17.27 Necessary scaffolding and approaches for conducting the above shall also be within the scope of the contract.

17.28 The contractor shall carryout any other test as desired by BHEL Engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning, commissioning, and operation, to demonstrate the completion of any part or whole work performed by the contractor.

17.29 During this period though the BHEL's / Client's staff will also be associated in the work, the contractor's responsibility will be to arrange required tools, man and plants till such time the commissioned units are taken over by BHEL's client.

17.30 For conducting gas tightness test, it may be required to erect the blowers and connecting ducts and commission the same for tightness test. It is the responsibility of the contractor to erect the blowers & dismantle once the test is over. Contractor shall carry out the work within the quoted rate and BHEL will provide dummies free of cost for conducting the test.

17.31 Contractor has to remove the all temporary supports, structures from inside of ducts and grind the all points after cutting and proper clean the duct and make it free from duct, weldments and burrs.

17.32 Contractor to provide necessary commissioning assistance from pre-commissioning state onwards and up to continuous operation of the unit & handing over to customer. The category of personnel to be as per site requirement and to meet the various pre-commissioning and commissioning programs made to achieve the schedule agreed with customer.

17.33 The commissioning activities will continue till handing over of the unit. It shall be the responsibility of the contractor to provide various categories of workers in sufficient numbers as per the work requirement along with supervisors including necessary consumable tools etc., during this period. The rate quoted shall indicate all these contingencies also. The various categories of workers required for pre-commissioning, commissioning and post-commissioning activities are as follows:

a) Fitters
b) Structural welders
c) Riggers
d) Unskilled workers
e) Supervisors
f) Electricians
g) Laggers
h) Sheet metal fabricator/fitter
i) Any other category of workers as may be required.

Further in addition to the above, contractor has to arrange the following minimum manpower **in each package** exclusively for assisting BHEL commissioning engineers during commissioning stabilization period. This manpower will be directly controlled by BHEL commissioning engineers.

1. One Supervisor in charge per shift for three shifts.
2. Two Fitters per shift for three shifts
3. Four Helpers per shift for three shifts
4. One Electrician per shift for three shifts

17.34 During commissioning any improvement or rectification due to design requirement is involved and if the contractor is asked to carry out the job, they shall be paid at man-day rates. For this purpose, daily labour report indicating therein nature of work carried out, consumables used, T&P Hired, etc. shall be maintained by contractor, and got signed by BHEL Engineer every day. It is not obligatory on the part of BHEL to get the works done by the contractor. They can employ any other agency if they so desire at that time.

17.35 During commissioning any improvement / repair / rework / rectification / fabrication / modification due to design improvement / requirement is involved, the same shall be carried out by the contractor promptly and expeditiously.

17.36 Hanger adjustment / re-adjustment during erection, before and after Hydraulic Test, during and after pre-commissioning/commissioning, are to be carried out by the contractor within Quoted Rate.

17.37 The contractor has to provide required man power assistance during pre-commissioning and commissioning checks of motor operated valves, actuators, control valves etc. without any extra charges.

17.38 D.S.L / equivalent system for hoisting equipments are also to be erected and commissioned including load testing by the contractor within the quoted rates. Required manpower including electricians is to be arranged by the contractor for carrying out commissioning of electrical hoist and load testing of electrical hoist. Required loads will be provided by BHEL free of cost. Any minor rectification or for improvement of motor IR valve, arrangement to be made by contractor.

17.39 No payment will be made for temporary installations made for testing of systems & similarly no payment will be made for electrical installations made for any temporary system.

All materials, equipment's necessary for installation of temporary system as above will be supplied by BHEL as free returnable issue in random sizes / lengths. However, servicing, fabrication,

erection, dismantling of the same after completion of the process, and handing over back to BHEL stores will be the responsibility of the Contractor.

