



VOLUME IA

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Balance work of Erection, Testing and assistance for commissioning & Trial Operation including handling of materials at BHEL / Client's Stores / Storage Yard and transportation to site of; Boiler & its Auxiliaries, ESP and its auxiliaries, Boiler integral piping, Critical Piping (P91, HP/LP piping), Structure for bunker (BHEL Mfg units Supplied items), Non Pressure Parts, Duct dampers and its support structure, Rotating Equipments, Air Pre Heaters, ID/FD/PA fans, SCR and its auxiliaries, FGD and its auxiliaries, Lining and Insulation, Supply and application of touchup painting, (As and wherever required) and balance erection work of Bunker and allied works in unit-3 at 3x800 MW PVUNL Patratu project, Jharkhand

BHARAT HEAVY ELECTRICALS LIMITED



TECHNICAL CONDITIONS OF CONTRACT (TCC)

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Chapter - I: Project Information

1. Project Information

Project Name: 3x800 MW Patratu Vidut Utpadan Nigam Ltd. (PVUNL) Patratu STPP. The proposed site is located near Patratu town in Ramgarh district of Jharkhand.

The latitudes and longitudes of the site are as follows:

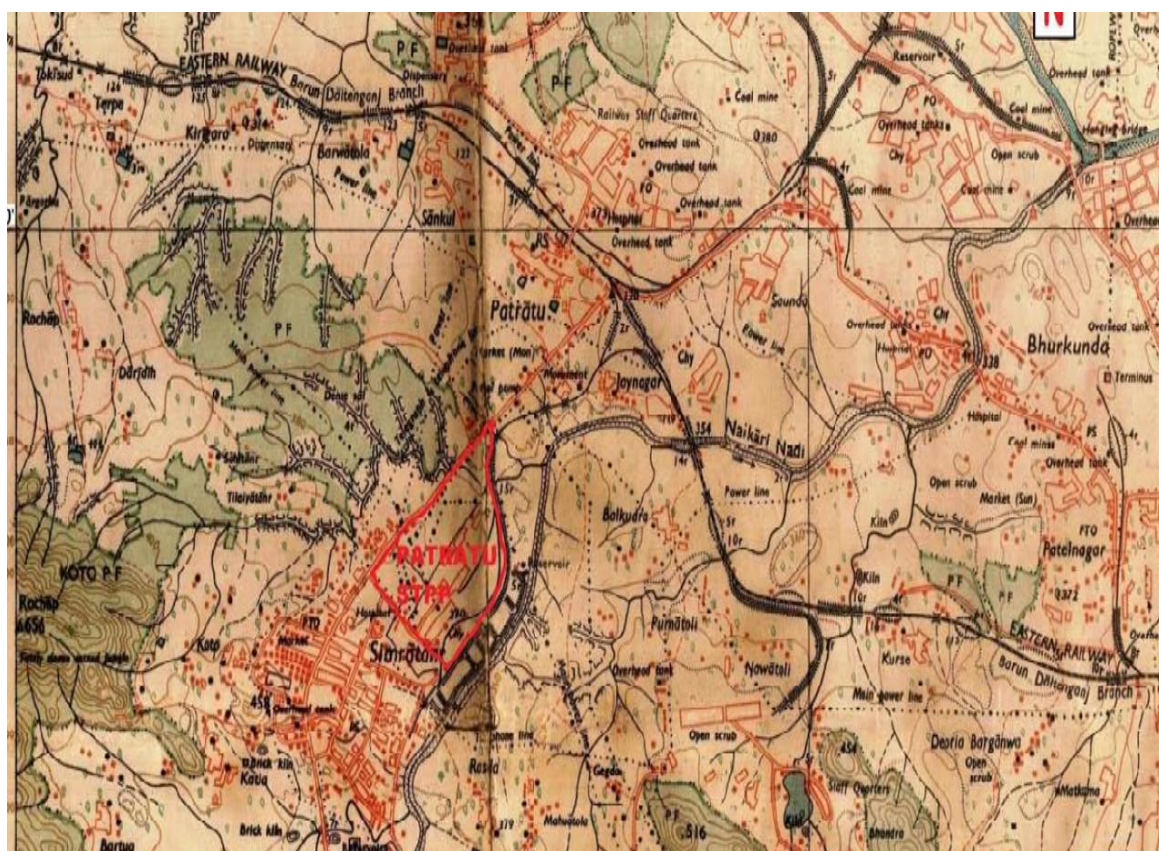
1	Project Name	3x800 MW Patratu Vidut Utpadan Nigam Ltd. (PVUNL) Patratu STPP	
2	Plant Site Location	Near Patratu town in Ramgarh district of Jharkhand	
3	Location Co-ordinate	Main Plant & Township:	
3.1	Corner name	Latitude	Longitude
3.2	Top Corner	23° 39 ' 00" N	85° 17' 51.5" E
3.3	Bottom Corner	23° 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 -03 Kms, Ramgarh- 30 Kms, Ranchi - 37 Kms	
5	Nearest Railway Station	Patratu-4 Kms	
6	Nearest Airport	Ranchi-45 Kms	
7	Nearest Seaport	Kolkata-424 Kms	
8	Nearest Road Access	Ranchi Patratu Ramgarh Rd	
9	Site Elevation	377 M 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)	

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Chapter - I: Project Information

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. The information given here in under are for general guidance and shall not be contractually binding on BHEL/ Owner. All relevant site data/information as may be necessary shall have to be obtained/ collected by the Bidder.

1.0	INSTRUCTIONS TO BIDDERS
1.1	The Bidder shall visit project site and acquire full knowledge and information about conditions prevailing at site and in & around the plant premises, together with site conditions, transportation routes, various distances, all the statutory, obligatory, mandatory requirements

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	of various authorities and all information that may be necessary for preparing the bid and entering into the Contract. All costs for and associated with site visits shall be borne by the bidder.															
1.2	Other contractors would be working in this area and their structures are to be protected. The material brought and stacked for construction should not make hindrance to other contractors.															
1.3	The information given herein is for general guidance and shall not be contractually binding on BHEL/Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.															
1.4	The contractor, in the event of this work awarded to him, shall establish an office at site and keep posted an authorized, responsible officer with valid Power of Attorney for the purpose of the contract. Any order or instructions of the 'Engineer' or his duly authorized representative, communicated to the contractor's representative at site office will be deemed to have been communicated to the contractor at his legal address.															
1.5	No claim will be entertained by BHEL on ground of lack of knowledge and the contractor's rates shall be deemed to have taken this into account.															
1.6	<div>Bidders may fix up their site visit in consultation with below mentioned contact person:</div> <table><tr><td>Name</td><td>Mr. Suman Mishra</td><td>Mr. Praveen Pandey</td></tr><tr><td>Designation</td><td>GM</td><td>Sr. Manager</td></tr><tr><td>Location:</td><td>3X800 Patratu Project</td><td>PSWR Nagpur</td></tr><tr><td>Email:</td><td>suman.mishra@bhel.in</td><td>praveen.pandey@bhel.in</td></tr><tr><td>Ph. No.</td><td>(+91) 94793 72033</td><td>(+91) 95740 15556</td></tr></table>	Name	Mr. Suman Mishra	Mr. Praveen Pandey	Designation	GM	Sr. Manager	Location:	3X800 Patratu Project	PSWR Nagpur	Email:	suman.mishra@bhel.in	praveen.pandey@bhel.in	Ph. No.	(+91) 94793 72033	(+91) 95740 15556
Name	Mr. Suman Mishra	Mr. Praveen Pandey														
Designation	GM	Sr. Manager														
Location:	3X800 Patratu Project	PSWR Nagpur														
Email:	suman.mishra@bhel.in	praveen.pandey@bhel.in														
Ph. No.	(+91) 94793 72033	(+91) 95740 15556														

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Chapter - II: Scope of Works

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

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

2.1 The scope of work for package as follows:

Balance work of the Erection, Testing and assistance for commissioning & Trial Operation including application of Insulation, Refractory, supply & touch-up painting as and where required including Handling of materials at BHEL / Client's Stores / Storage Yard and transportation to site etc. of

1. Balance work of Erection, Testing and assistance for commissioning & Trial Operation including handling of materials at BHEL / Client's Stores / Storage Yard and transportation to site of; Boiler & its Auxiliaries, ESP and its auxiliaries, Boiler integral piping, Critical Piping (P91, HP/LP piping), Structure for bunker (BHEL Mfg. units Supplied items), Non Pressure Parts, Duct dampers and its support structure, Rotating Equipments, Air Pre Heaters, ID/FD/PA fans, SCR and its auxiliaries, FGD and its auxiliaries, Lining and Insulation, Supply and application of touch-up painting, (As and wherever required).

And

2. Balance Erection work of Bunker & allied works, including supply & installation of items as per BOQ of Unit-3 at 3x800 MW PVUNL Patratu project

The Mechanical works in unit-3 Boiler and auxiliaries was under execution by other agency. The scope of works under this tender specification also include works left over by the earlier agency on "as is where is" basis as detailed in the TCC and BOQ. Apart from above information, the bidder should go through all the conditions of the tender and visit site prior to bidding.

The Complete Erection and Commissioning of Boiler and Auxiliaries as a system whole, shall be the responsibility of the bidder, comprising of the works executed by the earlier agency. Any rectification/modification/reworks arising in the already executed work and necessary for the completion of the work as per this tender scope, shall be in the scope of bidder and to be carried out as per instruction of BHEL Erection In charge. However, payment for such rectification /modification /reworks shall be regulated as per GCC/Rate Schedule.

- 2.2 The work to be carried out at quoted / accepted rates by the Contractor under the scope of these specifications covers the complete work of handling, loading and transporting of materials from project stores sheds / storage yards to site of erection or preassembly yard and unloading at pre-assembly area/erection site, checking, cleaning chipping and levelling of foundations, providing packers and shims/pre-assembling of equipments at the preassembly yard, inspection, minor rectification, preservation, erection, levelling, and other adjustments, cutting, edge / surface preparation, welding, grinding, radiography,

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Chapter - II: Scope of Works

LPI/ MPI/ UT testing wherever needed, heat treatment, carrying out air tightness test by soap solution / kerosene, hydraulic test, steam / air blowing, light up, chemical cleaning, passivation, steam blowing and safety valve floating including inter connection of all the termination points, erection and dismantling of all temporary piping, valves, pumps, tanks etc., required for the above operations, all pre-commissioning tests and trial runs of Boiler & its Auxiliaries, ESP and its auxiliaries, Boiler integral piping, Critical Piping (P91, HP/LP piping), Structure for bunker (BHEL Mfg. units Supplied items), Non Pressure Parts, Duct dampers and its support structure, Rotating Equipments, Air Pre Heaters, ID/FD/PA fans, mills, SCR and its auxiliaries, FGD and its auxiliaries, Lining and Insulation, Supply and application of touch-up Painting (as and where required) for Unit#3 of 3x800 MW PVUNL project Patratu.

