3X800 MW
PATRATU
BALANCE- FGD
MECHANICAL

TECHNICAL CONDITIONS OF CONTRACT (TCC)

BHARAT HEAVY ELECTRICALS LIMITED

INTRODUCTION

1	Project Name		3x800 MW Patratu Vidut Utpadan Nigam Ltd. (PVUNL) Patratu STPP
2	Plant Site Location		Near Patratu town in Ramgarh district of Jharkhand
3	Location Co-ordinate		
3.1	Corner name	Latitude	Longitude
3.2	Top Corner	23° 39 ‘ 00'' N	85° 17’ 51.5” E
3.3	Bottom Corner	23° 38 ‘12.5'' N	85° 17’ 27” E
3.4	Left Corner	23° 38 ‘ 22.5'' N	85° 17’ 10.6'' E
3.5	Right Corner	23° 38 ‘ 40'' N	85° 17’ 57'' E
4	Nearest Town/City		Patratu -03Kms Ramgarh– 30Kms Ranchi - 37Kms
5	Nearest Railway Station		Patrat-4Kms
6	Nearest Airport		Ranchi–45Kms
7	Nearest Seaport		Kolkata–424Kms
8	Nearest Road Access		Ranchi Patratu Ramgarh Rd
9	Site Elevation		377M above MSL
10	Ambient Temperature		
10.1	Mean of Daily Maximum Temperature		40°C (During May)
10.2	Mean of Daily Minimum Temperature		10.7°C (During December)
10.3	Wet Bulb Temperature		27°C (Maximum)
11	Annual Rainfall		311 mm average annually
12	Wind Speed		0 to 39 Km/Hr
13	Wind Direction		East North East to West South West
14	Seismic Zone		Zone III as per IS:1893

The vicinity map of the project is shown below

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

Bidders may fix up their site visit in consultation with below mentioned contact person:

Name	Mr. Suman Mishra	Mr. Praveen Pandey
Designation	GM	Sr. Manager
Location:	3X800 Patratu Project	PSWR Nagpur
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2.0 SCOPE OF WORK

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

PACKAGE:

ERECTION TESTING, COMMISSIONING, TRIAL OPERATION OF BALANCE WORK OF THE FGD UNIT#1, UNIT#2 AND FGD COMMON SYSTEMS AND ITS AUXILIARIES INCLUDING LINING & INSULATION, SUPPLY OF PAINTS AND TOUCHUP PAINTING, COLLECTION OF MATERIALS FROM BHEL/ CLIENT'S STORES/ STORAGE YARD, TRANSPORTATION AT SITE AND HANDING OVER THE PACKAGES TO CUSTOMER AT 3X800 MW PVUNL PROJECT PATRATU, JHARKHAND, INDIA.

The scope of work under specifications for Erection, testing, commissioning, trial run and handing over of the FGD system (Mechanical) mainly consists of Absorber tower along with oxidation blowers, Lime stone grinding and slurry preparation system consist of wet ball mills, lime stone silos, slurry pumps, Gypsum dewatering system, associated piping. It broadly consists of but not limited to following:

1. Taking delivery of the materials from the project storage yard /stores /sheds to erection site.
2. Their preservation, safe keeping, watch and ward
3. Checking, dressing, chipping and leveling of foundations.
4. Hydraulic testing, fill test of tanks/vacuum test, air/gas leak test, air tightness test, other pre-commissioning tests as per approved quality plan/drawings/ documents. Pre-assembly, if any, pre-erection checks as applicable.
5. Non-destructive examination & post weld heat treatment.
6. Insulation of FGD & Its auxiliaries.
7. Pre-commissioning checks/ tests, trial runs/ testing and commissioning.
8. Supply and application of paints and touch up painting of erected items
9. Trial operation and associated tests
10. Making FGD ready for PG test and assistance for conductance.
11. Completion of all facilities/ systems
12. Handing over of the FGD Systems
13. Providing assistance during commissioning.

2.1 BRIEF DESCRIPTION OF THE FGD SYSTEM

2.1.1 The FGD system shall be based on Wet Limestone Forced Oxidation process. Each unit shall be provided with an independent absorber.

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

2.1.3 Compressed oxidation air shall be blown through the slurry in the oxidation tank, to oxidize the Calcium sulphite to gypsum.

2.1.4 Clean gas from the absorber shall be taken to the Wet Chimney through three stage mist eliminators.

2.1.5 Limestone to the absorbers of the units shall be supplied by a wet limestone grinding system, common for the units. Limestone shall be fed to the Limestone day silos which in turn will feed the Limestone to wet ball mill through a gravimetric feeder.

2.1.6 The gypsum from the absorber(s) shall be pumped by dedicated gypsum bleed pumps to a common Gypsum Dewatering system consisting of two streams (2x100%) of primary and secondary hydrocyclone and vacuum belt filters for gypsum dewatering. The water removed from the absorber shall be recycled to the absorbers. The waste water from the system shall be collected and neutralized using lime and neutralized effluent shall be pumped at required pressure to waste water terminal point.

2.2 THE BRIEF LIST OF THE MAJOR EQUIPMENT TO BE ERECTED UNDER THE FGD SYSTEM BUT NOT LIMITED TO FOLLOWING:

2.2.1 Absorber System along with supporting structures

2.2.2 Isolation gates

2.2.3 Tanks of various sizes. (Some tanks should be supplied in segments/plates and some in fabricated condition. Agency has to fabricate the tanks from the supplied segments/ plates.

2.2.4 Lime stone grinding and slurry preparation system consist of lime stone silos,

2.2.5 Bunker, Gravimetric feeder, wet ball mills, Hydro-cyclones

2.2.6 Slurry pumps (Absorber Slurry recirculation pumps, Gypsum Bleed pumps, limestone Slurry feed pumps)

2.2.7 Gypsum Dewatering system consists of Vacuum belt filter, hydrocylones

2.2.8 Process water and cooling water storage system

2.2.9 Thermal Insulation and cladding sheets

2.2.10 Sump Pumps

2.2.11 Piping system

2.2.12 Equipment Cooling water System (PHEs, DMCW pumps)

2.2.13 Misc. platforms, galleries, handrails

2.2.14 Fire Protection System including hydrant, MVWS, HVWS

2.2.15 Equipment Handling System.

2.2.16 Agitators.

2.2.17 EOTs & Hoists.

2.3 TENTATIVE WEIGHT TO BE ERECTED FOR THE FGD SYSTEM SHALL BE 6702 MT (Including balance works of FGD#1+ FGD#2 & Common System) AND DETAILED BREAK UP INDICATED IN CHAPTER-XI "ESTIMATED WEIGHT FOR VARIOUS SYSTEMS IN SCOPE OF WORK (BOQ)".

2.3.1 The contractor is required to erect actual tonnage (irrespective of any variation plus or minus) which may be necessary to complete their work and commission above system and complete the work in all respects as detailed in tender specifications, for which payments shall be released on finally accepted tonnage rates. The contractor undertakes to erect / commission actual quantities as per instruction of the BHEL Engineer and accordingly the final contract price shall be worked out on the basis of quantities actually erected at site and payments shall also be regulated for the same.

2.3.2 The customer M/s. PVUNL 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.

2.4 Detailed description of major equipment (per unit & common) to be Installed, Tested and Commissioned under this specification is given below.

Below mentioned details are to give only general idea of FGD system/ equipment's to the bidder. Any equipment's/system's not mentioned in this specification but which are

required for the completion and smooth running of the FGD system contractor shall do the erection and commissioning of that system within the finally accepted rates / prices.

2.4.1 Absorber System:

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

2.4.1.1 Absorber tower complete with re-circulating slurry spray header(s) and nozzles, three stage mist eliminators, wash water nozzles, oxidation tank integral tower, oxidation headers and nozzles, and agitators and all internal systems integral to the working of the absorber.

2.4.1.2 2X100% absorption oxidation blower.

2.4.1.3 2x100% re-circulating slurry pump for each level of spray.

2.4.1.4 Complete Ducting System from ID fan common outlet duct to absorber tower & from absorber outlet to wet stack chimney.

2.4.1.5 2x100% Centrifugal/ positive displacement type oxidation blowers / compressors

2.4.1.6 1 No. Emergency water tank for spraying water at inlet of Absorber for upset condition.

2.4.1.7 2x100% gypsum bleed pumps.

2.4.1.8 Auxiliary Absorbent tank.

2.4.1.9 Passenger cum Goods elevator for each Absorber of minimum capacity of 1000 kgs.

2.4.1.10 Erection, alignment & welding of the Absorber Unit#1 is currently not envisaged in the scope of this work. However, if envisaged on a later date, then on the direction of BHEL engineer the agency may have to carry out the balance works of Erection, alignment & welding of the Absorber Unit#1. The decision of BHEL engineer is binding on the agency. Cost against the execution of balance works of Absorber Unit#1 will be paid as per the applicable BBU rates of this contract.

2.4.2 LIMESTONE GRINDING AND SLURRY PREPARATION SYSTEM (COMMON SYSTEMS FOR ALL THREE UNITS)

2.4.2.1 Limestone grinding system for all the (Three) units and shall comprise of:

2.4.2.2 Two numbers Limestone storage silos shall be complete with supporting steel

2.4.2.3 Structure, platforms, staircase, air canons, power operated gates, gravimetric feeders etc.

2.4.2.4 Two numbers of wet horizontal ball mills.

2.4.2.5 Two (2) limestone slurry tanks complete with all accessories and Agitator(s).
2x100% limestone slurry pumps for each absorber connected to each of the limestone slurry tank. Each pumps catering to slurry requirement of each unit's

absorber. Each mill shall be fed from an independent Limestone bunker. Each mill shall be complete with the following items, as a minimum requirement:

a) A bunker outlet gate
b) A gravimetric limestone feeder along with its drive and all other auxiliaries
c) One no. separator tank with agitator(s).
d) 2x100% Mill circuit pump.
e) One set of hydro-cyclone
f) A peripheral/central drives system with motor, speed reducer gearbox and other auxiliaries.
g) An auxiliary motor for inching operation with speed reducer.
h) Complete lubricating system
i) Lube oil pumps, coolers, duplex oil filters, connecting piping

2.4.3 GYPSUM DEWATERING SYSTEM (COMMON SYSTEMS FOR ALL THREE UNITS)

Each set of dewatering equipment (01 working set + 01 standby set) shall comprise of the following Systems as a minimum requirement:

2.4.3.1 One set of primary hydro-cyclones
2.4.3.2 One vacuum belt filter
2.4.3.3 Vacuum receiver tank
2.4.3.4 Vacuum pump
2.4.3.5 One set of secondary hydro-cyclones
2.4.3.6 Filtrate tank along with filtrate water pump
2.4.3.7 Cake washing Pumps for Vacuum Belt Filter.
2.4.3.8 Cloth washing Pumps for Vacuum Belt Filter.
2.4.3.9 Waste water tank along with agitator and centrifugal pumps
2.4.3.10 Lime neutralization tanks

2.4.4 PROCESS WATER STORAGE TANKS AND PUMPS

2.4.4.1 Two (2) Process water Storage tanks along with two numbers of 2x100 % Booster water pumps, if required.
2.4.4.2 2x100% Process Water Pumps for each unit connected to each of the Process water Storage tanks along with all necessary piping, valves.
2.4.4.3 2x100% Mist Eliminator Wash Water Pump for each unit connected to each of the Process water Storage tanks along with all necessary piping, valves.
2.4.4.4 Two (2) clarified water Storage tanks (each tank catering to the clarified water requirement for one vacuum Belt Filter) along with two numbers of 2x100 % clarified Booster water pumps, if required, from terminal point.

2.4.4.5 Emergency water storage tanks.

2.4.4.6 2x100% horizontal centrifugal pumps shall be provided for recirculation of filtrate water to absorber.

2.4.4.7 2x100% horizontal centrifugal pumps shall be provided for wash water requirements of belt filter.

2.4.5 PIPING

Slurry Piping

2.4.5.1 Piping from gypsum bleed pumps to gypsum dewatering system, along with recirculation lines (if required) necessary isolation and control valve Limestone slurry piping to each absorber, along with recirculation lines, all isolation and control valves.

2.4.5.2 All connecting pipes / chutes along with necessary valves between various systems of the mill and from hydro-cyclone to common slurry storage. All slurry pipes having Material of construction carbon steel and rubber lined. End connections are bolted flanged connections.

2.4.5.3 Oxidation Air piping

2.4.5.4 Service Water

2.4.5.5 Service Air & Instrument Air

2.4.5.6 Process water piping

2.4.5.7 Equipment Cooling water system piping

2.4.5.8 Piping and equipment, as per requirement / drawings are to be thermally. Insulated with bonded / unbounded mineral wool /LRB mineral wool and to be covered with aluminium cladding.

2.4.5.9 All the above systems of piping include the erection of pipes, bends, elbows, valves, fittings, impulse piping and including root valves, sampling lines, drains, hangers and supports & other accessories so as to make the systems complete in all respect.

2.4.6 Equipment Cooling Water System ((COMMON SYSTEMS FOR ALL THREE UNITS)

Equipment Cooling water system for all two units with a closed circuit cooling system for cooling of the various auxiliaries of FGD system. The equipment cooling system shall include the following :

2.4.6.1 2x100% capacity self-cleaning strainers on the secondary side.

2.4.6.2 3 x 50% (2 working + 1 standby) capacity of plate type heat exchangers.

2.4.6.3 4 x 50% (2 Working + 2 standbys) capacity FGD Auxiliary (Secondary) Cooling water pumps, along with drives.

2.4.6.4 3.20.11.5 3 x 50% (2 Working + 1 standby) capacity FGD DM (Primary) cooling water pumps along with drives.

2.4.6.5 One Overhead DM water tank (ECW O/H tank).

2.4.6.6 Alkali (Sodium Hydroxide) preparation tank, agitator and motor, piping, valves etc

2.4.7 Waste water System:

2.4.7.1 2x100% horizontal centrifugal pumps.

2.4.7.2 1x100% Waste water tank shall be provided which shall be sized for 12 hrs storage of waste water.

2.4.7.3 2x100% horizontal centrifugal pumps shall be provided for pumping the waste water from waste water tank.

2.4.7.4 2x 100% Lime Neutralization tanks.

2.4.7.5 2x100% Lime storage silos.

Notes:

1. **Weight schedule /BOQ of the FGD system given under CHAPTER XI - ESTIMATED WEIGHT FOR VARIOUS SYSTEMS IN SCOPE OF WORK (BOQ)**
2. The equipment /piping systems indicated above are only major items and does not cover all the equipment / piping system to be erected / commissioned. Contractors are however, required to erect / commission within the price quoted by them, all connected equipment / system shown in manufacturer's drawings / other documents which may be necessary for erection completion and overall commissioning of FGD system.
3. The contractor undertakes to erect/ commission actual quantities as per advice of BHEL Engineer and accordingly the final contract price shall be worked out on the basis of quantities actually erected at site and payments will also be regulated for the same.