In accounting of temporary materials/steel for fabrication(FOC) following wastage allowances are provided:

1. Structural items : 4%

a. Contractor shall cut / open / dismantle work, if needed, as per BHEL Engineer's instructions during commissioning for inspection, checking and make good the works after inspection is over.

b. Similarly, during the course of erection, if certain portion of equipments erected by the Contractor has to be undone for enabling other Contractors / agencies of BHEL / Customer to carry out their work, Contractor shall carry out such jobs expeditiously and promptly and make good the job after completion of work by other Contractors / agencies of BHEL / Customer as per BHEL engineer's / agencies of BHEL / Customer s instructions. Claims, if any, in this regard shall be governed as relevant clauses of 'General Conditions of Contract'.

c. All surplus steel and all wastage materials will be taken back on weighment basis. Surplus, unused and untampered steel shall be sorted section-wise and returned separately at a place directed by BHEL/Engineer within the project area. For return of such materials, contractor will not be entitled to any handling and incidental charges. All wastage / scrap (including melting scrap, wastage, and unusable scrap) shall be promptly returned to the stores and a receipt obtained for material accounting purposes. Scrap for reinforcement steel and structural steel shall be returned separately.

17.40 Contractor shall provide assistance in conducting of performance guarantee test (PG test) of the equipments under the scope of work. Contractor shall install all necessary tapping points; instruments etc and provide necessary assistance within the quoted rates. In case, PG test is getting delayed beyond the contract period (normal plus extension, if any) due to reasons not attributable to the Contractor, PG test issue will be mutually discussed and decided. However, installation of necessary tapping points, impulse pipes, approaches etc are to be completed by the Contractor.

17.41 Void

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

17.43 Contractor shall conduct the air/gas tightness test of all the ducts, dampers and gates under the scope of work. Erection etc. of blowers and blanks and putty required for conducting air tightness test shall be carried out as part of work. (Putty to be procured by the contractor without any extra cost to BHEL).

17.44 It is possible that due to any reason the final supporting may not be completed before conducting Hydraulic Test. The contractor may have to strengthen or install any additional supports as per instruction of BHEL. This work is a part of the work and no additional payment shall be made on this account.

17.45 All the shafts of the equipment shall have to be properly aligned to that of matching equipment to perfection, accuracy as required and the equipment shall be free from excessive vibration so as to avoid over-heating of bearings or other conditions, which may tend to shorten the life of the equipment. All bearings, shafts and other rotating parts shall be thoroughly cleaned and lubricated as per recommendations of BHEL engineer.

17.46 Lubricating oil units of the rotating machines are to be cleaned thoroughly before pouring of final lubricating oil. Topping up of lubricants during running of the set till handing over to be done by the vendor. Required lubricants both for first filling and topping up are to be supplied by BHEL free of cost. The empty containers of the lubricating oils should be returned to BHEL stores/place indicated by BHEL from time to time.

17.47 The instruction of the motor manufacturer regarding storage of the motors and re conservation must be strictly followed without any deviation.

17.48 The **'Initial Operation**'/Trial operation of the complete facility as an integral unit shall be conducted for continuous up to period specified. Upon completion of system checking/tests and as a part of **commissioning of facilities (COF)**, complete FGD plant/facilities shall be put on initial operation for a period of **thirty (30) days or 720 hours** stipulated as per Customer requirement. The Initial Operation shall be considered successful, provided that each item/ part of the facility can operate continuously at the specified operating characteristics, for the period of Initial Operation with all operating parameters within the specified limits and at or near the predicted performance of the equipment/ facility.

17.49 The completion criteria shall be as given in the commissioning procedure, and shall be done up to the satisfaction of BHEL Engineer.

The scope of the work will comprise of but not limited to the following:

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified)

18 PAINTING

18.1 **Painting:**

The scope of work shall also include supply and application of paint as per approved FQP / as required and specified as per painting schedules. Before commencement of Painting, the contractor has to obtain written clearance from BHEL/Customer for effective completion of surface preparation.

All structures, equipment, and other items, including shop-fabricated structures supplied by BHEL-PSER, shall be supplied with the finish coat of paint. However, in line with site requirements, the contractor shall be responsible for ensuring that the specified Dry Film Thickness (DFT), as per painting schedule or elsewhere, is achieved in accordance with the attached approved painting scheme for all such structures, equipment, and items prior to handing over to the BHEL / NTPC.