- 2.3** The quantities indicated in the tender specification are approximate and are liable for variation and alteration at the discretion of BHEL. The quoted unit rate shall be applicable for any additional product group also, if included at a later date integral to the main scope of work / package envisaged. The work executed shall be measured and priced as per the unit rate arrived at for each work area as mentioned in the relevant clauses.
- 2.4** The PGMA wise breakup of Boiler and Auxiliaries, ESP and Auxiliaries, Critical Piping (P91, HP/LP piping), NPP, rotating machinery, FGD, insulation etc. are indicated in the relevant chapters of this tender specification (separate annexure), but the contractor is required to erect actual tonnage which may be necessary to complete the work in all respects as detailed in the tender specifications, for which payments shall be released on finally settled rates. The weights and dimensions of material shown are approximate and are liable to vary. No increase in quoted / accepted rates / prices shall be allowed due to change in weights and dimensions of the equipment / materials.
- 2.5** The weights given in the Chapter-IX “ESTIMATED WEIGHT FOR VARIOUS SYSTEMS IN SCOPE OF WORK (BOQ)” are approximate and these are subject to change as per site conditions.
- 2.6** Supervisors / Engineers, consumables etc., required for the scope of work shall be provided by the contractor. All the expenditure including taxes and incidentals in this connection will have to be borne by him unless otherwise specified in the relevant clause. The contractor’s quoted rates should be inclusive of all such contingencies.
- 2.7** It shall be specially noted that, the contractor may have to work round the clock (24x7) to achieve the completion schedules / plans / targets during the entire course of erection, testing and commissioning works, which may involve payment of considerable overtime. Hence contractor’s quoted rate shall take into consideration of all expenses that will be incurred for such arrangement of personnel including labours, engineers / supervisors, T&Ps etc.

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Chapter - II: Scope of Works

- 2.8** The terminal points can be inferred from the relevant drawings and any further clarifications can be obtained / decided by BHEL and that is final and binding on the contractor for deciding the scope of work and effecting the payment for the work done up to the terminals. Carrying out work as per the specification between equipments constituting terminal points, whether the terminal equipments fall within the scope of work/specification, contractor shall carry out the terminal joints at either end. Also where the piping connection to the terminal points involve flanged joints, matching of flanges, fixing gaskets, bolting and tightening as per BHEL Engineers instructions is in the scope of work. In case piping connected to equipment, matching of flanges for achieving the parallelism and alignment at the equipment end, by suitably resorting to heat correction or other method as instructed by BHEL Engineer, with in the quoted rate.
- 2.9** The contractor shall submit a copy of license to undertake construction / repair of Boilers & Piping issued by Boiler inspectorate before commencement of Pressure Parts / Piping Erection.
- 2.10** The work shall conform to dimensions and tolerances given in various drawings and quality manuals provided by BHEL. If any portion of work is found to be defective in workmanship not conforming to drawings or other stipulations, the contractor shall dismantle and redo the work duly replacing the defective materials at his cost, failing which the job will be carried out by BHEL by engaging other agencies / departmentally and recoveries will be effected from contractor's bill towards expenditure incurred including BHEL's overhead charges.
- 2.11** Contractor has to work in close co-ordination with other erection agency at site. BHEL engineer will co-ordinate area clearance. In a project of such magnitude, it is possible that the area clearance may be less/more at a particular given time. Activities and erection program have to be planned in such a way that the milestone events like boiler light up, steam blowing, SV Floating etc., are achieved as per schedule/ plans. Contractor shall arrange & augment the resources accordingly.
- 2.12** No member of the already erected structure/ platform, pipes, grills, platform, other component and auxiliaries should be cut without specific approval of BHEL engineer.
- 2.13** The storage yard is located within the plant boundary and nearby (Approx. 3-4 KM) of the plant premises in 2-3 locations. All other materials have to be transported from storage yard to construction area by the contractor at his own cost.
- 2.14** During the course of erection, testing and commissioning, certain rework / modification / rectification / repairs / fabrication etc will be necessary on account of feedback/revision from various relevant sources, and also on account of design discrepancies/ alterations, manufacturing defects, site operations/ maintenance

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Chapter - II: Scope of Works

requirements. This will also include modifications / re-works suggested by BHEL / customer / other inspection group. Contractor shall carry out such rework / modification / rectification / fabrication / repairs etc promptly and expeditiously. Daily log sheets indicating the details of work carried out, man-hours etc shall be maintained by the contractor and got signed by BHEL engineer every day. Claim of Contractor if any, for such works will be governed by relevant clauses of 'General Conditions of Contract.

2.15 The scope of work covered under this specification is of highly sophisticated nature, requiring the best quality workmanship, engineering and construction management and green belt management. The contractor should ensure successful and timely completion of the work. The contractor must have adequate quantity of tools, construction aids, equipments etc., in his possession. He must also have on his rolls adequate trained, qualified and experienced supervisory staff and skilled personnel. The manpower deployment identified by contractor shall match with above scope of works.

2.16 Contractor shall execute the work as per sequence and procedure prescribed by BHEL at site. The erection manuals for boiler pressure parts, structures etc., which are available with BHEL site office are to be referred for compliance and guidance before taking up the work. Any failure to comply with the above might lead to rework and the cost for the same shall be borne by the contractor only. BHEL engineer, depending upon the availability of materials, fronts etc., will decide the sequence of erection and methodology. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the method of erection adopted in erection of similar jobs or for any reason whatsoever.

2.17 Brief feature of Steam Generator & Auxiliaries

Steam Generator is of 800 MW capacity including all related auxiliary equipments as specified below. The steam generator will be of once through, two pass, single reheat, radiant furnace, dry bottom, balanced draft, outdoor type, pulverized coal fired having super critical parameters with all necessary auxiliaries, integral piping, etc. Scope includes Erection, alignment and welding, bolting, fastening, grouting as applicable of:

1. Boiler structure, Bunker structure, Bunker, Transfer point(houses), Trestles, Galleries (PG-34,35,36,38,39)
2. Water cooled furnace complete with separators, water wall, headers, steam generating tubes, furnace bottom hoppers, drains, observation ports, etc.(PG ,04,05,06,07,08,09,10,11,12,)
3. Super heaters including safety valves with silencers, motorised main steam stop valves with integral bypass valve, start up vents, air vents, nitrogen connections,

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Chapter - II: Scope of Works

- etc. Re-heaters including safety valves with silencers, drains, air vents, etc.(PG-24)
4. In line, bare tube economizer, including vents, drains etc.(PG-19)
 5. De superheating spray system, sprays for Super heaters and Re heaters.(PG-16,17)
 6. Steam soot blowing system including long fully retractable rotary blowers for super heater, re heater and economizer; Sweep action soot blowers for regenerative air preheater along with necessary accessories. Soot blower System will be complete with drains, entire piping, fittings, control valves, safety valves etc (PG-20,21)
 7. Complete draft plant for the balanced draft system(PG -48,56)
 - a) 2 nos. Forced draft fans with drives, associated auxiliaries and accessories.
 - b) 2 nos. Induced draft fans with drives, associated auxiliaries and accessories.
 - c) 2 nos of Primary air fan with drives, associated auxiliaries and accessories.
 - d) Regenerative tri-sector air pre-heater 2 nos (PG-52)
 - e) 4 nos. steam coil air pre-heater (SCAPH) with drain collection system.
 - f) Air and Gas duct work with necessary metallic expansion joints, dampers and support steel work up.(PG-48)
 - g) Duct stiffening devices, mating flanges, access doors and brackets, supporting structure as applicable.
 8. Raw coal feeders system (PG-61)
 9. 2 nos Seal Air Fans(PG-55,56)
 10. 09 Nos of coal pulverizers (bowl mills), complete with all necessary accessories (including classifiers, seal air fans, etc).(PG-61)
 11. 2 nos Scanner air fans.(PG-43)
 12. Fuel oil system will cater to Heavy Furnace Oil (HFO) and Light Diesel oil (LDO) firing requirements of each Steam Generator. Fuel oil burners will be complete with diffusers, tips extension pipes, atomizers, burner shut off valves, flexible hoses and all other ancillaries.(PG-45)
 13. Valves, dampers etc with actuators.(PG-57)
 14. Hoists and cranes.(PG-99)
 15. Thermal insulation & refractory.(PG-31,32,33,37)
 16. Application of touch-up Painting
 17. Ducts and dampers BOF to ESP inlet, (PG-48)
 18. Refractory and Thermal insulation.(PG-31,32,33,37)
 19. SCR systems (Selective catalytic reduction systems)(PG-29,SD& SR)
 20. Lift support Structure(PG-35)
 21. Roof Sheeting(PG_-36)
 22. Buckstay (PG-08)
 23. Seal Boxes & Skin Casing (PG-09)
 24. Enclosure (Penthouse, Rear Arch, S-panel)(PG-31)
 25. Ignitor System
 26. PF Pipe/Coal Pipe & Supports

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27. PP supports fixed & Variable load hanger
28. MTM pad to PP components
29. CC Pump
30. Mill Reject System
31. Assistance for Acromate insert fixing
32. Acromate welding (if required)
33. CC Pump including DMCW piping from dearetor to CC pump.
34. Power Cycle Piping
35. HP LP Piping
36. **Insulation of erected items including vent stack.**
37. **BHEL-Trichy/BHEL-PEM/BHEL-Bhopal valves (As applicable)**
38. **Insulation supplied by BHEL-PEM**
39. The structure is bolted type

2.18 Brief feature of ESP & Its auxiliaries:

The scope of work under these specifications for Erection, testing, commissioning, trial operation & handing over of ESP system (Mechanical), broadly consists of Erection, alignment and welding, bolting, fastening, grouting as applicable of but not limited to following

- i. Foundation Checking and dressing to start of erection.
- ii. Pre assy, Erection, alignment of ESP intermediate frames.
- iii. Erection, alignment & Bolting ESP supporting Structures.
- iv. Erection alignment of casing walls and welding and Applicable NDT.
- v. Erection, alignment of LR & TR beams.
- vi. Erection & Alignment of collecting frames and emitting frames.
- vii. Erection and Alignment of roof panels.
- viii. Erection and alignment of collecting & emitting electrodes.
- ix. Erection and alignment of GD Screens.
- x. Erection and alignment of inner roofs.
- xi. Erection and alignment of outer roof,
- xii. Erection and alignment of funnels.
- xiii. Erection and alignment of hoppers.
- xiv. Erection and alignment of Hopper platforms.
- xv. Erection and alignment of HVRs,
- xvi. Erection of Roof structures and sheets
- xvii. Erection and alignment of Hoists.
- xviii. Erection and alignment of Hoods and gutters
- xix. Erection of Water washing piping.
- xx. Erection of emitting and collecting rapping systems
- xxi. Erection and alignment of platforms, stairs and doors.
- xxii. Erection alignment of Ducting from ESP outlet to Chimney including FGD ducts.
- xxiii. Erection of required tapping points.
- xxiv. Erection of Damper and gates.

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Chapter - II: Scope of Works

- xxv. Field charging,
- xxvi. Commissioning of Collecting and rapping systems
- xxvii. Installation of inter locks.

- ✓ Handling arrangements for rotating machines for ID fans.
- ✓ Electrostatic precipitator and stairways & galleries

2.19 Scope of work FGD system: Erection, testing, commissioning, trial run and handing over of the FGD system (Mechanical) as per the tender specifications. FGD system 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.

Refractory application (Castable & Pourable) in the furnace pent house, Goose neck, etc., Thermal insulation and cladding will be provided for the entire steam generator, flue gas / air ducting, etc. The insulation selected will meet the functional requirement. The steam generator will be provided with ribbed aluminium cladding and the ducts will have plain aluminium cladding.

2.20 MILL BUNKER STRUCTURE, COAL BUNKER, TRANSFER POINTS, TRESTLES AND GALLERIES, SILOS & HOPPERS INCLUDING FEEDER AND BUNKER FLOORS, PIPE RACKS, ESP CONTROL ROOM ETC.