2.5 Important information for the Erection Work of FGD system under this tender specifications:

2.5.1 Absorber tower have top elevation of approx. 47 mtr with 7 tier structure and average casing panels have size (6 mx4m x0.5 m).

2.5.2 Absorber System W/D (wet dry) interface having lining of C276 material .Site welding of liner is in the contractor scope. BHEL supplied the liner with plug

welding and special electrode for the welding of liner shall be supplied by BHEL Ranipet. Welding to be done as per approved procedure of BHEL/PVUNL.

2.5.3 Tanks shall be supplied by the units in more than one segment (rolled sections/plates) having height of each 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 (along with surface preparation by blasting or any other approved method and necessary testing i.e spark test/ pin hole test of the rubber lining) excluded from the scope of work and shall be done by rubber lining vendor of BHEL Ranipet.** However necessary assistance to be provided by the contractor. Sizes of the tank mentioned below to give general idea **to** the bidders regarding the extent of work.

Table-1:

Sr. N	**Description**	**Diameter in mm**	**Height in mm**	**Qty**
2	Belt filter washing tank	5500	5900	2
3	Filtrate Water Tank	8000	8900	1
4	Secondary Hydrocyclone Tank	9000	10300	1
5	Waste Water Tank	12000	13600	1
8	Lime stone Slurry Storage Tank	17500	19800	2
9	Auxiliary absorbent tank	17500	20400	1
10	Process Water tank	7000	7400	2
11	Clarified Water Tank (cake washing)	3000	3800	2
12	Emergency quench tank	5500	6000	3

2.5.4 Lime stone silos shall be supplied by the units in more than one segment (3 to 4 segment) and height of each segment shall be 2500 mm. Contractor shall have to complete the assembly, final welding, /NDT/testing as per the approved drawings/ documents/ FQP. Sizes of the silos mentioned below to give general idea to the bidders regarding the extent of work.

Table- 2:

Sr.No	Description	Diameter in MM	**Height in mm**	Qty
1	Lime stone Storage Silo	8100	12400(5400Mt straight height)	2

2	Lime stone silo	1200	2000(1000m Straight Height)	2

2.5.5 Erection and commissioning of the below mentioned equipment's/system under FGD system excluded from the scope of work under this contract. Erection and commissioning shall be done by the BHEL Ranipet vendor /system supplier/OEM of the system.

a. Absorber Elevator
b. Rubber lining of tanks and absorber
c. Rubber lining of pipes.

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

2.5.6 BHEL shall provide the technical support for commissioning of below mentioned equipment's on need basis. If support required during the erection same shall be Provided free of charges by BHEL.

a) Slurry Recirculation Pump System
b) Mist Eliminator & Accessories
c) Air Oxidation System
d) Slurry Pumps & Accessories
e) Agitators
f) Limestone Mill
g) Primary Hydroclone And Accessories
h) Secondary Hydroclone And Accessories
i) Gypsum Belt Filter And Accessories

Note: Quantities and dimensions mentioned above for tanks, silos, absorber are indicative and to give general idea regarding the extent of work.

2.6 **Touch-up Painting (Applicable in equipment & structures): All Duct structures/ components shall be supplied from BHEL units/ workshops with finish coats of paint. Therefore final painting is not applicable in the scope of contractor. However, touch up painting (wherever required), incidental to the work, shall be in the scope of the contactor, including supply of the required paints and primers and associated consumables.** Though the final painting is not there in the scope of the contractor, in case any shop painted structure/component is required to be repainted due to the reasons attributable to the contractor such as Mis-handling, damage during erection process, other reasons incidental to the work etc, such re-painting/finish painting of the

components/structures shall be in the scope of the contractor including the supply of paints and primers along with all required consumables. Painting shall be applicable for the Erected pipe lines and valves as per the applicable paintings schedule. supply of the paints, stencilling is in agency scope without additional cost.

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.
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 Contractor		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.
b	Labour Colony with internal roads, sanitation, complying with statutory requirements		Yes	
3.2.0	**ELECTRICITY**			
3.2.1	**Electricity For construction purposes** of Voltage 415 V**,** A.C., 3 Phase , 50 Hz	Yes		At Single point on chargeable basis. Applicable charges shall be as per rate of PVUNL prevailing during the execution period including applicable taxes, duties, levy etc.

Sl. No	Description PART I	Scope / to be taken care by		*Remarks*
		BHEL	**Bidder**	
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 basis. Applicable charges shall be as per rate of PVUNL prevailing during the execution period including applicable taxes, duties, levy etc.
a	Single point source	Yes		At a distance of 500 M from site (Distance is only estimated, 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**	
b	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	

Sl. No	Description PART I	Scope / to be taken care by		*Remarks*
		BHEL	**Bidder**	
c	Duties and deposits including statutory clearances if applicable		Yes	
3.3.0	**WATER SUPPLY**			
3.3.1	**For construction purposes: (Single point source provided by BHEL)**			
a	Making the water available at single point	**Yes**		Chargeable basis
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	Agency has to make his own arrangement at his own cost.
3.3.2	**Water supply for bidder's office, stores, canteen etc**			
a	Making the water available at single point		Yes	Agency has to make his own arrangement at his own cost
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	
3.3.3	**Water supply for Living Purpose**			
a	Making the water available at single point		Yes	Agency has to make his own arrangement at his own cost
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	
3.4.0	**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	

Sl. No	Description PART I	Scope / to be taken care by BHEL	 Bidder	*Remarks*
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	
3.5.0	**COMMUNICATION FACILITIES FOR SITE OPERATIONS OF THE BIDDER**			
a	Telephone, fax, internet, intranet, e-mail etc		Yes	
3.6.0	**COMPRESSED AIR wherever required for the work**		**Yes**	
3.7.0	**Demobilization of all the above facilities**		**Yes**	
3.8.0	**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 BHEL	 Bidder	*Remarks*
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

Sl. No	Description PART I	Scope / to be taken care by		*Remarks*
		BHEL	**Bidder**	
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
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		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 on chargeable basis. 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	As regards to contractor's office/store/canteen/labour colony & sheds 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.
3.10.6	The required energy meter for measuring power consumption shall be arranged by the contractor and taken care by the contractor.
3.10.7	Contractor has to make his own arrangements for his electricity requirement for his labour colony at his cost.
3.10.8	As there are bound to be interruptions in regular power supply, power cut/load shedding in any construction sites, contractor should make his own arrangement for alternative source of power supply through deployment of adequate number of DG sets at their cost during the power breakdown /failure to get urgent and important work to go on without interruptions. No separate payment shall be made for this contingency.
3.11	**CONSTRUCTION WATER**
3.11.1	Water (Raw water) required for construction purposes will be provided at one single point within the plant area on chargeable basis. The required water meter for measuring the consumption shall be provided and installed by the contractor. The required pumps & accessories, pipes for drawing water from the points and further distribution will be arranged by the contractor at their cost.
3.11.2	The water charges may vary from time to time as per PVUNL water conditions, Any dispute regarding consumption, the BHEL engineer decision will be final. In case of non-availability of water, the contractor shall make his own arrangements of water suitable for construction to have uninterrupted work. No separate payment shall be made for any contingency arrangement made by contractor, due to delay / failure for providing water supply. Contractor has to make his own arrangements for his water requirement for his labour colony at his cost.
3.11.3	In case of non-availability of water, the contractor shall make his own arrangements of **water suitable for construction purpose** to have uninterrupted work. No separate payment shall be made for any contingency arrangement made by contractor, due to delay / failure for providing water supply. Contractor has to make his own arrangements for his water requirement for his labour colony at his cost.
3.12	**DRINKING WATER** Bidder shall provide drinking water at the work spot at their cost.
3.13	**ONLINE SITE CONSTRUCTION MANAGEMENT SYSTEM (SCMS):**

	Contractor has to provide minimum 1 computer with one operator, for online material management, reporting of daily progress, billing and other similar activities, within the quoted rate. Computers shall have minimum configuration of Windows 7 OS, 4GB RAM and Internet Explorer 8 or above.
3.14	**CONSUMABLES:**
3.14.1	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.
3.14.2	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.
3.14.3	All other electrodes including stainless steel electrodes required for shall be arranged by the contractor at his cost. However, BHEL will provide imported electrodes as provided by manufacturing units. The bidder shall use the Customer approved quality welding electrodes only.
3.14.4	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.
3.14.5	All the shims, gaskets and packing, which go finally as part of equipment, shall be supplied by BHEL free of cost.
	Note: List of approved vendors attached as file Named: 'Annexure-2 Approved list of welding electrodes supplier'.
3.15	**MATERIAL SUPPLY:** BHEL will supply the materials / equipments 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.
3.16	**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, preassembly yard and contractor's material storage area etc. at his cost.
3.17	**GASES:** 3.17.1 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. 3.17.2 The contractor shall submit weekly / fortnightly / monthly statement report regarding consumption of all consumables for cost analysis purposes. 3.17.3 The contractor shall ensure safe keeping of the inflammable cylinder at a separate place away from normal habit with proper security etc. 3.17.4 BHEL reserves the right to reject the use of any gas in case required purity is not maintained.
3.18	**ELECTRODES SUPPLY AND STORAGE** 3.18.1 The bidder shall use the BHEL / Customer approved quality welding electrodes only. 3.18.2 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. 3.18.3 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. 3.18.4 Storage of electrodes shall be done in an air conditioned / controlled humidity room as per requirement, at his own cost by the contractor. 3.18.5 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. 3.18.6 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. 3.18.7 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.
3.19	**OTHER FACILITIES** 3.19.1 Adequate water less urinals (at least 2 nos in different locations) shall be arranged by the contractor within quoted rates, at site of construction at different areas, with proper disposal arrangement. 3.19.2 Vendors have to comply requirements of HSE & Statutory requirement in line with BHEL HSE plan, NTPC Safety requirement, Jharkhand/Central statutory requirement. 3.19.3 Agencies are to get registered (to take membership) from Safety Council of India, Mumbai/National Safety Council. 3.19.4 Vendors have to arrange labour rest sheds, drinking water facility, toilets, canteen facility as per local labour act/BOCW act. Maintaining hygiene and disposal of debris, scraps, canteen items and area cleaning is included in vendor's scope. 3.19.5 Agency has to arrange trained scaffolding experts with accreditation from statutory agencies with proper experience and they will issue fitness certificates for safe use. Such kind of qualified scaffolding experts will vary as per job requirement. At the same time, training has to be given by these experts at regular intervals for their own workers for increasing no. of experts. 3.19.6 Agencies HSE officers should have sufficient experience as per rule 209 of Bocw act central rule 1998. Agencies HSE officers will be part of BHEL HSE Team and they will be responsible for giving training on HSE issues in addition to normal field works and other normal site requirements. 3.19.7 Preparation of method statement, HIRA, Job Safety analysis, permit to work, Lifting plans, and all supporting documents as required for starting & continuation of work/job is in vendor's scope. 3.19.8 **Hydras are not allowed for materials transport, only pick and carry cranes shall be deployed by the agency.** 3.19.09 First aid centre will be maintained by BHEL and cost will be proportionately

	recovered from vendors. 3.19.10 Vendor has to arrange land within his quoted rate for making labour colony. Vendors labour colony has to be maintained with proper hygiene, drinking water, bathroom water, lighting arrangement, sewerage system. These facilities are to be regularly maintained including drains, surrounding, up-keepment of labour colony. BHEL/NTPC & local statutory authorities will visit labour colony from time to time and all healthy conditions are to be maintained by vendor. 3.19.11. Scaffolding pipes, clamps, safety nets, floor grills for working platforms are to be made of good quality with proper certifications as per IS Codes.
3.20	**DEWATERING:** Contractor shall ensure at all times that the work area & approach/ access roads are free from accumulation of water, so that the materials are safe and the erection/ progress schedule are not affected. No separate claim in this regard shall be admitted by BHEL.
3.21	**SITE ORGANISATION** **3.21.1** The contractor shall provide adequate staffing in the following areas in addition to the staffing requirements of execution as instructed/informed by BHEL: i. Overall planning, monitoring & control. ii. Quality control and quality assurance. iii. Materials management. iv. Safety, fire & security. v. Industrial relations and fulfilment of labour laws and other statutory obligations. **3.21.2** 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. **3.21.3** 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 site without written permission of BHEL.
3.22	**LAND FOR SITE OFFICE AND LABOUR COLONY** **3.22.1** Minimum Open space as made available by customer will be provided at free of charges to the contractor, for construction of temporary office shed, fabrication

	yard and storage area at the job site, contractor's stores shed(s). **3.22.2** BHEL shall not provide to the contractor any residential accommodation to any of his staff and the contractor has to make his own arrangements. Contractor has to make his own arrangements for labour colony. Location and area requirement for office / storage sheds / fabrication yard shall be discussed and mutually agreed

A: LIST OF TOOLS & PLANTS TO BE DEPLOYED BY THE CONTRACTOR –

4.1: Numbers of T&Ps to be deployed at site shall be decided with respect to Monthly plan and review formats (F-14) based on site requirement.

4.1.1 List of Major Tools and Plants

SN	DESCRIPTION OF EQUIPMENTS	CAPACITY (MINIMUM)	QUANTITY (No.)	REMARKS
1.	Crawler crane	75 MT/ 80MT	02	To be deployed as per instruction of BHEL Engineer. Tentative deployment: 1st crane From Start of Erection of U#1 FGD works till site requirement with consultation with Site CM/PD. 2nd from the Start of Erection of FGDU#2 works till site requirement with consultation with Site CM/PD.
2.	Crawler crane	150 MT	01	To be deployed as per instruction of BHEL Engineer. Tentative deployment: Tentatively from the 3rd month from the start of the work of FGD#1 till site requirement with consultation with Site CM/PD.

4.1.2 List of Other Tools and Plants:

SN	DESCRIPTION	CAPACITY (MINIMUM)	MINIMUM QUANTITY	*REMARKS*
1	Tyre mounted mobile crane	18T/20T	02 Nos.	First from Erection start to till trial run.
2	Tyre mounted mobile crane	12/14T	02 Nos.	From Erection start to till trial run
3	TRAILER WITH PRIME MOVER	20 MT	02 NOS.	1 from Start of FGD #1 erection & 2nd from the FGD Erection till site requirement with consultation with Site CM/PD.

