BALANCE-FGD MECHANICAL MAUDA

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Volume – IA

Balance work of Handling of materials at BHEL / Client's Stores / Storage Yard and transportation to site Erection, Testing, Assistance for commissioning & Trial Operation including supply & application of final painting and Handing Over of Flue Gas Desulphurization System (FGD) Erection and Commissioning of Unit 1, Unit 2 & Common Systems AT "2X500 MW NTPC Mauda, Stage- I, Maharashtra.

BHARAT HEAVY ELECTRICALS LIMITED

TECHNICAL CONDITIONS OF CONTRACT (TCC)
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1.0	**PROJECT INFORMATION**	
1.1.	INTRODUCTION AND CLIMATIC CONDITION	
Sl. No.	**Description**	**Details**
1.	**Project Title**	2X500 MW NTPC Mauda
2.	**Customer**	M/s National Thermal Power Corporation Limited. (NTPC)
3.	**Location**	Village-Mauda, Dist- Nagpur State–Maharashtra, India.
4.	**Nearest Airport**	2X500 MW NTPC Mouda. Village – Mouda Taluka – Mouda Dist.- Nagpur Maharashtra State, India"
5.	**Access By Road/Major Cities**	1. Nearest Port : Mumbai 2. Nearest Air Port : Nagpur/ 50 KM from Mauda town 3. Approach Road : Mauda site is connected to Mauda town by 04 KM long all weather roads. Mauda town is 40 KM from Nagpur on NH-6. 4. Railway Approach : Nearest Railway Station Chacher 8 Kms away from site on Nagpur-Kolkata Broad Gauge section of South Eastern Railway (main line).
6.	**Temperature**	a) Maximum : 50 degree centigrade b) Minimum : 6 degree centigrade
7.	**Seismic Zone**	As per IS: 1893.
8.	**Wind Speed**	44 m/s at ten meters above the ground level as per IS 875 (Part-3).

1.2.	**INSTRUCTIONS TO BIDDERS**

1.2.1.	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.	
1.2.2.	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.	
1.2.3.	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.	
1.2.4.	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.	
1.2.5.	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.	
1.2.6.	Name:	Mr. Madhur Nirmal Jain
	Designation:	Sr Manager
	Email:	madhur@bhel.in
	Ph no:	8238421969
	Name:	Mr. Anurag Singh
	Designation:	Senior Engineer
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2.0	**Scope of Works:**
2.1.	**The scope of work shall comprise but not limited to the following: (All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)** The work to be carried out under the scope of these specifications is broadly as under: Balance work of Handling of materials at BHEL / Client's Stores / Storage Yard and transportation to site Erection, Testing, Assistance for commissioning & Trial Operation including supply & application of final painting and Handing Over of Flue Gas Desulphurization System (FGD) Erection and Commissioning of Unit 1, Unit 2 & Common Systems AT "2X500 MW NTPC Mauda, Stage- I, Maharashtra. **Scope of work broadly consists of but not limited to following:**
2.1.1.	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, cleaning chipping and leveling of foundations, providing packers and shims/pre-assembling of equipment at the preassembly yard, inspection, minor rectification, preservation, erection, leveling, and other adjustments, cutting, edge / surface preparation, welding, grinding, radiography, LPI/ MPI/ UT testing wherever needed, heat treatment, carrying out air tightness test by soap solution / kerosene, hydraulic test, including supply and application of final painting.
2.1.2.	The quantities indicated in the tender specification are approximate and are liable for variation and alteration at the discretion of BHEL. The quoted unit rate shall be applicable for any additional product group also, if included at a later date integral to the main scope of work / package envisaged. 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.
2.1.3.	The PG wise breakup of Structures, Ducts, Absorber, etc. are indicated in the relevant chapters 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 on finally settled rates. The weights and dimensions of material shown are approximate and are liable to vary. No increase in quoted / accepted rates / prices shall be allowed due to change in weights and dimensions of the equipment / materials.
2.1.4.	The weights given in the relevant Chapter are approximate and these are subject to change as per site conditions.
2.1.5.	During the course of execution of work, certain rework / modification / rectification / repairs / fabrication etc will be necessary on account of feedback from various relevant sources, and also on account of design discrepancies/ alterations, manufacturing defects, site operations/ maintenance requirements. Contractors shall carry out such rework / modification / rectification / fabrication / repairs etc promptly and expeditiously. Daily log sheets indicating the details of work carried out, man-hours etc shall be maintained by the contractor and got signed by BHEL engineer every day. Claims from the contractor,

	if any, for such works will be dealt as per conditions of contract and payments will be released as per provision of contract.
2.1.6.	Supervisors / Engineers, consumables etc., required for the scope of work shall be provided by the contractor. All the expenditure including taxes and incidentals in this connection will have to be borne by him unless otherwise specified in the relevant clause. The contractor's quoted rates should be inclusive of all such contingencies.
2.1.7.	It shall be specially noted that the contractor's labour and staff may have to work round the clock to meet the completion schedules / plans, which may involve payment of considerable overtime. The contractor's quoted rates should be inclusive of all such contingencies.
2.1.8.	The terminal points can be inferred from the relevant drawings and any further clarifications can be obtained / decided by BHEL 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 equipment falls 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 involves 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, with in the quoted rate.
2.1.9.	The work shall conform to dimensions and tolerances given in various drawings and quality manuals provided by BHEL. If any portion of work is found to be defective in workmanship not conforming to drawings or other stipulations, the contractor shall dismantle and redo the work duly replacing the defective materials at his cost, failing which the job will be carried out by BHEL by engaging other agencies / departmentally and recoveries will be affected from contractor's bill towards expenditure incurred including BHEL's overhead charges.
2.1.10.	The work covered under this specification is of a highly sophisticated nature requiring the best quality of workmanship, engineering and construction management. The contractor should ensure the timely completion of the work. The contractor must have an adequate quantity of tools, construction aids, equipments, etc., in this possession. He must also have in his rolls adequately trained, qualified and experienced supervisory staff and skilled personnel.
2.1.11.	Contractor shall execute the work as per sequence and procedure prescribed by BHEL at site. The erection manuals for FGD system, 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.
2.1.12.	Contractor has to work in close co-ordination with other erection agencies 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 milestone events are achieved as per schedule/ plans. Contractor shall arrange & augment the resources accordingly.
2.1.13.	No member of the already erected structure/ platform, pipes, grills, platform, other component and auxiliaries should be cut without specific approval of BHEL engineer.

2.1.14.	The storage yard may be located within the plant boundary or ouside of the plant boundary. All materials have to be transported from the storage yard to construction area by the contractor at his own cost.
2.1.15.	FGD system trial run, resolving any deficiencies observed and handing over the FGD system to customer M/s NTPC.
2.1.16.	The customer NTPC and / or their consultant may depute their representative for checking and supervision of important stages of work. The contractor shall be required to provide all facilities for inspection of works, without any cost implications to the BHEL. Any defect in quality of work or deviations from drawings / specifications pointed out during such inspection shall be made good by the contractor in the same way as if pointed out by the BHEL Engineer, without any cost implication to BHEL.
2.1.17.	**Site Organization :** The contractor shall provide adequate staffing in the following areas in addition to the staffing requirements of execution as instructed/informed by BHEL: 1. Overall planning, monitoring & control. 2. Quality control and quality assurance. 3. Materials management. 4. Safety, fire & security. 5. Industrial relations and fulfillment of labour laws and other statutory obligations.
2.1.18.	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 organization 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.
2.1.19.	On award of contract, the contractor shall submit to BHEL site organization chart indicating the various levels of experts to be deployed on the job. 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 deviations in this regard will not generally be permitted.
2.1.20.	The contractor should also submit to BHEL for approval a list of construction equipment, erection tools, tackle etc prior to commencement of site activities. These tools & tackles shall not be removed from the site without written permission of BHEL.
2.1.21.	The organization chart for site should indicate the various levels of experts to be posted for supervision in the various fields in erection, commissioning etc as applicable. For proper supervision of the work, the contractor shall ensure providing one qualified supervisor against deployment of 15 workmen.
2.1.22.	Contractor shall submit within 15 days of LOI date, detailed program (L2 schedule) of construction / erection / commissioning along with matching resources T&P Deployment and manpower deployment schedule for approval to Site In-Charge/Project Manager-Nagpur. L2 schedule shall be the working level document demonstrating contractor's ability and methods of completing the work within the key milestones identified in the tender specification These programs would be amplified showing start of erection and subsequent activities and shall form the basis for site execution and detailed monitoring, The three monthly rolling program with the first month's program being tentative based on the site conditions would be prepared based on these program. The Contractor shall also be involved along with the Customer/BHEL to tie up detailed resource mobilization plan over the period of time of the contract matching with the performance targets.

2.1.23.	The program would be jointly finalized by the site in-charge of the contractor with BHEL/Customer's project coordinator as well as the site planning representative. The erection program will also identify the sequential erectable tonnages.
2.1.24.	Contractor shall submit daily work program based on above schedule. Deferment of the above schedule is not acceptable. Contractor will adhere to schedule & augment resources to ensure completion as per schedule.
2.1.25.	**Fire Protection system:** Necessary civil works for the fire protection system includes (trenches/ pedestals/ foundations /sheds/sand filling) excluded from the scope of this contract and shall be done by the civil agency of the BHEL. The fire detection package and associated C&I/cabling work is excluded from scope of this contract and shall be done by another agency. However, the wrapping and protective coating of the buried piping shall be in the scope of contractor including supply of wrapping and protective coating. Further, above ground piping painting shall be in the scope of contractor including supply of painting material. The complete Fire Detection and Protection Systems shall be as per the guidelines/ codes/standards / rules of TAC/ NFPA / IS: 3034 / OISD etc. and all the systems, equipment's and installation shall be got approved from TAC accredited professional(s)-India. Customer M/s NTPC will make arrangement of TAC approved agency for accreditation of work. The contractor has to facilitate TAC for getting approval. However, the contractor is responsible for availing the TAC approval for Fire protection system in total (for fire detection another agency of BHEL will be responsible). The contractor is also responsible for getting any necessary approval from the regulatory and statutory body of TAC if any is needed. Obtaining all reports from concerned statutory departments is the responsibility of the contractor. All these activities should be carried out within the quoted rates.
2.2.	**Brief Description of the FGD System:**
2.2.1.	**Flue Gas Section:** 1. **Ducts:** Ducting of FGD system will be provided as mentioned below: ▪ The duct from FGD Tapping point duct (ID Fan Common discharge duct to Chimney) up to Booster fan inlet. ▪ The duct from Booster fan outlet to Absorber inlet ▪ The duct from Absorber outlet to New ▪ Thermal insulation of lightly Resin Bonded rock wool for duct work along with Aluminium Cladding materials. 2. **Gates and Dampers:** The following Guillotine Gate and dampers along with applicable actuators as mentioned below will be provided. The sizes of Dampers have been considered based on flue gas volume flow:

Sl no	Location	Type	Actuator
1	FGD Inlet	Guillotine Gate	Electrical
2	Booster Fan outlet	Guillotine Gate	Electrical
3	FGD Bypass Damper	Biplane Damper	Pneumatic
4	FGD Outlet	Guillotine Gate	Electrical

3. **Booster Fan: The** total gas pressure loss in the FGD plant is compensated by two (2) numbers of Booster Fans. FGD Booster Fan shall be of double suction simply supported radial fan.

4. Absorber Internal and Auxiliary equipment:

- One number of Absorber systems complete with internals Spray Pipes, Spray Nozzles, Jet Air Sparger (JAS), Agitator will be provided.
- 2 stages Mist eliminator will be provided with suitable washing arrangement for periodic cleaning of mist eliminator to avoid clogging.
- Absorber Recirculation Pumps for each absorber will be provided to spray the slurry inside the absorber to achieve required SO2 removal efficiency.
- Agitators for thorough mixing of recirculation slurry
- These Mechanical Agitators are used during the FGD Bypass condition to keep the Gypsum slurry in suspension.
- Oxidation Air Blowers for each absorber will be provided for oxidation of Calcium sulphite to Calcium sulphate.
- Oxidation air nozzles/Jet air Spargers (JAS) nozzles will be provided inside the absorber to mix/agitate the gypsum slurry with the excess oxygen supplied from oxidation blowers to form gypsum.
- One number of Passengers cum Goods Elevator shall be provided with adequate landings for absorber.

5. Emergency Quenching System:

- The Emergency Quenching system is designed to protect the FGD and all other sensitive downstream equipment against high flue gas temperatures arising from situations like electrical blackout, failure of absorber recirculation pumps etc.
- The emergency Quenching system is designed by considering maximum excursion temperature as 300 Deg Centigrade for 10 minutes.
- Emergency quenching spray nozzles are located just above wet dry washing system for automatic spray of quenching water at the inlet to the absorber in case the gas temperature exceeds the design temperature due to failure of upstream equipment.
- For emergency quenching, the water will be supplied from an elevated tank (Emergency quench tank) installed on top of the absorber.

6. Absorber Area Sump & Pumps:

- The absorber area sump will be provided near each absorber.
- It is provided to collect drain discharged during shut-off operation of absorber recirculation pumps, dumping operation of the gypsum slurry in the absorber and recirculation pipe.

- This sump is used as relay sump to transfer slurry in the absorber system and to the emergency storage tank.
- Vertical slurry pumps will be provided for each absorber sump. Pumps will also be used for evacuating the absorber tank.

7. Limestone Handling Plant: Limestone would be received by trucks and pile would be formed. The limestone would then be dozed into the proposed limestone reclaim hoppers with grizzly. The limestone dozed into the hoppers shall be conveyed to the crusher house through belt conveyor, Vibro feeders, associated equipment like rack & pinion.
Tramp iron shall be separated by inline magnetic separator. The tramp iron picked up by the inline magnetic separator shall be discharged outside the crusher house where the inline magnetic separator is located through tramp iron chute.

Similarly, ferrous and non-ferrous metals shall be detected by metal detector. The metal detector shall identify the ferrous and non-ferrous metals and trip the respective conveyor on which it is located. Inline conveyor scale shall be provided on conveyor to continuously measure the rate of conveying on this conveyor.

In crusher house limestone will be fed to respective hammer mill crusher where it will be crushed. Crushed limestone then shall be fed to the respective bucket elevator through belt feeder. From respective bucket elevators limestone shall be fed to the respective belt feeders located in limestone silo building and from there limestone shall be fed to reversible belt weigh feeders in limestone silo building.

8. Ball Mill System:

- Limestone is stored and crushed in Limestone handling area. Crushed Limestone is conveyed till the inlet of Limestone storage silo hoppers.
- Numbers/ capacity of storage silo are decided for storage of crushed limestone for 24 hours requirement.
- The Limestone storage silo is made up of carbon steel and the hopper cones will be provided with SS lining
- Bunker outlet chute with motorized shut off gate will be provided for feeding limestone to the feeder
- Gravimetric feeders will be provided under each hopper.
- Wet Ball Mill System along with complete accessories will be provided for grinding of Limestone.

9. Limestone Slurry Storage System:

- Limestone Slurry tank designed for a storage capacity of 12 hours continuous limestone requirement
- The Slurry Tank will be provided with center mounted Agitator

- The Slurry Tank will be provided with Limestone slurry pumps

10. Gypsum Dewatering System:

- Gypsum dewatering system consisting primary stage of sets of hydro-cyclones and secondary stage of vacuum belt filters for dewatering of Gypsum.
- Gypsum bleed pumps from all absorbers, discharge the slurry to Primary hydro cyclone feed tank. Primary hydro cyclone feed pumps will be provided for each primary hydro cyclone feed tank to discharge the slurry to Primary hydro cyclone in Gypsum dewatering building.
- The underflow of Primary hydro cyclone is sent to vacuum belt filter.
- The overflow of primary hydro cyclones will be fed to Secondary Hydro cyclone feed tank.
- For maintenance of secondary hydrocyclone, a bypass line will be provided to divert the flow from primary hydrocyclone over flow to filtrate water tank.
- There will be vacuum Belt Filters for Gypsum dewatering.
- Secondary Hydro cyclone pumps will feed the slurry from Secondary hydro cyclone feed tank to secondary hydro cyclones. The underflow is fed to the filtrate water tank. The overflow is fed to the waste water tank.
- Neutralization tank is provided to control pH of waste water slurry
- The Gypsum cake from the belt filter will be discharged to Gypsum storage shed

11. Process Water System:

- Process water tanks will be provided as common to cater FGD process water requirement of all units.
- Each Process water tank is sized to supply the complete water requirement of FGD system of all units including common systems.
- Each tank will be provided with pumps and all pump will be connected to single header, from common header branches of designed size will be provided to all the required areas of FGD system.