Contractor shall carry out surface preparation and touch-up/ re-painting/finish painting work as per BHEL/Customer specification and instruction of BHEL engineer at site.

18.2 All exposed metal parts of the equipment, structure, auxiliaries, piping, and other items (covered within the scope of this contract) after installations are to be painted. Mostly the equipment / components installed are with one coat each of primer paint and synthetic enamel / heat resistant paint. However, due to aging, the same may have got deteriorated for peeled off. The surfaces are to be thoroughly cleaned of all dirt, rust, scales, grease, oils and other foreign materials by wire brushing, scrapping, any other method as per requirement of BHEL. The same will be inspected and approved by the engineer before painting.

18.3 Required paints, thinner, and other consumables such as wire brush, brush etc. shall have to be arranged by the contractor at their own cost. The required manpower, other required consumables, T & P etc. shall be provided by the contractor with in the quoted rate. The arrangement of primer/paint for final painting will be in contractor's scope.

18.4 After applying the primer paints all structure/ equipment/ items, shall be finish painted with two coats of alloyed resin machinery enamel paints as specified by BHEL engineer. In case proper finish is not obtained in two coats, the contractor shall apply additional coat(s) till proper finish is achieved. Before applying the subsequent coats, the thickness of each coat shall be measured

and recorded with BHEL / Customer. After completion of painting all bright spots shall be cleaned to the satisfaction of Engineer.

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

18.6 Contractor at no extra cost to BHEL shall supply all paints, primers, tools and other consumables including scaffolding materials required for finish painting. Paint is to be BHEL/Customer approved make only and painting should be as per colour scheme and quality approved / specified by Engineer. Valid Test Certificate for the paint so supplied shall be made available before use of the same on work. No paint whose shelf life has expired should be used for painting.

18.7 Painting of welded areas / painting of areas exposed after removal of temporary supports / touch-up painting on damaged areas of employer's structures, where inter-connection, welding / modification etc. has been carried out by the bidder. Clean the surface to remove flux spatters and loose rust, loose coatings in the adjoining areas of weld seams by wire brush and emery paper. (Painting procedure to be followed also for touch-up painting on damaged areas).

18.8 Each coat (Primer, intermediate, finish) shall have a minimum thickness of dry film thickness (DFT) in microns and the DFT of finish paint shall not be less than the specified. Necessary instrument for measuring the thickness of paint applied is to be arranged by the contractor.

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

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

18.11 The painters have to undergo test on a mock plate of size 1m*1m and only qualified painters will be allowed to work.

18.12 The contractor shall ensure availability of:

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

18.13 All paints should be stored in well-ventilated store. The painters and other personnel deployed should use proper protective equipment to avoid inhalation of fumes.

18.14 Complete primer, painting and surface preparation including supply for BOQ item 1.1a and 1.1b is included in scope of contractor and payment shall be made as per respective BOQ item.

18.15 Painting schedule is to be followed.

The scope of the work will comprise of but not limited to the following:

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified)

19.0 APPLICATION OF INSULATION

19.1 Handling at site stores / storage yard, Transportation to site of work, Application of refractory & Insulation materials and connected works for FGD & Auxiliaries including binding and cladding with sheets etc., using their own tools plants, tackles, all consumables, supervisor and men as enumerated in the scope of contract.

19.2 Application of refractory, wool insulation, sheet metal cladding, welding of hooks / supports to hold insulation and refractory's as wherever necessary for all the equipment covered in this contract are to be carried out as per instruction of BHEL Engineer at site.

19.3 Scaffolding for the insulation of equipment and integral piping is in the scope of this contract.

19.4 All insulations and refractory materials including iron components and other sheets casing materials, etc., required as per drawing will be supplied by BHEL and the same have to be erected / applied as per the drawings and specifications of BHEL by the contractor.

19.5 All attachment welding, including welding of hooks/ supports as per pitch both on equipment and piping shall be done as directed by Engineer. Attachment welding shall have to be done by certified welders. If necessary, contractor may have to cut the hooks to correct length. Application of red oxide paint including supply of paint on welded portions as directed by BHEL is also included in the scope of work.