SN	DESCRIPTION	CAPACITY (MINIMUM)	MINIMUM QUANTITY	*REMARKS*
4	Oxy Acetelyne Gas cutting Machine		Adequate nos.	As per requirement
5	3-PHASE DISTRIBUTION BOARD WITH COMPLETE SET UP FOR DRAWL OF CONSTRUCTION POWER	AS REQUIRED	as required	As per requirement
6	POWER CABLE FOR DRAWL OF CONSTRUCTION POWER	AS REQUIRED	as required	As per requirement
7	RADIOGRAPHY ARRANGEMENT WITH RADIOACTIVE ISOTOPE SOURCE	COBALT-60	as required	As per requirement
8	THEODOLITE OF REQUIRED ACCURACY	To ensure verticality of str columns.	1 Nos.	As per requirement
9	SELF DRILLING CUM TAPPING MACHINE FOR SCREWS Aluminium SHEETS	AS REQUIRED	4 nos. (As required)	As per requirement
10	WELDING GENERATOR (ELECTRICAL)	300 AMPERE RATING	AS REQUIRED	20 Nos. Since erection start
11	RADIOGRAPHY FILM VIEWER	AS REQUIRED	AS REQUIRED	As per requirement
12	Chain pulley blocks of various & suitable capacities		As Required	As per requirement
13	BAKING OVEN WITH THERMOSTAT AND TEMPERATURE GAUGE FOR WELDING ELECTRODES	AS REQUIRED	2 (As Required)	As per requirement
14	HOLDING OVEN WITH THERMOSTAT AND TEMPERATURE GAUGE FOR WELDING ELECTRODES	AS REQUIRED	2 (As Required)	As per requirement
15	PORTABLE OVEN FOR WELDING ELECTRODES	AS REQUIRED	(As Required)	As per requirement
16	ELECTRIC WINCH	2/3/5/10/15 TON CAPACITY	As per requirement	As per requirement

SN	DESCRIPTION	CAPACITY (MINIMUM)	MINIMUM QUANTITY	*REMARKS*
17	HAND WINCH	0.5 TON CAPACITY	As per requirement	As per requirement
18	SCAFFOLDING MATERIALS WITH CLAMPS.	SUITABLE FOR WORKING AT VARIOUS HEIGHTS	6,000 Pipes with 18000 clamps.	For Alignment, welding & Insulation works, qty may increases as per requirements.
19	PORTABLE GRINDING M/C	AS REQUIRED	as required	As per requirement
20	PORTABLE DRILLING M/C	AS REQUIRED	as required	As per requirement
21	HOISTING AND PULLEY DEVICES/PULLEYS	Assorted capacities	as required	As per requirement
22	FIRE RETARDANT TARPAULINS	AS REQUIRED	as required	As per requirement
23	FIRE EXTINGUISHER	AS REQUIRED	as required	As per requirement
24	Hydraulic Jacks	10/20/50/100 MT	as required	As per requirement
25	Dewatering pumps		as required	As per requirement
26	Spectrometer for metal testing		as required	As per requirement
27	Elco meter for paint thickness checking		as required	As per requirement
27	Hand Operated Megger 500 / 1000 V		as required	As per requirement
28	Tong Tester 10, 20 Or 50 Amp + / - 3 % Accuracy		as required	As per requirement
29	Digital and Analogue Multimetres		as required	As per requirement

SN	DESCRIPTION	CAPACITY (MINIMUM)	MINIMUM QUANTITY	*REMARKS*
30	Inclined Manometer 0-50 mm Water Column		as required	As per requirement
31	Calibrated Power driven HSFG bolt tightening machines with set value facility.		3 nos.	Qty may increases as per site requirements
32	AIR LEAK TEST EQUIPMENTS WITH ALL AUXILIARIES		01 SET	As per requirement
33	Air compressor	As per requirement	As per requirement	As per requirement

Note for 4.1.2: Any other T & P which may be required for successful and timely execution of the work covered within the scope of this tender shall be arranged and provided at site by the contractor at his cost. In case if the contractor fails to provide such equipments, BHEL will arrange for the same and the cost will be recovered from the contractor's bill with BHEL overheads, as applicable from time to time which may vary even during contract period.

4.2	**The above list as mentioned above, may not be required for entire contract period but contractor shall ensure the availability of the T&Ps as per work requirement and T&P Deployment schedule.** T&P Deployment schedule shall be finalized at site in consultation with BHEL Engineer based on the work fronts/work requirement. BHEL decision shall be final and binding regarding the T&P deployment schedule. Contractor shall mobilize / maintain the T&P's as per the deployment schedule notified time to time by BHEL Engineer.
4.3	Contractor has to deploy T&P, MMD, IMTE as per requirement of site and as decided by BHEL Engineer.
4.4	**Penalty due to non-availability of T&Ps:** In order to meeting the site requirement and in line with monthly plan and review format (F-14), Contractor has to mobilise their T&Ps and made available at site for required activities. For Major T&Ps (refer 4.1.1), if contractor fails due to, either of the case, mentioned hereunder, BHEL shall be entitled to impose penalty on Contractor till any alternate arrangement is made by 'Contractor' OR 'BHEL (on cost recovery basis)'. Case 1: Contract fails to mobilise the same within the mobilisation period of 30 days from the date of intimation. OR Case 2: After mobilisation of T&P at site, the work is getting hampered due to non-availability of T&P for more than 5 days from the date of such intimation,

	Penal rate for Major T&Ps is mentioned hereunder: a) 75 MT Crane – Rs. 1000/day/ Crane b) 150 MT Crane- Rs. 2000/day
4.5	i) In case T&P w.r.t requirement was not deployed by the contractor as per instruction of BHEL and BHEL had to deploy either its own T&P or ii) BHEL had to deploy the T&P from outside agency, -then recovery shall be done from the contractor as under: 4.5.1 In case BHEL had to deploy its own T&P, hire charges of T&P applicable for outside agencies as per extant guidelines by BHEL for "**Hire Charges on issue of Capital Tools & Plants**" shall be recovered. **4.5.2** In case BHEL had to deploy the T&P from outside agency, actual hiring cost plus applicable overheads shall be recovered.
4.6	All the tools and tackles/measuring instruments shall be duly tested/calibrated and valid certificate to that effect should be submitted to BHEL site in-charge before the start of work.
4.7	T&P's mentioned above shall be specifically deployed as per requirement. However, as per work requirement and availability of T&Ps the inter use in Material Handling and Mechanical works may be permitted as per the instruction of the BHEL Engineer.
4.8	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.
4.9	In case of any specific requirement of higher capacity crane apart from the vendors scope shall be provide by the BHEL on sharing basis free of charge,
4.10	The T&P deployment as specified in above table is only indicative, however the contractor has to ensure the availability of required T&P till completion of all the work under his scope in this tender
4.11	In the eventuality of contractor not deploying cranes / abnormal down time of cranes in his scope during the period specified above, and BHEL arranges for the same [either BHEL's own cranes / hired cranes], prevailing BHEL Corporate Crane hire charges (may vary from time to time) shall be recovered from the contractor's running bills. . Corresponding pages of Corporate Crane hire charges are enclosed as part of VOL I as File titled **"Annexure 1- BHEL T&P Hire Charges".** (Please note that these charges are

	may get revised further).
4.12	For loading and transportation, all necessary T&P such as Trailers, Cranes, Winches, welding generators, slings, jacks, sleepers, rails etc., are to be arranged by the contractor.
4.13	The contractor has to furnish a list of Tools and plants including cranes / tractors /trailers / trucks etc. which he has proposed to deploy for this work.
4.14	Crane operators deployed by the contractor shall be tested by BHEL before he go to operate the cranes.
4.15	The contractor shall arrange crane operator, diesel, petrol and other consumables required for the tools and plants, equipments etc. **Preventive and routine maintenance of T & P are also to be arranged by the contractor at his cost without any delay. Required number of experienced mechanics and helpers for routine maintenance of the above cranes shall be provided by the contractor within his quoted rate.**
B	***MEASURING AND MONITORING EQUIPMENTS (MMEs):*** To be finalized at site as per requirement. **NOTE:** 1. **All above T&Ps are to be deployed by contractor as and when required as per instruction of BHEL engineer. If works gets delayed due to non-availability of above T&Ps, BHEL reserves the right to deploy the same and recover the charges thereof from the contractor as per prevailing market rate/hiring rate/BHEL internal hiring rates + Applicable overhead rates.** 2. This above list of T&Ps is only indicative and neither exhaustive nor limiting. Quantities indicated above are only the minimum required. Contractor shall deploy all necessary T&P to meet the schedules & as prescribed by BHEL engineer and required for completion of work. 3. 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. 4. Necessary electrical / water / air connection required for operation of any of the tools & tackles shall be to Contractor‘s account. 5. Contractor has to submit the Calibration certificates of all the precision Equipement to BHEL. BHEL may ask for recalibration of the MMEs /precision equipments for ensuring quality of work. Contractor must re-ascertain/ recheck range and accuracy of each IMTE from BHEL Engineer well in advance before arranging calibration/ deployment.

6. Any T&Ps, 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&Ps/ crane provided by BHEL.

7. T&P and the mobilization shown in the above mentioned list is suggestive requirement. Mobilization schedule as mutually agreed at site for major T&Ps, have to be adhered to. Numbers / time of requirement will be reviewed time to time at site and contractor will provide required T&P / equipments to ensure completion of entire work within schedule / target date of completion without any additional financial implication to BHEL. Vendor will give advance intimation & certification regarding capacity etc. prior to dispatch of heavy equipments. Also on completion of the respective activity, demobilization of T&P in total or in part can be done with the due approval of engineer in charge. Retaining of the T&Ps during the contract period will be mutually agreed in line with construction requirement.

8. In the event of need of change of type of any of major T&Ps, approval shall be taken from BHEL Engineer in-charge prior to mobilization. The decision of Number of T&P required due to replacing the enlisted T&P as per above table, shall be taken after analyzing the production capacity and suitability of both the T&Ps.
9. Crane operators deployed by the contractor shall be tested by BHEL before they are allowed to operate the cranes.

10. The above list is only indicative and these T&Ps may not be required for entire contract period but contractor shall ensure the availability of the T&Ps as per work requirement and T&P Deployment schedule. T&P Deployment schedule shall be finalized at site in consultation with BHEL Engineer based on the work fronts/work requirement. BHEL decision shall be final and binding regarding the T&P deployment schedule. Contractor shall mobilize / maintain the T&P's as per the deployment schedule notified time to time by BHEL Engineer.

11. The T&P deployment as specified in above table is only indicative, however the contractor has to ensure the availability of required T&P till completion of all the work under his scope in this tender.

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

SL NO	DESCRIPTION & CAPACITY OF T&P	QUANTITY	REMARKS
1	Cranes	As required	Cranes other than mentioned under 4.1.1 above, which shall be required to complete the package shall be provided by BHEL. The Capacity of such Crane, Quantity and duration of deployment shall be drawn mutually during the review meeting held at site. BHEL decision on deployment of crane other than mentioned in Chapter-IV shall be final.

5.1	All the T&Ps mentioned above shall be given to contractor on shareable basis and the allotment is made by BHEL on need basis.
5.2	All the distribution boards, connecting cables, hoses etc., and temporary connection work including electrical connections for the BHEL issued T & Ps shall have to be arranged by the contractor at his cost.
5.3	The day-to-day and routine maintenance including replacement of spares for the BHEL T&Ps will be carried out by the contractor at his own cost. However, BHEL shall supply spare parts free of charges for normal wear and tear only.
5.4	Any loss/damage of tools by the contractor shall have to be replaced or otherwise cost thereof shall be recovered from the contractor.
5.5	Contractor shall make necessary arrangements like laying of special sleeper beds and steel plates (sleepers for BHEL owned/hired cranes shall be provided by the BHEL), assembly and dismantling of heavy attachment, boom, jib etc for movement and operation of the crane. Contractor shall provide necessary manpower assistance for initial and final assembly & dismantling and for subsequent operations of boom extension and reduction during execution of work. Levelled area in FGD area will be provided by BHEL/customer for the cranes Consolidation of the ground, if required (Area required for movement of crane), and preparation (including civil work with material) for placing crane for operation shall be done by the contractor, at his cost. Necessary steel plates / sleepers required for marching operation shall also be provided by the BHEL only for BHEL owned cranes. ***Note: For Crane:*** 1. The cranes may be BHEL owned or may be obtained on hiring basis including operating and maintenance crew.

	2. Operator and O&M for BHEL owned crane will be provided by BHEL. 3. Contractor shall provide the fuel for BHEL provided cranes (Hired/owned) for his use. 4. 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 for movement and operation of the BHEL provided cranes. 5. Cranes provided by BHEL will be on sharing basis with other agencies / contractors of BHEL. The allocation of cranes shall be 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. Augmentation of BHEL T & P under special circumstances shall be discretion of BHEL.

TIME SCHEDULE & MOBILIZATION

6.1	**INITIAL MOBILIZATION** After receipt of 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 within two weeks from the date of issue of Letter of Intent or 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	**MOBILIZATION FOR ERECTION, TESTING, ASSISTANCE FOR COMMISSIONING ETC.** The activities for erection, testing etc. shall be started as per directions of Construction Manager of BHEL. Contractor shall mobilize further resources (in addition to those required for activities under clause no. 6.1) as per requirement to commence the work of erection, testing etc. of FGD and auxiliaries, including touchup Painting (as and where required), duct structure etc progressively augment the resources to match schedule of the project.
6.2.1	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 fabrication. 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.
6.3	**COMMENCEMENT OF CONTRACT PERIOD AND TENTATIVE SCHEDULE** **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. 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. The Contractor has to subsequently augment his resources in such a manner that following major milestones of erection & commission are achieved on specified schedules.

According to the contract between BHEL and Owner the schedule of important milestones is as follows:

Schedule of FGD Unit #1, #2, and Common System:

SL No.	Milestones for Balance FGD#1, Common System and FGD#2.	Completion Schedule
1	Start of FGD Structure Erection	1st Month from date of start of Work
2	Equipment (incl all Pumps, agitators, Dehumidifier etc.) Erection Completion	8th Month from date of start of Work
3	Absorber Erection Completion	11th Month from date of start of Work
4	Commissioning of FGD Systems	12th Month from date of start of Work
5	Completion of FGD all facilities	15th Month from date of start of Work

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.

6.4 **CONTRACT PERIOD**

The contract period for completion of entire work under scope shall be **15 (Fifteen) months** from the "START OF CONTRACT PERIOD" as specified earlier for completion of the entire work.

6.4.1 The period from the commencement of preparatory work for erection till the actual "start of contract period" shall not be reckoned for the above purpose.