Process water is used for the following purposes:

a. **Absorber Make-Up Water**: The process water is used for absorber make-up water to control the Absorber Tank level.
b. **Wet/Dry Interface Washing**: The inside walls of the Absorber (wet/dry interface zone) has interface washing pipes mounted at the Absorber inlet. These interface washing pipes periodically shower water against the Absorber walls to clean off any buildup of soot or other residues from the flue gas.

c. **Washing of Mist Eliminator**: The Mist eliminator is washed intermittently by water fed from the processor water Tank. Inside of the process water Tank is pressurized to supply washing water to the Mist Eliminator.
d. **JAS washing:** JAS nozzles will be washed continuously to avoid scaling/clogging of JAS nozzles.
e. **Emergency Quenching Water**: Emergency Quenching Water is supplied from the Overhead Emergency Quench Tank.
f. **Cake & Belt Filter Washing**: Gypsum Cake and Cloth wash of Gypsum belt filter is washed. The water in the Belt filter washing tank is used for both cake and cloth washing.
g. **Feed water to limestone grinding area**: Feed water to the limestone grinding area will be used to supply the water to mill for grind the limestone and also to mill circuit tank to maintain 30% limestone slurry concentration.

12. Air System (Instrument and Service Air System): Instrument air is used for instrumentation or to control equipment for the Absorber Section, the Gypsum Dewatering Section, and the Limestone Preparation Section.

13. Absorber Sump & Pumps: The absorber area sump will be provided near each absorber. It is provided to collect drain discharged during shut-off operation of absorber recirculation pumps, dumping operation of the gypsum slurry in the absorber and recirculation pipe. This sump is used as relay sump to transfer slurry in the absorber system and to the emergency storage tank. Slurry pumps will be provided for each absorber sump. These pumps will also be used for evacuating the absorber tank.

14. Auxiliary Absorbent Tank & Pump: Auxiliary absorbent tank will be provided to stock the gypsum slurry stored in the absorber tank. The tank has the capacity to hold slurry of Absorber. Absorbent Tank will be provided with slurry Pumps to feed the gypsum slurry back to absorber tank.

15. Other Sump System: Gypsum Area Drain Sump with pumps will be provided in gypsum dewatering building. It is used for collecting drain from the dewatering area. Limestone Area Drain Sump with pumps is used for collecting drain from the Ball Mill System.

16. Fire Protection system (Common):

a. **Hydrant System:** Hydrant system consists of (pipe, hydrant valves, landing valves, water monitors, hoses, branch pipes and nozzles etc)
b. HVW & MVW Spray System (High Velocity and Medium Velocity): It shall consists of water mains network, deluge valves, isolation valves, Y type strainers, spray nozzles/ projectors, spray nozzles piping network.

17. **Diesel Generator Set:** For emergency power supply DG sets (2 no) with integral piping, exhaust support structure, exhaust piping, tank, enclosure etc.

	18. **Pump House for LHP & GHP Stage-I & II**: It shall consist of pumps for LHS & GHP, piping, valve etc .

3.0	FACILITIES IN THE SCOPE OF CONTRACTOR/BHEL (SCOPE MATRIX)			
Sl. No	Description Part I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
3.1	**Establishment**			
3.1.1	**For construction purpose:**			
a	Open space for office (as per availability)	Yes		Location will be finalized after joint survey with owner
b	Open space for storage (as per availability)	Yes		Location will be finalized after joint survey with owner **Note:** There can be more than one location of open storage yard, Closed shed/ Semi Closed shed. Bidder shall make his establishment accordingly
c	Construction of bidder's office, canteen and storage building including supply of materials and other services		Yes	
d	Bidder's all office equipments, office / store / canteen consumables		Yes	
e	Canteen facilities for the bidder's staff, supervisors and engineers etc		Yes	
f	Fire fighting equipments like buckets, extinguishers etc		Yes	
g	Fencing of storage area, office, canteen etc of the bidder		Yes	
3.1.2	**For living purposes of the Bidder**			
a	Open space for labour colony (as per availability)		**Yes**	Agency has to make his own arrangement at his own cost.

3.0	FACILITIES IN THE SCOPE OF CONTRACTOR/BHEL (SCOPE MATRIX)			
Sl. No	Description Part I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
b	Labour Colony with internal roads, sanitation, complying with statutory requirements		Yes	
3.2	**Electricity**			
3.2.1	Electricity for construction purposes only of Voltage 415/440 V, 3 phase, 50Hz	Yes		Chargeable. The charges for the actual energy consumed by the Contractor shall be Recovered by BHEL based on the prevalent rate of DISCOM.
a	Single point source	Yes		At a distance of 500 M from site (Distance is only tentative, it may vary upto an extent depending on site condition)
b	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
c	Duties and deposits including statutory clearances if applicable		Yes	
3.2.2	Electricity for the office, stores, canteen etc of the bidder	**Yes**		**Chargeable**
a	Single point source	Yes		At a distance of 500 M from site (Distance is only tentative, it may vary upto an extent depending on site condition)
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 etc		**Yes**	Agency has to make his own arrangement at his own cost.
a	Single point source		Yes	

3.0	**FACILITIES IN THE SCOPE OF CONTRACTOR/BHEL (SCOPE MATRIX)**			
Sl. No	**Description** **Part I**	**Scope / to be taken care by**		**Remarks**
		BHEL	**Bidder**	
b	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
c	Duties and deposits including statutory clearances if applicable		Yes	
3.3	**Water Supply**			
3.3.1	For construction purposes:			
a	Making the water available at single point		**Yes**	Contractor shall make all arrangements himself for supply of construction water as well as potable water for labour and other personnel at the work site/ colony. However, drawl of construction/potable water from bore-well shall be permitted if found suitable. Any statutory clearance required shall be obtained by the contractor.
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.			
a	Making the water available at single point		Yes	Contractor shall make all arrangements himself for supply of construction water as well as potable water for labour and other personnel at the work site/ colony. However, drawl of construction/potable water from bore-well shall be permitted if found suitable. Any statutory clearance required shall be obtained by the contractor.
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	

3.0	**FACILITIES IN THE SCOPE OF CONTRACTOR/BHEL (SCOPE MATRIX)**			
Sl. No	**Description** **Part I**	**Scope / to be taken care by**		**Remarks**
		BHEL	**Bidder**	
3.3.3	Water supply for Living Purpose			
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	
3.4	**Lighting**			
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		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		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**			
a	Telephone, fax, internet, intranet, e-mail etc.		Yes	
3.6	**Compressed Air** wherever required for the work		**Yes**	
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	

3.0	FACILITIES IN THE SCOPE OF CONTRACTOR/BHEL (SCOPE MATRIX)			
Sl. No	Description Part I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
3.7	Demobilization of all the above facilities		Yes	
3.8	Transportation			
a	For site personnel of the bidder		Yes	
b	For bidder's equipments and consumables (T&P, Consumables etc)		Yes	

Sl. No	Description Part II 3.9 Erection Facilities	Scope / to be taken care by		Remarks
		BHEL	Bidder	
3.9.1	Engineering works for construction:	Yes		
a	Providing the erection drawings for all the equipments covered under this scope	Yes		
b	Drawings for construction methods	Yes	Yes	In consultation with BHEL
c	As-built drawings – where ever deviations observed and executed and also based on the decisions taken at site- example – routing of small bore pipes		Yes	In consultation with BHEL
d	Shipping lists etc for reference and planning the activities	Yes		
e	Preparation of site erection schedules and other input requirements		Yes	In consultation with BHEL
f	Review of performance and revision of site 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

Sl. No	Description Part II 3.9 Erection Facilities	Scope / to be taken care by		Remarks
		BHEL	Bidder	
i	**Periodic visit of the senior official of the bidder to site to review the progress so that works are 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	
j	Preparation of preassembly bay/bed		Yes	
k	Arranging the materials required for preassembly		Yes	
3.10.	**Electricity:**			
3.10.1.	The construction power (415V) will be provided at a single point for construction purpose only at chargeable basis and the further distribution is to be arranged by the bidder at his cost. Construction power shall be provided from the nearest Substation / tapping point.			
3.10.2.	Any duty, deposit involved in getting the Electricity shall be borne by the bidder. As regards to contractor's office shed also, all such expenditure shall be borne by the contractor.			
3.10.3.	Provision of distribution of electrical power from the given single central common point to the required places with proper distribution boards, approved cables and cable laying including supply of all materials like cables, switch boards, pipes etc., observing the safety rules laid down by electrical authority of the State / BHEL / their customer with appropriate statutory requirements shall be the responsibility of the tenderer / contractor.			
3.10.4.	BHEL is not responsible for any loss or damage to the contractor's equipment as a result of variations in voltage / frequency or interruptions in power supply.			
3.10.5.	Necessary "Capacitor Banks" to improve the Power factor to a minimum of 0.8 shall be provided by the contractor at his cost. Penalty if any levied by customer on this account will be recovered from contractor's bills			
3.11.	**Construction Water** Water shall not be provided by BHEL and bidder has to make their own arrangement.			
3.12.	Drinking Water: **Bidder shall provide drinking water at the work spot at their cost.**			
3.13.	**Consumables:**			
3.13.1.	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.			

3.13.2.	All the required electrodes (in his 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, 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.
3.13.3.	BHEL will only provide only special type of electrode/ filler wire which is required for Absorber cladding strip welding and ducting (from absorber to chimney). This special type of electrode/ filler wire will be supplied by BHEL manufacturing units. All other electrodes/ filler wire including stainless steel electrodes/ filler wire required for site welding shall be arranged by the contractor at his cost. The bidder shall use the Customer approved quality welding electrodes/ filler wire only. The utilization of the welding wires/ electrode 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/ electrode is more than the actual requirement due to improper usage, the cost for the additional quantity so consumed shall be recovered from the contractor.
3.13.4.	The contractor shall provide within finally accepted price / rates, all consumables like welding electrodes (including alloy steel and stainless steel), all gases (inert, welding, and cutting), soldering material, dye penetrants, radiography films. Other erection consumables such as tapes, jointing compound, grease, mobile oil, M-seal, Araldite, petrol, CTC / other cleaning agents, grinding and cutting wheels are to be provided by the contractor. Steel, H&S, packers, shims, wooden planks, scaffolding and pre-assembly materials, hardware items etc. required for temporary works such as supports, scaffoldings, bed are to be arranged by him. Sealing compounds, gaskets, gland packing, wooden sleepers, for temporary work, required for completion of work except those which are specifically supplied by manufacturing unit are also to be arranged by him.
3.13.5.	All the shims, gaskets and packing, which go finally as part of equipment, shall be supplied by BHEL free of cost.
3.14.	**Material Supply:** BHEL will supply the materials / equipment indicated in the weight schedule from their respective manufacturing units which are to be executed / incorporated in the permanent system. In addition, the material such as lube oil, grease required for commissioning the erected equipments and chemicals required for chemical cleaning of equipments will be supplied free of cost by BHEL.
3.15.	**Lighting Facility:** 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.
3.16.	**Gases:**
3.16.1.	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.
3.16.2.	The contractor shall submit weekly / fortnightly / monthly statement report regarding consumption of all consumables for cost analysis purposes.

3.16.3.	The contractor shall ensure safe keeping of the inflammable cylinder at a separate place away from normal habit with proper security etc.
3.17.	**Electrodes Supply and Storage:**
3.17.1.	The bidder shall use the BHEL / Customer approved quality welding electrodes only.
3.17.2.	It shall be the responsibility of the contractor to obtain prior approval of BHEL, 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.
3.17.3.	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.
3.17.4.	Storage of electrodes shall be done in an air conditioned / controlled humidity room as per requirement, at his own cost by the contractor.
3.17.5.	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 and portable drying ovens shall be provided by contractor at his cost.
3.17.6.	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 first subsequent bills at market value plus departmental charges of BHEL communicated from time to time. Postponement of such recovery is not permitted.
3.17.7.	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.

4.0 **T&PS AND MMES TO BE DEPLOYED BY CONTRACTOR**

4.1. **Tools and Plants:**

List of Tool & Plants to be deployed by the contractor – The following minimum major Tools & Plants (T&P) shall be arranged by the Contractor within the quoted rate for execution of this contract:.

S.N.	Description Of Equipments	Capacity (Minimum)	Minimum Quantity	Remarks
1.	Tyre mounted / mobile crane (Telescopic boom, Hydraulically operated with turret function)	Above 75/80 MT and upto 120 MT	02 Nos	To be deployed as per instruction of BHEL Engineer.
2.	New generation Pick & carry type tyre mounted mobile crane. (Farana). **Hydra is not allowed.**	18/20/23 MT	03 Nos	To be deployed as per instruction of BHEL Engineer.
3.	Mixer for Grouting of equipment foundations			**As per requirement**
4.	Trailer with prime mover	20 MT	02 Nos	To be deployed as per instruction of BHEL Engineer.
5.	Trailer with prime mover	40 MT	As required	To be deployed as per instruction of BHEL Engineer.
6.	Tractor Trailer	15/20MT	As required	To be deployed as per instruction of BHEL Engineer.
7.	Truck	Adequate capacity	As required	To be deployed as per instruction of BHEL Engineer.
8.	Slings, 'D'-Shackles, Max Puller.	01 MT TO 10MT	As required	To be deployed as per

					instruction of BHEL Engineer.
	9.	Slings, 'D'-Shackles, Max Puller, Pulley Blocks, Hydraulic Jacks, Etc Above 10 Mt.	As required	As required	To be deployed as per instruction of BHEL Engineer, WITH TEST REPORTS
	10.	Spanner Sets Ring/D	Upto 56 MM	As required	To be deployed as per instruction of BHEL Engineer.
	11.	Tube expander	As required	1 No	**As per requirement**
	12.	Air compressor (electric/diesel operated)	210 CFM, 7 Kg/Cm2	02 nos.	
	13.	Submerged ARC Welding M/c		Adequat e nos.	
	14.	Oxy Acetelyne Gas cutting Machine		Adequat e nos.	
	15.	DC arc welding machine		As required.	
	16.	Electric operated Bolt tightening machines		As required	
	17.	3-phase distribution board with complete set up for drawl of construction power	As required	As required	
	18.	Power cable for drawl of construction power	As required	As required	
	19.	Radiography arrangement with radioactive isotope source	Iridium-192	As required	
	20.	Theodolite of required accuracy	To ensure verticality of structural columns.	As required	
	21.	Self-drilling cum tapping machine for screws of roof sheets	As required	As required	
	22.	Electro-hydraulic pipe bending machine	Up to 2" NB and 12 mm thick pipes	As required	

			Radiography film viewer	As required	As required	
			Hydraulic pipe bending machine (manual)	For bending of pipes up to 50 mm nb size	As required	
			Pipe chamfering machine /Tube Cutting	4-14"	As required	
			Pipe chamfering machine /Tube Cutting	14-20"	As required	
			Pipe cutting & beveling machines		Adequate nos.	
			Chain pulley blocks of various & Suitable capacities		As Required	As per the instructions of BHEL Engineer
			Baking oven with thermostat and temperature gauge for welding electrodes	As required	As Required	
			Baking & Holding oven with thermostat and temperature gauge for welding electrodes	As required	As Required	
			Portable oven for welding electrodes	As required	As Required	
			Electric winch	2/3/5/10 /15 MT capacity	4 Nos	As per the instructions of BHEL Engineer
			Hand winch	0.5 MT capacity	As Required	
			Scaffolding materials with clamps.	Suitable for working at various heights	As required	For Alignment, welding & Insulation works
			Profile making M/c	For aluminium sheet cladding work	as required	
			Nibbling M/c	For refractory	as required	

			Shearing M/c	and other required activities	as required	
			Portable grinding M/c	As required	as required	
			Portable drilling M/c	As required	as required	
			Hoisting and pulley devices/pulleys	As required	As required	
			Fire retardant tarpaulins	As required	As required	
			Fire extinguisher	As required	as required	
			Hydraulic Jacks	10/20/50 /100 MT	as required	
			Dewatering pumps		as required	
			Various sizes of clamps/ fixtures for assembling		as required	
			Magnetic particle testing equipment-Dry & Wet Type		as required	
			Spectrometer for metal testing		as required	
			Alco meter for paint thickness checking		as required	
			Hand Operated Megger 500 / 1000 V		as required	
			Tong Tester 10, 20 Or 50 Amp + / - 3 % Accuracy		as required	
			Digital and Analogue Multimetres		as required	
			U Tube Manometer 0-2000 mm Water Column		as required	
			Inclined Manometer 0-50 mm Water Column		as required	
			Calibrated Pneumatic Torque wrench		4 nos.	
			~~Bolt Tension Calibrator~~		~~as required~~	
			Safety Net		As required	**To be deployed from begining**

			Man lifter for bolted structure bolt tightening	Min 120ft boom	02 Nos	As per the instructions of BHEL Engineer
			Plate rolling/bending machine		As required	As per the instructions of BHEL Engineer (For fabrication)
			PUG machine		As required	As per the instructions of BHEL Engineer (For fabrication)
4.2.	All the T&Ps required for this scope of work, except the Tools & Plants provided by BHEL are to be arranged by the contractor with in the quoted rates.					
4.3.	The age of the contractor deployed cranes/pick-up carry crane mentioned above should be within 15 years as on date of deployment. Contractor has to provide documentary evidence/ proof for age of the crane at the time of deployment to BHEL Engineer.					
4.4.	The contractor to furnish a list of Tools and plants including tractors / trailers/ trucks etc. which contractor proposed to deploy for this work.					
4.5.	Fill pumps shall be arranged by the contractor, wherever required.					
4.6.	For testing LP lines necessary Hydraulic Test pumps/ Hand pumps are to be arranged by the contractor.					
4.7.	For handling at store and transportation, contractor shall make his own arrangement.					
4.8.	For transportation, material handling, loading& unloading of all components / equipments, the contractor has to make his own arrangements at his own cost. BHEL will not provide any crane / T&Ps for unloading the above components. All necessary T&P such as, Trailers, Cranes Winches, Welding generators, Slings, Jacks, Sleepers, Rails etc. are to be arranged by the contractor.					
4.9.	All the T & P, lifting tackles including wire ropes, slings, shackles and electrically operated equipment shall be got approved by BHEL Engineer before they are actually put on use. Test certificates obtained from the statutory authority should be submitted before their usage.					
4.10.	All the T & P arranged by contractor including electrical connections wherein required shall be reliable / proven / tested with necessary test certificate.					
4.11.	All instruments, measuring tools etc. are to be calibrated periodically as per the requirement of BHEL and necessary calibration certificates are to be submitted to BHEL before use.					
4.12.	Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.					
4.13.	Also Refer Chapter-V in connection with BHEL T & Ps V of this booklet.					