Erection, alignment, welding, bolting, grouting and touch-up painting as applicable for fabricated structures (supplied from BHEL units) of Mill bunker structures, Coal bunkers, tipper floor structure, feeder floors structures, pipe rack along ESP, ESP control room structure as per BOQ for Bunker structural works in Mill Bunker structures, etc.

Where ever the supply together is covered in the scope of bidder, as per BOQ, necessary approvals from BHEL / PVUNL shall be taken by bidder for the design, inspection procedure & vendor. List of items for which such approvals required will be frozen during execution of the contract.

Contractor shall procure and supply the items, if any as per BOQ, to PVUNL Project Patratu site for structural works from BHEL / PVUNL approved vendors, meeting the specification, Drawings and instructions of the Engineer.

2.21 Touch-up Painting (Applicable in entire scope of work): All Boilers 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 contractor, including supply of the required paints and primers and associated consumables.

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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.

Note- The above is for providing general idea of Boiler (SG) and auxiliaries. It is possible that some of the equipment have been completely or partly erected by earlier BHEL agency and balance work needs to be done as per scope of this tender by bidder. For equipment where no erection was done by earlier agency and part of this scope, complete erection and commissioning shall be done by the bidder. Same is reflected in BOQ and PGMA wise details provided with this tender document and, thus, shall be governed accordingly.

TECHNICAL CONDITIONS OF CONTRACT (TCC)
Chapter – III: Facilities in the scope of Contractor/BHEL
(Scope Matrix)

Sl. No	Description	Scope / to be taken care by		Remarks
		BHEL	Bidder	
3.1	PART I 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	Firefighting equipments like buckets, extinguishers etc		Yes	
g	Fencing of storage area, office, canteen etc of the bidder		Yes	
3.1.2	FOR LIVING PURPOSES OF THE BIDDER			
a	Open space for labour colony (as per availability)		Yes	Agency has to make his own arrangement at his own cost.
b	Labour Colony with internal roads, sanitation, complying with statutory requirements		Yes	
3.2	ELECTRICITY			
3.2.1	Electricity For construction purposes only of Voltage 415/440 V, 3 phase, 50Hz	Yes		FREE (however any taxes, duties, levy etc. as charged by customer, shall be paid by contractor.)

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Chapter – III: Facilities in the scope of Contractor/BHEL
(Scope Matrix)

Sl. No	Description PART I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
a	Single point source	Yes		At a distance of 500-600 M from site (Distance is only tentative, it may vary up-to 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			
a	Single point source	Yes		Chargeable basis. At a distance of 500-600 M from site (Distance is only estimated, it may vary up-to 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	
c	Duties and deposits including statutory clearances if applicable		Yes	

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Chapter – III: Facilities in the scope of Contractor/BHEL
(Scope Matrix)

Sl. No	Description PART I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
3.3	WATER SUPPLY			
3.3.1	For construction purposes: (Single point source provided by BHEL on chargeable basis)	Yes		
a	Making the water available from 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	
3.3.2	Water supply for bidder's office, stores, canteen etc.			
a	Making the water available at single point		Yes	
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	
3.3.3	<u>Water supply for Living Purpose</u>			
a	Making the water available at single point		Yes	
b	Further distribution as per the requirement of work including supply of materials and execution		Yes	
3.4	LIGHTING			
a	For construction work (supply of all the necessary materials) 1. At office/storage area 2. At the preassembly area 3. At the construction site /area		Yes	
b	For construction work (execution of the lighting work/ arrangements) 1. At office/storage area 2. At the preassembly area 3 At the construction site /area		Yes	
c	Providing the necessary consumables like bulbs, switches, etc during the course of project work		Yes	

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(Scope Matrix)

Sl. No	Description PART I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
d	Lighting for the living purposes of the bidder at the colony / quarters		Yes	
3.5	COMMUNICATION FACILITIES FOR SITE OPERATIONS OF THE BIDDER			
a	Telephone, fax, internet, intranet, e-mail etc.		Yes	
3.6	COMPRESSED AIR wherever required for the work		YES	
a	Supply of Compressor and all other equipments required for compressor & compressed air system including pipes, valves, storage systems etc		Yes	
b	Installation of above system and operation & maintenance of the same		Yes	
c	Supply of the all the consumables for the above system during the contract period		Yes	
3.7	Demobilization of all the above facilities		Yes	
3.8	TRANSPORTATION			
a	For site personnel of the bidder		Yes	
b	For bidder's equipments and consumables (T&P, Consumables etc)		Yes	
3.9	Engineering works & Materials 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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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(Scope Matrix)

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		In consultation with BHEL
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	Laying of racks for gantry crane if provided by BHEL or brought by the contractor/bidder himself		Yes	Not Applicable
L	Arranging the materials required for preassembly		Yes	
M	COVID-19 PREVENTIVE MEASURE		Yes	

3.10 ELECTRICITY:

3.10.1 The construction power (415V) will be provided at a single point for construction purpose only on free of cost . Further distribution is to be arranged by the bidder at his cost. Construction power shall be provided from the nearest Substation / tapping point at a distance of approx.500-600 M from site. The distance is only estimated, it may vary upto an extent depending on site condition.

3.10.2 Any duty, deposit involved in getting the Electricity shall be borne by the bidder. As regards to contractor's office shed also, all such expenditure shall be borne by the contractor.

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- 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 further distribution is to be arranged by the bidder at his cost. Construction water shall be provided at a distance of 500-600 M from site. Distance is only estimated, it may vary upto an extent depending on site condition. Charges as incurred at actuals during execution.
- 3.11.2 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. BHEL is not responsible for any loss or damage to the contractor's equipment due to any reason. Any dispute regarding water consumption and distribution, the BHEL engineer decision will be final and binding.

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3.11.3 The water charges may vary from time to time as per PVUNL prevailing charges, 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.

3.11.4 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):

3.13.1 The bidder will have to supply and install 02 Nos. of PCs with Operators, 02 no multifunction higher capacity printer (preferably 1 printer should have A3 size printing facility) and accessories along with one operator per PC with power backup, for the online material management system, reporting of daily progress, billing and other similar activities pertaining to contractor's scope of work. PCs & printers are to be installed at places as per instruction of BHEL Engineer.

Computers shall have minimum configuration multimedia PC work station Core i3/i5, 1 GHZ or above, 320 GB HDD or above, 4 GB RAM or above, 100 MBPS LAN card of DELL/HP/ASUS or equivalent make with window 10 O/S with required accessories like mouse, keyboard, UPS and required software like MS Office 2010 Professional, AutoCAD 2011 or higher, ADOBE PDF CREATOR (version 8.0 or higher) with one laser jet printer compatible for A4 and A3 size printing (ink/ cartridge for which to be supplied as and when required, (the consumption may be assumed as 1 cartridge per month).

3.13.2 These computers/ printers & accessories shall remain contractor's property/ ownership for all legal/technical purposes. However, contractor will be allowed to take out the same after completion of the site works as per instruction of BHEL Engineer.

3.14 CONSUMABLES:

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(Scope Matrix)

- 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 Only TIG welding wires for CS, AS & SS welding will be supplied by BHEL free of cost for Boiler for applicable Pressure Parts as provided by manufacturing units. 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. The utilization of the TIG welding wires issued by BHEL shall be duly accounted for exercising maximum care and ensuring economical usage for minimum wastage. If during erection, it is found that the consumption of filler wire is more than the actual requirement due to improper usage, the cost for the additional quantity so consumed shall be recovered from the contractor.
- 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.
- 3.14.5 Sealing compounds and GI wires for insulation mattress binding shall be provided by the agency with in finally accepted price/rates.
- 3.14.6 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.
- 3.14.7 All the shims, gaskets and packing, which go finally as part of equipment, shall be supplied by BHEL free of cost.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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(Scope Matrix)

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, pre-assembly yard and contractor's material storage area etc. at his cost. BHEL has already installed sufficient numbers of high mast lights in different areas of plant premises. However, agency has to arrange the lighting facilities at different elevations of Boiler cavity and other systems surroundings etc.

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.

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- 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 4 nos in alternate levels) shall be arranged by the contractor within quoted rates, at site of construction at different level and different areas like boiler structure, 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.

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- 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, only pick and carry cranes shall be deployed by the agency.**
- 3.19.9 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, upkeepment 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.
- 3.19.12 DEWATERING:**
- Contractor shall ensure at all times that the work area & nearby 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.

3.20 SITE ORGANISATION

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- 3.20.1 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.
- 3.20.2 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.
- 3.20.3 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.

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Chapter – IV: T&Ps and MMEs to be deployed by Contractor

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

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

S.N.	DESCRIPTION OF MAJOR T&Ps	CAPACITY	QUANTITY	REMARKS
1.	Crawler Crane	150 MT	01 No.	Crane to be made available at site from the start of work till the actual event of Oil Synchronization
2.	Tyre mounted crane	100 MT	01 Nos.	Crane to be made available at site from the start of work till the Completion of ESP transformers, roof erection completion & FGD Ducts & Absorber erection completion.

4.2 Other T&Ps: The following minimum Tools & Plants (T&P) shall be arranged by the Contractor for execution of work as per Technical Conditions of Contract of this tender within the quoted rate. Mobilization of below mentioned T&P shall be as per site requirement in consultation with Boiler In-charge.

SN	DESCRIPTION	CAPACITY (MINIMUM)	MINIMUM QUANTITY	REMARKS
1.	Tyre mounted	35/40 MT	02 No	First Crane shall be made available at site from commencement of work till as per Site requirement.
2.	Tyre mounted mobile crane	18/20 MT	02Nos.	
3.	Tyre mounted mobile crane	10/12/14 MT	04 Nos.	
4.	Trailer with prime mover	20 MT	02 No	
5.	Trailer with prime mover	40 MT	01 Nos.	
6.	Low bed trailer Low bed trailer with min 70-100 feet span	60 MT	01 No.	
7.	Ultrasonic hardness testing machine (Ultrasonic contact impedance (UCI))		As required	GE or Kraut Kramer or Microdur make or reputed branded ultrasonic hardness testing machine. (Hardness test may be Brinell,

TECHNICAL CONDITIONS OF CONTRACT (TCC)
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SN	DESCRIPTION	CAPACITY (MINIMUM)	MINIMUM QUANTITY	REMARKS
				Vickers and Rockwell tests as per the discretion of BHEL.)
8.	DG SET – 250 KVA	As required	02 set	For continuous/uninterrupted back up power during welding & post weld heat treatment of HP joints.
9.	Air compressor (electric/diesel operated)	210 CFM, 7 KG/CM2	02 nos.	
10	Tig welding set	As required	As required	
11	Submerged ARC WELDING M/C		Adequate nos.	
12	Oxy Acetylene Gas cutting Machine		Adequate nos.	
13	DC arc welding machine		As required.	
14	3-phase distribution board with complete set up for drawl of construction power	As required	As required	
15	Power cable for drawl of construction power	As required	As required	
16	Pre heating / stress relieving set (heating control panel, cables, heating elements, thermometers etc.)	As required	As required	
17	Radiography arrangement with radioactive isotope source	As required	2 sets	As per Requirement, (quantity may vary as per site requirement.)
18	Radiography arrangement with radioactive isotope source	Cobalt-60	As required	
19	Theodolite of required accuracy	To ensure verticality of structural columns.	02 Nos.	Mobilization As per site requirement in consultation with Boiler Incharge