6.5 **PROVISION OF PENALTY IN CASE OF SLIPPAGE OF INTERMEDIATE MILESTONES:**

In case of slippage of Two Major Intermediate Milestones, mentioned as M1 & M2 hereunder, Delay Analysis shall be carried out on achievement of each of these two Intermediate Milestones in reference to F-14.

Milestones	Activities	To be completed by
M1	Equipment (incl all Pumps, agitators, Dehumidifier etc.) Erection Completion	8th Month from date of start of Work
M2	Commissioning of FGD Systems	12th Month from date of start of Work

6.5.1 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.
6.5.2	In case of slippage of these identified Intermediate Milestones, Delay Analysis shall be carried out on achievement of each of these two Intermediate Milestones.
6.5.3	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.
6.5.4	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.
6.5.5	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.
6.5.6	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.
6.5.7	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.
6.5.8	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.
6.5.9	*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.
6.6	**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.

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

7.1 Payment Schedule for FGD:

Sr. No	**Contract (FGD Package)**						
	Rate Schedule Identification	**(Absorber/ Structure/ Duct/ Gates /dampers) (1.1)**	**(Tanks) (1.2)**	**(Rotating M/c) (1.3)**	**(Insulation & Sheeting) (1.4)**	**(Piping (incl. SS, CS, Alloy Steel etc.)) (1.5)**	**(Misc Eqpt/ structure steel) (1.1)**
I	**PRO RATA PAYMENTS (85%)**						
1	Completion of preassembly, (if not applicable this portion shall be clubbed with Placement in position)	20%	20%	20%		20%	20%
2	Placement in position	25%	20%	20%	50%	20%	25%
3	Alignment	20%	10%	20%		10%	20%
4	Welding /bolting/fixing as required	15%	20%	20%	35%	15%	15%
5	Completion of non-destructive examination & stress relieving/ heat treatment, (if not applicable, then this portion to be paid along with welding	5%	10%	5%		10%	5%
6	H&S wherever applicable as per drawing					5%	
7	Hydro test of piping/ water fill test /Vaccum box test of tanks/Holiday		5%			5%	

	Test (as applicable)						
8	**TOTAL FOR PRO RATA PAYMENTS**	**85%**	**85%**	**85%**	**85%**	**85%**	**85%**
II	**STAGE MILESTONE PAYMENT (15%)**						
1.	Completion of air & gas tightness test for FGD inlet & Outlet Ducts	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
2.	Completion of Trial run of Slurry pumps/absorber system commg (If Slurry pump not in scope)	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
3.	Trial run of Wet ball mills or absorber system commg (If mills are not in scope)	2%	2%	2%	2%	2%	2%
4.	Trial run of Oxidation Blower	1% (4x0.25%)	1% (4x0.25%)	1% (4x0.25%)	1% (4x0.25%)	1% (4x0.25%)	1% (4x0.25%)
5.	Trial run of FGD System	2%	2%	2%	2%	2%	2%
6.	Completion of touchup Painting	2%	2%	2%	2%	2%	2%
7.	Area cleaning, temporary structures cutting/removal and return of scrap	1%	1%	1%	1%	1%	1%
8.	Liquidation of pending points	2%	2%	2%	2%	2%	2%
9.	Completion of all contractual obligation and de mobilization of site office	1%	1%	1%	1%	1%	1%
	TOTAL FOR STAGE/MILESTONE PAYMENTS (15%)	**15%**	**15%**	**15%**	**15%**	**15%**	**15%**
	TOTAL I + II	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

7.2	**SECURED RECOVERABLE ADVANCES:** Interest Free Secured Mobilization Advance as per GCC Clause No. 2.13.1: Interest Free Mobilization Advance shall be disbursed in specifically mentioned stages of major resource mobilization as specified hereunder: 1. For Installation and Erection of Site Infrastructure by contractor i.e. site office, stores etc. – 1.5%. 2. For Mobilization of Crawler Crane 75/80 MT- 01 No. -1.5% 3. For Mobilization of Crawler Crane 150 MT - 01 No. -2% Note: 1. BHEL Site-CM shall be the certifying authority for assessing the admissibility of advance to contractor.
7.3	**Documents required for RA Bill:** I. GST Complied Invoice of the work done as per approved BBU. II. WAM -6 for RA Bill. III. Jointly signed Measurement sheet. IV. Power of Attorney before submission of Bill. V. Validity of Bank Guarantees as applicable under the contract. **HR/IR compliance documents:** I. Wages payment sheet as per applicable minimum wages. II. Proof of PF contribution submission. III. Proof of ESI/ WC contribution submission IV. Proof of Bonus payment as per Bonus Act if applicable. V. Proof of EL payment if applicable. **VI.** Any other statutory document if applicable.

7.4	**Documents required for Final Bill:** The final bill is drawn as soon as the entire work is completed. From the final amount due, all amounts already claimed up to the previous running account bill will be deducted. It should be ensured that in the final bill the following additional particulars have been provided: o Final Bill in WAM-7 Format. o 'No claim' certificate from the contractor. o Clearance certificates where ever applicable viz. Clearance Certificates from Customer, various Statutory Authorities like Labour department, PF Authorities, Commercial Tax department etc. o Final Material re-conciliation statement duly approved by BHEL. o Indemnity Bond as per prescribed format. o Deviation statement showing the difference between the actuals and as per the contract. o Final Delay Analysis.

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

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

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

Not Applicable

10.0 EXCLUSIONS

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

i. Sub-delivery items and electrical components such as push-buttons, junction boxes etc.
ii. E&C work of cable trays, cables and earthing etc
iii. Control panels, EPMS, MCC etc.
iv. Electrical & C&I items of handling system (PG 99)
v. All electrical and control & instrumentation items except those specified elsewhere in these specifications.
vi. Civil works except to the extent specifically indicated elsewhere in this tender.
vii. Pneumatic copper tubing and fittings thereof.
viii. Testing and commissioning of heating elements, thermostats, HV rectifier transformers.
ix. Electrical and C&I items of Variable Frequency Drives as provided elsewhere in these specifications.

WEIGHT SCHEDULE:-

Balance FGD U#1, U#2 & Common System (SUMMARY) FOR 3X800 MW PVUNL PROJECT PATRATU

Table : WEIGHT DETAIL OF FGD AND ITS ACCESSORIES

Balance Applicable PGMA of FGD#1 & FGD#2	

PGMA	Description	FGD# 2 (Weig ht in MT)	FGD#1 Balance Weight (MT)	Total Balance weight of FGD#1+ FGD#2	Category	Rate identifier	Remarks
FW213	ABSORBER SYSTEM INTERNALS	22		22	Struct/Duct/Dam per	1.1	
FW215	MIST ELIMINATOR & ACCESSOR	28		28	Struct/Duct/Dam per	1.1	
FW219	ABSORBER SYSTEM-BASE	61		61	Struct/Duct/Dam per	1.1	
FW220	ABSORBER SYSTEM-STRUCTURES	816		816	Struct/Duct/Dam per	1.1	
FW221	ABSORBER SYSTEM-CASING BOT	130		130	Struct/Duct/Dam per	1.1	
FW222	ABSORBER SYSTEM-CASING TOP	607		607	Struct/Duct/Dam per	1.1	
FW223	ABSORBER SYSTEM ACCESSORIE	39		39	Struct/Duct/Dam per	1.1	
FW224	ABSORBER SYSTEM-LINING-C27	89		89	Struct/Duct/Dam per	1.1	
FW227	EMERGENCY QUENCH SYSTEM	9		9	Struct/Duct/Dam per	1.1	
FW228	ABSORBER-W/D INTERFACE	14		14	Struct/Duct/Dam per	1.1	
FW229	W/D WASH SYSTEM	9		9	Struct/Duct/Dam per	1.1	
FW251	EXPANSION JOINT BETWEEN BY	15		15	Struct/Duct/Dam per	1.1	
FW253	EXPANSION JOINT BETWEEN SC	16		16	Struct/Duct/Dam per	1.1	
FW255	DUCT BETWEEN BYPASS DUCT I	146		146	Struct/Duct/Dam per	1.1	
FW257	DUCT BETWEEN SCRUBBER AND	146		146	Struct/Duct/Dam per	1.1	
FW260	DUCT STRUCTURE BETWEEN DUC	86		86	Struct/Duct/Dam per	1.1	

FW262	DUCT STRUCTURE BETWEEN SCR	86		86	Struct/Duct/Damper	1.1	
FW280	FOUNDATION MATL FOR DUCT S	10		10	Struct/Duct/Damper	1.1	
FW281	FOUNDATION MATL FOR SCRUBB	50		50	Struct/Duct/Damper	1.1	
FW282	FOUNDATION MATL FOR ELEVAT	10		10	Struct/Duct/Damper	1.1	
FW292	STRUCTURES FOR ELEVATOR	4		4	Struct/Duct/Damper	1.1	
FW293	ELEVATOR AND ACCESSORIES	4		4	Struct/Duct/Damper	1.1	
FW314	MISCELLANEOUS-FGD SYSTEM	20		20	Struct/Duct/Damper	1.1	
FW610	GALLARIES&RAILINGS FOR SCR	218		218	Struct/Duct/Damper	1.1	
Sub Total of Structure/Duct /Damper		2635		2635			
FW212	SLURRY RECIRCULATION PUMP	80	80	160	Rotary Mc	1.3	
FW230	AIR OXIDATION SYSTEM	14	14	28	Rotary Mc	1.3	
Motor	RC Pump Motors	208	208	416	Rotary Mc	1.3	
Motor2	Oxidation Blowers motors	34	34	68	Rotary Mc	1.3	
Sub Total of Rotary Mc		336	336	672			
FW244	OXIDATION AIR DISTRIBUTION	20	20	40	piping	1.5	
Sub Total of Piping		20	20	40			
FW265	LINING OF DUCT BETWEEN SCR	18	18	36	Insulation	1.4	
FW267	INSULATION MATERIALS FOR D	40	40	80	Insulation	1.4	
FW268	FIXING COMPONENTS AND CLAD	40	40	80	Insulation	1.4	
Sub Total of Insulation		98	98	196			
FW226	EMERGENCY QUENCH WATER TAN	22	22	44	Tank	1.2	
Sub Total of Tanks		22	22	44			
Sub Total Of Separate system		**3111**	**476**	**3587**	**0**		

CAT	Rate Sc ID		FGD#1 Balance Weight (MT) (common System)	Total Balance weight of FGD#1 + FGD#2	Category	Rate identifier	Remarks
FW710	MONORAIL FOR HOIST & CRANE		60	60	Struct/Duct/Damper	1.1	Common to all 3 units
FW721	AGITATOR SUPPORT		50	50	Struct/Duct/Damper	1.1	Common to all 3 units
FW722	GALLERIES & RAILINGS FOR T		50	50	Struct/Duct/Damper	1.1	Common to all 3 units
FW729	LIMESTONE SILO- SS 304 LINI		10	10	Struct/Duct/Damper	1.1	Common to all 3 units
FW730	LIMESTONE SILO STRUCTURE		385	385	Struct/Duct/Damper	1.1	Common to all 3 units
FW732	LIMESTONE SILO ACCESSORIES		28	28	Struct/Duct/Damper	1.1	Common to all 3 units
FW733	LIMESTONE SILO APPROACH PL		18	18	Struct/Duct/Damper	1.1	Common to all 3 units
FW740	FOUNDATION MATL FOR TANKS		30	30	Struct/Duct/Damper	1.1	Common to all 3 units
FW761	STRUCTURE FOR PIPERACKS		60	60	Struct/Duct/Damper	1.1	Common to all 3 units
FW763	FNDN:MATL FOR PIPE RACK GY		22	22	Struct/Duct/Damper	1.1	Common to all 3 units
FW766	PLATFORM FOR PIPE RACK-LEF		75	75	Struct/Duct/Damper	1.1	Common to all 3 units
FW769	TRESTLE FOR PIPE RACKS		50	50	Struct/Duct/Damper	1.1	Common to all 3 units
Sub Total of			838	838			

Structure/Duct /Damper							
FW226	EMERGENCY QUENCH WATER TAN		22	22	Tank	1.2	
FW731	LIMESTONE SILO		180	180	Tank	1.2	common system to all 3 units
FW742	LIMESTONE SLURRY STORAGE T		160	160	Tank	1.2	common system to all 3 units
FW743	AUXILIARY ABSORBER TANK		142	142	Tank	1.2	common system to all 3 units
FW744	FILTRATE TANK		18	18	Tank	1.2	common system to all 3 units
FW745	WASTAGE WATER TANK		85	85	Tank	1.2	common system to all 3 units
FW747	HYDROCLONE WASTE WATER TAN		23	23	Tank	1.2	common system to all 3 units
FW748	PROCESS WATER TANK		30	30	Tank	1.2	common system to all 3 units
FW798	AIR RECEIVERS		7	7	Tank	1.2	common system to all 3 units
FW802	NEUTRALISATION TANK & ACCE		3	3	Tank	1.2	common system to all 3 units
FW741	LINING FOR TANK AND SUMPS		36	36	Tank	1.2	common system to all 3 units
Sub Total of Tanks			706	706			

FW701	SLURRY PUMPS & ACCESSORIES		60	60	Rotary Mc	1.3	Common to all 3 units
FW702	WATER PUMPS & ACCESSORIES		60	60	Rotary Mc	1.3	Common to all 3 units
FW715	HANDLING EQUIPMENT IN FGD		150	150	Rotary Mc	1.3	Common to all 3 units
FW720	AGITATORS		50	50	Rotary Mc	1.3	Common to all 3 units
FW734	LIMESTONE MILL		470	470	Rotary Mc	1.3	Common to all 3 units
FW736	PRIMARY HYDROCLONE AND ACC		20	20	Rotary Mc	1.3	Common to all 3 units
FW737	SECONDARY HYDROCLONE AND A		10	10	Rotary Mc	1.3	Common to all 3 units
FW738	GYPSUM BELT FILTER AND ACC		180	180	Rotary Mc	1.3	Common to all 3 units
Motor	Wet ball Mill Motor		36	36	Rotary Mc	1.3	Common to all 3 units
Sub Total of Rotary Mc			1036	1036			
FW751	PROCESS WATER PIPE ACCESSO		85	85	piping	1.5	Common to all 3 units
FW753	SLURRY PIPE ACCESSORIES		200	200	piping	1.5	Common to all 3 units
FW754	SERVICE AIR PIPE ACCESSORI		60	60	piping	1.5	Common to all 3 units
FW755	INSTRUMENT AIR PIPE ACCESS		60	60	piping	1.5	Common to all 3 units
FW758	VALVES AND FITTINGS COMMON		130	130	piping	1.5	Common to all 3 units

Sub Total of Piping			535	535			
	Sub Total of Common system		**3115**	**3115**			
Grand Total Common Systems and FGD#1+FGD#2				**6702**			

Non Billable PGMA

1. FW790- Tools
2. FW988- Commissioning Spares
3. FW997 – Mandatory Spares

Summary of Estimated Weight (in MT) of Various System in The Scope of Work

1. FGD and Its accessories weight						
Rate Sc ID*	**Package**	**FGD U#1**	**FGD-Common (Applicable Pkg#A)**	**Total Weight FGD#1**	**FGD#2**	**Total Tonnage**
1.1	Absorber/Structure/ Duct/ Gates/Damper		838	838	2635	**3473**
1.2	Tanks	22	706	728	22	**750**
1.3	Rotary machines	336	1036	1372	336	**1708**
1.4	Insulation & Sheeting	98	0	98	98	**196**
1.5	Piping (Incl. SS, CS, Alloy Steel etc.)	20	535	555	20	**575**
	TOTAL	**476.00**	**3,115.00**	**3,591.00**	**3,111.00**	**6,702.00**

* Rate Sc ID: Rate schedule ID/ Rate schedule Identifier

NOTE TO WEIGHT SCHEDULE:

1. The information furnished is only a description regarding the items to be erected by the contractor. BHEL reserves the right to add or exclude any components / items / systems according to the site requirements / customer requirements to complete the system in all respects.
2. The above detailed Bill of Quantity is furnished for reference.