4.14.	Other Relevant clauses shall be referred in Special Conditions of Contract (SCC)
4.15.	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 procure/hire the equipment/ T&P and get the work done and charge the contractor as per current market rate/hiring rate + applicable BHEL overhead.
4.16.	**Measuring and Monitoring Equipments (MMEs):** As per requirement to be finalized at site, shall meet the requirements as per field quality plan and other erection, testing related activities
4.17.	**Note:** 1. This above list of T&Ps is only indicative and neither exhaustive nor limiting. Quantities indicated above are only the minimum required. The contractor shall deploy all necessary T&P to meet the schedules & as prescribed by BHEL engineer and required for completion of work. 2. Depending upon the nature of work and availability of facilities locally, contractor may have to arrange for a temporary workshop for facilitating uninterrupted progress of work. 3. Necessary electrical / water / air connection required for operation of any of the tools & tackles shall be to Contractor‘s account. 4. Contractor has to submit the Calibration certificates of all the precision Equipement to BHEL. BHEL may ask for recalibration of the MME‟s /precision equipments for ensuring quality of work. Contractor must reascertain/ recheck range and accuracy of each IMTE from BHEL Engineer well in advance before arranging calibration/ deployment. **5. <u>Considering operational safety, the use of material handling equipment “HYDRA” is banned, agencies has to deploy the Pick & Carry cranes (Farana) of required capacity.</u>** 6. Any T&P‟s, Cranes, Slings, D-shackles and other lifting tackles, Trailers required for shifting of material from store to site shall be arranged by contractor over and above T&P‟s/ crane provided by BHEL 7. Any or part or all of the T&Ps of the contractor identified for the tendered package shall not be engaged for any works other than that of the works intended in this tender. 8. 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 for releasing the T&P.

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

5.1.

Sl No	Description & Capacity of T&P	Quantity	Remarks
1	Cranes of Capacity above 120 MT.	As decided by BHEL	All cranes (except Contractor scope) required for the contracted scope of work will be arranged by BHEL as per requirement.
2	Industrial Air Blower and accessories with power cable	20,000 m^3/hr	For ATT of ducts and absorber

5.2. However, if in any unforeseen circumstances, requirement of any T&Ps (available with BHEL at site) arises, on request of bidder the same may be provided on chargeable basis but BHEL reserves the right of provision of such T&Ps. Charges shall be applied as per BHEL norms and guidelines and direction of engineer in-charge.

5.3. Contractor shall transport from BHEL stores, install, operate, carry out maintenance, dismantle after use and return to BHEL stores T&Ps mentioned above for his use.

5.4. Contractor shall make necessary arrangements like laying of special sleeper beds and steel plates (all arranged by contractor), assembly and dismantling of heavy lift 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. Contractor shall also make necessary arrangements like laying of special sleeper beds and steel pates (all arranged by contractor) for movement and operation of the crane. Levelled area in FGD area will be provided by BHEL/customer for the cranes. Consolidation of the ground, if required, and preparation (including civil work with material) for placing crane for operation shall be done by the contractor, at his cost. Necessary plates / sleepers required for marching operation shall also be provided by the contractor within quoted rates. Required numbers of mild steel plates of 40/45/50 mm thick and 12 metre length x 3 metre width (around 6 numbers) for the above purpose is to be arranged by contractor within his quoted rate.

5.5. Contractor shall provide the fuel, lubricants and consumables for BHEL provided cranes (hired/owned) for his use.

5.6. Cranes provided by BHEL will be on sharing basis with other agencies / contractors of BHEL. The allocation of cranes shall be at the discretion of BHEL engineer, which shall be binding on the contractor. Cranes will be deployed at appropriate time as decided by BHEL for suitable duration and intended purpose.

5.7. Above T&P and cranes will be used for erection of all units including common system and Duct erection also on sharable basis

5.8. Cranes are only for erection purposes and shall not be available for material handling or transportation purposes. The contractor shall make their own arrangements for material transportation to erection site.

5.9. The contractor has to provide his 40 MT (as per site requirement) crane free of cost for Assembly of BHEL cranes.

5.10.	Above T&P will be provided on sharing basis only. Contractor has to plan his 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.
5.11.	Suitable capacity cranes, if required, for erection will be provided by BHEL free of hire charges.
5.12.	Operator for BHEL owned crane will be arranged by BHEL.
5.13.	Necessary electrical / water / air connection required for operation of any of the BHEL's T & Ps shall be Contractor's account. All the distribution boards, connecting cables, hoses etc., and temporary connection work including electrical connections shall have to be arranged by the contractor at his cost.
5.14.	The contractor at his cost shall arrange for grouting of anchor points of T & Ps issued to him. Necessary grout materials are to be arranged by the contractor at his cost.
5.15.	The Contractor shall be responsible for the safe and proper use of the above equipments issued to his. Day-to-day maintenance and operation of equipment's shall be the contractor's responsibility and shall be as per instructions / standard practice of BHEL Engineer
5.16.	Apart from the above-mentioned tools, any other tools and plants required for satisfactory completion of the work has to be arranged by the contractor.
5.17.	Monthly utilisation report of the above equipment shall be furnished by contractor for cost analysis purpose.
5.18.	In case of non-availability of the above, due to any unavoidable reason, like breakdown, overhaul etc., contractor shall make arrangement at his own cost to meet the erection schedules. No extra claim will be admitted due to the non-availability of any of the above equipment. No delay in execution of work shall be accepted on this account.
5.19.	The contractor shall return the T & P issued to him by BHEL in good working condition as and when so desired by BHEL. (Completion or reduction in work load) for diversion for other work. If such return is delayed by contractor due to his fault without written consent of BHEL, hire charges as applicable according to BHEL policy will be levied from such time it was requisitioned by BHEL to the time of actual return and the amount so decided and arrived at, will be recovered from the contractor's bill.
5.20.	Contractor shall always have experienced operators and technicians for routine and breakdown maintenance of the equipment. Any delay in rectification of defects will warrant BHEL rectifying the defect and charging the cost to the contractor.
5.21.	If at any time it is noticed that contractor is not using any of the T & P or equipment properly according to the instructions of BHEL, BHEL will have the right to withdraw all such equipment and any cost due to this shall be contractor's account.
5.22.	All the T & P would be issued only at BHEL stores, and it shall be the responsibility of the contractor to take delivery from BHEL stores, transport the same to site and return the same to BHEL stores in good condition after use.
5.23.	Contractor shall make good any loss or damage to the equipments supplied to him and day to day maintenance and operations of equipments shall be borne by the contractor including all consumables like petrol, oil and air filters etc.
5.24.	Any Loss / Damage of tools by the contractor, the same shall have to be replaced by the contractor or otherwise cost thereof shall be recovered from the contractor.
5.25.	Any loss / damage to any or part of the above equipments shall be to contractor's account and the expenditures on these accounts will be recovered from contractor's bills in case contractor fails to make good the loss.

6.0	**Time Schedule and Mobilization:**
6.1.1.	The entire work as detailed in the Tender Specification shall be completed from the date of "Start of Contract period" at site, for the mentioned scope of work shall be completed within 15 (Fifteen) months from the date of "Start of Contract period" at site.
6.1.2.	VOID.
6.1.3.	During the total period of contract, the contractor has to carry out the activities in a phased manner as required by BHEL and the program of milestone events.
6.1.4.	The erection work shall be commenced on the mutually agreed date between the bidder and BHEL engineer and shall be deemed as completed in all respect only when the unit is in operation. The decision of BHEL in this regard shall be final and binding on the contractor. The scope of work under this contract is deemed to be completed only when so certified by the site Engineer.
6.1.5.	The contractor shall have to mobilize his resources earlier than the start of contract period for preparatory work like taking over and chipping of foundations, blue matching, grouting of packer plates etc or start of Pre-Assembly/fabrication of Ducts. 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.
6.1.6.	Initial Mobilization: After receipt of fax LOI, Contractor shall discuss with Project Manager / Construction Manager regarding initial mobilization. Contractor shall reach site, make his site establishment and be ready to commence the erection work as per the directions of Construction Manager/ Project Manager of BHEL. Such resources shall be progressively augmented to match the schedule of milestones and commissioning.
6.2.	**Commencement of Contract Period and Tentative Schedule**
6.2.1.	**Erection/placement on its designated foundation / location, of the first major permanent equipment / component / column covered in the scope of these specifications, (whichever is earlier as decided by BHEL) shall be recognized as "Start of contract period".** Smaller items like packer plates, shims, anchors, inserts etc. will not be considered as start of contract period. 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 engineer is final.
6.2.2.	Based on the availability of civil foundations from BHEL and materials from manufacturing units, contractor may have to advance the start of erection after getting clearance from construction manager, or the start of erection may get delayed due to site condition.
6.2.3.	The Contractor has to subsequently augment his resources in such a manner that following major milestones of erection & commission are achieved on specified schedules. **The schedule of important milestones is as follows:**
6.2.4.	

S No	ITEM DESCRIPTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

	Contractual Obligation Completion	Contractual Obligation Completion	Contractual Obligation Completion	Contractual Obligation Completion	Contractual Obligation Completion	Contractual Obligation Completion
					Completion of Ducts Insulation Unit 2	
						Completion of Ducts Insulation Unit 2
	Completion of Bolting Unit 2	ATT of Ducts Unit 2				
		Water Fill Test Absorber 2			Completion of Ducts Insulation Unit 1	
	Completion of Handing over of		Trial Run of Equipment	Readiness of Tanks		Completion of Ducts Insulation Unit 1
	Completion of Bolting Unit 1	ATT of Ducts Unit 1				
		Water Fill Test Absorber 1		Water Fill Test of Tanks	Erection Start	Erection Start
	Erection Start	Erection Start	Erection Start	Erection Start		
	Structure	**Non Pressure Parts**	**Rotating Machines**	**Tanks**	**Mineral Wool**	**Fixing Components**
	1	**2**	**3**	**4**	**5**	**6**

	7	**Aluminium Sheeting**			Erection Start				Completion of Ducts Insulation Unit 1			Completion of Ducts Insulation Unit 2				Contractual Obligation Completion
	8	**CS Piping**	Erection				HT/Pneumatic Test	Completion of Supports	Completion of Piping							Contractual Obligation Completion
	9	**SS Piping**	Erection				HT/Pneumatic Test	Completion of Supports	Completion of Piping							Contractual Obligation Completion

6.2.5. Above time schedule is tentative and in order to meet above schedule in general, and any other intermediate targets set, to meet customer/project schedule, contractor shall arrange & augment all necessary resources from time to time as per the instructions of BHEL.

6.3. CONTRACT PERIOD

The contract period for completion of entire work under scope for each of the packages shall be 15 (Fifteen) Months from the "COMMENCEMENT OF CONTRACT PERIOD" as specified earlier for completion of the entire work.

6.4. Provision of Penalty in case of slippage of Intermediate Milestones:

Milestones	Activities	Completion Period from DOS
M1	Water fill test of Absorber Unit 1	3rd Month from Date of start
M2	LHP System Erection Completion	6th Month from Date of start

6.4.1. 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.

6.4.2. In case of slippage of these identified Intermediate Milestones, Delay Analysis shall be carried out on achievement of each of these two Intermediate Milestones.

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.	*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.
6.4.10.	Common activities shall be completed in Phase wise manner/ Instruction of Engineer within the Contractual time.
6.4.11.	Above milestone dates has to be completed in parallel.
6.4.12.	Bidders are requested to submit Resource deployment plan Area wise with detail program in line with above schedule in the form of Bar Chart/ MS project planer along with their offer.
6.5.	Bidders are requested to submit Resource deployment plan Area wise with detail program in line with above schedule in the form of Bar Chart/ MS project planer along with their offer.
6.6.	**COMPLETION OF WORK AND COMMENCEMENT OF GUARANTEE PERIOD**
6.6.1.	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, labor hutments and other things shall be removed.Site and work cleared of rubbish and all waste materials shall be delivered up clean and tidy to the satisfaction of the Engineer at the Contractor's expenses.
6.6.2.	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.

6.6.3.	The Engineer shall certify to the contractor the date on which the work is completed and the date thereof for commencement of Guarantee Period. Guarantee Period shall be as given in GCC.

<table>
<tr><td>7.0</td><td>Terms of Payment:</td></tr>
<tr><td>7.1.</td><td>Pro-rata payment shall be based on the quantities of individual item and item rate of individual items as derived in BOQ CUM RATE SCHEDULE.</td></tr>
<tr><td>7.1.1.</td><td>Bidders to note that this is an '<u>Item rate contract</u>'. Payment shall be made for the actual quantities of work executed at the Unit item rate .</td></tr>
<tr><td>7.1.2.</td><td>Milestones payment for each Item heads identified in BOQ shall be on Pro-Rata basis common to all PGs and shall be released on achievement of the following stage / milestones events (as per Cl no 7.2.2.1 to 7.2.2.8 of the following table) for the tonnage erected.
<table>
<tr><th>7.1.2</th><th>Stage/ Milestone Payments</th><th>% Payment</th></tr>
<tr><td>7.1.2.1</td><td>Completion of air & gas tightness test for Ducts</td><td>2%</td></tr>
<tr><td>7.1.2.2</td><td>Total Water-run Test of Absorber</td><td>2%</td></tr>
<tr><td>7.1.2.3</td><td>Handing Over of floors to civil agency for Casting (to be paid on pro-rata basis)</td><td>3%</td></tr>
<tr><td>7.1.2.4</td><td>Painting Completion (to be paid on pro-rata basis)</td><td>3%</td></tr>
<tr><td>7.1.2.5</td><td>Area cleaning, temporary structures cutting/removal and return of scrap</td><td>1%</td></tr>
<tr><td>7.1.2.6</td><td>Punch List points/pending points liquidation</td><td>2%</td></tr>
<tr><td>7.1.2.7</td><td>Material Reconciliation</td><td>1%</td></tr>
<tr><td>7.1.2.8</td><td>Completion of Contractual Obligation</td><td>1%</td></tr>
<tr><td></td><td>Total for Stage /Milestone Payments (15%)</td><td>15%</td></tr>
</table></td></tr>
<tr><td>7.2.</td><td>-Void-</td></tr>
<tr><td>7.3.</td><td>-Void-</td></tr>
<tr><td>7.4.</td><td>-Void-</td></tr>
<tr><td>7.5.</td><td>SECURED RECOVERABLE ADVANCES:
Interest Free Secured Mobilization Advance as per GCC Clause No. 2.13.1 will be payable under exceptional circumstances on approval of BHEL Construction Manager at Site. Interest Free Mobilization Advance shall be disbursed in specifically mentioned stages of major resource mobilization as specified hereunder:
The deployment of below list of T&P are not necessarily to be in the same order as mentioned in the
1. For Installation and Erection of Site Infrastructure by contractor i.e. site office, stores etc. – 1.5%.
2. For Mobilization of Pick & carry type tyre mounted mobile crane. (Farana 18/20/23 MT – 2 nos. -1%
3. For Mobilization of Tyre mounted / mobile crane (Telescopic boom, Hydraulically operated with turret function) Above 75/80 MT and upto 120 MT- 02 Nos -2.5%</td></tr>
</table>

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	**Variation in Taxes & Duties:** 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.