19.6 The contractor has to supply and apply heat resistant primer on welded portions before application of insulation.

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

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

19.9 The contractor should ensure, proper finishing surface of the insulation, sheeting and cementing.

19.10 The contractor should ensure that the finished surface of the insulation works conforms to the dimensions and tolerances given in the drawings. Aesthetic finish and accuracy of work are most important.

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

19.12 Aluminum sheet cladding will be fabricated to the sizes and shapes specified in drawings. Beading, Swaging, beveling of sheets, crowning the sheets, if necessary, will be carried out by him. Two coats of anti-corrosive black bituminous paint are to be applied on inner surfaces of the cladding. Bitumen sealing compound on the joints if necessary is included in the scope of this work. The contractor may note that he will also supply anti-corrosive black bituminous paint & bituminous sealing compound required for above works at his cost. However, if any material for such a purpose is received from BHEL Manufacturing Units then the same shall be issued free of cost to Contractor.

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

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

19.15 The contractor is liable for the exact accounting of the material issued to him and he shall make any unaccountable losses good. Allowed Wastage for the material issued are as below:

a. Wool/ LRB mattresses and cladding sheets 2%
b. Insulation bricks and mortar 2%
c. Castable Refractory 1%

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

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

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

19.19 Removal type insulation shall be provided for valves, fittings, expansion joints, etc as per the drawing or as directed by BHEL Engineer.

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

19.21 Insulation of expansion joints, dampers, etc. shall be carried out after NDT/air tightness test is completed.

19.22 Day-to-day cleaning of insulation debris and scraps to be ensured by the contractor. Excessive wastage will attract cost recovery.

The scope of the work will comprise of but not limited to the following:

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified)

20.0 APPLICATION OF COATING AND WRAPPING

COATING & WRAPPING - Under Ground Protection for Buried Piping External Surfaces shall be done as follows.

20.1 The Supply of Wrapping and Coating Material for the Raw water/Yard/FPS Piping is in the scope of bidder. No separate payment shall be made for the supply of the Wrapping and Coating Materials including its primer etc. **The tentative quantity of wrapping & coating material in FPS is approx. 2,000 Sq Mts of 4mm Sheet for cumulative both stages**. **Quantities are tentative and liable to vary.** Bidder has to calculate the quantity of wrapping and coating confirming to the wrapping and coating datasheet for the total Buried piping.

20.2 The materials used for coating and wrapping are

a. Coating Primer (Coal Tar Primer)
b. Coating Enamel (Coal Tar Enamel)
c. Wrapping Materials

20.3 The external surfaces of the buried pipes shall be thoroughly cleaned by sand/shot blasting method for free of rust, weld scales, burns etc., before start application of anti-corrosive coats. Slag Blasting may also be considered. Kerosene, solvent or other cleaning material should not be used for external cleaning of the pipes. The above work shall be carried out to the satisfaction of BHEL engineers or as instructed by BHEL engineers.

20.4 The entire length of pipe shall be cleaned and coated leaving the end about 230 mm for joints, which shall be coated manually after laying in the trench, welding and testing the pipe.

20.5 Coating & Wrapping of site joints shall be done after completion of weld and / or flanged connections and after completion & approval of Hydro testing. Materials required for coating, wrapping and consumables required for cleaning operations are to be arranged by the contractor within the quoted rate.

20.6 All primer / Coating / Wrapping materials and method of application shall conform to mentioned IS code, as per tech specs, except asphalt/bitumen material.

20.7 Total thickness of coating and wrapping shall not be less than 4.00 mm.

20.8 For all Underground Pipes, Underground Protection shall be provided for the Piping System as per the FQP provided during the due course of erection of the system.

20.9 T&Ps and instruments required for the above are to be arranged by the contractor within the quoted rates.

20.10 Tests to be carried out after application – (a) Bond / Adhesion test (b) Holiday test. The preservative paint, anti-corrosive tape, all the required consumables, T&Ps and the instruments required for the above application and testing are to be arranged by the contractor at his cost.