3. The weight indicated above is approximate and liable to vary. However, the payment will be made to the contractor for the tonnage actually erected at the respective category as per the quoted / accepted tonnage rate.

4. There may be variation or addition of PGMAs, description, weights etc., and any additional scope of work supplied under the above package shall be erected by the contractor and payment will be made as per the quoted / accepted rate in the respective category.

5. The erection & dismantling of air blowers and connecting pipes and ducts providing blanks/ dummies at the required locations and conducting gas tightness test is in the scope of the contract and shall be carried out within the quoted rate.

GENERAL REQUIREMENTS – COMMON TO ALL WORK	
12.1	Site Visit by the Bidder- The bidder shall, prior to submitting his tender for the work, visit and examine the site of works and its surroundings at his own expense, and obtain and ascertain for himself on his own responsibility all information that may be necessary for preparing his tender and entering into a contract, and take the same into account in the quoted contract price for the work.
12.2	The bidder shall satisfy themselves about the following factors: i) Site conditions including access to the site, existing and required roads and other means of transport/communication for use by him in connection with the work including diverting and re-routing of services. ii) Requirement and availability of land and other facilities of his enabling works, establishment of his nursery, office, stores etc. iii) Ground conditions including those bearing upon transportation, disposal, handling and storage of materials required for the work or obtained there-from. iv) Source and extent of availability of suitable materials, including water etc., and labour (skilled and unskilled) required for work, and laws and regulations governing their use and employment. v) Geological, meteorological, topographical and other general features of the site and its surroundings as are pertaining to and needed for the performance of the work. vi) The limit and extent of surface and subsurface water to be encountered during the performance of the work, and the requirement of drainage and pumping. vii) The type of equipment and facilities needed, for and in the performance of the work: viii) The extent of lead and lift required for the work in complete form overthe entire duration of the contract, and ix) All other information pertaining to and needed for the work including information as to the risks, contingencies and other circumstances which may influence or affect the work or the cost thereof under this contract.
12.3	Scope of work covered under this specification requires quality workmanship, engineering and green belt management along with the supply of all consumables,

	tools and tackles and testing instruments. The contractor shall ensure timely completion of work. The contractor shall have adequate tools, measuring instruments etc. in his possession. He shall also have adequate trained, qualified and experienced engineers, supervisory staff and skilled personnel. The manpower deployment identified by contractor shall match with above scope of works.
12.4	It is not the intent to specify herein all details of all material. Any item related this work not covered by this but necessary to complete the system will be deemed to have been included in the scope of the work.
12.5	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.
12.6	Site testing wherever required shall be carried out for all items / materials installed by the contractor to ensure proper installation and functioning in accordance with drawings, specifications and manufacturer's recommendations.
12.7	The contractor shall carryout additional tests if any, which the Engineer feels necessary because of site conditions and also to meet system specification
12.8	The work shall be executed under the usual conditions without affecting power plant construction / operation and in conjunction with other operations and contracting agencies at site. The contractor and his personnel shall co-operate with the personnel of other agencies, co-ordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.
12.9	All the work shall be carried out as per instructions of BHEL engineer. BHEL engineer's decision regarding the correctness of the work and method of working shall be final and binding on the contractor.
12.10	Wherever Construction sequences are furnished by BHEL, the contractor shall follow the same sequence.
12.11	Contractor shall execute the supply and works as per sequence prescribed by BHEL at site engineer. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the methods of execution of similar job in any other site or for any reasons whatsoever. If required by BHEL, the contractor shall change the sequence of his operation so that work on priority sectors can be completed within the projects schedule. The contractor shall afford maximum assistance to

	BHEL in this connection without causing delay to agreed completion date.
12.12	Contractor shall, transport all materials to site (From Storage Yard) and unload at site / working area for inspection and checking. All material handling equipment required shall be arranged by the contractor.
12.13	Contractor shall retain all T&P / Testing instrument / Material handling equipment's etc. at site as per advice of BHEL engineer and same shall be taken out from site only after getting the clearances from engineer in charge. The contractor at his cost shall arrange necessary security measures for adequate protection of his machinery, equipment, tools, materials etc. BHEL shall not be responsible for any loss or damage to the contractor's construction equipment and materials. The contractor may consult the Engineer-in-Charge on the arrangements made for general site security for protection of his machinery equipment tools etc.
12.14	The Contractor may have to execute work in such a place and condition where other agencies also will be under such circumstances. However, completion time for construction, agreed will be subject to the condition that contractor's work is not hampered by the agencies.
12.15	Contractor has to work in close co-ordination with other agency at site. BHEL engineer will co-ordinate area clearance. In a project of such magnitude, it is possible that the area clearance may be less / more at a particular given time. Activities and Construction 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.
12.16	The contractor must obtain the signature and permission of the security personnel of the customer / BHEL 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
12.17	Contractor shall remove all scrap materials periodically generated from his working area and collect the same at one place earmarked for the same. Load of scraps is to be shifted to a place earmarked by BHEL. Failure to collect the scrap is likely to lead to accidents and as such BHEL reserves the right to collect and remove the scrap at contractor's risk and cost if there is any failure on the part of contractor in this respect.
12.18	The contractor shall ensure that his premises are always kept clean and tidy to the

	extent possible. Any untidiness noted on the part of the contractor shall be brought to the attention of the contractor's site representative who shall take immediate action to clean the surroundings to the satisfaction of the Engineer in- Charge.
12.19	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. 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.
12.20	No member of the already erected structure / buildings, other component and auxiliaries should be removed / modified without specific approval of BHEL engineer.
12.21	Some time 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.
12.22	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
12.23	Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.
12.24	Completion of work, all the temporary buildings, structures, pipe lines, cable etc. shall be dismantled and levelled and debris shall be removed as per instruction of BHEL by the contractor at his cost. In the event of his failure to do so, the expenditure towards clearance of the same will be recovered from the contractor. The decision of BHEL Engineer in this regard is final.
12.25	It is the responsibility of the contractor to do the checking, testing etc. if necessary, repeatedly to satisfy BHEL Engineer with all the necessary tools and tackles, manpower etc. without any extra cost. The testing will be completed only when jointly certified so, by the BHEL Engineer
12.26	The contractor's work shall not hinder other work, either underground or over ground, such as electrical, phone lines, water or sewage lines, etc. In areas of overlap, the contractor shall work in coordination with other related contractors.
12.27	VOID

12.28	**SITE INSPECTION**
12.28.1	The owner / employer or his authorized agents may inspect various stages of work during the currency of the contract awarded to him. The contractor shall make necessary arrangements for such inspection and carry out the rectification pointed out by the owner / employer without any extra cost to the owner / employer. No cost whatsoever such duplication of inspection of work be entertained.
12.28.2	BHEL / Customer will have full power and authority to inspect the works at any time, either on the site or at the contractor's premises. The contractor shall arrange every facility and assistance to carry out such inspection. On no account will the contractor be allowed to proceed with work of any type unless such work has been inspected and entries are made in the site inspection register by customer / BHEL.
12.28.3	**Wherever the performance of work by the contractor is not satisfactory in respect of workmanship, deployment of sufficient labour or equipment, delay in execution of work or any other matter, BHEL shall have the right to engage labour at normal ruling rates and get the work executed through other agency and debit the cost to the contractor and the contractor shall have no right to claim compensation thereof.** In such a case, BHEL shall have the right to utilize the materials and tools brought by the contractors for the same work.
12.29	**DOCUMENTATION**
12.29.1	**The following information shall be furnished by the bidder within two weeks of award of contract for purchaser's approval** a) Bar chart covering planned activities at site b) Detailed organization chart c) Details of T&P available with contractors with documents proofs.
12.29.2	The following information shall be furnished by the bidder after testing and inspection: Test certificates of various tests conducted at site. All inspection and test certificates shall be signed by BHEL representative also.
12.30	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.
12.31	The terminal points decided by BHEL shall be final and binding on the Contractor for

	deciding the scope of work and effecting payment for the work done.
12.32	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.
12.33	The work covered under this specification is of highly sophisticated nature, requiring the best quality workmanship, supervision, engineering and construction management. The Contractor should ensure proper planning and successful & timely completion of the work to meet the overall project schedule. The Contractor must deploy adequate quantity of tools & plants, modern / latest construction aids etc. He must also deploy adequate trained, qualified and experienced supervisory staff and skilled personnel.
12.34	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.
12.35	All necessary certificates and licenses, permits & clearances required including certificates/license/clearances to carry out this work from the respective statutory/ local authorities are to be arranged by the Contractor at his cost in time to ensure smooth progress of work.
12.36	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.
12.37	The Contractor shall perform any services, tests etc, which may not be specified but

	nevertheless, required for the completion of work within quoted rates.
12.38	All necessary certificates and licenses required for carrying out this work are to be arranged by the Contractor expeditiously.
12.39	The Contractor shall execute the work in the most substantial and workman like manner. The stores shall be handled with care and diligence.
12.40	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.
12.41	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.
12.42	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'.
12.43	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.

12.44	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.
12.45	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.
12.46	**Storage yard located at two to three different places and are about 3-4 KM from FGD area (May note that 3-4 KM is a range and a few KMs can be main road and a few KMs may not be main road. Further there are no traffic restrictions as such). 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.**
12.47	Plant materials should not be used for any temporary supports / scaffolding/ preparing pre-assembly bed etc.
12.48	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.
12.49	**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.**

12.50	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.
12.51	Layout of field routed/ small bore piping shall be done as per site requirement. Necessary sketch for routing these lines should be got approved from BHEL by the Contractor. There is a possibility of slight change in routing the above pipe lines even after completion of erection.
12.52	Welding of necessary instrumentation tapping points, thermowell, thermocouple pad, metal temperature pad and clamps, root valve, condensing vessel, flow metering & measurement devices, and control valves to be provided on pipe lines, tanks, pumps and piping are covered within the scope of this specification. The installation of all the above items will be Contractor's responsibility even if: a) Items are not specifically indicated under the respective product groups as given in the technical specifications. b) Items are supplied by an agency other than BHEL. Pre-heating, NDE, and Post weld heat treatment for above shall be done as per the specifications as part of work.
12.53	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.
12.54	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.
12.55	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.

12.56	In installation of various equipments it may become necessary to install these on temporary supports/ hanger due to various reasons including non-availability of suspension materials. Contractor shall install such temporary suspensions/hangers and later on shift the relevant equipments to their respective permanent hangers/ suspensions/ supports as incidental to work. Requisite materials for such temporary arrangements will be provided by BHEL on free -returnable basis which shall be returned to BHEL after the use.
12.57	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.
12.58	All works such as cleaning, levelling, aligning, trial assembly, dismantling of certain equipments / components for checking and cleaning, surface preparation, fabrication of sheets, tubes and pipes as per the general engineering practice and as per BHEL engineers instructions at site, cutting, weld desposing, grinding, straightening, chamfering, filing, chipping, drilling, reaming, scraping, lapping, fitting up etc as may be applicable in such erection works and which are treated incidental to the erection work and necessary to complete the work satisfactorily shall be carried out by the Contractor as part of the work.
12.59	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. Contractor's offer shall cover all such contingencies.
12.60	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.
12.61	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 the part of the scope of work.