This Chapter consists of Part A & Part B of Volume II "Price bid":

9.0 **Bill of Quantity: Summary of Weight of BOQ under the Scope for the Package :**

SN	Description of work	UOM	Quantity to
1	**STRUCTURE**		
1.1	Pre Assembly	MT	4,917.88
1.2	Placement in Position	MT	4,944.39
1.3	Alignment	MT	6,074.41
1.4	Welding /Bolting/Fixing	MT	6,131.40
1.5	Completion of NDE & SR/Heat treatment	MT	6,147.66
1.6	Milestones	MT	4,944.39
2	**Non Pressure Parts Including Tanks**		
2.1	Pre Assembly	MT	3,435.16
2.2	Placement in Position	MT	3,482.93
2.3	Alignment	MT	3,801.97
2.4	Welding /Bolting/Fixing	MT	3,882.55
2.5	Completion of NDE & SR/Heat treatment	MT	3,975.88
2.6	Milestones	MT	3,485.13
3	**Rotating Machines**		
3.1	Pre Assembly	MT	894.95
3.2	Placement in Position	MT	902.67
3.3	Alignment	MT	929.98
3.4	Welding /Bolting/Fixing	MT	929.98
3.5	Completion of NDE & SR/Heat treatment	MT	929.98
3.6	Milestones	MT	902.67
4	**Mineral Wool**		
4.1	Placement in Position	MT	100.00
4.2	Alignment	MT	100.00
4.3	Welding /Bolting/Fixing	MT	100.00
4.4	Milestones	MT	100.00
5	**Fixing Components**		
5.1	Placement in Position	MT	110.00
5.2	Alignment	MT	110.00
5.3	Welding /Bolting/Fixing	MT	110.00
5.4	Milestones	MT	110.00
6	**Aluminium Sheeting**		

	6.1	Placement in Position	MT	114.00	
	6.2	Alignment	MT	114.00	
	6.3	Welding /Bolting/Fixing	MT	114.00	
	6.4	Milestones	MT	114.00	
	7	**CS Piping**			
	7.1	Pre Assembly	MT	534.45	
	7.2	Placement in Position	MT	534.45	
	7.3	Alignment	MT	534.45	
	7.4	Welding /Bolting/Fixing	MT	534.45	
	7.5	Completion of NDE & SR/Heat treatment	MT	534.45	
	7.6	Hangers & Supports	MT	534.45	
	7.7	Hydraulic Test or Pneumatic Test	MT	534.45	
	7.8	Milestones	MT	534.45	
	8	**SS Piping**			
	8.1	Pre Assembly	MT	8.00	
	8.2	Placement in Position	MT	8.00	
	8.3	Alignment	MT	8.00	
	8.4	Welding /Bolting/Fixing	MT	8.00	
	8.5	Completion of NDE & SR/Heat treatment	MT	8.00	
	8.6	Hangers & Supports	MT	8.00	
	8.7	Hydraulic Test or Pneumatic Test	MT	8.00	
	8.8	Milestones	MT	8.00	

9.1.

Note:

1.1 To meet the Project schedule, or otherwise, BHEL at its discretion, may withdraw 15% of awarded work or may awards additional 15% of the awarded work from other packages within the premises to the bidder after due notice of a period of 7 days' by BHEL. Vendor may be asked to execute part work of other Packages within the premises and vice versa.

1.2 The bidders have to execute the additional work of other package by deploying additional resources and without impacting their original schedule at the same rate & terms and Conditions.

1.3 Applicability of this clause shall not entitle bidder for compensation under Quantity variation clause.

2. The above detailed Bill of Quantity is furnished for reference. The weights mentioned above are approximate and liable to vary as per design consideration. There will be change in PG, weight, description etc. However, payments will be made to the contractor for the tonnage erected at the respective category as per the quoted / accepted rate. Quantity Variation will be dealt as per General Conditions of Contract.

	3. Besides Buildings/Area indicated in the weight schedule, there is likelihood of addition of Buildings/Areas integral to FGD system. The quoted rate shall be applicable for such product groups also. **4.** There may be variation or addition of Buildings/Areas, 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. Identifying the category shall be on discretion of BHEL Engineer. **5.** 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 are installed. i.e. CS & SS piping. **6.** Imported electrodes / TIG welding wires released by manufacturing Units will be supplied by BHEL. All other electrodes / TIG welding wires are to be supplied by contractor under his scope. In the case of Piping category, payment rates will be derived on actual type of material received/used at site. Example- If a material falls under SS Category as per Tech Bid. However, if actual material supplied is of CS, then payment will be made under CS rate category and vice versa.

10.0	**General**
10.1.	Contractor shall execute the work as per sequence and procedure prescribed by BHEL at site. The applicable erection manuals which are available with BHEL site office are to be referred for compliance and guidance before taking up the work. Any rework on this failure to comply with will be to account of 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 in other projects or for any reason whatsoever.
10.1.1.	Contractor has to work in close co-ordination with other erection agencies 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 milestones are achieved as per schedule / plans. Contractor shall arrange & augment the resources accordingly.
10.1.2.	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 scaffolding works or as bed for pre-assembly works. Contractor shall arrange himself all such materials. 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.
10.1.3.	All the works such as cleaning, leveling, 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 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.
10.1.4.	The work covered under this specification is of highly sophisticated nature, requiring the best quality workmanship, engineering and construction management. The contractor should ensure successful and timely operation of equipment installed. The contractor must have adequate quantity of tools, construction aids, equipments etc., in his possession. He must also have on his rolls adequate trained, qualified and experienced supervisory staff and skilled personnel.
10.1.5.	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 effected for such excess drawls at the rate prescribed by manufacturing units.
10.1.6.	No member of the already erected structure, platform, pipes, grills, other component and auxiliaries should be cut without specific approval of BHEL engineer.
10.1.7.	No temporary supports shall be welded on the pressure parts of piping. Welding of temporary supports, cleats, etc. on the columns shall be avoided. In case of absolute necessity contractor shall take prior approval from BHEL Engineer. Further, any

	cutting or alternation of member of the structure of platform or other equipment shall not be done without specific prior approval of BHEL Engineer.
10.1.8.	Contractors shall ensure that all their Staff / Employees are exposed to periodical training programme conducted by qualified agencies / personnel on ISO 9001 – 2008 Standards.
10.1.9.	Contractor has to clear the front, expeditiously and promptly as instructed by BHEL Engineer for other agencies, like piping, Turbine, Generator erection, Cabling, instrumentation, insulation etc., to commence their work from / on the equipments coming under this scope. Sometimes, more than one agencies 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.
10.1.10.	The terminal points decided by BHEL are final and binding on the contractor for deciding the scope of work and effecting the payment for the work done up to the terminals.
10.1.11.	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.
10.1.12.	All the necessary certificates and licenses required to carry out this scope of work are to be arranged by the contractor then and there at no extra cost.
10.1.13.	Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.
10.1.14.	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.
10.1.15.	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.
10.1.16.	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 from contractor's bills.
10.1.17.	On completion of work, all the temporary buildings, structures, pipe lines, cables etc. shall be dismantled and levelled and debris shall be removed as per instructions 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. The decision of BHEL Engineer in this regard is final.
10.1.18.	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.
10.1.19.	The work shall be executed under the usual conditions affecting major power plant construction and in conjunction with numerous other operations at site. The Contractor and his personnel shall cooperate with personnel of BHEL, BHEL'S Customer, Customer's consultants and other Contractors, coordinating his work with

	others and proceed in a manner that shall not delay or hinder the progress of work of the project as a whole.
10.1.20.	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.
10.1.21.	The work shall confirm to dimensions and tolerances specified in the various drawings / documents that will be provided during various stages of erection. If any portion of work is found to be defective in workmanship, not conforming to drawings or other stipulations due to Contractor's fault, the Contractor shall dismantle and re-do the work duly replacing the defective materials at his cost, failing which the work will be got done by BHEL and recoveries will be effected from the Contractor's bills towards expenditure incurred including cost of materials and departmental overheads of BHEL as per GCC.
10.1.22.	The Contractor shall perform any services, tests etc, which may not be specified but nevertheless, required for the completion of work within quoted rates.
10.1.23.	All necessary certificates and licenses required for carrying out this work are to be arranged by the Contractor expeditiously.
10.1.24.	The Contractor shall execute the work in the most substantial and workman like manner. The stores shall be handled with care and diligence.
10.1.25.	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.
10.1.26.	All cranes, transport equipment, handling equipment, tools, tackles, fixtures, equipment, manpower, supervisors/engineers, consumables etc, except otherwise specified as BHEL scope of free issue, required for this scope of work shall be provided by the Contractor. All expenditure including taxes and incidentals in this connection will have to be borne by Contractor unless otherwise specified in the relevant clauses. The Contractor's quoted rates should be inclusive of all such contingencies.
10.1.27.	During the course of erection, testing and commissioning certain rework / modification / rectification / repair / fabrication etc may become necessary on account of feed back / revision of drawing etc. This will also include modifications / re-works suggested by BHEL / customer / other inspection group. Contractor shall carry out such rework / modification / rectification / fabrication / repair etc promptly and expeditiously. Daily log sheets signed by BHEL engineer and indicating the details of work carried out, man-hours etc shall be maintained by the Contractor for such reworks. Claim of Contractor if any, for such works will be governed by relevant clauses of 'General Conditions of Contract'.
10.1.28.	All works such as cleaning, leveling, aligning, trial assembly, dismantling of certain equipments / components for checking and cleaning, surface preparation, fabrication of structures, tubes and pipes 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.
10.1.29.	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 for such usage.
10.1.30.	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.
10.1.31.	Contractor shall plan and transport equipments, components from storage to erection site and erect them in such a manner and sequence that material accumulation at site does not lead to congestion at site of work. Materials shall be stacked neatly, preserved and stored in the Contractor's shed and at work areas in an orderly manner. In case it is necessary to shift and re-stack the materials kept at work areas/ site to enable other agencies to carry out their work or for any other reason, same shall be done by Contractor most expeditiously as incidental to work.
10.1.32.	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.
10.1.33.	Hangers & suspensions, supports etc for tubes, piping, & ducts etc will be supplied in running / random lengths / sizes which shall be cut to suitable sizes and adjusted as required.
10.1.34.	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.
10.1.35.	Layout of field routed/ small bore piping shall be done as per site requirement. The necessary sketch for routing these lines should be got approved from BHEL by the Contractor. There is a possibility of slight change in routing the above pipelines even after completion of erection.
10.1.36.	Certain instrumentation like pressure switches, air sets, filters, regulators, pressure gauges, junction boxes, power cylinders, dial thermometers, flow meters, valve actuators, flow indicators, centrifugal/speed switches of motors, accumulators etc are received in assembled condition as integral part of equipments. Contractor shall dismount such instruments for calibration and hand over the same to BHEL. C & I erection agency will do storage / re-erection calibration etc.
10.1.37.	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.

10.1.38.	Actuators/drives of valves, dampers, gates, powered vanes etc may have to be serviced, lubricated, before erection, during pre-commissioning & commissioning, including carrying out minor adjustments required as incidental to the work.
10.1.39.	All electrical motors have to be tested for IR & PI values prior to the trial run. Where required, dry out may have to be carried out by using external heating source. Contractor shall make all arrangements in this regard and complete the work as instructed. BHEL will provide the motorized insulation testers.
10.1.40.	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. Contractors 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.
10.1.41.	The work shall be carried out strictly in accordance to the "Field Quality Plan" approved by BHEL/client. Contractor, jointly with BHEL, shall prepare all necessary records of measurements/readings/ protocols etc.
10.1.42.	Interconnection/ hookup, if any, with the existing system shall form part of work. Such interconnections, hookups 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. The contractor's offer shall cover all such contingencies.
10.1.43.	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.
10.1.44.	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 relevent drawings or as per advice of BHEL engineer prior to erection. This forms part of the scope of work.
10.1.45.	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.
10.1.46.	BHEL is operating a 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. The contractor shall install necessary hardware to hook-up with the BHEL's system and use the same for his scope of work.
10.1.47.	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.

10.1.48.	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.
10.1.49.	All lubricants and chemicals required for testing, preservation, chemical cleaning / acid cleaning, oil flushing, and the lubricants for trial runs of the equipments and trial operation of the unit will be supplied by BHEL free of charges.
10.1.50.	Adequate water less urinals (at least 2 nos.) shall be arranged by the contractor within quoted rates, at site of construction at different locations.
10.1.51.	**Utility Points**
10.1.51.1.	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.
10.1.51.2.	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.
10.1.52.	**Documentation**
10.1.52.1.	Contractor shall be supplied with two 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.
10.1.52.2.	After successful completion, testing and commissioning of installation work, as built drawings / documents if any, in line with the actual work carried out as per site routing drawing shall be submitted by the contractor as agreed for the project.
10.1.52.3.	The contractor shall maintain a record in the form as prescribed by BHEL for all operations carried out on each weld and maintain a record indicating the number of welds, the name of welders who welded the same, date and time of start and completion, preheat temperature, radiographic results, rejections if any, percentage of rejection, etc. and submit copies of the same to the BHEL Engineer as required.
10.1.53.	**Site Inspection**
10.1.53.1.	The contractor shall maintain at site a joint protocol for recording actual measurement of work carried out at site, inspection and witnessing of various tests conducted by the contractor.
10.1.53.2.	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 for such duplication of inspection of work be entertained.
10.1.54.	**Platforms, Crossovers & Canopies**

10.1.54.1.	Platforms, ladders, crossovers, and canopies 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 outdoor pumps and motors. Platforms, ladders, crossovers and canopies shall have to be fabricated from raw materials supplied by BHEL and erected by contractor as per instruction of BHEL and shall be paid as per accepted tonnage rate for "structures".

11.0	**Progress of Work**
11.1.	Refer forms F-14 to F-18 of volume I D (Forms & Procedure) of volume –I book-II. Plan and review will be done as per the formats.
11.2.	Contractor is required to draw mutually agreed monthly erection programs in consultation with BHEL well in advance. Contractor shall ensure achievement of agreed program and shall also timely arrange additional resources considered necessary at no extra cost to BHEL.
11.3.	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.
11.4.	Tenderers have to furnish a list of Tools and Plants including cranes, Tractor / Trailers etc., which they propose to deploy for this work.
11.5.	The contractor shall submit daily, weekly and monthly 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.
11.6.	The contractor shall submit weekly / fortnightly / monthly statement report regarding consumption of all consumables for cost analysis purposes.
11.7.	The contractor shall submit a report of any damage, shortage, discrepancy etc., every week detailing in this regard.
11.8.	11.1 The monthly report as a booklet shall be submitted at the end of every month and shall contain the following details:- a. Colour Progress photographs to accompany the report should be submitted. b. Erection progress in terms of tonnage and welding joints, radiography and stress relieving 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, mill wright fitters, welders, riggers, khalasis, grinder-men, gas-cutters, electricians, crane operators and helpers. Data will be spilt up under the work area of Silo Structure, Crusher House, Silo Fabrication, Duct Welding, Absorber Welding etc. e. Data on categories of labour like mill wright fitters and shall be shown in detail. Data shall be split up under the work areas like Silo Structure, Crusher House, Silo Fabrication, Duct Welding, Absorber Welding etc.

	f. Consumables report giving consumption of all types of gases and electrodes during the previous month. g. Availability report of cranes h. Safety implementation report in the format Pending material and any other inputs required from BHEL for activities planned during the subsequent month
11.9.	The manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.
11.10.	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 from contractor's bills.