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SN	DESCRIPTION	CAPACITY (MINIMUM)	MINIMUM QUANTITY	REMARKS
20	Self-drilling cum tapping machine for screws of boiler	As required	6 nos. (As required)	
21	Arrangement for UT of higher thickness joints with recording facility & required calibration blocks.	Type USN 50 or equivalent/ up graded type	02 SET (As required)	During pressure parts pre assembly & erection
22	Electro-hydraulic pipe bending machine	Up to 2" nb and 12 mm thick pipes	2 Nos	
23	Welding rectifiers (electrical)	300 ampere rating	As required	Since Start of work
24	Welding generator (diesel operated)	300 ampere rating	As required	
25	Radiography film viewer	As required	As required	As per site requirement.
26	Hydraulic pipe bending machine (manual)	For bending of pipes up to 50 mm nb size	4 Nos	During Trim piping erection work.
27	Pipe chamfering machine /Tube Cutting	4-14"	As required	During pressure parts pre assembly & erection
28	Pipe chamfering machine /Tube Cutting	14-20"	As required	During pressure parts pre assembly & erection
29	Pipe cutting & beveling machines		Adequate nos.	During pressure parts pre assembly & erection
30	Chain pulley blocks of various & Suitable capacities		As Required (as per the instructions of BHEL Engineer)	Since Start of Work
31	Baking oven with thermostat and temperature gauge for welding electrodes	As required	(As per Required)	Since Start of Work
32	Holding oven with thermostat and temperature gauge for welding electrodes	As required	(As per Required)	Since Start of Work

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SN	DESCRIPTION	CAPACITY (MINIMUM)	MINIMUM QUANTITY	REMARKS
33	Portable oven for welding electrodes	As required	(As per Requirement)	Since Start of Work
34	Electric winch	2/3/5/10/15 ton capacity	As per requirement	Since Start of Work
35	Hydraulic test/pressurizing pump	Upto 400 kg per cm ²	As per site requirement	For Piping and other areas Incl. installation, electrical connection, erection, testing and dismantling, temporary pipelines, fittings, etc. shall be carried out by the contractor as part of this work.
36	Filling pumps	As Required	As Required	For hydro/other tests of various systems
37	Furnace maintenance platform (sky climber)	Adequate capacity	2 nos./	to cover one length and one width of furnace including corners
38	Hand winch	0.5 ton/1.0 MT capacity	As required	
39	Scaffolding materials with clamps.	Suitable for working at various heights	As required	For Erection, Alignment, welding & Insulation, painting works
40	Profile making m/c	For aluminium sheet cladding work	as required	
41	Nibbling m/c	For refractory and other required activities	as required	
42	Shearing m/c		as required	
43	Water pump to lift water to top of boiler		2 set	Before start of refractory application.
44	Portable grinding m/c	As required	as required	Since Start of Work
45	Portable drilling m/c	As required	as required	
46	Hoisting and pulley devices/pulleys	Assorted capacities	As required	Since Start of Work

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SN	DESCRIPTION	CAPACITY (MINIMUM)	MINIMUM QUANTITY	REMARKS
47	Fire retardant tarpaulins	As required	As required	Since Start of Work
48	Fire extinguisher	As required	as required	
49	Hydraulic Jacks	10/20/50/100 MT	as required	
50	Dewatering pumps(Electrical & Diesel engine operated)		as required	
51	Various sizes of clamps/ fixtures for assembling		as required	
52	Portable hardness tester		as required	
53	Hardness testing equipment (Equotip or Microdur make) 33 Stress relieving equipment with temperature		As per requirement	
54	Magnetic particle testing equipment-DRY & WET Type		as required	
55	Temperature recorder for 0-1000C 6/12 points with thermo couples / rods and compensating cable		as required	Since Start of Work
56	elcometer for paint thickness checking		as required	
57	Hand Operated Megger 500 / 1000 V		as required	
58	Tong Tester 10, 20 Or 50 Amp + / - 3 % Accuracy		as required	
59	Digital and Analogue Multimetres		as required	

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SN	DESCRIPTION	CAPACITY (MINIMUM)	MINIMUM QUANTITY	REMARKS
60	U Tube Manometer 0-2000 mm Water Column		as required	
61	Inclined Manometer 0-50 mm Water Column		as required	
62	Bolt Tension Calibrator		as required	
63	Special Slings for Erection of Ceiling Girders & other heavy components		as required	As per requirement
64	Concrete Blocks		As required	For making bed of steel structure for checking dimensional accuracy, configuration and minor rectification.
65	Wooden/Concrete sleeper 1.5-2.0 Mtr length	Since beginning	As required	For material storage at site.
66	PA UT machine		As per requirement	Shall be deploying as per site requirement
67	PORTABLE MAGNETIC STRUCTURESCOPE		01 No	
68	Calibrated Power driven HSFG bolt tightening machines with set value facility.		10 Nos	As per Site requirements
69	PMI (Positive Material Identification)		01 Nos.	At the start of Pressure part Coils , Panels , and tubes Welding (As per site requirement) Additional PMI machine shall be deployed as per requirement.
70	Equipment for carrying out preheating, post-heating, radiography, and other NDT test like LPI/MPI etc along with consumables.	As required	As required	

TECHNICAL CONDITIONS OF CONTRACT (TCC)
Chapter – IV: T&Ps and MMEs to be deployed by Contractor

SN	DESCRIPTION	CAPACITY (MINIMUM)	MINIMUM QUANTITY	REMARKS
71	Stress relieving equipment with automatic recording devices such as 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.	As required	As required	
72	Men lifter		01 Nos	As per site requirement.
73	Portable Drilling machine		02 Nos	Having capacity to make a drill the Upto 32 mm Dia
T & P for chemical cleaning				
74	Circulating Pump	200-300T/Hr, 200-250 M Head Centrifugal, single/multi stage back pull out design, impeller and casing made of cast steel with base frame, motor, starter, cables. essential spares etc	4 Nos	4 NOS STARTER AND ALONG WITH REQUIRED CABLE AND LUGS for acid cleaning
75	ACID/CHEMICAL HANDLING PUMP	50 T/Hr, 200 M Head, for handling 31% concentration Hcl or 40% EDTA concentration ph 5.5 to 6.0/ 25%	3 nos	3NOS STARTER AND ALONG WITH REQUIRED CABLE AND LUGS. Note-All other piping, valves and related accessories shall be supplied by BHEL

TECHNICAL CONDITIONS OF CONTRACT (TCC)
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SN	DESCRIPTION	CAPACITY (MINIMUM)	MINIMUM QUANTITY	REMARKS
		CONCENTRATE D AMMONIA		
	List of suggestive safety Equipments/PPEs to be included in List of minimum T&P:			
76	Safety Net (Conforming IS 11057:1984) Safety Net (Net Size: 10m x 5m, Mesh Size: 25 mm, Mesh Rope: 2mm double cord, Border/Tie Cord: 12mm diameter polypropylene rope (tested as per IS: 5175).Two meters length shall be provided at all four corners.			Min-100 Nos/unit
77	Fall Arrester 'Rope grab fall arrester' & anchorage line. Anchorage Line: 14mm- 16 mm diameter, three strand twisted Polyamide rope. Rope Grab fall arrester: Openable & Guided type Fall Arrestor (on flexible line) conforming EN 353-2 & works on 14-16 mm diameter polyamide rope. Material: Nickel Chrome plated Steel Connector: Karbiner conforming to EN 362 (Minimum Strength 22 KN), material: Steel			Min. 100 nos. of Rope Grab Fall arrester' and Karbiner each. Min 30 nos. anchorage line, 30 metre long each, 10 nos. anchorage line, 40 metre long each
78	Horizontal life line Stainless Steel Wire rope of 8mm diameter. Minimum six nos. of steel U-bolt clips are required for clamping each wire rope to a rigid support (03 nos. of U-bolt clips at each end).			Min 15 nos. of wire rope, each 40 metre long Min 30 nos. of wire rope, each 25 metre long.
79	Ladders on column The minimum design live load on metallic ladder shall be a single concentrated load of 100 kilo grams. All rungs shall have a minimum diameter of 1- 2 meters, and minimum clear length of rungs shall be 40.6 centimeters. The distance between rungs shall not exceed 30.5 centimeters. Each ladder shall have maximum height of 9.0 metre.			Cumulative length of ladders is 1200 metres

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SN	DESCRIPTION	CAPACITY (MINIMUM)	MINIMUM QUANTITY	REMARKS
	The ladder shall have proper fastenings for attaching it to a column using positive means such as bolt, weld or other type of fasteners.			

83 : PASSENGER CUM GOODS ELEVATOR

“The contractor has to Supply, install, operate and maintain passenger cum goods lift (temporary lift ,1.5 MT capacity) in boiler to facilitate access to various platform elevations upto top floor. Civil Foundation shall be provided by BHEL as per drawing submitted by the agency. Necessary grouting including supply of grout materials shall be in the scope of the bidder. The dismantling of the erected lift, Transport / removal from site is also covered in this scope of work. The contractor has to arrange operators, technicians for round the clock operation and maintenance is to be carried out by the contractor at his cost. The operation and maintenance shall be carried out till the end of contract period, or the date, on which the lift is dismantled as per the directives of BHEL, whichever is earlier” Foundation drawing for the proposed passenger lifts shall be submitted by the agency.

Said elevator in boiler to facilitate access to various platform elevations up-to top floor. The elevator shall conform to the national standard and industrial safety code as applicable. These shall be deployed at the time of start of pressure parts work in consultation with BHEL site engineer.

The probable suppliers for the elevator are:

01. M/s Avon Cranes Pvt Ltd, Gurgaon
02. M/s Mekaster Engineering & Equipment Pvt Ltd, Halol.

Laying of sleepers and rails and routine maintenance of the dip trolley system including assembly and dismantling are in Contractor’s scope.

4.2 MEASURING AND MONITORING DEVICES (MMD):

As per requirement to be finalized at site, shall meet the requirements as per field quality plan and other erection, testing related activities.

4.3 FACILITY TO BE PROVIDED BY THE CONTRACTOR FOR P91/P92/Other Alloy steels WELDING (where applicable)

4.3.1 Required no. of operators/ Technicians/ Electrician for installation, commissioning & operating continuously.

4.3.2 Gas Burners arrangement with required gas for maintaining temperature in the event of power failure.

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4.3.3 Ultrasonic Flaw detector with recording device & complete accessories (Digital Type – Krautkramer Model USN 50 or equivalent) capable of storing calibration data. All recordable indications will be stored in memory of digital flaw detector and in PC (to be provided by the contractor) for review at later period.

4.3.4 EQUOTIP or MICRODUR make or equivalent portable hardness tester.

4.3.5 MPI/LPI Kits with required consumables.

4.3.6 Consumables

4.3.6.1 Glass fibre cloth – 1mm x 1000mm – Temp rating – 1260 °C.

4.3.6.2 Glass fibre cord – Dia 3mm (twisted) Temp rating – 1260 oC.

4.3.6.3 Ceramic fibre Blanket – RT Grade, density 96Kg/M3 – Temp rating – 1260 oC.

4.3.6.4 Ceramic fibre rope – Fibre Glass braided, Dia 12mm – Temp rating – 1260 oC.

4.3.6.5 K Type Thermocouple – 0.5mm Dia Single Strand individual fiber glass insulated

4.3.6.6 Heavy duty TC connectors for – K Type Thermocouple – 0.5mm Dia Single Strand individual fibre glass insulated.

4.3.6.7 All other consumables/ equipment required to carry out the work.

4.3.7 Adequate no of DG Set, operator and fuel for P-91 welding is in Bidders scope.

Note to Point no 4.3:

1) The induction heating equipment and other equipment shall be drawn from BHEL stores, transported and installed & commissioned wherever required. For routine maintenance & attending all type of break-down maintenance, contractor shall deploy sufficient manpower, tools and plant within the quoted rate.