20.11 The top of the buried pipe shall be as per drawing.

20.12 Also refer the Wrapping and Coating Schedule and painting schedule enclosed.

20.13 Protection of Internal Surface for buried pipe.

- Surface cleaning to be done as per the Approved Customer Specifications.
- Refer to the Painting schedule enclosed.

20.14 Protection of External Surface (Over ground Piping)

- Surface cleaning to be done as per the Approved Customer Specifications.
- Also refer the painting schedule enclosed.

The scope of the work will comprise of but not limited to the following:

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified)

21.0 PRESERVATION & PROTECTION OF COMPONENTS

21.1 At all stages of work, equipments/materials in the custody of Contractor, including those erected, will have to be preserved as per the instructions of BHEL. Necessary preservation agents including the primer & paint, for the above work shall be provided by the Contractor.

21.2 The Contractor shall make suitable security arrangements including employment of security personnel and ensure protection of all materials/ equipment in their custody and installed equipments from theft/fire/pilferage and any other damages and losses.

21.3 The entire surplus, damaged, unused materials, packaging materials / containers, special transporting frames, gunny bags, etc shall be returned to BHEL stores by the Contractor.

21.4 The Contractor shall not waste any materials issued to agency. In case it is observed at any stage that the wastage/excess utilisation of materials is not within the permissible limits, recovery for the excess quantity used or wasted will be affected with departmental charges from the Contractor. Decision of BHEL on this will be final and binding on the Contractor.

21.5 For any class of work for which no specifications have been laid down in these specifications, work shall be executed as per the instructions of BHEL.

22.0 SPECIAL FEATURE

22.1 Primer & Paints including thinner as per painting specification shall be arranged by contractor within the quoted price.

22.2 The contractor shall also weld all thermo wells, small length of pipes to all pressure, flow and level tapping points, isolating valves and root valves on all equipment under scope of erection of this contract.

22.3 The services of an independent testing laboratory shall be retained by the Contractor to perform welder qualification tests for welders. All the welders carrying out welding at site shall carry an identification badge, which shall indicate the category and the grade of welding for which they have been tested and authorised to carry out welding

22.4 **Records:** Welder's performance shall be monitored regularly and record of their performance shall be maintained by contractor in a manner acceptable to the employer. Contractor shall maintain such records including record of procedure qualification & welder qualification and hand-over to the BHEL/DVC at the end of work.

22.5 **MARKING:** On completion of each welded joint, the welder shall mark his regularly assigned identification mark near the joint. The welder's identification numbers, inspection stamps or code symbol stamps and any other information shall not be directly stamped on any alloy steel piping. In alloy steel piping, all such information shall be stamped on separate marking plate which shall be tack welded on pipe near the weld.

22.6 **Welding Equipment** - Contractor to ensure the availability of sufficient nos of welding equipment during each phase of project construction so as not to impede the progress of the project

22.7 Sub-contracting of NDT & PWHT / SR Agencies- NDT & PWHT / SR contract shall be awarded by the contractor strictly to BHEL/Customer approved NDT & PWHT / SR agencies only.

22.8 The contractor has to provide his crane (as per site requirement) and manpower, free of cost, for Assembly of BHEL cranes.

23.0 Specific Exclusion:

The following works are specific exclusions from the scope of work under erection, testing & commissioning of tender specification-

i. All electrical and control & instrumentation items except those specified elsewhere in these specifications.

ii. Erection and commissioning of the below mentioned equipment's/system under FGD system excluded from the scope of work under this contract. Erection and commissioning shall be done by the BHEL MU vendor /system supplier/OEM of the system.
   a. Absorber Elevator
   b. Rubber lining of tanks and absorber
   c. Glass flake lining of ducts (absorber outlet to wet stack chimney portion)

   However, contractor scope limited to extend the necessary assistance along with T&Ps, scaffolding to the vendor during the erection and commissioning of the above system

iii. E&C work of cable trays, cables and earthing etc

iv. Control panels, EPMS, MCC etc.