12.0	**Civil Works, Foundation, Grouting** **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.)
12.1.	Foundation for the equipment to be erected shall be provided by BHEL/clients of BHEL. The dimension of the foundation and anchor bolt pits shall be checked by the contractor for their correctness as per drawings. Further, top elevation of foundations shall be checked with respect to bench mark etc. All adjustments of foundations surfaces, enlarging the pockets in foundations etc. as may be required for the erection of equipment plants shall be carried out by the contractor.
12.2.	Cleaning of foundation surfaces, pocket holes and anchor bolt pits etc., dewatering, making them free of oil, grease, sand and other foreign materials by soda wash, water wash, compressed air or any other approved methods etc., form/shuttering work are within the scope this work.
12.3.	The contractor at his cost shall arrange for grouting of foundation bolt holes of column and equipment as specified in the drawings / specification or as advised by the Engineer of BHEL after preparing the foundation top surface for grouting, all the materials for grouting (sand, gravel & cement including special Cement) shall be arranged by the contractor. The grouting has to be done upto basement level. The required consumables like Portland cement, gravel, sand etc., have to be provided by the contractor at his cost. The required special cement like conbextra, GP1, GP2, PAGAL, shrinkomp etc., or its equivalent as approved by BHEL if required shall be arranged by the contractor at his cost.
12.4.	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. Also, minor chipping, dressing of foundations up to 25 mm for obtaining proper face for packer plates/shims, and may be required for the erection of the equipment/plants will have to be carried out by the contractor without extra cost.
12.5.	The surface of foundations shall be dressed to bring the surface of the foundations to the required level and smoothness prior to placement of equipment.
12.6.	Foundation pockets are to be cleaned thoroughly before placing the columns/equipments. Verticality of foundation bolts to be checked along with correctness of the threads and freeness of the nut movement. If required cleaning of the threads to be done with proper dies.
12.7.	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 Engineers instructions.
12.8.	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.
12.9.	All the materials required for grouting including special cements like Conbextra GPI, GP2, ACC- Shrinkkomb-N20, Sika Anckor, NSG/ NSG -1, CICO Excem GP, or its equivalent as approved by BHEL and other materials like Portland cement, sand 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.
12.10.	Certain packer plates and shims over and above the quantity received as part of supplies from manufacturing units of BHEL will have to be cut out from steel plates/sheets at site by the contractor to meet site requirement. However, machining of the packers, wherever necessary, will be arranged by BHEL at free of cost.
12.11.	Shims and packer plates required for temporary use are to be arranged by the contractor within the quoted rate.
12.12.	The contractor at his cost shall arrange for grouting of anchor points of T & Ps issued to him. Necessary grout materials are to be arranged by the contractor at his cost.
12.13.	Non shrink cementitious flowable grout shall be used for grouting of pockets and under pinning work below base plate of columns. Nominal thickness of grout shall be 50 mm. Non shrink cum plasticizer admixture shall be added in the grout. Crushing strength of the grout shall generally be one grade higher than that of the base concrete. Minimum grade of grout shall be M30.
12.14.	However, for Equipment Foundations, high strength (Minimum Characteristic Compressive Strength of 60 N/mm2 at 28 days) ready mixed non-shrink, Chloride free, Cement based, free flowing, non-metallic grout as recommended by Equipment manufacturer shall be used. The ready-mix grout shall be of reputed make as approved by the customer. Total grouting of the columns/equipments including pocket grouting, grouting at the gap between foundation and base plates top surface of column/equipments is in the scope of the contractor. The quoted rate shall inclusive of the same.
12.15.	Generally, the tolerance on column pedestal elevation is -20 mm & + 30 mm. Tolerance between individual columns centre is ± 5 mm. The tolerance between the first row of column to the last row of columns is ± 15 mm. Tolerance on diagonal dimensions is 25 mm (maximum-cumulative) and 10mm maximum for adjacent columns. The tolerance of pitch distances of the foundation bolts is ± 3 mm. These are general guidelines and documents available with BHEL to be referred before taking up the work.
12.16.	The contractor shall arrange for grouting of foundation bolt holes of equipment and final grouting of equipment as per the drawings / specification as advised by the Engineer or BHEL after preparing the foundation surface for grouting. The contractor has to arrange, a representative from the supplier of special cement for witnessing the grouting and other works at their cost including any miscellaneous expenditure for this activity. BHEL will not pay any service and incidental charges for arranging the supplier representative. The contractor to take note of this aspect and quote accordingly.
12.17.	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.

12.18.	The certificate of the grout is to be submitted 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.
12.19.	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.
12.20.	Certain packer plates and shims over and above the quantity received as part of supplies from manufacturing units of BHEL will have to be cut out from steel plates / sheets at site by the contractor to meet site requirement. However, machining of the packers, wherever necessary, will be arranged by BHEL at free of cost.
12.21.	Providing & grouting of pocket holes, pipe sleeves and under base plate of structural steel work/ machinery/ pipe supporting structures including roughening of surface, cleaning, ramming, curing etc. with non-shrink cementitious flowable grout as per specification using non-shrink cum plasticizer admixture. Crushing Strength of the grout shall be one grade higher than that of the base concrete (however grade of grout shall be minimum M30 to max M35 grade).
12.22.	Providing & grouting of pocket holes, pipe sleeves and under base plates of structural steel work / machinery / pipe supporting structures including roughening of surface, cleaning, ramming, curing etc. all complete with Conbextra GP-1 / Conbextra GP-2 or its equivalent.
12.23.	**Procedure for Grouting:**
12.23.1.	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.
12.24.	**Civil Works**
12.24.1.	**The major civil works like excavation, compaction, sand filling & etc. for the buried piping identified in this contract are excluded from the scope of this work**. However, the widening of the trench at the weld joint area for giving free working space on each side of the pipe is included in the scope of this work. This type of incidental works is to be carried out by the contractor within quoted rates. The required coordination with civil and other agencies shall be extended by the contractor to ensure smooth execution of works.
12.24.2.	Box cutting and excavation of earth up to the required depth and width, concreting etc., are not covered in the scope of works of this tender and shall be carried out by others on phased manner as per the site requirement and decided by BHEL site in-charge. As and when the clearance for erection of piping is given, contractor shall carry out erection work promptly without any delay and release for further civil in a phased manner as instructed be site in-charge.
12.24.3.	**Necessary excavation for buried pipe and backfilling with earth is excluded from the scope of bidder and shall be done by BHEL. BHEL will release excavated clear front to bidder for erection of buried pipe. Dewatering with all necessary arrangement required like pumps after handing over of excavated front is under the scope of bidder**. Foxholes (cutting of earth below pipe joint) for welding will be

	in bidder's scope. No separate payment shall be made on account of fox holes, dewatering, as detailed above and the erection and commission rate as per price schedule of River/Canal Water piping shall be inclusive of the same. Concrete bedding / encasing is excluded from scope of work.

13.0	**ERECTION**
13.1.	All normal erection and assembly techniques necessary for completion of works under this specification and magnitude have to be carried out. The omission of specific technique /method/process does not absolve the contractor of his responsibility for the particular operation. These would include,
13.1.1.	Scaffolding and rigging operations,
13.1.2.	Machine / flame / electric cutting, grinding, welding, radiography and stress relieving
13.1.3.	Fitting, fettling, filing, straightening, chamfering chipping, scrapping, reaming, as cleaning, checking, levelling, blue matching, aligning and assembly.
13.1.4.	Machining, surface grinding, drilling, doweling, shaping.
13.1.5.	Temporary erections for alignment, dismantling of certain equipment for checking, cleaning, servicing and site fabrication.
13.1.6.	Insulation and painting
13.2.	Any fixtures, scaffolding materials, approach ladder, concrete block supports, steel structures required for temporary supporting, pre-assembly or checking, welding, lifting and handling during pre-assembly and erection shall be arranged by contractor at his cost.
13.3.	No members of any ladder / structure / platform should be cut without specific approval of BHEL. In case it is necessary to cut, the contractor shall rectify / repair in a manner acceptable to BHEL / customer without any additional cost.
13.4.	The contractor shall erect scaffolding / temporary platforms for erection. These should be of adequate capacity and should never be overloaded. These should be replaced when not found suitable during erection work and dismantled on work completion and removed from work site.
13.5.	It shall be the responsibility of the contractor to provide ladders on columns for initial work till such a time the 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. In case it is absolutely necessary then the contractor shall cut the temporary structure and rectify the column as directed by the engineer.
13.6.	The contractor is strictly prohibited in using the FGD/ Auxiliary Components for any temporary supporting or scaffolding works etc. In case of such misuse a sum of determined by Engineer will be recovered from contractor's bills.
13.7.	**Absorber Erection Sequence**
13.7.1.	Below mentioned erection sequences is indicative only and give the general idea to the contractor for absorber erection. : Absorber is a rectangular type with elevation of 41m.

	L= 9.9 m, W= 20.4 m, H= 41 m Max size of plate is 3m X 12m and 9 mm thick (incl. cladding of 2 mm thick). However above dimensions may vary during engineering finalization.
1.	Marking and packer liner setting
2.	Bottom plate installation
3.	Ist stage casing panel installation
4.	Baffle panel installation
5.	Scaffolding and Structure up to 24.8 Mtr.
6.	2nd stage casing panel installation
7.	Scaffolding and Structure up to 28.5 Mtr.
8.	3rd stage casing panel installation
9.	Inlet duct panel installation
10.	Scaffolding and Structure up to 31.75 Mtr.
11.	4th stage casing panel installation
12.	Scaffolding and Structure up to 35.4 Mtr. and spary pipe installation
13.	5th stage casing panel installation
14.	Scaffolding and Structure up to 39 Mtr.
15.	6th stage casing panel installation
16.	Scaffolding and Structure up to 43 Mtr.
17.	7th stage casing panel installation
18.	Scaffolding and Structure up to 47 Mtr. and remaining structure erection
19.	Ceiling panel installation
20.	2 mm C276 strip welding
21.	Dismantling of scaffolding up to mist eliminator level
22.	Absorber internals (Spray pipe and mist eliminator) installation
23.	Dismantling of scaffolding up to spray pipe level
24.	Absorber internals (Spray pipe and spray nozzle) installation
25.	All scaffolding dismantling
26.	Fiber grating installation
27.	Agitator installation
13.8.	**Casing Panel Installation**
13.8.1.	Splices of bottom plates at which casing panel are located shall be cleaned.
13.8.2.	Location of casing shall be marked on the foundation. Then, according to the casing panel assembly drawings, the location of vertical splices between plates shall be marked
13.8.3.	Temporary assembly of lower stage casing panel shall be done by Tack-weld the guide pieces to the bottom plate at prescribed intervals of inside and outside the circular marking.
13.8.4.	Temporary assembly of upper stage casing panel shall be done as per Match marks which have been provided on the inside surface of the lower stage casing panel shall be matched to vertical splice line and assembled.
13.8.5.	After that welding of the casing panel to be done the weld between lower stage casing panel and bottom plate shall be performed in a suitable time after the completion of vertical splice for lower stage casing panel.

13.8.6.	Vertical splice shall be welded from side by back step method of 1/3 of wall plate width after the completion of assembly of upper wall plate. After the welding from outside, grinding from inside shall be performed with grinder. Welding of horizontal splices shall alternate across the 1st wall. 2nd wall weld's shall be laid simultaneously.
13.8.7.	Spacers used for root gap of welds shall be removed.
13.8.8.	Appurtenances such as manholes and nozzles shall be installed after marking on correct locations in accordance with the layout dwgs. The time to install then shall be decided in consideration of site construction progress. (2) The location of large diameter nozzles which will be connected to rubber lined pipes shall be determined in accordance with the final piping locations which shall be set at the site.
13.9.	**Spray Pipe Installation**
13.9.1.	Check all concerned absorber dimensions, ie. tolerance of absorber casing, support beam location, absorber nozzle location, flange face location, bolt hole location, size and spacing etc., before Spray Pipe installation.
13.9.2.	i. Install the temporary support on absorber nozzles for inserting Spray Pipe into absorber. The temporary support shall be installed at almost the same height of bottom of Spray Pipe ii. Lift Spray Pipe up to the same height as absorber nozzle. iii. Insert the tip of Spray Pipe into the absorber, and unload the tip of Spray Pipe onto the temporary support. iv. Insert Spray Pipe into the absorber by using of chain block. v. Insert bolt to Spray Pipe flange and Spray Pipe saddle, and tighten as temporary. Then check the horizontal level and insert shim plate to adjust the horizontal level. The level tolerance should be referred to specific drawing. vi. Tighten all the bolts and nuts. In case of dissimilar material between Spray Pipe flange (especially FRP made) and absorber flange, bolt tightening procedure should be strictly complied with the specific drawings in order to prevent the crack on the flanges. vii. Loosen the saddle setting bolts and nuts by half rotation to allow the Spray Pipe thermal expansion, and then lock the nuts by double nuts fixing.
13.10.	**Spray Nozzle**
13.10.1	1. Modify the scaffolding for installation of Spray Nozzle. 2. Set the Spray Nozzle on the Spray Pipe flange, and tighten the bolts and nuts up to about 75% of full torque by using of torque wrench. 3. Check the horizontal level of Spray Nozzle face within the tolerance which is specified in the drawings, and tighten up to full torque. This level is most important for FGD performance. 4. The special care shall be taken to SiC made Spray Nozzle, since these are weak against mechanical shock and impact.

13.11.	**Mist Eliminator Installation**
13.11.1.	1. Check all concerned absorber dimensions, ie. tolerance of absorber casing, support beam location, bolt hole location, size and spacing etc., before installation of Mist Eliminator. 2. Insert the lower washing spray pipe into the absorber. In order to protect the FRP made pipe, do not slide the pipe on the support. 3. Insert the dedicated shim plates between pipe and pipe support, and fixing U-bands or U-bolts and external flanges. 4. Install the lower panel of Mist Eliminator and tightly coupled each other by means of comb brace and tie insulock. 5. Install the lower down washing spray pipe and upper up washing spray pipe as same manner as the above. 6. Install the upper panel of Mist Eliminator, and install upper washing spray pipe as same manner as the above. 7. After installation of Mist Eliminator, to protect the panels by means of load spreaders e.g. wooden planks to allow walking on them during further stage of installation.
13.12.	Certain adjustment in length may be necessary while erecting pipelines / ducts / casings etc. The contractor should remove the extra lengths / add extra lengths to suit the final layout after preparing edges afresh by adopting specified heat treatment procedures.
13.13.	Suspensions for ducting will be supplied in running lengths, which shall be cut to size and adjusted as required. Ducts / expansion bellows are dispatched to site in loose walls plates / pieces and these are to be assembled and welded at site along with stiffeners etc., before erection within the finally accepted rates. All joints connecting duct expansion piece and dampers shall be seal welded on inside as well as on outside.
13.14.	Mechanical erection works associated with the power cylinders, valves, valve actuators etc., coming under various groups shall be provided by contractor within the finally accepted rates. The Erection, testing and commissioning of all electrically operated valves, actuators and dampers is covered within the scope of this specification.
13.15.	The contractor shall carry out trial run of all motors including checking the direction of rotation in the uncoupled condition. Checking of alignment and recoupling of the motor to the driven equipment as per instructions of BHEL engineer and to their satisfaction. All electrical motors have to be tested for IR & PI values prior to the trial run. Where required, dry out may have to be carried out by using external heating source. Contractor shall make all arrangements in this regard and complete the work as instructed. Vendor shall all necessary MMDs including the motorized insulation testers for the above test.
13.16.	The contractor shall fabricate pipe, special bends etc., threading and welding as required for installing lube oil system and carry out the acid cleaning of the fabricated piping. The contractor shall also service the lube oil system, carrying out the hydraulic test of oil coolers etc.
13.17.	Contractor shall carry out kerosene testing of all bearing housings of various rotating equipment like pumps, fans etc., as per BHEL engineer's instructions. Performance of hydro test of oil coolers of rotating machines and hydro test of other equipment as per

	BHEL engineer's instructions is included in the scope of work. Forced lube oil system of motors or rotating equipment form parts of the work under this specification.
13.18.	Certain rotating machinery after initial runs and commissioning of the equipment have to be hot aligned as per the instructions of BHEL engineer. Cleaning fans, ducting etc., free of extraneous steel, scaffolding materials electrodes, all foreign materials etc., before trial run of rotating machinery, and at various stages of pre-commissioning activities as per BHEL engineer's instruction, is within the scope of work.
13.19.	Some of the rotating equipment and electrical motors are provided with protective greases only. Contractor shall arrange for cleaning of the same with kerosene or some other reagent. If necessary, dismantling some of the parts of the equipment would be necessary. He shall arrange for re-greasing / lubricating them with recommended lubricants and for assembling back the dismantled parts, at quoted rate. Lubricants will, however, be supplied free of cost by BHEL.
13.20.	After initial trial of rotating equipment, control and power cabling for motors and other equipment / instrumentation shall have to be disconnected for checking alignment and re-setting / re-alignment / hot alignment. Contractor shall have to arrange for disconnecting control and power cabling as per BHEL engineer's instructions and clearance and reconnect the control and power cabling after realignment. Quoted tonnage rate shall be inclusive of the above.
13.21.	Packer plates supplied may have to be machined to the correct dimensions. It may also be necessary to blue match the same with each other/ with equipment / with foundations as per BHEL instructions
13.22.	Contractor shall arrange changing of preservative oil in the gearboxes, journal and other bearing assemblies of rotating equipment when in storage areas or after erection of equipment as the case may be as per the instructions of BHEL engineer. Necessary lubricants / oil will be supplied by BHEL and the same will be drawn by contractor from BHEL / customer's stores and transporting to site. No additional payment will be made for such works even though supply of lube oil might have been made under regular dispatch-able unit (DU) number against product group main assembly (PGMA) and appearing in the shipping list. Prior to the commissioning of the equipment, oil should be drained and collected in drums provided by BHEL and returned to BHEL / customer's stores.
13.23.	The fans, mills and other rotating machines shall be checked for clearances and other vital tolerances. Necessary assistance for balancing of equipment during trial run, if required, shall be provided by the contractor free of cost.
13.24.	Whenever required the contractor shall arrange for pre-qualification of process task performers.
13.25.	Ducts/ expansion bellows (metallic & non-metallic) are normally supplied in loose wall plates/ segments and these are to be assembled and welded at site before erection. Correction of ovalities/ distortion of ducts, expansion bellows etc occurred during transportation/ handling are to be carried before erection as part of work. Erection of mechanical components of non-metallic joints is included in the scope of work. All joints connecting ducts, expansion pieces and dampers shall be seal welded. These welds have to be made leak proof and tested as per technical instruction / requirement.
13.26.	Non specified jobs at the interface / terminal points like bolting welding, gasket changing etc. have to be done by the contractor within the quoted price.