2) The contractor shall provide electrical cables & switches required for extending power supply to the induction heating equipment. All the equipment shall be protected by providing covers or sheds at site by the contractor with in the quoted rate.

3) Diesel Generator for P 91/92 welding, along with required cables, switches, fuel and operator, has to be arranged by the contractor within the quoted rates. In the eventuality of contractor not making necessary arrangements to ensure availability of DG set as per requirement at site, BHEL will arrange the same at the contractor's cost with applicable overheads.

Contractor to follow and ensure the following related to DG set deployment at site:

- All rules & regulations pertaining in the state of Jharkhand to run DG sets are to be strictly followed.
- Statutory permission is to be obtained from Inspection authority.
- Separate earth pits for Body and neutral are to be made.
- All safety precautions and protections are to be installed before starting of the DG sets.

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- Installation inspection is to be done by the authority.
- Payment of electricity duty and generation duty is to be paid by the contractor.

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, as the case may be, + 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-asertain/ 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 considering parallel working in Main plant structural area. 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.

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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. The contractor shall submit the valid test certificate/calibration certificates for all the T&Ps before put into actual use at site. The certificates shall be renewed time to time as instructed by BHEL Engineer
10. Crane operators deployed by the contractor shall be tested by BHEL before they are allowed to operate the cranes.
11. 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.
12. APR (As per Requirement)- Contractor has to deploy T&P, MMD, IMTE as per requirement of site and as decided by BHEL Engineer.
13. Apart from above mentioned T&P, Any additional item required in addition to above mentioned T&P for proper execution of scope of work, contractor has to arrange such T&P within quoted rate on the instruction of BHEL in writing in a reasonable period within two weeks from the written instruction from BHEL.
14. T&P's mentioned above shall be specifically deploy as per the respective packages. 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.
15. 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.
16. 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

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part of VOL I as File titled “**Annexure 1- BHEL T&P Hire Charges**”. (Please note that these charges are as valid up to May 31, 2021 and may get revised further).

17. The loading, unloading and transportation of contractors T&Ps shall be in the scope of contractor. All necessary items such as Trailers, Cranes, Winches, welding generators, slings, jacks, sleepers, rails etc., are to be arranged by the contractor at his own cost.
18. 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.
19. 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.
20. **BHEL will provide Huck bolting machine with one set of 12mm and 16mm jaws. Further Requirement of jaws to be arranged by the contractor at his cost. Consumables like O-ring, backup ring, springs, hydraulic fluid for top-up etc., required for maintenance of the huckbolting machine to be arranged by contractor at his cost.**
21. Penalty due to non availability of T&Ps:
In order to meeting the site requirement and in line with monthly plan and review format (F-14), Contractor has to mobilise their T&Ps and made available at site for required activities.
For Major T&Ps, if contractor fails due to, either of the case, mentioned hereunder, BHEL shall be entitled to impose penalty on Contractor till any alternate arrangement is made by ‘Contractor’ OR ‘BHEL (on cost recovery basis)’.
Case 1: 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:

- 150 MT Crane – Rs. 3000/day
- 100 MT Crane – Rs. 1000/day
- Passenger Cum Goods Elevator – Rs. 500/day
- Acid/Chemical cleaning pump – Rs. 500/day
- Acid Unloading pump – Rs. 250/day

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5.1 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 decided by BHEL	All cranes (except Contractor scope) required for mentioned work will be arranged by BHEL as per requirement.
2	Induction Heating machine	As required	For welding of P-91,P-92,P-22, P-23, any other Alloy steel where required & pipes as applicable.
3	Air Leak Test equipment with all auxiliaries.	01 Set	For leakage test of Boiler and ducts.
4	Boiler Hydraulic Pressure Testing Pump with accessories (Above 400 Kg/cm ²)	As required	
5	Huck bolting machine complete set	As required	

- 5.2 All the T&Ps mentioned in clause 5.1 above shall be given to contractor on sharable basis and the allotment is made by BHEL on need basis.
- 5.3 HLHR crane is to be used for erection of boiler ceiling structures and equipment/ components above boiler ceiling structure, heavy structures of bunker that require services of this crane as decided by BHEL. This crane will accordingly be deployed at appropriate time as decided by BHEL for suitable duration and intended purpose.
- 5.4 Contractor shall transport from BHEL stores, install, operate, carry out maintenance, dismantle after use and return to BHEL stores all T&Ps mentioned in Sr no 5.1 for his use.
- 5.5 BHEL provided cranes are owned or hired by BHEL. Operator for BHEL owned crane will be arranged by BHEL. Operators for hired crane will be provided by the hiring agency.
- 5.6 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

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for initial and final assembly & dismantling and for subsequent operations of boom extension and reduction during execution of work. Levelled area in boiler 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 plates / sleepers required for marching operation shall also be provided by the BHEL only for BHEL owned cranes.

- 5.7 Contractor shall provide the fuel, and consumables for BHEL provided cranes (hired/owned) for his use. Lubricants for crane (hired/owned) shall be provided by the BHEL.**
- 5.8 Cranes are only for erection purpose and shall not be available for material handling or transportation purpose. Contractor shall make their own arrangements for material transportation to erection site.
- 5.9 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.
- 5.10 The contractor at his cost shall arrange for grouting of anchor points of T&Ps issued to him. Necessary grout materials are to be arranged by the contractor at his cost.
- 5.11 Filling pump for other than main boiler, for hydro test shall be arranged by the contractor, if required. For testing LP lines, necessary hydraulic test pumps/ hand pumps are to be arranged by the contractor.
- 5.12 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.
- 5.13 Any loss/damage of tools by the contractor shall have to be replaced or otherwise cost thereof shall be recovered from the contractor.
- 5.14 The contractor shall make necessary arrangement like laying of special sleeper beds, assembly & dismantling of heavy lift attachment, boom, jib etc. for movement and operation of crane.
- 5.15 Hydraulic testing pumps for Boiler and HP lines shall be provided by BHEL free of hire charges. The testing pumps will be issued to the contractor in working conditions. Installation, electrical connection, erection, testing and dismantling and returning to BHEL stores, etc, shall be carried out by the contractor as part of this work without

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter – V: T&Ps and MMEs to be deployed by BHEL on sharing basis

any extra charges. In case any servicing of the test pump is to be done during the course of the test, the contractor shall provide the necessary labour for the same. The spares will be arranged by BHEL.

- 5.16 BHEL will only provide induction heating Machines (Either Old type or compact type as per availability). The consumables such as electrodes and filler wire (except as specified in shipping list), thermocouple, ceramic pads and insulation, induction coil etc. has to be arranged by the contractor.

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 (**sleepers for BHEL owned cranes shall be provided by the BHEL**) for movement and operation of the crane.
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.

5.17 Facility to be provided by BHEL for P91/P92/other Alloy steels Welding.

- 5.16.1 Induction Heating M/C with accessories as indicated above.
- 5.16.2 Welding Electrodes for P91 welding.
- 5.16.3 The following consumables:
 - One set of annealing cable shall be provided. Additional annealing cables required, if any, till total work completion, shall be procured by the contractor, at his cost.
 - One set of Compensating Cables (Common for all Induction heating machine) Additional compensating cables required till total work completion, shall be procured by the contractor, at his cost.

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Chapter – VI: Time Schedule

6. TIME SCHEDULE & MOBILIZATION

6.1 INITIAL MOBILIZATION

After receipt of fax/Email 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 **15 days** 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 as per requirement to commence the work of erection, testing etc. of Boiler, SCR, ESP, FGD and auxiliaries, Rotating machines, PCP including touchup Painting (as and where required), Bunker, Bunker structure etc & Insulation 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

Commencement of Contract Period: The date of Start of contract period shall be the mutually agreed date between the bidder and BHEL engineer to start the work. In case of discrepancy, the decision of BHEL engineer is final.

The Contractor has to subsequently augment his resources in such a manner that following major milestones of erection & commission are achieved on specified schedules. The schedule of important milestones is as follows:

<u>Boiler & Its Auxiliaries, PCP & Bunker U#3</u>		
SL No.	Milestones	Tentative Schedule w.r.t date of start of work (Unit # 3)
1.	Erection of Start	1 st Month

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2.	ESP Erection start	1 st Month
3.	Boiler Hydro Test- drainable	6 th Month
4.	Boiler Light Up (BLU)	10 th Month
5.	Chemical cleaning completion	12 th month
6.	Steam Blowing Completion &	13 th Month
7.	Safety Valve Floating	14 th month
8.	Oil Synchronization	15 th Month
9.	Synchronization on coal	15 th Month
10.	Full Load Operation	16 th Month
11.	Completion of Trial Run	17 nd Month
12.	Completion of Facilities	18 th Month
13.	Handing over and Reconciliation	20 th Month

6.4 CONTRACT PERIOD

The contract period for completion of entire work under scope shall be **20 (Twenty) months** from the “START OF CONTRACT PERIOD” as specified earlier for completion of the entire work.

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	Boiler Light up	10 th Month from Date of Start
M2	Synchronization on coal	15 th Month from Date of start

Note A: Provision of Penalty in case of slippage of Intermediate Milestones:

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

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Chapter – VI: Time Schedule

- b. 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.
- c. 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.
- d. 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.
- e. 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.
- f. 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.
- g. 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.
- h. Contractor shall make all possible efforts to expedite the activities, in case of delay of any intermediate milestone, to maintain over all project completion schedule.

Note B:

- 1. 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.
- 2. The above schedule is tentative. In case the activities in the schedule are to be advanced, the related Erection activities in the scope of the contractor are to be advanced to meet the project requirement. No extra payment whatsoever shall be paid on this account.
- 3. The contractor shall submit a detailed area/structure wise L3 schedule within 7 days in consultation with BHEL based on the tentative schedule provided as above. The detailed L3 schedule shall be approved by BHEL and same shall be implemented. Bidder shall submit L3 schedule in MS Projects to meet the agreed project schedule covering various milestone activities and their split up details such as mobilization, procurement of materials, fabrication & erection activities. This schedule shall also clearly indicate the interface facilities / inputs applicable in each package.

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Chapter-VII: Terms of Payment

7. Terms of payment

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

Payment shall be done on per unit basis (per MT/Sqm/nos.) against individual head viz. Pre-Assembly, Placement, Alignment, ATT, fixing of bolts, cladding sheets etc. as per unit rate finalized in rate schedule. Refer Chapter XXII of TCC, for arriving rates of individual items.

Note 1: Material reconciliation shall be complied on monthly basis.