v. Electrical & C&I items of handling system.

vi. Civil works except to the extent specifically indicated elsewhere in this tender.

vii. Pneumatic copper tubing and fittings thereof.

viii. Testing and commissioning of heating elements, thermostats, HV rectifier transformers.

ix. Electrical and C&I items of Variable Frequency Drives as provided elsewhere in these specifications.

x. Hume pipes for pipe crossing

Package Description: Erection, Testing, Commissioning, Completion of facilities, PG Test & Handing Over including Handling of materials at BHEL / Client's Stores / Storage Yard and transportation to site, preparation of foundation, NDT, fixing of hangers & supports, application of lining, Insulation, Supply & Painting, Stenciling & Labelling of: -

- **Package-A:** Mechanical works of FGD & Auxiliaries including FDPS of U#2 & U#3 at NTPC Barh Stage-I (3x660 MW) and**,**
- **Package-B:** Balance Mechanical Works of FGD & Auxiliaries including common systems and FDPS of U#4 & U#5 at NTPC Barh Stage-II (2x660 MW)

Section-I

S. No.	Description of Items	UOM	PKG-A	PKG-B	Total Pkg-A+B	Weightage for Unit Rate
1.1	**Structure, Duct and dampers etc as per tender specifications**	MT	**10801.69**	**7704.70**	**18,056.39**	0.7120756807
1.1a	**Procurement of raw materials & fabrication of auxiliary support, small beam, inserts, shear keys etc. (as per requirement.)**	MT	**100.00**	**100.00**	**200.00**	0.0216626942
	<u>STRUCTURAL WORKS: Structural steel works including all labour, material (unless otherwise specified in BOQ/contract specification), equipments unless otherwise specified, transportation, handling etc. at all level as per specification, drawings and as directed by engineer - in - charge for the following:</u> **Supply, fabrication (Non Galvanised fabricated Structures as per specification), transportation, from work shop to site etc. of structural steel with mild steel (E250) rolled section / built up section / combination of both will be welded type and field connections will generally be bolted type (unless otherwise specified) conforming to**					

S. No.	Description of Items	UOM	PKG-A	PKG-B	Total Pkg-A+B	Weightage for Unit Rate
	IS:2062 and technical specification, pipes conforming to IS:1161/ IS:1239, chequered plate conforming to IS: 3052, mild steel rounds, monorails, stays, safety chains, ladders, MS grating etc. in columns, beams, gantry girders, bunkers, silos, hoppers, roof trusses, portals, laced purlins, space frames, hangers, struts, monorails, galleries, stiffeners, wall beams, sheeting runners, brackets, stub columns, bracings, cleats, trestles, base plates, splice plates, chequered plate flooring, decking and seal plates, steel frame grid over false ceiling, walkway platforms, ladders, stairs, stringers, treads, landings, hand-rails etc as applicable, including blast cleaning, application of primer, intermediate & finish paint as mentioned below and as given in specification, fabrication, straightening, cutting, bending, rolling, grinding, machining, drilling, welding, electrodes and other consumables, alignment (weight of welds not payable), assembly, edge preparation, preheating (min preheat and interpass temperature of 20^{o} C for welding over 20 mm and upto 40 mm & 66o C for welding over 40 mm and upto 63 mm & 110^{o} C for thickness over 63 mm & use of low hydrogen / radiogenic electrodes), post heating, testing of welders, inspection of welds, visual inspection, non destructive and special testing, rectification and correction of defective welding works, production test plate, inspection and testing, erection scheme, protection against damage in transit, stability of					