13.27.	Instrument tapping coming on the FGD and associated equipment's to be welded/fitted by the contractor with in the quoted price
13.28.	The terminal points decided by BHEL should be final and binding on the contractor for deciding the scope of work and effecting payment for the work done.
13.29.	Actuators / drives of dampers, gates, powered vanes etc. may have to be serviced, lubricated, before erection, during pre-commissioning & commissioning, including carrying out minor adjustments required as incidental to the work.
13.30.	All rotating machines and equipment shall be cleaned, lubricated, checked for their smooth rotation, if necessary by dismantling and refitting before erection. If, in the opinion of Engineer, the equipment is to be checked for clearance, tolerance at any stage of work or during commissioning period, all such works are to be carried out by contractor at his cost.
13.31.	All the shafts of rotating equipment shall be properly aligned to those of the matching equipment within design tolerances All bearings, shafts and other rotating parts shall be thoroughly cleaned and suitably lubricated before starting.
13.32.	All the motors and equipment shall be suitably doweled after alignment of shafts with taper / parallel machined dowels as per the direction of the Engineer. Dowel pins required are be machined by the contractor at his own cost. However the materials for dowel pins shall be issued by BHEL free of cost.
13.33.	The HT motor bearings shall be blue matched at site and checked for bearing clearances. The contractor if required shall carry out scraping of bearing housing. No extra claim for blue matching up to 1mm initial gap will be entertained.
13.34.	The contractor at no extra cost to BHEL shall carry out servicing and realignment of skid mounted equipment.
13.35.	Certain instruments like pressure gauges, pressure transmitters, temperature gauges, flow switches and indicators, etc., are received in assembled condition as integral part of equipment. Contractor shall be responsible for safe receipt, installation and custody of these instruments supplied mounted on skids / equipment. The calibration of skid / equipment mounted instruments shall be arranged by BHEL through other agency engaged for C&I. Contractor will be informed by BHEL engineer about the details of C&I agency. The contractor shall coordinate with the C&I agency for removal, calibration and re-installation of the instruments. Though C&I agency will remove and reinstall the instruments after calibration, the contractor for this package will maintain the list of all the instruments removed & reinstalled. Instruments prior to removal and after reinstallation shall be considered in custody of the contractor for this package.
13.36.	All electrical panels, control gears, motors and such other devices shall be properly dried by heating to improve IR valve, before they are energized. Bearings, slip rings commutators and other exposed parts shall be protected against moisture ingress and corrosion during storage and periodically inspected.
13.37.	The contractor shall completely erect and test all the piping systems, covered in the specification including sampling lines up to and including sample coolers, hangers & supports, valves and accessories in accordance with the drawings furnished. This includes all necessary bolting, welding, pre-heating, stress relieving, testing, cleaning and painting. System shall be demonstrated in condition to operate continuously in a manner acceptable to the Engineer. Welding shall be used throughout for joining pipes except where flanged, screwed or other type joints are specified or sown on the

	drawings. All piping shall be erected true to the lines and elevation as indicated in the drawings.
13.38.	Pipes sent in standard length shall be cut to suit the site conditions and the layouts. Tubes or pipes wherever deemed to be convenient will be sent in running lengths with sufficient bends. Bends upto 65-mm nominal bore will have to be fabricated at site. Only cold cutting methods are to be employed for cutting of pipes and tubes irrespective of the size and material. Gas Cutting , if any ,will be allowed only in CS LP piping
13.39.	The contractor shall ensure lowering of pipes in position with adequate precautions as to avoid any damage to either material or men. Only the anchoring points earmarked for the purpose of lowering the pipes are to be used.
13.40.	It is possible that a few flanges may not be matching. The contractor shall be required to cut and re-weld the same as and when required without any additional cost.
13.41.	Wherever piping erected by the contractor is connected to equipment / piping erected by the other agencies the joint at the connecting point shall be the responsibility of the contractor who is erecting the piping under this specifications.
13.42.	Normally the high-pressure valves will have prepared edges for welding. But, if it becomes necessary, the contractor will prepare new edges or recondition the edges by grinding or chamfering to match the corresponding tubes and pipes within the scope of the work.
13.43.	All fittings like `T'-pieces, weld neck flanges, reducers etc., shall be suitably matched with pipes for welding. The valves will have to be checked, cleaned or overhauled in full or in part before erection and during commissioning.
13.44.	The contractor shall be responsible for correct orientation of all valves so that seats, stems and hand wheels will be in desired location. It is the responsibility of the contractor to obtain the information regarding orientation of valves not fully located on drawings before the same are installed.
13.45.	Suspension for piping, etc., will be supplied in running lengths, which shall be cut to suitable sizes and adjusted as required.
13.46.	The adjustment of all hangers & supports erected in both cold & hot conditions for maintaining the proper slopes towards the drain pots and application of cold pull in the piping wherever required is also included in the scope of the contractor.
13.47.	Spring suspensions / constant load hangers have to be pre-assembled for required load and erection carried out as per instructions of BHEL. Any adjustments, removal of temporary arrests / locks etc., have to be carried out as and when required.
13.48.	Contractor shall install piping in such a way that no excessive or destructive expansion forces exists in either the cold condition or under conditions of maximum temperature and pressure. All bends, expansion joints and any other special fittings necessary to take care of proper expansion shall be incorporated as per the advice of Engineer. During installation of expansion joints, anchors, care must be taken to see that full design movement is available at all times from maximum and minimum temperature.
13.49.	The hanger assemblies shall not be used for attachment of rigging to hoist the pipes into position. Other means shall be used to securely hold the pipe in position till pipe supports are completely assembled and attached to the pipe and building structure.
13.50.	Layout of small-bore piping, oil systems etc. as required shall be done as per site requirement. Necessary sketch for routing these lines should be got approved from

	BHEL by the contractor. There is a possibility of slight change in routing the above pipelines even after completion of erection or from aesthetic point of view. Contractor at no extra cost should carry this out. As built drawing is to be submitted by the contractor after erection completion.
13.51.	All the valves, including motorized valves, flap valves, dampers, actuators, etc. shall be serviced and lubricated to the satisfaction of Engineer before erecting the same and during pre-commissioning also. Welding or jointing of extension spindle for valves to suit the site conditions and operational facility shall be part of erection work within the quoted rates.
13.52.	Erection and welding of necessary instrumentation tapping points, thermocouple pads, thermo-wells, valves, battery of first root valves, condensing vessels, flow nozzles and control valves to be provided on, auxiliaries and pipe lines are covered within the scope of this specification. This will be the responsibility of the contractor and will be done as per the instructions of BHEL Engineer. The welding of all the above items will be contractor's responsibility even if the: a. Product groups, under which these items are released, are not covered in the scope of this tender. b. Items are supplied by any agency other than BHEL.
13.53.	The contractor shall carry out the tightening of the field bolts on the equipment and piping covered under this specification by using either the calibrated torque wrench method or the turn of part method. The methods used the tools and the equipment deployed shall be subject to the approval of Engineer. The competent technicians shall carry out the bolting work.
13.54.	The contractor shall prepare as built piping drawing & submit to BHEL Engineer for approval & verification of material used.
13.55.	Plate Type Heat exchangers will be supplied for cooling of Auxiliary Cooling water lines. Vendor scope covers erection of these PHEs as per the instruction of BHEL engineers.
13.56.	Contractor has to make canopies for motors, actuators, lub oil units, control valves etc. Material for this will be supplied in random lengths / sizes. No separate payment for fabrication is envisaged. Only the erection tonnage rate applicable for Misc eqpt. / structure steel item no. 3 of rate schedule will be paid for this work.
13.57.	BHEL will provide free of cost only the shims and packer plates (either machined orplain) which go as permanent part of the equipment. 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/machining and de-burr the same. However, machining of the packers wherever necessary shall be arranged by the contractor.
13.58.	All lifting tackles including wire-ropes slings, shackles, used by the contractor, shall be got approved by BHEL Engineer. It will be the responsibility of the contractor to ensure safe lifting of the equipment taking due precautions to avoid any accidents and damages to equipment and personnel. Calibration/fitness testing certificates from recognized agency are to be submitted to BHEL site office for equipment/instrument/appliances to be used, as per requirement of BHEL/ISO system. Expenditure on such works forms a part of the scope of work.

13.59.	The contractor shall erect scaffoldings/Temporary platforms supports etc required during erection before the permanent supports are erected. These should be of adequate capacity and shall never be overloaded. These should be replaced when not found suitable during erection work. All structure materials required for the above shall be arranged by the contractor at his own cost. No such material shall be supplied by BHEL in any case. Welding of temporary supports, cleats etc on the columns shall be avoided. In case of absolute necessity, contractor shall take prior approval from BHEL Engineer. Further, any cutting or alteration of member of the structure or platform or other equipment shall not be done without specific prior approval of BHEL Engineer.
13.60.	Tanks shall be supplied by the units in more than one segment (rolled sections) having height of segment approx. 2500 mm. Contractor have to complete the assembly at site with necessary welding/NDT/testing as per the approved FQP. Rubber lining of the tanks shall be in the scope of the rubber lining vendor.
13.61.	Lime stone silos shall be supplied by the units in more than one segment (3 to 4 segment) and height of segment shall be 2500 mm. Contractor shall have to complete the assembly, final welding,/NDT/testing as per the approved drawings/ documents/ FQP.

13.62 Piping

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.)

13.62.1 Handling at site stores / storage yard, transporting to site, inspection, preassembly, erection, alignment, welding, NDT, fixing of hangers & supports, 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, trial operation & handing over to customer of piping and its associated items / systems , hangers and supports, valves and other miscellaneous equipments.

13.62.2 Brief list of system / sub system, approximate weight of pipes and accessories to be erected by the contractor mentioned in the Bill of Quantity and number of joints mentioned in Erection Welding Schedule of this tender specification are meant for giving general idea to the tender 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 in stage by stage, welded, erected and aligned as per the drawing dimensions / tolerance and instructions of BHEL Engineers.

13.62.3 The work on piping systems (air, water, oil, steam, gas etc.,) will include laying, edge preparation, fixing and welding of the elbows / fittings / valves etc., welded on the lines, 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.

13.62.4 Pre Assembly joints to be marked in isometrics drawings in consultation with BHEL Engineers and submit to BHEL before starting work. Contractor to maintain Line History sheet (LHS) of all Pipe lines as per BHEL Format and submit before HT to BHEL/Customer for getting HT Clearance.

13.62.5 Carrying out erection of piping 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 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. 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, with in the quoted rate.

13.62.6 Erection of all drains / vents / relief / escape / safety valve, piping to various tanks/ sewage / drain canal / flash box / flash tank / condenser / sump / atmosphere etc. from the stubs on the piping to the equipments erected by the contractor is completely covered in the scope of work.

13.62.7 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.

13.62.8 Pipes shall not be dropped to avoid impact or bump.

13.62.9 Normally weld neck valves will have prepared edges for welding. But if it becomes necessary the contractor shall 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.

13.62.10 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.

13.62.11 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.

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

13.62.13 All the dampers, valves, lifting equipments, actuators / 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 in the equipments, if there are problems in the operation they have to be attended by the contractor during the tenure of the contract.

13.62.14 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.

13.62.15 In the case of structural members, pipes, plates, ducts etc, 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 within the quoted rates / prices.

13.62.16 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.

13.62.17 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 joint assemblies 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.

13.62.18 Fine fittings, 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. 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.

13.62.19 Erection of platform and supporting structures around the equipments / valves / filters etc., is covered in the scope of contract and shall be erected by the contractor as per accepted tonnage rate for —Hangers and Supports.

13.62.20 Additional platforms for approaching different equipments as per the site requirement, which may not be indicated in drawings, shall be assembled and erected by contractor. However, the contractor shall be paid for this work on accepted tonnage rate for

—Hangers and Supports. The steel materials required for these works shall be supplied by BHEL free of cost and the contractor will have to install them to suit the requirement.

13.62.21 The Contractor shall carry out the reaming and honing of coupling holes with his own reamers, honing machine and honing accessories etc at his own cost.

13.62.22 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.

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

13.62.24 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.

13.62.25 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.

13.62.26 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 as per the drawings.

13.62.27 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.

13.62.28 All the valve packing with asbestos base to be lubricated once in 6 months till handing over. Necessary gland packing will be supplied by BHEL.

13.62.29 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 less than or equal to NB 65 mm will have to be fabricated at site adopting specified heat treatment procedures, wherever required at no extra cost.

13.62.30 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.

13.62.31 All piping supplied in running meter has to cut and edge prepare as per the standards / drawings and as per the instruction of BHEL Engineer within the quoted rate.

13.62.32 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 and edge prepared at site to required length to suit layout as given in the

erection drawing. 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.

13.62.33 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, are in the scope of work. No extra payment will be admitted for such works.

13.62.34 For any mismatch while matching the joints in tubes, the cutting, adjusting, re welding, addition of spool pieces shall be done by the contractor to match site conditions without any extra payment.

13.62.35 Fittings like bends, tees, elbow, mitre bends, reducers, flanges, thruster blocks, etc., will be supplied as loose items and edge preparation if required shall be carried out by the contractor.

13.62.36 Certain adjustments in length may be necessary while erecting pipelines. Removing / adding extra lengths / to suit the final layout, preparing edges afresh and adopting specified heat treatment procedure are in the scope of work.

13.62.37 For pipes nominal 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.

13.62.38 Piping below size 2**''**, 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.

13.62.39 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 instructions.

13.62.40 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.

13.62.41 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 equipments, 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 equipments / 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.

13.62.42 In case of piping connected to equipment, matching of flanges for achieving the parallelism and alignment at equipment end by suitably resorting to heat correction or other method as instructed by BHEL Engineer is within scope of work.

13.62.43 The surface of the pipes to be joined shall be suitably prepared as per instructions of BHEL Engineers. Edge preparation shall be done by chamfering machine, whenever required and all welding surfaces must be cleaned thoroughly. All works due to the mistake of the contractor shall be repaired / redone at contractor‘s cost. Instrumentation drains, stubs which are sent in loose from manufacturing units are to be welded at site as per BHEL Engineer‘s instructions.

13.62.44 Flame cutting of piping and other equipment shall be strictly done as per BHEL Engineer‘s instructions and in his presence only.

13.62.45 All the weld joints on equipments 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.,

13.62.46 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.

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

13.62.48 Erection of Flow nozzles, flow switches, steam traps, filters, flow meters, other metering elements, spray nozzles, steam traps, flow orifices, flow indicators, control valves, aux. control valves, CRH NRV, HPBP Valve and suction strainers of BFP, CEP & Booster pumps 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 / Customer stores, transport to site, suitably cutting the erected piping, cleaning, erection, welding, radiography and stress relieving and commissioning.

13.62.49 Erection of Flow nozzles, flow orifices, flow switches, flow meters, flow indicators, spray nozzles, steam traps, filters, suction strainers, other metering elements, control valves, NRVs, servomotors 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 issue and collecting the same from BHEL stores, transport to site, suitably cutting the erected piping, cleaning, erection, welding, radiography and stress relieving and commissioning.

13.62.50 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.

13.62.51 The contractor has to fabricate stainless steel orifice plate within the quoted rate. No extra payment will be made for fabrication of above orifice plates. The required stainless steel plate will be supplied by BHEL.

13.62.52 Fixing, fitting, welding of thermo wells, stubs, hoses, tapping points, root valves and instruments etc., on different lines / equipments (which will be supplied by BHEL) is within the scope of work. Fixing of Pick-Ups, Probes & Accessories for vibration monitoring system is the scope of this specification.

13.62.53 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 are in the scope of work.

13.62.54 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.

13.62.55 **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.** All embedded temperature measuring elements provided in the bearings will have to be terminated at the junction box by the contractor. Thermo wells 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 thermo wells and flow elements with branch pipes be installed and welded.