7.2 Payment terms for temporary Piping:

Payment for temporary piping will be made at the rate applicable for **Non-pressure parts** items as per following break-up;

- a. 50% on completion of installation of temporary piping.
- b. 25% on dismantling
- c. 15% on return of BHEL Stores
- d. 10% on Material reconciliation

7.3 Void

7.4	Progressive Payment/ Final Payment: The payments for works under the scope of this contract for both the packages shall be as per clause no 2.6; 2.22; 2.23 of General Conditions of Contract and Volume-IB, Chapter-X of SCC.
7.4.1	<u>Documents required for RA Bill:</u>
	GST Complied Invoice of the work done as per approved BBU.
	WAM -6 for RA Bill.
	Jointly signed Measurement sheet.
	Power of Attorney before submission of Bill.

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Chapter-VII: Terms of Payment

	Validity of Bank Guarantees as applicable under the contract.
	Monthly HSE Compliance Certificate certified by BHEL- Safety
	Monthly Material reconciliation statement alongwith RA Bill.
	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.
7.4.2	<u>Documents required for Final Bill:</u>
	<p>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:</p> <ul style="list-style-type: none"> • Final Bill in WAM-7 Format. • 'No claim' certificate from the contractor. • Clearance certificates where ever applicable viz. Clearance Certificates from Customer, various Statutory Authorities like Labour department, PF Authorities, Commercial Tax Department etc. • Final Material re-conciliation statement duly approved by BHEL (bi-monthly basis). • Indemnity Bond as per prescribed format. • Deviation statement showing the difference between the actuals and as per the contract. • Final Delay Analysis.
7.4.3	The payment for running bills will be released after submission of running bill complete in all respects with all documents. It is the responsibility of the contractor to make his own arrangements for making timely payments towards labour wages, statutory payments, outstanding dues etc. and other dues in the meanwhile. No interest shall be payable for the delayed payment (if any).
	Few points of consideration are as below:

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Chapter-VII: Terms of Payment

	<p>i. The measurements sheets of work done in a month shall be submitted in triplicate duly agreed/signed by BHEL Engineer. The contractor shall extend all necessary assistance for verification of measurements of works without any extra cost.</p> <p>ii. Material reconciliation shall be complied on monthly basis.</p> <p>iii. The RA bill payments are interim payments and bills shall be submitted in prescribed formats.</p> <p>iv. Recoveries on account of electricity, water, statutory deductions etc. shall be made as per terms of contract.</p> <p>v. BHEL will release payment through Electronic Fund Transfer (EFT)/RTGS.</p> <p>vi. Final bill shall be submitted after completion of works and upon material reconciliation along with all prescribed formats.</p> <p>Quoted Rates are inclusive of all labour, contractor's equipment, temporary works, consumables and all matters and things of whatsoever nature, charges for Safety Aspects/Compliance to Safety Rules including operations and maintenance services (if applicable) etc., and other services, as identified in the tender Documents, as necessary for the proper execution of the subject work.</p>
7.5	<p>SECURED RECOVERABLE ADVANCES:</p> <p>Interest Free Secured Mobilization Advance as per GCC Clause No. 2.13.1 will be payable under exceptional circumstances on certification of BHEL Construction Manager at Site. Interest Free Mobilization Advance shall be disbursed in specifically mentioned stages of major respective resource mobilization as specified hereunder:</p> <ol style="list-style-type: none"> For Mobilization of <u>01 no. of Crane of 150 MT capacity, 1 no. of Farana</u> - <u>2.0%</u> of Contract value. For Mobilization of balance <u>required T&Ps (including 01 no. of Tyre Mounted Crane of 100 MT capacity) and resources at site</u> to start the work - 1.5% of Contract value. For Installation and Erection of <u>Site Infrastructure</u> by contractor i.e. site office stores, labour hutment etc. - <u>1.5%</u> of Contract value. <p>Note:</p> <ol style="list-style-type: none"> BHEL Site-CM shall be the deciding authority for assessing the admissibility of advance payment to contractor. In case contractor do not fulfil the agreed conditions of payment of earlier mobilization advance, BHEL Construction Manager will have the authority to not allow the subsequent mobilization advance to contractor.

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Chapter-VII: Terms of Payment

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Chapter-VIII: Taxes and Duties

8.0	TAXES & DUTIES
8.1	<p>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.</p> <p>However, provisions regarding GST on output supply (goods/service) and TDS/TCS as per Income Tax Act shall be as per following clauses.</p>
8.2	GST (Goods and Services Tax)
8.2.1	<p>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.</p>
8.2.2	<p>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.</p>
8.2.3	<p>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.</p>
8.2.4	<p>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.</p>
8.2.5	<p>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.</p>
8.2.6	<p>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.</p>

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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	<p>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: -</p> <ul style="list-style-type: none">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.

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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/alterd/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	<p><u>Variation in Taxes & Duties:</u></p> <p>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.</p> <p>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.</p> <p>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.</p>
8.3	<p><u>Income Tax:</u></p> <p>TDS/TCS as applicable under Income Tax Act, 1961 or rules made thereunder shall be deducted/collected from contractor's bill.</p>

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.

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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.

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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,

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	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.

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BILL OF QUANTITY/WEIGHT SHCHEDULE

Summary of Weight of BOQ for Boiler, ESP, SCR, FGD, PCP, Mill bunker structure, Coal bunkers, ESP control room, transfer houses, ID- Ducts, Structure, Gates & dampers, Rot. M/c, Insulation:-

Table- 1: SUMMARY OF TOTAL TONNAGE CATEGORY WISE U#3		
Sr. No	Descriptions	Balance weight for "Placement in Position" In MT (in scope)
1	Structure	13,769
2	Pressure parts	5,059
3	Non Pressure Parts	11,099
4	Rotary machines	1,050
5	Air Preheater (APH)	1,376
6	Insulations Wool Matress	3,056
7	Insulation -pourable and castable	270
8	Insulation-iron parts	1148
9	Insulation -Al cladding sheets	889
10	ESP & Its Auxiliaries	4,543
11	FGD & Its Auxiliaries(Struc/Duct/damper)	3,363
12	Power Cycle Piping P-91/92	1,436
13	Piping Including P-11,P-12,P- 22,(HP Piping)	1,812
14	LP Piping	939
15	SS Piping	26
16	Hangers/Pumps & Tanks	1,425
17	Bunker	2,775
	Total	54,035

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Note to weight schedule:

1. The weights mentioned above are approximate and liable to vary as per design consideration. There will be change in PG, weight, description etc. However payments will be made for the tonnage actually erected at the quoted rate. Quantity Variation will be dealt as per clause 2.14 of General Conditions of Contract (Volume I BCD).
2. **Besides PG / PGMA indicated in the weight schedule, there is likely hood of addition product groups integral to Boiler, ESP, Critical piping, FGD, SCR etc. and its aux. The quoted rate shall be applicable for such product groups also. There may be variation or addition of PGMAs, description, weights etc., and any additional scope of work supplied under the above package shall be erected by the contractor and payment will be made as per the quoted / accepted rate in the respective category at the discretion of BHEL.**
3. Rate Schedule Identified for PGMAs are based on envisaged material specification. Payment shall be made on the basis of material specification of actual material received and erected at site. BHEL's decision in this regard shall be final.
4. The erection & dismantling of temporary piping, pumps, tanks, dummy plates & blanks, valves, pressure gauges and other miscellaneous equipment required for the test. for pre-commissioning and commissioning activities like hydraulic test, chemical cleaning, steam blowing etc. are covered in this contract and shall be carried out as a part of work. Payment will be made at the rate applicable for **Non-pressure parts** for items. Weight for the same will be based on jointly measured quantity and corresponding standard weights. No payment will be made for the equipments brought by the Contractor such as pumps etc and foundations made by the Contractor for temporary systems. Weight for the same will be based on jointly measured quantity and corresponding standard weights. Except contractor scope materials/Pump.

Note: Required pipes, valves, blanks, plates etc., will be given by BHEL. Temporary piping, pumps, valves, flanges, blanks etc shall be removed by him and returned to BHEL. All thermo well points are to be seal welded, with plug in position. All Temperature Element points are to be provided with blanks and welded.

5. Imported electrodes / TIG welding wires released under XX992 will be given by BHEL. All other electrodes / TIG welding wires are to be supplied by contractor under his scope.
6. Fixing components for insulation: The scope of works covers welding of all attachment on the pressure parts for fixing insulation & refractory.
7. The Erection of HT MOTORS are covered in this scope of contract. However, dry out, testing and commissioning is not in the scope of this contract.

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8. The erection and dismantling of air blowers and connecting pipes and ducts, providing blanks / dummies at the required locations and conducting gas tightness test is in the scope of the contractor and shall be carried out within the quoted rate.
9. Payment for additional CONTROL VALVES / STEAM TRAPS/ FLOW NOZZLES / ORIFICES & OTHER VALVES AND FITTINGS (except temporary system valves) will be made as per the quoted / accepted tonnage rate of respective piping category in which these material is installed. i.e. P91, HP Piping, LP Piping & SS piping.

10. Extra work rates for welding:

The quantum of welding joints indicated in **Welding schedule 'Chapter XXI of Vol-I** of Technical Conditions of Contract is approximate and is liable for variation in PG, description, size, materials, NDT requirements etc. The indicated joints will be grouped into category of carbon steel (inclusive of SA106GrC or equivalent) and Alloy steel (inclusive of T91/P91) and convert them in to equivalent joints (Dia 63.5x6.3mm) as per the formula below:

$$\begin{aligned}\text{No. of equivalent Joints} &= \text{Dia X Thickness} / (63.5 \times 6.3) \\ &= \text{Dia X Thickness} / 400.05\end{aligned}$$

If the total no of equivalent joints in each category exceeds 25% of the total equivalent joints in that category contractor will be paid extra as per the rate indicated below:

- a) One extra Equivalent joints of Carbon Steel (CS) = Rs 254/-
- b) One extra Equivalent Joints of Alloy Steel (AS) = Rs 561/-

Non Destructive Testing (NDT) and Stress Relieving (SR) if applicable shall be carried out by the contractor within these rates.