12.62	**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.**
12.63	BHEL is operating web based computerized E-store system that includes, inter-alia, issue of materials, daily progress reporting, Contractor's running monthly billing and material reconciliation through a computerized data management system. Contractor shall install necessary hardware to hook-up with the BHEL's system and use the same for his scope of work.
12.64	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.
12.65	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.
12.66	**There are few locations of storage yard within/beside plant premises. Major storage yard is located outside the Main Plant Boundary, in more than one location, at a distance of approximately 3-4 KM from the erection site (May note that 3-4 KM is a range and a few KMs can be main road and a few KMs may not be main road. Further there are no traffic restrictions as such).** 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

Following Annexures shall be integral parts of this tender (attached separately):

Annexure -1	BHEL T&P Hire Charges
Annexure -2	Approved list of welding electrodes supplier
Annexure -3	List of approved vendors for Paint supplier
Annexure -4	Painting Scheme
Annexure-5	Guidelines for Selection of NDE and Heat Treatment Agencies at Site

13	**DETAILS OF SCOPE OF WORK FOR FGD & Auxiliaries** The scope of work is further detailed in the specifications hereinafter. 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.)
13.1	***MAIN SUPPORTING STRUCTURES, EXTERNAL STRUCTURES, ELEVATOR STRUCTURES, STAIRWAYS, GALLERIES & PLATFORMS & HANDLING ARRANGEMENT***
13.1.1	In some cases, the structural material will be supplied in random lengths, which have to be fabricated to suit the requirement as incidental to work. Also, it may sometimes be necessary to remove some of the erected members to facilitate erection of bigger/ pre-assembled equipments. In such cases, the removal and re-erection of such members as agreed by the BHEL Engineer, will have to be done by the Contractor as incidental to work.
13.1.2	Contractor shall arrange materials required for temporary cat ladders & working platforms during erection of columns, platforms and other structural components. Such arrangements shall, as far as possible, be only of clamping & bolting type, as welding on columns etc will not be permitted. After the completion of work these shall be removed.
13.1.3	All the hand rails and toe guards shall be provided as per drawings and site requirement. hand rails supplied in running lengths shall be suitably cut, edge prepared and welded. Also, hand rails/ guards may have to be provided from the safety point of view in certain places though not indicated in the erection drawings. The weld joints of hand rails shall be ground smooth to flush finish.
13.1.4	Electroforged floor grills will be supplied for this project. These may have to be cut to suit requirement. Cutting shall be done only by mechanical cutters **and not by gas cutting**. Cold galvanizing compound is to be applied on the cut surface/edge. Cold galvanizing paint supply is in Contractor scope.
13.1.5	Fixing of floor grills shall be done by self-tapping screws **and not by weldable studs.** Special purpose electrically operated hand tools are available in the market for this, which drills, taps and fixes the screws in a single operation. Supply of necessary self-drilling-cum-tapping screws and fixing clips are in contractor scope. Contractor shall deploy the **drilling cum fixing machine** required for this purpose as a regular scope of work.
13.1.6	The Contractor shall also install additional platforms of permanent nature for

	approaching different equipment as per the site requirement and to meet O&M requirements, though these may not indicated in the erection drawings. Materials required for such platforms will be supplied by BHEL in random sizes on free issue basis. These have to be fabricated to suit the requirement. Payment only for erected weight as certified by BHEL engineer shall be made at the rate applicable for structures. No payment is envisaged for fabrication of structures.
13.1.7	All relevant provisions as above shall apply, mutatis-mutandis, to the work of external structures, interconnecting structures, elevator structures, and gallaries & equipment handling system etc.
13.2	***OTHER PRODUCTS AND SYSTEMS AND COMMON REQUIREMENTS*** a) Any connection with ESP outlet to chimney ducting shall be in agency scope. b) Ducts / expansion bellows (metallic & non-metallic) are normally supplied in loose components / segments and these are to be assembled and welded/ jointed at site before erection. The fabric portion of non-metallic expansion joints (NMEJ) namely bolster, fabric belt and canopy shall be installed by Contractor under supervision/guidence of equipment supplier/BHEL for the first few cases. Contractor shall ensure that all subsequent NMEJ are assembled with due care and proper procedure. In simillar manner 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. c) Certain structural items like, roof cladding structure, platform etc will be supplied in running lengths which shall be cut to required suitable sizes and adjusted/trimmed as part of work. d) Contractor has to make canopies for motors (If no supplied by the BHEL units), actuators, material for this will be supplied in random lengths / sizes. No separate payment for fabrication is envisaged. Only the erection tonnage rate applicable for structure will be paid for this work. e) Actuator / drives of dampers, gates etc may have to be serviced, lubricated before erection, during precommissioning and commissioning, including carrying out adjustments required as incidental of the work. f) All welded joints should be painted with anticorrosive paint / primer immediately after completion of all work. Necessary paints and other consumables for the above work are in the scope of the Contractor.

	g) Hangers and suspensions, support steels for ducts and other equipments, etc will be supplied in running/random lengths/ sizes, which shall be cut to suitable sizes and adjusted as required. h) Touch up and preservative painting of all components issued to and/or erected by Contractor shall form part of scope of work. The Contractor shall arrange all paints, primer and consumables, T&P and facilities. l) **ARRANGING PAINTS, PRIMERS FOR TOUCHUP PAINTING (AS APPLICABLE) AS PER TENDER SPECIFICATION FOR ALL ERECTED MATERIALS UNDER SCOPE OF THIS PACKAGE IS IN THE SCOPE OF CONTRACTOR.**
13.3	**Erection Sequence of FGD**
13.3.1	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, 13.3.1.1 Scaffolding and rigging operations, 13.3.1.2 Machine / flame / electric cutting, grinding, welding, radiography and stress relieving. 13.3.1.3 Fitting, fettling, filing, straightening, chamfering chipping, scrapping, reaming, as cleaning, checking, levelling, blue matching, aligning and assembly. 13.3.1.4 Machining, surface grinding, drilling, doweling, shaping 13.3.1.5 Temporary erections for alignment, dismantling of certain equipment for checking, cleaning, servicing and site fabrication. 13.3.1.6 Insulation and painting
13.3.2	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.
13.3.3	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.

13.3.4	The contractor shall erect scaffolding / temporary platforms for erection. These should be of adequate capacity and shall never be over loaded. These should be replaced when not found suitable during erection work and dismantled on work completion and removed from work site.
13.3.5	It shall be the responsibility of the contractor to provide ladders on columns for initial work till such time stairways are completed. For this, the ladder should not be welded on the column and should be pre-fabricated 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.
13.3.6	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.
13.3.7	**Below mentioned erection sequence is indicative only and give the general idea to the contractor for absorber erection. :** 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. Rubber lining (Only to indicate erection schedule).

	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
13.3.8	**Casing Panel Installation** **i.** Splices of bottom plates at which casing panel are located shall be cleaned. ii. 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. iii. 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. iv. 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. v. 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. vi. 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. vii. Spacers used for root gap of welds shall be removed. viii. 1. 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 line pipes shall be determined in accordance with the final piping locations which shall be set at the site.

13.3.9	**Spray Pipe Installation** **i.** Check all concerned absorber dimensions, i.e. tolerance of absorber casing, support beam location, absorber nozzle location, flange face location, bolt hole location, size and spacing etc., before Spray Pipe installation. **ii.** 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 **iii.** Lift Spray Pipe up to the same height as absorber nozzle. **iv.** Insert the tip of Spray Pipe into the absorber, and unload the tip of Spray Pipe onto the temporary support. **v.** Insert Spray Pipe into the absorber by using of chain block. **vi.** 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. **vii.** 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. **viii.** 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.
13.3.10	**Spray Nozzle** **i.** Modify the scaffolding for installation of Spray Nozzle. 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. **ii.** 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. The special care shall be taken to SiC made Spray Nozzle, since these are weak against mechanical shock and impact.

13.3.11	**Mist Eliminator Installation** **i.** 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. **ii.** 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. **iii.** Insert the dedicated shim plates between pipe and pipe support, and fixing Ubands or U-bolts and external flanges. **iv.** Install the lower panel of Mist Eliminator and tightly coupled each other by means of comb brace and tie insulock. **v.** Install the lower down washing spray pipe and upper up washing spray pipe a same manner as the above. **vi.** Install the upper panel of Mist Eliminator, and install upper washing spray pipe as same manner as the above. 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.
13.4	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.
13.5	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.
13.6	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.
13.7	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.
13.8	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.
13.9	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.
13.10	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.
13.11	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.
13.12	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. Quote tonnage rate shall be inclusive of the above.
13.13	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
13.14	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.
13.15	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.
13.16	Whenever required the contractor shall arrange for pre-qualification of process task Performers.
13.17	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.
13.18	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.
13.19	Instrument tapping coming on the FGD and associated equipment's to be welded/fitted by the contractor with in the quoted price.
13.20	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.
13.21	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.
13.22	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.
13.23	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.
13.24	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.
13.25	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.
13.26	The contractor at no extra cost to BHEL shall carry out servicing and realignment of skid mounted equipment.
13.27	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.

13.28	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.
13.29	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.
13.30	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.
13.31	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.
13.32	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.
13.33	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.
13.34	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.
13.35	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 over hauled in full or in part before erection and during commissioning
13.36	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.
13.37	Suspension for piping, etc., will be supplied in running lengths, which shall be cut to suitable sizes and adjusted as required.
13.38	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.
13.39	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.
13.40	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.
13.41	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.
13.42	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.
13.43	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.
13.44	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.
13.45	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.
13.46	The contractor shall prepare as built piping drawing & submit to BHEL Engineer for approval & verification of material used.
13.47	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.
13.48	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. No separate payment for fabrication is envisaged. Only the erection tonnage rate applicable for structure will be paid for this work.
13.49	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.
13.50	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.
13.51	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.
13.52	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.
13.53	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 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.
13.54	Complete the assembly, final welding,/NDT/testing as per the approved drawings/ documents FQP

14 PREPARATION OF FOUNDATIONS, AND GROUTING OF EQUIPMENT OF FGD & ITS AUXILIARIES

14.1	Minor adjustment of foundation level, dressing and chipping of foundation surfaces and blue-matching (wherever required) for of all equipments as per BHEL Engineers instructions, should be done by the Contractor as part of the work. Contractor/BHEL shall prepare protocols before taking over the foundations. Dressing and chipping of foundations up-to 20 mm for achieving proper levels will be within the scope of work/specification.
14.2	All temporary foundations and anchor points required for installing erection Equipments and winches, foundations for pumps, tanks etc are in the scope of Contractor. All building materials like cement, steel including re-inforcement bars, grits cements etc for such temporary foundations shall have to be arranged by the Contractor within the quoted rates. All such foundations shall be demolished and normal ground conditions restored after the usage.
14.3	BHEL will provide free of cost only the shims and packer plates (either machined or plain) 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 and de-burr the same. However, machining of the packers wherever necessary, shall be arranged by contractor.
14.4	Complete grouting of structures equipments, including anchor/ foundation bolts, beneath base, base hollows etc, as may be applicable, is included in the scope of Contractor. Arranging all labour, building materials including cement, ordinary portland as well as quick setting – free flow - non-shrink grout mix (e.g. conbextra gp1/gp2), form work, shuttering, and any other requirements is in the Contractor's scope. Contractor shall obtain approval of BHEL for cement (Ordinary Portland as-well-as quick setting – free flow- non-shrink grout mix) prior to use. Cleaning of foundation surfaces, pocket holes and anchor bolt pits and de-watering and making them free of oil, grease, sand and other foreign materials by soda washing, water washing, compressed air and other approved methods are within the scope of this specification/ work.
14.5	After the grouting has finally set and cured, alignment of equipments involved shall be checked again to verify for any disturbance or any other reason. If required, de-coupling of equipments has to be done for conducting the verification. In case any disturbance is noticed the cause, if any, shall be removed and re-alignment done as part of work.
14.6	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.

15	**WELDING, RADIOGRAPHY AND OTHER NON-DESTRUCTIVE TESTING, POST WELD HEAT TREATMENT**
15.1	Installation of equipment involves good quality welding, NDE checks, post weld heat treatment etc. Contractor's personnel engaged should have adequate qualification on the above works.
15.2	The method of welding (viz) arc, TIG/MIG or other method will be indicated in the detailed drawing/documents. BHEL Engineer will have the option of changing the method of welding as per site requirement.
15.3	Unsatisfactory and continuous poor performance may result in discontinuation of concerned welder.
15.4	The welded surface shall be cleaned of slag and painted with primer paint to prevent rusting, corrosion. For this consumables like paint /primer etc will be in the Contractor's scope.
15.5	Welding electrodes have to be stored in enclosures having temperature and humidity control arrangements. This enclosure shall meet BHEL specifications.
15.6	Welding electrodes, prior to their use, call for baking for specified period and will have to be held at specified temperature for specified period. Also, during execution, the welding electrodes have to be carried in portable ovens.
15.7	All charges towards testing of Welders for destructive and nondestructive test, testing and approval of welders for engaging in the erection work shall be borne by the contractor.
15.8	All welded joints shall be subjected to acceptance by BHEL Engineer.
15.9	All the welded joints shall be subjected to Non-Destructive testing as per the drawings / standards / procedures and as per the site requirement contractor's quoted rate shall inclusive of the same.
15.10	Engineer may stop any welder from the work if his performance is unsatisfactory for any reason or if there is a high percentage of rejection in the joints welded by him. The welder having passed qualification tests does not absolve the contractor of contractual obligation to continuously check the welder's performance.
15.11	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.

15.12	The contractor shall carry out the root run welding of all HP / LP piping, valves by TIG welding method only. The contractor shall have to carry out full TIG welding of butt weld joints of tubes / pipes of lesser thickness if required. During the root runs of stainless steel joints, the contractor shall before and during welding have to purge the pipes with inert gas. All arrangements required for the above shall be the responsibility of the contractor at no additional cost.
15.13	All expenses for testing of contractor's welders including destructive and non-destructive tests conducted by BHEL at site or at laboratory shall have to be borne by the contractor only. Limited quantity of raw material required for making test pieces will be supplied by BHEL free of cost.
15.14	The regulators used on welding machines shall be calibrated before putting these into use for work. The Contractor at his cost shall also arrange periodic calibration for the same.
15.15	Only BHEL/ CUSTOMER approved electrodes and filler wire are to be arranged and used by the contractor, within the finally quoted price. BHEL/ PVUNL 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.
15.16	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.
15.17	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.
15.18	All welds shall be painted with anticorrosive red oxide paint once radiography and stress reliving works are over. Necessary consumables and scaffolding etc including paints shall be provided by contractor at his own cost.
15.19	Pre-heating, radiography and other NDT tests, post heating and stress relieving after welding of tubes, pipes, including attachment welding wherever necessary, are part of erection work and shall be carried out by the contractor in accordance with the instructions of the Engineer. Contractor at his cost shall arrange all equipment and consumables essential for carrying out the above process.
15.20	Contractor shall arrange all necessary stress relieving equipment with automatic recording devices. The contractor arrange for labour, heating elements, thermocouples, thermo-chalks, temperature recorders, thermocouple attachment units, graphs, sheets insulating materials like asbestos cloth, ceramic beads, asbestos ropes etc. required for heat treatment/ stress relieving operations. The contractor should take a note of the following,
15.21	Temperature shall be measured by thermocouple and recorded on a continuous printing type recorder. All the recorded graphs for heat treatment works shall be the property of BHEL.
15.22	All stress relieving equipment will be used after due calibration and submission of test certificate to BHEL. Periodic calibration from Govt. Approved / accredited Test Houses traceable to National / International standards will also be arranged by the contractor for such equipment at his cost.
15.23	The contractor shall obtain the signature of Engineer or his representative on the strip chart of the recorder prior to the starting of SR operations.
15.24	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.
15.25	The technical particulars, specification and other general details for radiography work shall be in accordance with ASME, IBR or ISO as specified by BHEL.
15.26	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).