13.62.56 Suspension for piping etc., will be supplied in running lengths and shall be cut to suitable sizes and adjusted as required. Hangers' components which are being supplied in loose shall be assembled at site and erected as part of the work.

13.62.57 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.

13.62.58 All hangers, supports and anchors (including concreting or welding) shall be installed as per drawing and complete 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 and provided at no extra cost. However, the raw material required for fabrication of such supports shall be supplied by BHEL free of cost.

13.62.59 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.

13.62.60 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.

13.62.61 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.

13.62.62 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.

13.62.63 All welded joints should be painted with anti-corrosive paint, once radiography and stress relieving works are over.

13.62.64 The piping components are sent in parts for convenient transportation /layout requirements. They are to be cleaned, pre-assembled in stage by stage, welded, erected and aligned as per the drawing dimensions / tolerance and instructions of BHEL Engineers.

13.62.65 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 equipments etc. as per BHEL Engineer‘s instructions within the quoted rate.

13.62.66 **Contractor should obtain the formal clearance from Inspectorate of Boilers to carry out erection & Welding of piping 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. Inspection fee, if any shall be paid by BHEL.**

13.62.67 Contractor shall arrange all equipments, alignment bolts, tools, Consumables like welding electrodes in their scope (all types except those supplied by BHEL), 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 contractor‘s scope. Only filler wires as stipulated by manufacturing units and identified in relevant shipping list will be supplied to the contractor free of cost. Any excess requirement shall be arranged by the contractor

/ BHEL at contractor's cost. Argon / Nitrogen gas for stainless steel tubes purging during welding to be arranged by contractor within the quoted rates.

13.62.68 The Matching Pieces / Nozzles / Reducers (including the reducers to be connected with HP Heaters) supplied for connecting BFP discharge piping with the Heaters are forming part of the systems and are also in the scope of work including issue, transportation, suitably cutting the erected piping, cleaning, erection, welding, radiography and stress relieving and commissioning.

13.62.69 Cutting and removal of dummies for all the shop welded stubs (irrespective of the equipments 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.

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

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

13.62.72 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.

13.62.73 All the shafts of rotating equipment shall have to be properly aligned to those of matching equipment to perfection, accuracy as required and the equipment shall be free from excessive vibration so as to avoid overheating of bearings or other conditions which may tend to shorten the life of the equipment.

13.62.74 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.

13.62.75 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.

13.62.76 The contractor shall take necessary measures to see that all the machined surfaces are preserved and covered.

13.62.77 All dimensions / elevations refers to centerline 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 site engineer's advice.

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

13.62.79 Contractor has to arrange required fire retardant covering material at their cost to protect the machined components, assembled parts and insulation materials drawn from BHEL before and after erection.

13.62.80 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 shall be arranged by the contractor at his cost.

13.62.81 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.

13.62.82 The temporary structures / items welded to permanent members / pipes are to be cut and removed without any damage. In case of any damage, the same has to be made good by the contractor at his cost.

13.62.83 Before lifting the heavy components, soft materials like gunny bags to be used while lashing the rope to avoid dents, rubbing marks etc. The capacity, number of sheave pulleys, size of the rope, guide pulley locations are to be decided at site with respect to the capacity and positioning of the winch. The end caps provided at shop for various stubs are to be removed during final fit up only.

13.62.84 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.

13.62.85 All the works such as cleaning, leveling, 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.

13.62.86 Normally the high pressure valves will have prepared edges for welding. But, if it becomes necessary the contractor shall prepare new edges or recondition the edges by grinding or chamfering to match the corresponding tubes and pipes. All fittings like

'T'pieces, weld neck flanges, reducers etc., shall be suitably matched with pipes for welding.

13.62.87 Erection of all the piping systems supplied along with PEM / Bhopal / BAP supplied auxiliaries covered in this contract, is to be erected by the contractor as per the accepted tonnage rate.

13.62.88 The contractor shall provide any fixtures, concrete blocks / wooden sleepers, etc., which are required for temporary supporting / preassembly of the components at site.

13.62.89 Normally the valves will have prepared edges for welding. But if it becomes necessary the contractor shall prepare new edges or recondition the edges by grinding or chamfering to match the corresponding tubes and pipes. All fittings like "T" pieces, weld neck flanges, reducers, elbows, flanges, inserts etc., shall be suitably edge prepared and matched with pipes for welding. No extra cost shall be paid for this.

13.62.90 The valves will have to be checked, cleaned or overhauled in full or in part before erection, after chemical cleaning and during commissioning. All the valves, after chemical cleaning, have to be checked, cleaned or over hauled in full or part before erection if called for as part of scope.

13.62.91 All site-fabricated pipes will be issued in running metres as straight. These are to be cut and edge prepared at site to required length to suit layout as given in the erection drawing. All the 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.

13.62.92 Erection of flow switches, steam traps, filters, flow meters, other metering elements, flow orifices, flow indicators, control valves supplied either by BHEL or customer forming part of the system is in the scope of work. This will include collecting from BHEL/Customer stores, transport to site, suitably cutting the erected piping, cleaning, erection, welding, radiography and stress relieving and commissioning.

13.62.93 Fixing / Fitting / welding of thermo wells, stubs, hoses, tapping points, root valves and instruments etc., on different lines / equipments (which will be supplied by BHEL) is within the scope of work. Fixing of Pick-ups, Probes & Accessories for vibration monitoring system for the erected equipments / pipe lines are covered in the scope of this specification.

13.62.94 Wherever hanger 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. The required structural steel materials for temporary supports 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. The above works shall be carried out by the contractor within quoted rate.

13.62.95 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 equipments etc., as per BHEL Engineer's instructions.

13.63 Utility Points

13.63.1 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 B O M to BHEL for approval.

13.63.2 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.

13.64 Galvanised Steel Piping

13.64.1 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.

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

13.64.3 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.

13.64.4 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.

13.64.5 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.

13.65 Buried Piping

13.65.1 The 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.

13.65.2 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.

13.65.3 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 are to be carried out by the contractor within quoted rates.

13.65.4 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.

13.65.5 Dewatering of excavated area for pipe laying, welding, wrapping coating etc is in the scope of the contractor.

13.65.6 Preparation of pipe surface as per customer consultant's specification by sand / shot / grit blasting 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.

13.65.7 Contractor shall arrange all the equipments, 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 contractor's scope.

13.66 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.

13.67 Erection - Fire Protection System

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

13.67.1 GALVANISED STEEL PIPING

13.67.1.1 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.

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

13.67.1.3 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.

13.67.1.4 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.

13.67.1.5 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.

13.67.2 Buried Piping

13.67.2.1 The 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.

13.67.2.2 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.

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

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

13.67.2.5 Dewatering of excavated area for pipe laying, welding, wrapping coating etc is in the scope of the BHEL.

13.67.2.6 Preparation of pipe surface as per customer consultant's specification by sand / shot / grit blasting 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.

13.67.2.7 Erection of platform and supporting structures around the equipment / valves / filters / in the Fire protection system area, etc. Is covered in the scope of contract and shall be erected by the contractor as per accepted tonnage rate for other structural work

13.67.2.8 All dimensions / elevations refers to centerline 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 site engineer's advice.

13.67.2.9 Contractor should fabricate bends of </=2" diameter size from running meters of pipe.

13.67.2.10 Contractor shall arrange all the equipments, 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 contractor's scope.

13.67.3 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. 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.

Scope of Service: DG Sets

13.68.1 Receipt of materials (2 sets of DG Set) from BHEL's/Customer's Store/storage yards; handling at BHEL's/Customer's Store / storage yards / site of works; Transportation between BHEL's/Customer's Store / storage yards and site of works.

13.68.2 Preparation of foundations (chipping/ levelling of concrete) ; fabrication of packer plates from raw materials, cutting of required shims, drilling, tapping, grinding, cleaning, blue matching, pre-assembly/trial assembly, dismantling of certain items/equipment/components for checking & cleaning, blue matching, erection, leveling and alignment of loose components of 3 sets of the DG Sets; grouting of foundation bolts, Sole / Base plates, etc. with non-shrink grout materials Conbextra GP-2; testing; trial run, commissioning and handing over to customer.

13.68.3 Arrangement of T&P, special tools and tackles for handling, complete planning, monitoring of work, site supervision, testing and trial run of the DG Sets (3 sets). Total estimated Static Weight of the one set of DG and Acoustic Set is 11.5 MT(approx.) and 7 MT (approx.) respectively. Dynamic weight is 1.5 times the static weight.

13.68.4 Any scaffolding, temporary platforms, ladders etc. that may be required for the purpose of the DG Sets erection shall be arranged by the vendor for the execution of work. All miscellaneous steel, if required, necessary for the DG Sets erection and commissioning are to be arranged by the Contractor / bidder.

13.68.5 Arranging of Tools; calibrated MME [(Measuring and Monitoring Equipment) traceability to National and International standards] like High Precision Spirit Level, Vernier Calipers, Filler Gages, inside/outside Micrometers, Dial gauges, Measuring Tapes, Surface plate, etc. etc. required for the DG Sets erection & alignment; required capacity of slings & D-shackles; Trailer with prime mover; loading, unloading, shifting of materials shall be in the scope of the Contractor / bidder

13.68.6 For grouting of the DG Sets foundation bolts and Base / Sole plates etc. (as required for completion of erection of DG Sets) with fresh non-shrink (free flow) grout materials Conbextra GP-2 cement including form work & shuttering materials is to be arranged by the Contractor / bidder at his cost. Batch certificate of Conbextra GP-2 cement should be submitted well in advance for verification and acceptance of the same for use.

13.68.7 All electrical equipment have to be tested for IR & PI values prior to the trial run. If required, dry out of electrical equipment may have to be carried out by using external heating source (Halogen lamps) using own manpower and other resources. No separate payment is envisaged for the same.

13.68.8 The contractor/ bidder 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 the action of weather and from damages or defacement and shall also cover the finished parts immediately on completion of work as per BHEL's Engineers instructions. The machined/finished surfaces should be greased and covered.

13.68.9 Required manpower assistances are to be provided during the course of commissioning with required hand tools.

13.68.10 Arranging of required sizes of Allen Keys and Ring spanners / D-spanners spanners required for erection of the DG Sets are to be arranged by bidder. Torque wrenches of required capacity, if/ as required, are also to be arranged by the bidders. The list of consumables, T&P, MME etc. etc. mentioned in various clauses are not intended to be exhaustive. Contractor / bidder shall arrange at his cost all approved consumables, Conbextra GP-2 cement, T&P, MME etc. required though not listed specifically.

13.68.11 All welders shall be tested and approved by BHEL / Customer engineers before actually they are engaged on work.

13.68.12 Welding of necessary instrumentations to be provided for the DG Sets are covered within the scope of this specification.

The contractor/bidder shall at his cost perform any services, test etc. although not specified but nevertheless required for the completion of work. Access to site for inspection by BHEL/Customer engineers shall be made available by contractor all times.

Note:

- Brief list of equipments / sub-assemblies to be erected by the contractor & approximate weight and size of individual heavy components are given under the (Bill of quantity) and is meant for giving general idea to the tender only about magnitude of the work involved. The components are sent in parts for convenient transportation. They are to be cleaned, assembled in stage by stage, fastened / welded, erected and aligned as per the drawing dimensions / tolerance and instructions of BHEL Engineers.
- The terminal points decided by BHEL are final and binding on the contractor for deciding the scope of work and effecting the payment for the work done up to the terminals.
- All normal erection and assembly techniques necessary for completion of works under this specification and magnitude have to be carried out. It is not possible to specifically list out all of them. Absence of any specific reference will not absolve the contractor of his responsibility for the particular operation. These would include equipment for checking, cleaning, servicing and site fabrication.

  I. Scaffolding and rigging operations
  II. Flame / electric cutting, grinding, welding, radiography and stress relieving & wrap inspection by HOLIDOY equipment.
  III. Fitting, fettling, filing, straightening, chamfering chipping, Scrapping, reaming, cleaning, checking, leveling, blue matching, Aligning and assembly.
  IV. Surface grinding, drilling, doweling, shaping.
  V. Temporary erections for alignment, dismantling of certain equipment for checking, cleaning, servicing and site fabrication

- 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.
- Sometimes it may become necessary for the contractor to handle certain unrequired 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.

  Materials shall be stacked neatly, preserved and stored in the contractor's shed/work area in an orderly manner. In case it is necessary to shift and restack 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 has to arrange required fire proof tarpaulins to protect the machined components / assembled parts drawn from BHEL before and after erection at their cost.
- 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. 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.

- It shall be the responsibility of the contractor to provide ladders for all pipe trenches for erection purpose. Rollers to be provided for the pipe to be welded for easy work. No temporary welding on any structural member is permitted except under special circumstances with the approval of BHEL.
- 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.
- 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.,
- Contractors 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.
- 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.
- 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.
- 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.
- All fittings like elbows, tees, reducers, weld neck flanges, inserts etc., shall be matched with pipes for welding which may require re-edge preparation, grinding etc., No extra cost shall be paid for this.
- The valves will have to be cleaned, checked, lapped or overhauled in full or in parts before erection, during commissioning. Any special tools required for lapping only will be arranged by BHEL.
- 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 NDT, heat treatment procedure shall be carried out by the contractor within the quoted rate.

- Contractor shall remove the bridge, stopper etc., by gouging/ grinding and not by hammering. Any burrs left on the equipments / 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.
- All erectable gaskets, fasteners and other hardware shall be supplied by BHEL free of cost if any.
- The piping, valves etc will be provided by BHEL free of cost. However dismantling of the piping, valve etc, its cleaning and edge preparation, for its reuse, if required, will have to be done by the contractor without any extra claim.
- All pipes including Canal water / Raw water piping (underground and over ground) shall be supplied by BHEL in fabricated condition in tentatively 6 mtr to 12 mtr length. Fittings like tees, reducers, elbows, manholes, mitre bends, flanges etc shall be supplied by BHEL in fabricated condition. Cutting of tees, elbows / reducers to suit the pipe fitting / erection as required, is to be done without any extra claim.
- The contractor may have to carry out fabrication of mitre bends, tees, reducer of sizes NB 250 and above for LP piping systems. Pipes will be supplied in running meters by BHEL free cost. Required number of mitre bends, tees is to be fabricated by the LP piping erection contractor. Payment shall be made as per applicable item of price schedule.
- Erection & welding, of all valves, misc fittings required to complete the system but not specifically mentioned in relevant chapter of tender is covered in the scope of contract and payment will be made as per applicable piping item of mechanical price schedule. All such materials will be supplied by BHEL. The erection activity of valve also includes cleaning, servicing and final painting of valves. All counter flanges, bolts, nuts, washer, gaskets etc shall be supplied by BHEL loose (free issue).
- Any other connected material supply which is not covered in BOM but required to complete the system shall be erected by the vendor and payment in this case shall be made as per applicable item rate.
- 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.
- Protection of pipeline against floatation during the contract 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.

Material Handling, Transportation and Site Storage:

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 fotherwise specified.)

- Loading at BHEL / Customer stores and storage yard, transport to site, unloading at site / working area of equipment, placement on respective foundation / location, fabrication yard, 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.
- 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, trailor 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. **Store / storage yard located at approx. 3.0KM away from erection site.**
- Contractor shall plan and transport equipments, components from storage yard to erection site and erect them in such a manner and sequence that material accumulation at site does not lead to congestion at site of work.
- 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.
- Sometimes it may become necessary for the contractor to handle certain unrequired 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.
- Materials shall be stacked neatly, preserved and stored in the contractor's shed / work area in an orderly manner. In case it is necessary to shift and restack 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.

14.0 **Welding, Heat Treatment, Radiography and NDT (All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified)**

14.1. All welders 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 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.

14.2. 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.

14.3. 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 engineer.

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

14.5. 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.

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

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

14.8. 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.

14.9. 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.

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

14.11. The contractor shall also be equipped for carrying out other NDT like LPI / MPI/UT / Hardness test etc. as required as per welding schedules / drawings within the finally accepted price / rates. For UT machine shall be used of recordable type.

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

14.13. Contractor for radiography work shall use iridium-192. The geometric un-sharpness shall not exceed 1.5 mm. The contractor should take adequate safety precautions while carrying out radiography. Contractor at his cost shall arrange necessary safe guards required for radiography (including personnel from BARC).

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

14.15. 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.

14.16. 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.

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

14.18. 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.

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

14.20. 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.

14.21. 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.

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

14.23. 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/NTPC/UPRVUNL 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.

14.24. Radiography on LP piping joints is not envisaged. However, other NDT test as called for in the FQP including LPI, MPI and HT will have to be carried out. 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.

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

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

14.27. 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.

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

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

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

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

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

15.0 **Application of Insulation** (All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified)

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

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

15.3. 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.

15.4. 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.

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

15.6. 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.

15.7. 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.

15.8. 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.

15.9. 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.