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9.1 Detailed (PGMA wise) weight of BOQ for Boiler, ESP, SCR,FGD,PCP, Mill bunker structure, Coal bunkers, ESP control room, transfer houses, ID- Ducts, Structure, Gates & dampers, Rot. M/c, Insulation:-

BALANCE WORK OF BOILER#3 VERTICAL PACKAGE-3x800 MW PVUNL Patratu project			
SI No	Description	Unit	Balance Qty to execute
SECTION 1- BOILER & AUXILIARIES			
1.1 Structure			
1.1.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	13,712
1.1.2	PLACEMENT IN POSITION	MT	13,769
1.1.3	ALIGNMENT	MT	13,833
1.1.4	WELDING / BOLTING / FIXING	MT	14,840
1.1.5	COMPLETION OF NON DESTRUCTIVE EXAMINATION & STRESS RELIEVING, HEAT TREATMENT (IF NOT APPLICABLE, THEN THIS PORTION TO BE PAID ALONG WITH WELDING/BOLTING/FIXING)	MT	14,914
1.1.6	COMPLETION OF SHEET COVERING FOR BOILER ROOF, BURNER ROOF, LIFT SHAFT CLADDING, COMPLETION OF GUTTERS	MT	15,214
1.1.7	PAINTING	MT	33,406
1.1.8	AREA CLEANING, TEMPORARY STRUCTURE CUTTING/REMOVAL AND RETURN OF SCRAP	MT	33,406
1.1.9	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	33,406
1.1.10	MATERIAL RECONCILIATION	MT	13,769
1.1.11	COMPLETION OF CONTRACTUAL OBLIGATION	MT	33,406
1.2 Pressure Parts			
1.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	3,006
1.2	PLACEMENT IN POSITION	MT	5,059
1.3	ALIGNMENT	MT	8,180
1.4	WELDING / BOLTING / FIXING	MT	6,796
1.5	COMPLETION OF NON DESTRUCTIVE EXAMINATION & STRESS RELIEVING, HEAT TREATMENT (IF NOT APPLICABLE, THEN THIS PORTION TO BE PAID ALONG WITH WELDING/BOLTING/FIXING)	MT	7,471
1.6	COMPLETION OF ATTACHMENT WELDING,FIN WELDING,SUPPORTS	MT	7,184
1.7	COMPLETION OF ROOF SKIN CASING & ALL CLADDING WORKS	MT	12,002
1.8	HANGERS & SUPPORTS ETC WHEREVER NECESSARY AS PER DRG.	MT	7,297
1.9	COMPLETION OF AIR & GAS TIGHTNESS TEST FOR FURNACE	MT	12,002
1.10	BOILER HYDRAULIC TEST(DRAINABLE)	MT	12,002
1.11	BOILER HYDRAULIC TEST(NON DRAINABLE)	MT	12,002

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1.12	REHEATER COILS HYDRAULIC TEST	MT	12,002
1.13	BOILER LIGHT UP	MT	12,002
1.14	ABO/CHEMICAL CLEANING	MT	12,002
1.15	SAFETY VALVE FLOATING	MT	12,002
1.16	AREA CLEANING, TEMPORARY STRUCTURE CUTTING/REMOVAL AND RETURN OF SCRAP	MT	12,002
1.17	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	12,002
1.18	MATERIAL RECONCILIATION	MT	5,059
1.19	COMPLETION OF CONTRACTUAL OBLIGATION	MT	12,002
1.3 Non Pressure Part			
1.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	10,900
1.2	PLACEMENT IN POSITION	MT	11,100
1.3	ALIGNMENT <u>(As per Amendt.ref no-BHE/PW/PUR/NTPRT-BLR PCP ESP FDG - U3/2314/Corg-02, Dated-21.10.2020)</u>	MT	11,279
1.4	WELDING / BOLTING / FIXING	MT	11,351
1.5	HANGERS & SUPPORTS ETC WHEREVER NECESSARY AS PER DRG.	MT	11,273
1.6	AIR & GAS TIGHTNESS TEST	MT	11,827
1.7	ABO/CHEMICAL CLEANING	MT	11,827
1.8	STEAM BLOWING	MT	11,827
1.9	COAL FIRING	MT	11,827
1.10	PAINTING	MT	11,827
1.11	AREA CLEANING, TEMPORARY STRUCTURE CUTTING/REMOVAL AND RETURN OF SCRAP	MT	11,827
1.12	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	11,827
1.13	MATERIAL RECONCILIATION	MT	11,089
1.14	COMPLETION OF CONTRACTUAL OBLIGATION	MT	11,827
1.4 Rotating Machines			
1.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	1,050
1.2	PLACEMENT IN POSITION	MT	1,050
1.3	ALIGNMENT	MT	1,454
1.4	WELDING / BOLTING / FIXING	MT	1,546
1.5	EQUIPMENT TRIAL OPERATION	MT	2,484
1.6	CLEAN AIR FLOW TEST	MT	2,484
1.7	BOILER LIGHT UP	MT	2,484
1.8	ABO/CHEMICAL CLEANING	MT	2,484
1.9	STEAM BLOWING	MT	2,484
1.10	COAL FIRING	MT	2,484
1.11	FULL LOAD	MT	2,484
1.12	TRIAL OPERATION OF UNIT	MT	2,484

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1.13	PAINTING	MT	2,484
1.14	AREA CLEANING, TEMPORARY STRUCTURE CUTTING/REMOVAL AND RETURN OF SCRAP	MT	2,484
1.15	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	2,484
1.16	MATERIAL RECONCILIATION	MT	1,050
1.17	COMPLETION OF CONTRACTUAL OBLIGATION	MT	2,484
1.5 Air Preheater (APH)			
1.1	Completion of Support steel squareness and levelling, Expansion arrangement, Housing panel erection and alignment, Erection, alignment and welding of pedestals	MT	1,376
1.2	Completion of Erection, alignment and welding of Support Bearing, Guide Bearing, Rotor post, Bottom and Top centre sections, Hot and cold end connecting plates	MT	1,376
1.3	Completion of erection and alignment of modules	MT	1,376
1.4	Completion of erection, alignment and welding of Pin Rack assembly and Drive assembly	MT	1,376
1.5	Completion of seals setting	MT	2,628
1.6	Erection, alignment and welding of Lube oil systems, Cleaning Device, Fire sensing device, Deluge and water wash lines, Observation port and lighting assemblies and other accessories	MT	2,628
1.7	Completion of PGMA	MT	2,628
1.8	Air preheater Trial Run	MT	2,628
1.9	BOILER LIGHT UP	MT	2,628
1.10	ABO/CHEMICAL CLEANING	MT	2,628
1.11	STEAM BLOWING	MT	2,628
1.12	SAFETY VALVE FLOATING	MT	2,628
1.13	COAL FIRING	MT	2,628
1.14	PAINTING	MT	2,628
1.15	AREA CLEANING, TEMPORARY STRUCTURE CUTTING/REMOVAL AND RETURN OF SCRAP	MT	2,628
1.16	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	2,628
1.17	MATERIAL RECONCILIATION	MT	1,418
1.18	COMPLETION OF CONTRACTUAL OBLIGATION	MT	2,628
1.6 Insulation - Wool Matress			
1.1	PLACEMENT IN POSITION	MT	3,056
1.2	ALIGNMENT	MT	3,056
1.3	WELDING / BOLTING / FIXING	MT	3,056
1.4	COMPLETION OF ROOF SKIN CASING & AI CLADDING WORKS	MT	3,056
1.5	BOILER LIGHT UP	MT	3,056
1.6	ABO/CHEMICAL CLAENING	MT	3,056
1.7	STEAM BLOWING	MT	3,056

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1.8	SAFETY VALVE FLOATING	MT	3,056
1.9	COAL FIRING	MT	3,056
1.10	FULL LOAD	MT	3,056
1.11	TRIAL OPERATION OF UNIT	MT	3,056
1.12	Area cleaning, temporary structures cutting/removal and return of scrap	MT	3,056
1.13	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	3,056
1.14	MATERIAL RECONCILIATION	MT	3,056
1.15	COMPLETION OF CONTRACTUAL OBLIGATION	MT	3,056
1.7 Insulation - Pourable & Castable			
1.1	PLACEMENT IN POSITION	MT	270
1.2	ALIGNMENT	MT	270
1.3	WELDING / BOLTING / FIXING	MT	270
1.4	COMPLETION OF ROOF SKIN CASING & AI CLADDING WORKS	MT	270
1.5	BOILER LIGHT UP	MT	270
1.6	ABO/CHEMICAL CLAENING	MT	270
1.7	STEAM BLOWING	MT	270
1.8	SAFETY VALVE FLOATING	MT	270
1.9	COAL FIRING	MT	270
1.10	FULL LOAD	MT	270
1.11	TRIAL OPERATION OF UNIT	MT	270
1.12	Area cleaning, temporary structures cutting/removal and return of scrap	MT	270
1.13	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	270
1.14	MATERIAL RECONCILIATION	MT	270
1.15	COMPLETION OF CONTRACTUAL OBLIGATION	MT	270
1.8 Insulation - Iron Parts			
1.1	PLACEMENT IN POSITION	MT	1,148
1.2	ALIGNMENT	MT	1,148
1.3	WELDING / BOLTING / FIXING	MT	1,148
1.4	COMPLETION OF ROOF SKIN CASING & AI CLADDING WORKS	MT	1,148
1.5	BOILER LIGHT UP	MT	1,148
1.6	ABO/CHEMICAL CLAENING	MT	1,148
1.7	STEAM BLOWING	MT	1,148
1.8	SAFETY VALVE FLOATING	MT	1,148
1.9	COAL FIRING	MT	1,148
1.10	FULL LOAD	MT	1,148
1.11	TRIAL OPERATION OF UNIT	MT	1,148
1.12	Area cleaning, temporary structures cutting/removal and return of scrap	MT	1,148

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1.13	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	1,148
1.14	MATERIAL RECONCILIATION	MT	1,148
1.15	COMPLETION OF CONTRACTUAL OBLIGATION	MT	1,148
1.9 Aluminium Cladding Sheet			
1.1	PLACEMENT IN POSITION	MT	889
1.2	ALIGNMENT	MT	889
1.3	WELDING / BOLTING / FIXING	MT	889
1.4	COMPLETION OF ROOF SKIN CASING & AI CLADDING WORKS	MT	889
1.5	BOILER LIGHT UP	MT	889
1.6	ABO/CHEMICAL CLAENING	MT	889
1.7	STEAM BLOWING	MT	889
1.8	SAFETY VALVE FLOATING	MT	889
1.9	COAL FIRING	MT	889
1.10	FULL LOAD	MT	889
1.11	TRIAL OPERATION OF UNIT	MT	889
1.12	Area cleaning, temporary structures cutting/removal and return of scrap	MT	889
1.13	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	889
1.14	MATERIAL RECONCILIATION	MT	889
1.15	COMPLETION OF CONTRACTUAL OBLIGATION	MT	889
2.1 ESP & ITS AUXILIARIES			
1.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	4,543
1.2	PLACEMENT IN POSITION	MT	4,543
1.3	ALIGNMENT	MT	5,465
1.4	WELDING / BOLTING / FIXING	MT	7,706
1.5	COMPLETION OF HOPPERS ALONG WITH ALL DOORS, HEATING ELEMENTS, POKING DOORS, ETC	MT	10,024
1.6	COMPLETION OF INNER, OUTER ROOF INSULATOR HOUSING, RECTIFIER TRANSFORMERS, PENT HOUSE MONO RAILS, HOISTS ETC	MT	10,538
1.7	ERECTION OF EMITTING AND COLLECTING RAPPING SYSTEM WITH ALL DRIVES	MT	14,346
1.8	AIR & GAS TIGHTNESS TEST	MT	14,346
1.9	GAS DISTRIBUTION TEST	MT	14,346
1.10	CHARGING OF ESP FIELDS	MT	14,346
1.11	FULL LOAD	MT	14,346
1.12	TRIAL OPERATION OF UNIT	MT	14,346
1.13	Painting	MT	14,346
1.14	Area cleaning, temporary structures cutting/removal and return of scrap	MT	14,346

TECHNICAL CONDITIONS OF CONTRACT (TCC)

CHAPTER IX - ESTIMATED WEIGHT FOR VARIOUS SYSTEMS IN SCOPE OF WORK (BOQ)