15.27	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.
15.28	All radiographs shall be free from mechanical, chemical or process marks, to the extent they should not confuse the radiographic image and defect finding. Penetrameter as per ASME or ISO must be used for each exposure.
15.29	Lead numbers and letters are to be used (generally 6mm size) for identification of radiographs. Contract number, joint identification, source used, welder's identification and SFD are to be noted down on paper cover of radiograph.
15.30	Lead intensifying screens for front and back of the film should be used as per the above referred ASME specification.
15.31	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.
15.32	For multiple exposures on pipes, an overlap of about 25-mm of film should be provided.
15.33	Radiography personnel with sufficient experience and certified by M/s BARC for conducting radiographic tests in accordance with safety rules laid down by Division of Radiological protection only have to be deployed. These personnel should also be registered with DRP / BARC for film badge service.
15.34	All arrangements for carrying out radiography work including dark room and air conditioner and other accessories shall be provided by contractor within the space allotted for office at his cost. As an alternative the contractor may deploy an agency having all above facilities and who are duly approved / accredited by BARC and / or other Regulatory authorities. Detailed particulars of such agencies will be submitted and got approved by BHEL Engineer before the actual deployment of agency for radiography work.
15.35	The contractor shall have a dark room fully equipped with radiography equipment, film (un-exposed), chemicals and any other dark room accessories if they keep the source inside the plant. Or Agency should tie up with A RT agency inside the plant premises with Dark room and pit room facilities. Or Agency should be tie up with an outside agency for the dark/pit room facility out side the plant premises.
15.36	The agency has to ensure the timely testing of weld joints in failing of same BHEL may take alternative arrangement on Agency risk and cost.
15.37	Radiography inspection of welds shall be performed in accordance with requirements and recommendation of BHEL Engineer. The quantum of radiographic inspection shall be as per provision of ASME / BHEL/PVUNL approved documents. Subsequently radiographic inspection will be done on the basis of quality of welding. However

	minimum percentage of joints to be radiographed shall not be less than the requirement of BHEL welding schedule / IBR / Customer's requirements. The percentage may be increased depending upon the quality of joints and at the discretion of BHEL. Radiography on LP piping joints is not envisaged. However other NDT test as called for in the FQP including LPI, MPI and HT will have to be carried out.
15.38	All the Radiographs shall be properly preserved and shall become the property of BHEL. They are to be reconciled with the work done, joints radiographed and submitted to BHEL / customer
15.39	Since radioisotopes are being used, all precautions and safety rules as prescribed by BHEL/BARC/ Customer shall be strictly followed. BARC / DRP certificate to be provided before taking up the work.
15.40	Radiography of joints shall be so planned after welding that the same is done either on the same day or next day of the welding to assess the performance of HP welders. If the performance of welder is unsatisfactory, he is to be replaced immediately.
15.41	Wherever radiographs are not accepted, on account of bad shot, joints shall be radiographed and re- submitted for evaluation.
15.42	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
15.43	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.
15.44	Heat treatment and 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.
15.45	The contractor shall assist BHEL Engineer in preparing complete field welding schedule for all the field welding activities to be carried out in respect of piping and equipment erected by him involving high pressure welding at least 30 days prior to the scheduled start of erection work at site. The contractor shall strictly adhere to such schedules.
15.46	Check shots as per the requirement of BHEL/ PVUNL will be taken at agency cost.
15.47	Welding of galvanised iron pipes/fittings would be permitted provided the same is carried out by means of special electrodes suitable for the above application and the same shall be approved by contractor. After, welding, welded portions shall be applied with three coats of zinc silicate treatment/rich paint over one coat of suitable primer. Further, the Contractor shall provide proper zinc paint at the point of welding.

16	**LINING AND INSULATION** Application of insulation, finishing, cladding and outer casing etc of the following: 1. FGD and its auxiliaries.
16.1	All attachment welding, including welding of hooks / supports as per pitch both on equipment and piping shall be done as directed by Engineer. Attachment welding shall have to be done by certified welders. If necessary contractor may have to cut the hooks to correct length. Application of red oxide paint including supply of paint on welded portions as directed by BHEL is also included in scope of work.
16.2	The mineral wool mattresses (bonded / un-bonded) / LRB mattresses are received at site in standard sizes. These are to be dressed / cut to suit site requirements by the contractor.
16.3	The number of layers / thickness of mineral wool / LRB mattresses for auxiliaries, pipe lines, valves and other vessels shall be as per various drawings and as directed by Engineer. For applying the mineral wool mattress, the required holding materials, if necessary by fabrication of rings/ hooks shall be fixed as directed and as per drawings and spec.
16.4	The contractor should ensure, proper finishing of surface of the insulation, sheeting and cementing.
16.5	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.
16.6	It is the responsibility of the contractor to ensure that the insulation materials and sheet metal covering issued to him for application are well protected against loss or damage from weather conditions. Closed / semi closed sheds or any other arrangements required for this will by him at his cost. If any damage occurs to the material due to improper storage or due to any causes attributable to the contractor except for normal breakage or damages allowed in such cases, the cost of such damaged material shall be to the account of the contractor.
16.7	Aluminum sheet cladding will be fabricated to the sizes and shapes specified in drawings. Beading, swaging, beveling of sheets, crowning the sheets if necessary will be carried out by him. Two coats of anti-corrosive black bituminous paint are to be applied on inner surfaces of the cladding. Bitumen sealing compound on the joints if necessary is included in the scope of this work. Contractor may note that he will also supply anti-corrosive black bituminous paint & bituminous sealing compound required for above works at his cost. However if supply by the BHEL MUs same will be issue free of charges to contractor.

16.8	Aluminum sheet metal cladding over insulation will consists of plain / ribbed / corrugated sheets. The sheets will be supplied in standard sizes. Cutting them to required size, grooving, fabricating bends, boxes etc., for proper covering is contractors responsibility. Any cutting / bending / welding of fabricated skin casing sheets if required will also covered within the scope of this contract.
16.9	A logbook shall be maintained by the contractor to obtain clearance for application of insulation. If the contractor does the work on his own accord without prior permission the area may have to be redone at his cost.
16.10	The work shall conform to dimension and tolerances specified in the various drawing and documents that will be provided during the execution. if any portion of the work is found to be defective in workmanship or not conforming to drawings or other specifications, 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 engaging other agencies or departmentally and recoveries will be deducted from Contractor's bills towards expenditure incurred including BHEL Overhead charges.
16.11	All insulation and refractory materials including iron components and outer sheet casing materials, cladding sheets etc required will be supplied by BHEL and the same have to be erected/ applied as per the drawings and specifications of BHEL by the Contractor.
16.12	The Contractor shall provide all the necessary scaffolding materials, temporary structures and necessary safety devices etc, during all stages of work. Scaffolding materials (poles, gratings etc) shall be of light weight construction. Contractor shall arrange steel pipes & clamps with accessories like base plate attachment, fixing pins, struts etc for scaffolding required for this work. However, BHEL's decision in this regard shall be final and binding. Contractor shall arrange the scaffolding materials in sufficient quantity. The Contractor shall provide the required quantity of wire, nails, and planks for formwork and other materials for shuttering and curing works.
16.13	Wool insulation is received at site as loose bonded mattresses in standard sizes. These are to be dressed/cut to suite the equipments. Multiple layers of wool have to be applied as directed and as per drawings and specifications for all equipments/ systems covered under the scope of work.
16.14	The cladding and outer casing are aluminium sheets. All relevant specifications and procedures with regards to beading, sealing etc for alunimium sheets have to be adhered to.
16.15	Cladding/outer casing shall be fixed expeditiously, so as to avoid damage to the insulation from the weather. The overlapping surface of outer casing/cladding sheet shall be coated with sealing compound, which will be supplied by BHEL free of cost.

16.16	To take care of bimetal corrosion due to variety of metals in contact of each other viz retainer to support, support to outer casing/cladding, cladding-to-cladding etc, suitable paints specified by BHEL, to be applied and/or neoprene rubber packing/strips or any other insert may have to be fixed as required.
16.17	The Contractor shall leave certain gaps and openings while doing the work as per the instructions of BHEL Engineer to facilitate inspection during commissioning to fix gauges, fittings, instruments etc. these gaps will have to be finished as per drawings at later date by the Contractor at his cost.
16.18	Contractor shall cut open works in needed as per BHEL Engineer's instructions during commissioning for inspection, checking and make good the works after inspection is over without any extra payment.
16.19	A log book shall be maintained by the Contractor for the clearance of the area for application of refractory and insulation. Where the Contractor does the work on his own accord without prior permission, the work should be re-done, at his own cost, where necessitated.
16.20	Wastage allowances for the material issued are envisaged as follows: ➢ a Wool mattresses - 2% ➢ b Cladding sheets - 2% The wastage allowance will be applicable on the net issued quantity i.e. total quantity issued reduced by the quantity returned to stores as unused/fresh item. Contractor shall reconcile the material issues periodically as prescribed by BHEL site.
16.21	If during erection and commissioning any of the parts are to be insulated temporarily fixed and then replaced by permanent ones at a later date or if any of the parts are to be removed for modification, rectification, adjustment and then refitted or if some parts are to be opened for inspection and checking and for measurement of metal surface temperature the same may necessitate removal and re-application of insulation and sheet metal cladding, which shall be done by the contractor and the erection rate quoted shall be inclusive of such contingencies.
16.22	Removable type of insulation shall be provided for valves, fittings, expansion joints etc as per the drawings or as directed by BHEL Engineer.
16.23	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.
16.24	The following works are also included in the scope of this contract. **a) Cutting of cladding sheets as per the profile of the equipment and**

	painting on inner surface two coats of bituminous paint. Paint will be arranged by Contractor. **b) Cutting of the wool mattresses in the required shape and application of finishing layer of required thickness wherever required.**

17	**PAINTING** **<u>Touch-up Painting:</u> All structures / components shall be supplied from BHEL units/ workshops with finish coats of paint. Therefore, final painting is not applicable in the scope of contractor for structures & components however painting shall be applicable for the piping erected by the agency.** **Touch up painting** (wherever required), **incidental to the work, shall be in the scope of the contactor, including supply of the required paints and primers and associated consumables.** Though the final painting is not there in structures and equipment the scope of the contractor, in case any shop painted structure/component is required to be repainted due to the reasons <u>attributable to the contractor</u> such as Mis-handling, damage during erection process, other reasons incidental to the work etc, such re-painting/finish painting of the components/structures shall be in the scope of the contractor including the supply of paints and primers along with all required consumables & deployment of tools e.g wire brush, paint brush, Spray M/c, cleaning agents etc. Contractor shall carry out surface preparation and touchup painting/ painting in piping works as per BHEL/Customer specification and instruction of BHEL engineer at site.
17.1	Paints and painting work carried at site shall confirm to the following codes and standards: IS:5 – Colour for ready mixed paints and enamels. IS : 101 Part 1 to 9 – Methods of sampling and test for paints, varnishes and related products IS : 1477 Part I&II – Code of practice for painting of ferrous metals in building IS : 2932 – Specifications for enamel, synthetic and exterior, a) Under Coating b) Finishing IS: 9407 – Colour code for identification of pipelines used in thermal power plants. Contractor shall satisfy himself, availability of all information in the specifications for proper selection of the paints and ensure their applications as per Codes.
17.2	**Primer Painting:** a) After surface preparation, two coats of **epoxy resin based zinc primer** shall be applied. Dry film thickness of each coat shall be as per the recommendations of primer/paint manufacturer. Primer shall be applied by either spraying or bushing ensuring a continuous film without “holidays”. Primer coat shall be immediately applied without any time lag after the surface preparation. b) Any equipment shall be carefully examined and where ever the primer coat is damaged shall be recoated with primer. However over the field welds, bolts and nuts

	etc. two primer coats as per a) shall be applied.
17.3	**Finish <u>Painting (Pipes & its associated component)</u>** a) After the primer coat has dried out, the surface shall be cleaned of dust without scratching or in any way damaging the primer coat. Over this, dry surface finish painting shall be carried out. b) Finish painting shall be carried out in two coats. Dry film thickness of each coat shall be as per the recommendation of the primer/paint manufacturer. Minimum thickness including primer and paint coating shall be as per specification. c) Paint shall be applied either by brushing or spraying. It shall be ensured that brush marks are a minimum and the requirements of workmanship are as specified in IS: 1477 (for site painting works on systems, structures and components). d) Paint used shall be stirred frequently to keep the pigment in suspension. Paint shall be of ready mixed type in original sealed containers as packed by the paint manufacturer. Addition of thinners shall not be permitted. e) No painting shall be done in frost/foggy weather or when the humidity is high enough to cause condensation on the surface to be painted. Paint shall not be applied when the temperature of the surface to be painted is 5^{o} C or below. f) Work of painting of condenser surfaces in various areas and at various stages of work are specified elsewhere in these specifications.
17.4	Components of pumps & Motors and auxiliaries will in general be supplied painted by BHEL manufacturing units as per their standard applicable painting schemes. Contractor shall carry out primer and finish painting coats and DFT requirement with colour codes & specifications as per requirement of customer. All exposed metal parts of the equipment including piping, structures, railings etc. wherever applicable, after installation unless otherwise surface protected, shall be first painted with at least one coat of suitable primer which matches the shop primer paint used, after thoroughly cleaning all such parts of all dirt, rust, scales, greases, oils and other foreign materials by wire brushing, scraping or sand blasting, and the same being inspected and approved by BHEL engineer for painting. Afterwards, the above parts shall be finished with two coats of alloyed resin machinery enamel paints.
17.5	**Touch-up painting on damaged areas –** a) For coatings damaged up to metal surface. Surface preparation shall be carried out by manual cleaning. Minimum 6 inches

	adjoining area with existing coating shall be roughened by wire brushing, emery paper rubbing etc., for best adhesion of patch primer. Primer coat of touch-up primer has to be applied by brush immediately after the surface preparation. Over this primer coat, finish coat and final finish coat shall be applied as covered above by brush within maximum seven (7) days of application of touch up primer.
17.6	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. (a.) 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. (b.) Painting procedure to be followed for touch-up painting on damaged areas.
17.7	The scope of work includes painting (including supply) of colour bands, lettering, marking and signs for direction of flow/rotation, names etc of approved colours as per the standard colour codes and specifications specified in tender specification or as advised by BHEL/Customer engineer at site for the equipments / components covered in these specifications.
17.8	In certain isolated instances where it is not possible to clean the equipments as explained above, cleaning by grinding might have to be resorted to. No damage to the equipment/components should be caused.
17.9	Surface to be painted should be free of oil and grease. It should be removed by using suitable cleaning agents including permitted solvents. Surface cleaned by chemical agent, if required, shall be treated further as prescribed in use of such cleaning agents.
17.10	During the preparation of surface, if the shop coat is damage by chemical cleaning or by mechanical means, contractor shall repair the same free of cost.
17.11	Specified drying time shall be permitted from one to another coat.
17.12	This work requires working at higher altitudes from ground level to as high as 50 mtr and more. The work spread is also substantial involving substantial run of structures and piping. Contractor shall take sufficient precautions to avoid any accident and hazard in all respects. The ropes, ladders, scaffolding materials, clamps etc and climber used should be of standard quality for safe and smooth execution of work.
17.13	Contractor shall carry out the work in such a way that other erected equipment, structure, civil foundations and other property are not damaged. For damages in any of such cases due to lapses by Contractor, BHEL shall have the right to recover the cost of such damages from the Contractor.
17.14	Contractor shall take due care to cover/protect the equipment which are already painted while carrying out the painting of other adjacent equipment. If so happens, it shall be cleaned and repainted by the Contractor without any extra charges.
17.15	In general, painting of structural parts and colour bands, lettering, marking of