S. No.	Description of Items	UOM	PKG-A	PKG-B	Total Pkg-A+B	Weightage for Unit Rate
	structures, installation of temporary structures, setting column bases, rectification, dismantling and removal of all temporary structures (weight of temporary structures not payable), etc all complete as per technical specification. **- Providing bolt, nuts, washers, fasteners as per 8.8 grade (weight of erection bolts, nuts, washers, fasteners and welds not payable)** **- Blast cleaning for making surface conforming to Sa 2 ½ finish of ISO 8501-1 with surface profile 40-60 Micron and providing with two component moisture curing zinc (ethyl) silicate primer coat (having minimum 80% of metallic Zinc content in dry film, solid by volume minimum 60% ±2%) of minimum 70 micron DFT, including other associate works etc all complete. The primer coat shall be applied in shop immediately after blast cleaning by airless spray technique. Zinc dust composition and properties shall be Type-II as per ASTM D520-00.** **-Providing and applying Intermediate coat of two component polyamide cured epoxy with MIO Content (containing lamellar MIO minimum 30% on pigment, solid by volume minimum 80% ±2%) of minimum 100 micron DFT. This coat shall be applied in shop after an interval of minimum 24 hours (from the application of primer coat) by airless spray technique including protection and cleaning, scoffolding etc. all complete as per**					

S. No.	Description of Items	UOM	PKG-A	PKG-B	Total Pkg-A+B	Weightage for Unit Rate
	specification. **-Providing and applying Finish Coat of two pack aliphatic Isocyanate cured acrylic finish paint (solid by volume minimum 55% ±2%) with Gloss retention (SSPC Paint Spec No 36, ASTM D 4587, D 2244, D 523) of Level 2 (after minimum 1000 hours exposure, Gloss loss less than 30 and colour change less than 2.0 ΔE) and minimum 70 micron DFT including protection and cleaning, scaff-holding, touchup painting etc. all complete as per specification. This coat shall be applied at shop after an interval of minimum 10 hours and within six (6) months (from the completion of Intermediate coat), Colour and shade of the coat shall be as approved by the BHEL / NTPC.** **All Materials shall be procured from the CUSTOMER approved sources only**					
1.1b	**Fabrication of Structures including Preparation of detailed drawing (based on input drawing provided by BHEL), review and approval of fabrication drgs, in consultation with BHEL through detailing agency & reviewing agency, approved by BHEL (Material shall be issued by BHEL free of cost).** **- Blast cleaning for making surface conforming to Sa 2 ½ finish of ISO 8501-1 with surface profile 40-60 Micron and providing with two component moisture curing zinc (ethyl) silicate primer coat (having minimum 80% of metallic Zinc content in dry film, solid by volume minimum 60% ±2%) of minimum 70 micron DFT, including other associate works etc all complete.**	MT	**100.00**	**250.00**	**350.00**	0.0115860697

S. No.	Description of Items	UOM	PKG-A	PKG-B	Total Pkg-A+B	Weightage for Unit Rate
	The primer coat shall be applied in shop immediately after blast cleaning by airless spray technique. Zinc dust composition and properties shall be Type-II as per ASTM D520-00. -Providing and applying Intermediate coat of two component polyamide cured epoxy with MIO Content (containing lamellar MIO minimum 30% on pigment, solid by volume minimum 80% ±2%) of minimum 100 micron DFT. This coat shall be applied in shop after an interval of minimum 24 hours (from the application of primer coat) by airless spray technique including protection and cleaning, scoffolding etc. all complete as per specification. -Providing and applying Finish Coat of two pack aliphatic Isocyanate cured acrylic finish paint (solid by volume minimum 55% ±2%) with Gloss retention (SSPC Paint Spec No 36, ASTM D 4587, D 2244, D 523) of Level 2 (after minimum 1000 hours exposure, Gloss loss less than 30 and colour change less than 2.0 ΔE) and minimum 70 micron DFT including protection and cleaning, scaff-holding, touchup painting etc. all complete as per specification. This coat shall be applied at shop after an interval of minimum 10 hours and within six (6) months (from the completion of Intermediate coat), Colour and shade of the coat shall be as approved by the BHEL / NTPC.					
1.2	**Tanks under FGD system etc as per tender specifications**	MT	**47.14**	**45.73**	**92.87**	0.0037324067
1.3	**Rotating Machines etc as per tender specifications**	MT	**743.46**	**740.73**	**1484.19**	0.0376825366