15.10. 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.

15.11. 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:

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

15.12. 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.

15.13. 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.

15.14. 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.

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

15.16. 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.

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

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

16.0 **Painting Including Finish Painting & Stenciling** (All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

16.1. The scope of work shall also include supply and application of final painting of all the erected equipment's & Structures as required and specified as per painting schedules. Before commencement of Final Painting, the contractor has to obtain written clearance from BHEL/Customer for effective completion of surface preparation.

16.2. 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.

16.3. 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.

16.4. 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.

16.5. 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.

16.6. 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.

16.7. 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).

16.8. 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.

16.9. 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.

16.10. 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.

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

16.12. The contractor shall ensure availability of

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

16.13. 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.

16.14. Please Refer Annexure 1 (Painting Schedule) also.

17.0 **Testing, Pre-Commissioning & Commissioning and Post Commissioning** (All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified)

17.1. Contactor shall carry out all the required tests and pre-commissioning and commissioning activities required for their 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. HT and LT electrical testing of motors and megger/IR value checking is also part of scope. These tests/ activities may not have been listed in these specifications.

17.3. The 'initial operation'/ trial operation of the complete facility as an integral Unit shall be conducted for 720 hours. During the period of initial operation of 720 hours, the FGD system shall operate continuously at full load for a period not less than 72hours. 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.

17.4. 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)

17.5. All the tests may have to be repeated till all the equipment satisfy the requirement /obligation of BHEL at various stages. The contractor shall do all the repairs for sitewelded joints arising out of the failure during testing.

17.6. Scope of pre-commissioning activities cover installation of all necessary equipment including temporary piping, supports, valves, blanking, with accessories with access platforms valves, pressure gauges, electrical cables, switches, cutting of some existing valve, or for any other tests as the case may be and will carry out above activities under this scope of work as per instruction of BHEL Engineer. The scope also covers the offsite disposal of effluents of the tests under the scope of this contract as per instruction of BHEL Engineer.

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

blowers and blanks and putty, temporary fixtures & ducts required for conducting air leak test are to be installed. (Putty to be procured by the contractor). • Dismantling of the temporary equipment etc. and return the same to the BHEL stores is also included in the scope of work. The above is only a broad breakup of the temporary works. The engineer at site will make final break up. His decision will be final and binding by all the parties.

17.8. Contractor shall lay all necessary electric cables and switches etc. required for the air leak test, other tests etc., and maintain the system till the tests are completed satisfactorily.

17.9. It shall be the responsibility of the contractor to provide various category of workers in sufficient numbers along with Supervisors during pre-commissioning, commissioning and post commissioning of equipment and attending any problem in the equipment erected by the contractor till handing over. Contractor will provide necessary consumables, Certified T&P's, IMTE's 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.

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

17.11. 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.

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

17.13. The contractor shall make all necessary arrangements including making of temporary closures on piping/ equipment for carrying out the hydrostatic testing on all piping equipment covered in the specification at no extra cost.

17.14. The valves will have to be checked, cleaned or overhauled in full or in part before erection, during pre-commissioning and commissioning as may be necessary.

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

17.16. All temporary supports shall be removed in such ways that pipe supports are not subjected to any sudden load. During hydraulic testing of the 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.

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

Engineer to ensure that no valves and valve actuators are left unserviced. Wherever necessary as required by BHEL Engineer, the contractor shall arrange to lap / grind valve seats. Cleaning and servicing of all the filters / strainers, toppings of oils coming in the system shall be done by the contractor within the accepted price.

17.18.

17.19. Necessary technical support during commissioning of the equipments shall be provided by BHEL.

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

17.21. 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 hydro test, or for any other tests as the case may be and will carry out above activities under this scope of work as per instructions of BHEL. The scope also covers the offsite disposal of effluents.

17.22. Any temporary fasteners, gaskets etc, if required to be provided for commissioning of the system, are under the scope of this contract within the quoted rates.

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

17.24. The contractor shall make all necessary arrangements including making of temporary closures on piping/ equipment for carrying out the hydrostatic testing on all piping equipment covered in the specification a no additional cost. The contractor shall carryout the required test on the pipelines such as Hydraulic test of various piping system, Ultrasonic Test for weld defects and finding thickness, Dye Penetration test, Magnetic particles test for weld defects and material defects etc. All facilities (manpower, materials, equipment, consumables etc) including proper approaches wherever required for these tests shall be arranged by the contractor along with qualified technician within finally accepted rates.

17.25. In certain places blanking has to be resorted prior to Hydraulic test and spool pieces have to be erected in place of control valve, 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.

17.26. 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.

17.27. Valves will have to be checked, cleaned or overhauled in full or in part before erection, alkali flushing, steam blowing and during commissioning as may be necessary.

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

17.29. 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.

17.30. 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 s 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.

17.31.

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. After synchronization, the commissioning activities will continue. It shall be the responsibility of the contractor to provide manpower including necessary consumables, hand tools and supervision as part commissioning assistance for a period of six months after synchronization or till handing over of sets to customer, whichever is earlier.

17.34. Commissioning of the FGD & Aux will involve trial runs of all the equipments erected. Contractor shall provide required workers along with supervisors with all the requisite tools round the clock and material for all these works, which shall form part of the work to be done.

17.35. 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 as per GCC clause no. 2.15. For this purpose, daily labour report indicating therein nature of work carried out, consumables used, 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.

17.36. During commissioning changing of gaskets, tightening of bolts, realigning of rotating and other equipment, attending to leakage and minor adjustments erected equipment may arise. The quoted rate of the contractor shall be inclusive of all such works.

17.37. 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.

17.38. 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 the 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 free of cost. The empty containers of the lubricating oils should be returned to BHEL stores/ place indicated by BHEL from time to time.

17.39. 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.

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

17.41. Attending punch points post commissioning and resolve the deficiency for handing over the Unit to customer.

17.42. All oils and greases to be filled in the main equipment's as first fill and subsequent topping up's will be furnished by BHEL. All services including labor and T&P will be provided by the contractor for transporting from BHEL/ customer stores handling, filling, emptying, refilling etc. The consumption of lubricants/chemicals shall be properly accounted for. Surplus material if any shall be properly stacked/tagged and returned to BHEL/Customer stores at no extra cost to BHEL. BHEL reserves the right to recover costs for wastage by the contractor.

17.43. 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 required temporary pipes / ducts, blowers and dummies free of cost for conducting the test.

17.44. The commissioning activities and trial operations 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 precommissioning, 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 exclusively for assisting BHEL commissioning engineers during stabilization and trial operation 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.

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

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

18.1. Sub-delivery items and electrical components such as push-buttons, junction boxes etc.

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

18.3. Control panels, MCC etc.

18.4. Electrical & C&I items of handling system

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

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

18.7. Pneumatic copper tubing and fittings thereof. .

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

18.9. Elevators: 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 carried out by the BHEL vendor /system supplier/OEM of the system.

- Absorber Elevator
- Day Silo Elevator
- FGD Control Room Elevator

19.0 Specific Inclusions: The following works are specific inclusions in the scope of work under erection, testing & commissioning of tender specification-

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

19.2. 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.

19.3. Void

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

19.5. Wet ball mill internal lining will be carried out at site. Supply and application of lining is in the scope of BHEL-Hyderabad. Manpower assistance for lining of Wet Ball Mill is in the contractor scope.

19.6. The complete Fire Detection and Protection Systems shall be as per the guidelines/ codes/standards / rules of TAC/ NFPA / IS: 3034 / OISD etc. and all the systems, equipment's and installation shall be got approved from TAC accredited professional(s)-India. Customer M/s NTPC will make arrangement of TAC approved agency for accreditation of work. The contractor has to facilitate TAC for getting approval.

However, the contractor is responsible for availing the TAC approval for Fire protection system in total (for fire detection another agency of BHEL will be responsible). The contractor is also responsible for getting any necessary approval from the regulatory and statutory body of TAC if any is needed. Obtaining all reports from concerned statutory departments is the responsibility of the contractor. All these activities should be carried out within the quoted rates.

Tentative Manpower for the Package:

	Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Total Manpower (Skilled+Semi Skilled+ Unskilled)	200	180	180	180	180	180	180	180	180	100	100	100	80	80	80
2	Total nos of supervisor required	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4
3	Welders	30	30	30	30	30	30	30	30	30	20	20	10	10	10	10
4	Total nos of Safety Supervisor	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
5	Total nos of Engineer/ Supervisor	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2
6	Planning/Quality Engineer/Supervisor	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
7	Store Keeper	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8	**Construction Manager**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Total	246	226	226	226	226	226	226	226	226	134	133	123	103	103	103

Note:

1. Manpower mentioned above for Mechanical Package is tentative.
2. It is the prime responsibility of the contractor to augment the manpower on the actual requirement based on front availability and to fulfill the commissioning schedule of the FGD Project
3. 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 organization 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.

The schedule of important milestones for the Package is as follows:

S No	ITEM DESCRIPTION	1	2	3	4	5
		Contractual Obligation Completion	Contractual Obligation Completion	Contractual Obligation Completion	Contractual Obligation Completion	Contractual Obligation Completion
1	**Structure**	Completion of Bolting Unit 1	ATT of Ducts Unit 1			
2	**Non Pressure Parts**	Completion of Handing over of Floors to civil		Trial Run of Equipment	Readiness of Tanks	
3	**Rotating Machines**	Completion of Bolting Unit 2	ATT of Ducts Unit 2			
4	**Tanks**		Water Fill Test Absorber 2			Completion of Ducts Insulation Unit 1
5	**Mineral Wool**			Completion of Ducts Insulation Unit 2		
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
1		Erection Start	Erection Start	Erection Start	Erection Start	
2						
3			Water Fill Test Absorber 1		Water Fill Test of Tanks	Erection Start
4		Erection Start				
5						

6	**Fixing Components**			Erection Start		Completion of Ducts Insulation Unit 1			Completion of Ducts Insulation Unit 2							Contractual Obligation Completion
7	**Aluminium Sheeting**			Erection Start				Completion of Ducts Insulation Unit 1			Completion of Ducts Insulation Unit 2					Contractual Obligation Completion
8	**CS Piping**	Erection Start				HT/Pneumatic Test Readiness	Completion of Supports	Completion of Piping								Contractual Obligation Completion
9	**SS Piping**	Erection Start				HT/Pneumatic Test Readiness	Completion of Supports	Completion of Piping								Contractual Obligation Completion

21.0	**Following Technical Specifications shall be integral parts of this tender (attached separately):**
21.1.	MOUDA FGD PACKAGE PAINTING SCHEME for FGD SYSTEM, BOOSTER FAN& GATES& DAMPERS
21.2.	LIMESTONE AND GYPSUM HANDLING SYSTEM
21.3.	LAYOUT OF ID SYSTEM ELEVATION
21.4.	PLANT LAYOUT OF FGD SYSTEM (DUCT, BUF, ABSORBER AND WET STACK)
21.5.	PLANT LAYOUT OF FGD SYSTEM (LIMESTONE AND GYPSUM SYSTEMS)
21.6.	PLANT LAYOUT OF FGD SYSTEM
21.7.	MISCENENEOUS PIPING LAYOUT FOR FGD
21.8.	BHEL T&P HIRE CHARGES
	NOTES: o Contractor has to make him well conversant with the Customer and BHEL's Technical Specification. In case of ambiguity between BHEL and customer specification, customer specification shall prevail. o Above documents have been uploaded Separately.

This Chapter consists of Part A & Part B of Volume II "Price bid":

CONTENTS	
Description	**Remarks**
PART A: Instructions to the Bidders	Instructions
PART B: BOQ and % weightage for amount of individual items of Schedule of quantity	BOQ and % weightage for amount of individual items of Schedule of quantity
PART C: Total Lump Sum Price for entire scope of Work	This part is available in the E- Procurement portal entitled as **"Part-C of Vol-II Price Bid**".

Part A: Instructions to the Bidders

1. The quantity indicated in the BOQ for both the Packages is approximate only and is liable for variation. Payment will be as per actual quantity executed as certified by BHEL Engineer.

2. **Bidders shall quote Total Lump-sum Price for the entire scope of work at the excel sheet provided in the E-Procurement Portal titled as "Part-C of Vol-II Price Bid".** Price mentioned elsewhere in the offer of the bidder shall be treated as Null and Void.

3. BHEL has fixed the % weightages as in "Part-B" for the amount of individual items of Schedule of Quantity of Package-A w.r.t. the total price of Price Bid Vol-II for package.

4. Based on the pre-fixed % weightages, amount of individual items shall be derived by BHEL. This amount shall not be rounded off.

5. Based on the quantities of individual item and the amount arrived in Sl. No.-6 above, item rate of individual items shall be derived by BHEL. This item rate shall be rounded off up to two decimal places and shall be used to calculate the total amount of an item.

6. For the convenience of bidders, BHEL has issued an excel sheet with all requisite formulae as detailed above. ***However, this excel sheet shall not form part of contract document. Further, this sheet should not be uploaded at the e-Portal.***

7. Bidders to note that this is an 'Item rate contract'. Payment shall be made for the actual quantities of work executed at the Unit rate arrived at as per serial no 6 above.

PART B: % weightage for amount of individual items of Schedule of quantity w.r.t. the total price (as quoted by the bidder in "Part C of Vol-II-Price Bid") for Package-C are given in following table-

SN	Description of work	Balance Mechanical works of (FGD) Erection and Commissioning of Unit 1, Unit 2 & Common Systems AT 2X500 MW NTPC Mauda		
		UOM	Quantity to	% Weightage
1	**Structure**			
1.1	Pre Assembly	MT	4,917.88	0.08708470
1.2	Placement in Position	MT	4,944.39	0.08755420
1.3	Alignment	MT	6,074.41	0.10756430
1.4	Welding /Bolting/Fixing	MT	6,131.40	0.10857350
1.5	Completion of NDE & SR/Heat treatment	MT	6,147.66	0.02721540
1.6	Milestones	MT	4,944.39	0.06566560
2	**Non Pressure Parts Including Tanks**			
2.1	Pre Assembly	MT	3,435.16	0.06067200
2.2	Placement in Position	MT	3,482.93	0.06151570
2.3	Alignment	MT	3,801.97	0.06715060
2.4	Welding /Bolting/Fixing	MT	3,882.55	0.06857380
2.5	Completion of NDE & SR/Heat treatment	MT	3,975.88	0.01755560
2.6	Milestones	MT	3,485.13	0.04616590
3	**Rotating Machines**			
3.1	Pre Assembly	MT	894.95	0.01166810
3.2	Placement in Position	MT	902.67	0.01176870
3.3	Alignment	MT	929.98	0.01212480
3.4	Welding /Bolting/Fixing	MT	929.98	0.01212480
3.5	Completion of NDE & SR/Heat treatment	MT	929.98	0.00303120
3.6	Milestones	MT	902.67	0.00882660
4	**Mineral Wool**			
4.1	Placement in Position	MT	100.00	0.00421180
4.2	Alignment	MT	100.00	0.00168470

4.3	Welding /Bolting/Fixing	MT	100.00	0.00126350
4.4	Milestones	MT	100.00	0.00126350
5	**Fixing Components**			
5.1	Placement in Position	MT	110.00	0.00599930
5.2	Alignment	MT	110.00	0.00239970
5.3	Welding /Bolting/Fixing	MT	110.00	0.00179980
5.4	Milestones	MT	110.00	0.00179980
6	**Aluminium Sheeting**			
6.1	Placement in Position	MT	114.00	0.00670950
6.2	Alignment	MT	114.00	0.00268380
6.3	Welding /Bolting/Fixing	MT	114.00	0.00201280
6.4	Milestones	MT	114.00	0.00201280
7	**CS Piping**			
7.1	Pre Assembly	MT	534.45	0.01483800
7.2	Placement in Position	MT	534.45	0.01978400
7.3	Alignment	MT	534.45	0.01483800
7.4	Welding /Bolting/Fixing	MT	534.45	0.01978400
7.5	Completion of NDE & SR/Heat treatment	MT	534.45	0.00494600
7.6	Hangers & Supports	MT	534.45	0.00494600
7.7	Hydraulic Test or Pneumatic Test	MT	534.45	0.00494600
7.8	Milestones	MT	534.45	0.01483800
8	**SS Piping**			
8.1	Pre Assembly	MT	8.00	0.00036050
8.2	Placement in Position	MT	8.00	0.00048070
8.3	Alignment	MT	8.00	0.00036050
8.4	Welding /Bolting/Fixing	MT	8.00	0.00048070
8.5	Completion of NDE & SR/Heat treatment	MT	8.00	0.00012020
8.6	Hangers & Supports	MT	8.00	0.00012020
8.7	Hydraulic Test or Pneumatic Test	MT	8.00	0.00012020
8.8	Milestones	MT	8.00	0.00036050