	direction of flow/rotation etc will be carried out by brush painting. However, areas/equipments inaccessible for manual painting have to be painted by spray painting. The decision of BHEL engineer, in this regard, shall be final and binding on the Contractor. Laying of air hose pipe and any other line required shall be done by Contractor at his cost
17.16	Final painting work shall be started after obtaining clearance from BHEL engineers and as per his instructions.
17.17	Acceptance of Final Painting for required thickness shall be as per the thickness measured by Alcometer by Customer/BHEL Engineer. Contractor shall have to carry out painting till the required thickness is achieved.
17.18	Painting two coats of bituminous paint on Insulation cladding sheet inner surface.
17.19	The scope of painting includes application of color bands, lettering the names of the systems equipment's; tag Nos of valves, marking the directions of flow and other data required by BHEL within the quoted rate.
17.20	The actual color to be applied shall be approved by the customer before starting of actual painting work.
17.21	Primer & finish paint shall be of reputed paint supplier approved by BHEL / Customer. Contractor has to procure paints from the BHEL / Customer approved agencies only, and the paints should be as per the customer painting specification. The quality of the finish paint shall be as per the standards of IS or equivalent as approved by BHEL / Customer. Before procurement of paint the contractor has to obtain the clearance from BHEL authorities. The batch certificates of paints to be submitted to BHEL Engineer before using the same.
17.22	No paint shall be applied when the surface temp is above 55 deg. Centigrade or below 10 deg. Centigrade, and when the humidity is greater than 90% to cause condensation on the surface or frost / foggy weather.
17.23	All surfaces to be painted shall be thoroughly cleaned, free from scales, dirt and other foreign matter. Paint shall be applied in an even & uniform film free from lumps, streaks, runs, sags and uncoated spots.
17.24	Before applying the subsequent coats, the thickness of each coat shall be measured and recorded with BHEL / Customer.
17.25	Wherever applicable, supply and application of primer / final painting of all the insulation items erected under the scope of this tender. The painting shall be as required and specified in the painting schedule, which forms the part of this tender book.
17.26	Required paints, thinner other consumable 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 arrangements of primer/paint will be in contractor's scope.
17.27	Any equipment which has been given the shop coat of primer shall be carefully examined after its erection in the field and shall be treated with touch up coat of same primer wherever the shop coat has been abraded, removed or damaged during transit / erection, or defaced during welding.

17.28	Mostly the equipment / items / components will be supplied with one coat of primer paint and one coat of finish paint. However, during storage and handling, the same may get peeled off / deteriorate. All such surfaces are to be thoroughly cleaned and to be touch up painted with suitable approved primer and finish paint matching with shop paint / approved final color.
	NOTE: PAINTING **Contractor shall arrange all paints, primers, tools and other consumables including scaffolding materials required for touch-up painting. Paint is to be BHEL approved make only and painting should be as per colour scheme and quality approved / specified by Engineer. Valid Test Certificate for the paint so supplied shall be made available before use of the same on work. No paint whose shelf life has expired should be used for painting.**

18.1	Testing, & commissioning will involve, though not limited to these, various testing e.g., leak test, trial runs of equipments; checking/setting various clearances/ parameters, ensuring operation of various equipments free of undue restrictions, trial operation and loading etc are some of these activities. All the activities for commissioning of the set, as informed by BHEL from time to time shall be completed.
18.2	All these tests should be repeated till all the equipments satisfy the requirement / obligations of BHEL to their client and also the relevant statutory authority.
18.3	No payment will be made for temporary installations made for testing of systems & similarly no payment will be made for electrical installations made for any temporary system.
18.4	All materials, equipment's necessary for installation of temporary system as above will be supplied by BHEL as free returnable issue in random sizes / lengths. However, servicing, fabrication, erection, dismantling of the same after completion of the process, and handing over back to BHEL stores will be the responsibility of the Contractor. In accounting of materials following wastage allowances are provided: 1. Structural items : 4% ✓ Contractor shall cut / open / dismantle work, if needed, as per BHEL Engineer's instructions during commissioning for inspection, checking and make good the works after inspection is over. ✓ Similarly, during the course of erection, if certain portion of equipments erected by the Contractor has to be undone for enabling other Contractors / agencies of BHEL / customer to carry out their work, Contractor shall carry out such jobs expeditiously and promptly and make good the job after completion of work by other Contractors / agencies of BHEL / customer as per BHEL engineer's / agencies of BHEL / customers instructions. Claims, if any, in this regard shall be governed as relevant clauses of 'General Conditions of Contract
18.5	Commissioning activities will continue till the completion of trial operation. During this period Contractor shall make available the services of separate dedicated workforce comprising of suitable skilled and semi-skilled / un-skilled workmen and supervisory staff alongwith necessary tools and plants, consumables etc.
18.6	It shall be specifically noted that the Contractor may have to work round the clock during the pre-commissioning and commissioning period alongwith BHEL Engineers and hence considerable overtime payment is involved. The Contractor's

	quoted rates shall be inclusive of all these factors.
18.7	The Contractor shall carry out any other tests as desired by BHEL engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning and commissioning, to demonstrate the completion of any part or whole of work performed by the Contractor.
18.8	During this period, though BHEL/ client's staff will also be associated in the work, the Contractor's responsibility will be to arrange for complete requirement of men and required tools and plants, consumables, scaffolding and approaches etc., till such time the commissioned unit is taken over.
18.9	Conducting of performance guarantee test (PG test) is in the scope of work. Contractor shall install all necessary tapping points; instruments etc and provide necessary assistance in this regard.
18.10	In case PG test is getting delayed beyond the contract period (normal plus extension if any) due to reasons not attributable to the Contractor, PG test issue will be mutually discussed and decided. However installation of necessary tapping points, impulse pipes, approaches etc are to be completed by the Contractor.
18.11	The Contractor shall carry out any other tests as desired by BHEL engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning and commissioning, to demonstrate the completion of any part or whole of work performed by the Contractor.
18.12	**FGD commissioning and testing:**
18.12.1	The contractor shall carry out all the required tests, pre-commissioning and commissioning activities required for the successful and reliable operation of FGD system as per the approved commissioning procedure / quality plans of BHEL/PVUNL. 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/hydrocyclones, etc. as instructed by BHEL using their own consumables, labour and scaffoldings etc. Specific omission of any test which is required for the successfully commissioning of the FGD system does not absolve the contractor of its responsibilities of performing of that test.
18.12.2	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 but contractor shall conduct the tests as per the approved commissioning procedure.
18.12.3	The 'Initial Operation'/trial operation of the complete facility as an integral unit shall be conducted for 720 continuous 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 72 hours .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.
18.12.4	Specialized test equipment, if any, shall be provided by BHEL / its client free of hire charges. However contractor has to take proper care of the equipment issued to him.
18.12.5	After completion of erection of ducts, the contractor shall conduct the air/gas tightness of the inlet duct from ID fan outlet 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 to BHEL).
18.12.6	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 site welded joints arising out of the failure during testing.
18.12.7	The scope of pre-commissioning activities cover installation of all necessary equipment including temporary piping, supports, valves, blanking, pumps, tanks, with access platforms valves, along with accessories required for hydro test for any other tests. The scope also covers the offsite disposal of effluents of the tests under the scope of this contract as per instruction of BHEL Engineer.
18.12.8	It shall be the responsibility of the contractor to provide various category of workers in sufficient numbers along with Supervisors during Pre-commissioning, commissioning and post commissioning of equipment and attending any problem in the equipment erected by the contractor till handing over. The contractor will provide necessary consumables, T&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.
18.12.9	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.
18.12.10	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.
18.12.11	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
18.12.12	The contractor shall make all necessary arrangements including making of temporary closures on piping / equipment for carrying out the hydro-static testing on all piping, equipment covered in the specification at no extra cost.
18.12.13	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.
18.12.14	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.
18.12.15	All temporary supports shall be removed in such ways that pipe supports are not subjected to any sudden load. During hydraulic testing of pipes, all piping having variable spring type supports shall be held securely in place by temporary means while constant spring type support hangers shall be pinned or blocked solid during the test.
18.12.16	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.
18.12.17	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.
18.12.18	The scope of pre-commissioning, commissioning and post commissioning activities cover installation of all necessary temporary piping, supports, valves, blanking,

	pumps, tanks etc. and other accessories with access platforms valves, pressure gauges, electric cables, switches, cutting of some of existing valve, placing of rubber wedges in the valves etc., required for hydro test, or any other tests as the case may be and will carry out above activities under this scope of work as per instructions of BHEL. The scope also covers the off site disposal of effluents.
18.12.19	It shall be the responsibility of the contractor to preserve the cleaned surface as per BHEL's requirement.
18.12.20	The contractor shall make all necessary arrangements including making of temporary closures on piping/ equipment for carrying out the hydro-static testing on all piping equipment covered in the specification at no additional cost. The contractor shall carryout the required test on the pipelines such as Hydraulic Test of various piping systems, Ultrasonic Test for weld defects and finding thickness, Dye penetrant test, Magnetic particles test for Weld defects and materials defects etc. All facilities (manpower, materials, equipment, consumables etc.) including proper approaches wherever required shall be provided by the contractor for satisfactory conduction of above tests. Special equipment such as magnetic particle tester, ultrasonic test kit and engineers required for these tests shall be arranged by the contractor along with Qualified technician within finally accepted rates.
18.12.21	In certain places blanking has to be resorted prior to Hydraulic test and spool pieces have to be erected in place of control valves, orifices and other fittings and these spool pieces have to be subsequently replaced with the regular valves/ fittings by the contractor at no extra cost.
18.12.22	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.
18.12.23	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.
18.12.24	All the shafts of the equipment shall have to be properly aligned to that of matching equipment to perfection, accuracy as required and the equipment shall be free from excessive vibration so as to avoid over-heating of bearings or other conditions, which may tend to shorten the life of the equipment. All bearings, shafts and other rotating parts shall be thoroughly cleaned and lubricated as per recommendations of BHEL engineer.
18.12.25	During commissioning changing of gaskets , tightening of bolts, realigning of rotating and other equipment, attending to leakage and minor adjustments of erected equipment may arise. The quoted rate of contractor shall be inclusive of all

	such works.
18.12.26	Lubricating oil units of the rotating machines are to be cleaned thoroughly before pouring of final lubricating oil. Topping up of lubricants during running of the set till handing over to be done by the vendor. Required lubricants both for first filling and topping up are to be supplied by BHEL free of cost. The empty containers of the lubricating oils should be returned to BHEL stores/place indicated by BHEL from time to time.
18.12.27	The instruction of the motor manufacturer regarding storage of the motors and re conservation must be strictly followed without any deviation.
18.12.28	Attending the punch points post commissioning and resolve the deficiency for handing over the unit to customer M/s PVUNL.

19	**PRESERVATION & PROTECTION OF COMPONENTS** i. At all stages of work, equipments/materials in the custody of Contractor, including those erected, will have to be preserved as per the instructions of BHEL. Necessary preservation agents including the primer & paint, for the above work shall be provided by the Contractor. ii. The Contractor shall make suitable security arrangements including employment of security personnel and ensure protection of all materials/ equipment in their custody and installed equipments from theft/fire/pilferage and any other damages and losses. iii. Contractor shall collect all scrap materials periodically from various area of work site, deposit the same at one place earmarked at site or shift the same to a place earmarked in BHEL/ client's stores. In case of failure of Contractor in compliance of this requirement, BHEL will make suitable arrangement at Contractor's risk and cost. iv. The entire surplus, damaged, unused materials, packaging materials / containers, special transporting frames, gunny bags, etc shall be returned to BHEL stores by the Contractor. v. The Contractor shall not waste any materials issued to him. In case it is observed at any stage that the wastage/excess utilisation of materials is not within the permissible limits, recovery for the excess quantity used or wasted will be effected with departmental charges from the Contractor. Decision of BHEL on this will be final and binding on the Contractor. vi. For any class of work for which no specifications have been laid down in these specifications, work shall be executed as per the instructions of BHEL.

Table -1 Schedule of Quantities

Weightages / Factor for PACKAGE

PACKAGE: ERECTION TESTING, COMMISSIONING, TRIAL OPERATION OF BALANCE WORK OF THE FGD UNIT#1, UNIT#2 AND FGD COMMON SYSTEMS AND ITS AUXILIARIES INCLUDING LINING & INSULATION, SUPPLY OF PAINTS AND TOUCHUP PAINTING, COLLECTION OF MATERIALS FROM BHEL/ CLIENT'S STORES/ STORAGE YARD, TRANSPORTATION AT SITE AND HANDING OVER THE PACKAGES TO CUSTOMER AT 3X800 MW PVUNL PROJECT PATRATU.

Rate Sc ID	Item Description	BOQ		Weightage Factor "X" for item Price w.r.t total amount quoted by bidder
		UOM	QTY (in MT)	
1.1	Absorber/Structure/Duct/ Gates / Damper	MT	3473	0.508770399
1.2	Tanks	MT	750	0.109680183
1.3	Rotary Machine	MT	1708	0.184353031
1.4	Insulation & Sheeting	MT	196	0.036838435
1.5	Piping (incl. SS, CS, Alloy Steel etc.)	MT	575	0.160357952
	Total weight	**MT**	6,702.00	1

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

Instruction to Bidders for Vol-II-Price Bid and Schedule of Rates and Quantities

1. **Bidders shall quote Total Lump-sum Price for the entire scope of work in Rupees for Tendered Package only in VOL II PRICE BID at BHEL E-procurement Portal.** Any other entry elsewhere in the offer of the bidder shall be treated as Null and Void.

2. BHEL has pre-fixed the Weightages / Factor as detailed above in this chapter for deriving the Unit Rates for the BOQ item. Considering BHEL pre-fixed "**Weightage Factor"** and the "Total Price" quoted as per sl.no. 1 above; "Item Price" of individual items shall be derived by Multiplying the "Weightage Factor" and "Total price".

3. Unit Rate/Item Rate shall be calculated by dividing "Item Price" as derived in Sl.no. 2 above, with its quantity. "Item rate" thus arrived shall be rounded off to two decimal places.

4. Grand Total amount for the work shall be derived by BHEL by summing up respective total amounts which are obtained by multiplying respective item Quantities of individual item to the applicable rate per UOM (Unit rate as derived in Sl.no. 3 above) rounded off to Two decimal places.

5. Grand total amount thus derived shall be rounded off to zero decimal places and shall be considered for award of the work.

6. **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 Sl No. 3 above.**