S. No.	Description of Items	UOM	PKG-A	PKG-B	Total Pkg-A+B	Weightage for Unit Rate
1.4	**Insulation and sheeting, etc. for FGD system as per specifications.**					
1.4.1	INSULATION- MINERAL WOOL	MT	**228.53**	**733.08**	**961.61**	0.0351408597
1.4.2	INSULATION- FIXING COMPONENTS	MT	**136.66**	**264.10**	**400.76**	0.0168280134
1.4.3	INSULATION- SHEETING	MT	**22.55**	**169.02**	**191.56**	0.0091603709
1.5	**Piping systems (including valves, flanges, fittings , H&S etc.) as per tender specifications**					
1.5.1	SS Piping	MT	**50.00**	**55.68**	**105.68**	0.0147231177
1.5.2	Carbon steel piping including fire protection piping	MT	**988.68**	**829.05**	**1817.73**	0.1244869156
1.5.3	Carbon steel Buried piping including Supply and Application of Wrapping and Coating	MT	**50.00**	**47.00**	**97.00**	0.0065727439
1.6	**Erection of Misc. Equpt./Str steel/ etc.**	MT	**69.92**	**70.43**	**140.35**	0.0054002474
1.7	**Providing PG test assistance for Unit#2, Unit#3, U#4 & U#5**	LS	**2.00**	**2.00**	**4.00**	0.0009483433
	Total Section-I (MT)		**13,338.62**	**11,009.52**	**24,348.14**	**1**

Section-II: Package-A

S.No.	Deployment of Requisite Manpower as mentioned below at site, within 15 days, as and when intimated by BHEL. This deployment shall be over and above the requirement as per Contractual clause. The deployed manpower shall report to BHEL and may be deployed at any location. BHEL shall make payment on pro rata monthly basis on actual deployment (considering 26 working days in a month). In case the contractor does not deploy or delays deployment of above said manpower with reference to specific instructions from BHEL, BHEL will levy penalty of Rs. 100 per service day, for such delay	UOM	PKG-A	UNIT RATE (Rs.)	Amount
1.0	Computer operator (Skilled)	**Manmonth**	15	**27,861.60**	**4,17,924**
	Execution/Mobilisation of special resources (PVC/ORC Shall Not be applicable on Section-II)				

Section-II: Package-B

S.No.	Deployment of Requisite Manpower as mentioned below at site, within 15 days, as and when intimated by BHEL. This deployment shall be over and above the requirement as per Contractual clause. The deployed manpower shall report to BHEL and may be deployed at any location. BHEL shall make payment on pro rata monthly basis on actual deployment (considering 26 working days in a month). In case the contractor does not deploy or delays deployment of above said manpower with reference to specific instructions from BHEL, BHEL will levy penalty of Rs. 100 per service day, for such delay	UOM	PKG-B	UNIT RATE (Rs.)	Amount
1.0	Computer operator (Skilled)	**Manmonth**	15	**27,861.60**	**4,17,924**
	Execution/Mobilisation of special resources (PVC/ORC Shall Not be applicable on Section-II)				

Note: The quantity indicated in the BOQ is approximate only and is liable for variation. Payment will be as per actual quantity executed as certified by BHEL Engineer above Unit rate of individual items of BOQ.

THIS TENDER SPECIFICATION CONSISTS OF FOLLWING ANNEXURE:

S.N.	DESCRIPTION
Annexure-1	T&P Hire Charges
Annexure-2	Guidelines for NDE and Heat Treatment Agency
Annexure-3	Labour Colony Shed drawing
Annexure-4	GA Drawings
Annexure-5	Technical Specification – NTPC
Annexure-6	Customer Quality Document
Annexure-7	Approved Vendor List
Annexure-8	Bolt tightening procedure
Annexure-9	Fit bolt concept document
Annexure-10	Minimum wages at NTPC Barh
Annexure-11	Standard Guidelines for Labour Colony or Worker Accommodation
Annexure-12	Painting Schedule
Annexure-13	HSE Guidelines

NOTE- ALL THE ABOVE-MENTIONED ANNEXURE ARE UPLOADED ON E-PROCUREMENT PORTAL.