1.15	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	14,346
1.16	MATERIAL RECONCILIATION	MT	4,565
1.17	COMPLETION OF CONTRACTUAL OBLIGATION	MT	14,346
3.1 FGD & Its Auxiliaries (Absorber/Structure/Duct Damper)			
1.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	3,363
1.2	PLACEMENT IN POSITION	MT	3,363
1.3	ALIGNMENT	MT	3,363
1.4	WELDING / BOLTING / FIXING	MT	3,363
1.5	COMPLETION OF NON DESTRUCTIVE EXAMINATION & STRESS RELIEVING/ HEAT TREATMENT (if not applicable, then this portion to be paid along with WELDING/BOLTING/FIXING)	MT	3,363
1.6	HANGERS & SUPPORTS ETC WHEREVER NECESSARY AS PER DRG	MT	3,363
1.7	HYDRAULIC TEST OR PNEUMATIC TEST	MT	3,363
1.8	AIR & GAS TIGHTNESS TEST	MT	3,363
1.9	Completion of Trial run of Slurry pumps	MT	3,363
1.10	Trial run of Wet ball mills	MT	3,363
1.11	Commissioning of Absorber System	MT	3,363
1.12	Trial run of Oxidation Blower	MT	3,363
1.13	Trial run of FGD System	MT	3,363
1.14	Painting	MT	3,363
1.15	Area cleaning, temporary structures cutting/removal and return of scrap	MT	3,363
1.16	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	3,363
1.17	MATERIAL RECONCILIATION	MT	3,363
1.18	COMPLETION OF CONTRACTUAL OBLIGATION	MT	3,363
4.1 Power Cycle Piping P-91/92 (5A)			
1.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	1,436
1.2	PLACEMENT IN POSITION	MT	1,436
1.3	ALIGNMENT	MT	1,436
1.4	WELDING / BOLTING / FIXING	MT	1,436
1.5	COMPLETION OF NON DESTRUCTIVE EXAMINATION & STRESS RELIEVING, HEAT TREATMENT (IF NOT APPLICABLE, THEN THIS PORTION TO BE PAID ALONG WITH WELDING/BOLTING/FIXING)	MT	1,436
1.6	HANGERS & SUPPORTS ETC WHEREVER NECESSARY AS PER DRG	MT	1,436
1.7	HYDRAULIC TEST OR PNEUMATIC TEST	MT	1,436
1.8	FLOATING OF LINES, FINAL ADJUSTMENT OF SUPPORTS FOR COLD AND HOT VALUES (if not applicable, this portion to be clubbed along with hydraulic test/pneumatic test)	MT	1,436

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CHAPTER IX - ESTIMATED WEIGHT FOR VARIOUS SYSTEMS IN SCOPE OF WORK (BOQ)

1.9	BOILER LIGHT UP	MT	1,436
1.10	STEAM BLOWING	MT	1,436
1.11	Rolling & synchronization	MT	1,436
1.12	FULL LOAD	MT	1,436
1.13	TRIAL OPERATION OF UNIT	MT	1,436
1.14	Completion of all drains and vents to respective locations and placement of instrument sensors after steam blowing	MT	1,436
1.15	Painting	MT	1,436
1.16	Area cleaning, temporary structures cutting/removal and return of scrap	MT	1,436
1.17	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	1,436
1.18	Submission of 'As Built Drawings'	MT	1,436
1.19	MATERIAL RECONCILIATION	MT	1,436
1.2	COMPLETION OF CONTRACTUAL OBLIGATION	MT	1,436
4.2 Piping Including P-11,12,22 (HP Piping)			
1.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	1,812
1.2	PLACEMENT IN POSITION	MT	1,812
1.3	ALIGNMENT	MT	1,812
1.4	WELDING / BOLTING / FIXING	MT	1,812
1.5	COMPLETION OF NON DESTRUCTIVE EXAMINATION & STRESS RELIEVING, HEAT TREATMENT (IF NOT APPLICABLE, THEN THIS PORTION TO BE PAID ALONG WITH WELDING/BOLTING/FIXING)	MT	1,812
1.6	HANGERS & SUPPORTS ETC WHEREVER NECESSARY AS PER DRG	MT	1,812
1.7	HYDRAULIC TEST OR PNEUMATIC TEST	MT	1,812
1.8	FLOATING OF LINES, FINAL ADJUSTMENT OF SUPPORTS FOR COLD AND HOT VALUES (if not applicable, this portion to be clubbed along with hydraulic test/pneumatic test)	MT	1,812
1.9	BOILER LIGHT UP	MT	1,812
1.10	STEAM BLOWING	MT	1,812
1.11	Rolling & synchronization	MT	1,812
1.12	FULL LOAD	MT	1,812
1.13	TRIAL OPERATION OF UNIT	MT	1,812
1.14	Completion of all drains and vents to respective locations and placement of instrument sensors after steam blowing	MT	1,812
1.15	Painting	MT	1,812
1.16	Area cleaning, temporary structures cutting/removal and return of scrap	MT	1,812
1.17	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	1,812
1.18	Submission of 'As Built Drawings'	MT	1,812
1.19	MATERIAL RECONCILIATION	MT	1,812

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1.20	COMPLETION OF CONTRACTUAL OBLIGATION	MT	1,812
4.3 LP Piping			
1.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	939
1.2	PLACEMENT IN POSITION	MT	939
1.3	ALIGNMENT	MT	939
1.4	WELDING / BOLTING / FIXING	MT	939
1.5	COMPLETION OF NON DESTRUCTIVE EXAMINATION & STRESS RELIEVING, HEAT TREATMENT (IF NOT APPLICABLE, THEN THIS PORTION TO BE PAID ALONG WITH WELDING/BOLTING/FIXING)	MT	939
1.6	HANGERS & SUPPORTS ETC WHEREVER NECESSARY AS PER DRG	MT	939
1.7	HYDRAULIC TEST OR PNEUMATIC TEST	MT	939
1.8	FLOATING OF LINES, FINAL ADJUSTMENT OF SUPPORTS FOR COLD AND HOT VALUES (if not applicable, this portion to be clubbed along with hydraulic test/pneumatic test)	MT	939
1.9	BOILER LIGHT UP	MT	939
1.10	STEAM BLOWING	MT	939
1.11	Rolling & synchronization	MT	939
1.12	FULL LOAD	MT	939
1.13	TRIAL OPERATION OF UNIT	MT	939
1.14	Completion of all drains and vents to respective locations and placement of instrument sensors after steam blowing	MT	939
1.15	Painting	MT	939
1.16	Area cleaning, temporary structures cutting/removal and return of scrap	MT	939
1.17	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	939
1.18	Submission of 'As Built Drawings'	MT	939
1.19	MATERIAL RECONCILIATION	MT	939
1.20	COMPLETION OF CONTRACTUAL OBLIGATION	MT	939
4.4 HANGERS & SUPPORTS			
1.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	1,426
1.2	PLACEMENT IN POSITION	MT	1,426
1.3	ALIGNMENT	MT	1,426
1.4	WELDING / BOLTING / FIXING	MT	1,426
1.5	BOILER LIGHT UP	MT	1,438
1.6	STEAM BLOWING	MT	1,438
1.7	Rolling & synchronization	MT	1,438
1.8	FULL LOAD	MT	1,438
1.9	TRIAL OPERATION OF UNIT	MT	1,438
1.10	Painting	MT	1,438

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1.11	Area cleaning, temporary structures cutting/removal and return of scrap	MT	1,438
1.12	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	1,438
1.13	Submission of 'As Built Drawings'	MT	1,438
1.14	MATERIAL RECONCILIATION	MT	1,426
1.15	COMPLETION OF CONTRACTUAL OBLIGATION	MT	1,438
4.5 SS Piping			
1.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	26
1.2	PLACEMENT IN POSITION	MT	26
1.3	ALIGNMENT	MT	26
1.4	WELDING / BOLTING / FIXING	MT	26
1.5	BOILER LIGHT UP	MT	26
1.6	STEAM BLOWING	MT	26
1.7	Rolling & synchronization	MT	26
1.8	FULL LOAD	MT	26
1.9	TRIAL OPERATION OF UNIT	MT	26
1.10	Painting	MT	26
1.11	Area cleaning, temporary structures cutting/removal and return of scrap	MT	26
1.12	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	26
1.13	Submission of 'As Built Drawings'	MT	26
1.14	MATERIAL RECONCILIATION	MT	26
1.15	COMPLETION OF CONTRACTUAL OBLIGATION	MT	26
SECTION 2- BUNKER & ALLIED WORKS			
	STRUCTURAL WORKS: Structural steel works including all labour, material (unless otherwise specified in BOQ/contract specification)		
F2301.1	Structural steel of mild steel/High strength steel rolled section / built up section / combination of both conforming to IS:2062, pipe sections]		
1.1	On pre - assembly wherever applicable (if not applicable, this portion shall be clubbed with placement in position)	MT	2,601
1.2	Placement in position	MT	2,776
1.3	Alignment	MT	2,776
1.4	Welding / bolting / fixing	MT	2,688
1.5	Completion of non destructive examination & stress relieving, heat treatment (if not applicable, then this portion to be paid along with welding)	MT	2,688
1.6	Hangers & supports etc ,Readiness of floors for concrete pouring as applicable	MT	2,870

TECHNICAL CONDITIONS OF CONTRACT (TCC)

CHAPTER IX - ESTIMATED WEIGHT FOR VARIOUS SYSTEMS IN SCOPE OF WORK (BOQ)

1.7	Readiness for feeding coal(1% of each mill)& completion of side cladding	MT	2,870
1.8	Coal firing	MT	2,870
1.9	Trial Operation of Unit	MT	2,870
1.10	Painting	MT	2,870
1.11	Area cleaning ,temporary structures cutting / removal and return of scrap	MT	2,870
1.12	Punch list points /pending points liquidation	MT	2,870
1.13	Material reconciliation	MT	2,870
1.14	Completion of contractual obligation	MT	2,870
A1502	<p>METAL DECK SHEET Type-I, Transporatation of MS Deck sheets from BHEL Storage yard to erection site, erection and fixing permanently colour coated galvanised MS troughed metal sheet decking plate of approved colour over roof purlins for cast-in-situ roof slab as per relevant IS code and Grade as per specification. Bare metal thickness(BMT) of deck plate shall be minimum 0.8mm with minimum trough depth of 44mm of grade G250 as per AS1397/grade SS255 as per ASTM A653M/ grade S250GD as per EN 10326 with zinc coating to class Z275 and shall serve as permanent shuttering to the roof slab 40mm thick measured over crest of metal decking & shall have adequate strength to support weight of green concrete and imposed loads of min 100 kg/sqm (for two span condition) during construction between beams as per manufacturer's recommendations/ calculations/ test certificates for approval including fixing of plates to beams, side lapping, end lapping etc. all complete for below mentioned spans. The sheet shall be permanently coated with silicon modified polyster(SMP silicon content 30%-50%) paint or super polyster paint of minimum 20 micron DFT on exposed surface (facing operating floor) over primer coat of minimum 5 micron(nominal) and minum 10 micron (nominal) SMP or super polyester paint over primer coat of minum 5 micron (nominal) on other face. SMP and polyster paint system sahll be of idustrial finish of product type 4 of AS/NZ2728, including fixing of sheet to top flange of beam with drawn arc welding of headed shear anchor studs @ 260mm c/c in the trough and stich screws between two adjacent sheets and sealing with epoxy sealant.The shear anchor studs shall confirm to type B studs specified in AWS D1.1/D1.1M or equivalent as shear connector of 16 mm dia & 65 mm length manufactured from cold drawn round steel bars confirming to ASTM A 29 of grade designation 1010 through 1020 of standard quality with either semi killed or killed welded by drawn arc stud welding through metal deck sheet. (Deck Sheets shall be provided by BHEL) except sheets, other materials shall be in the agency scope -fasteners and fixing components (like Sealant, screws etc</p>		
a	Span Upto 1800mm	SQM	1,605
b	Span Exceeding 1800mm and upto 2500 mm	SQM	1,605

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B1502	METAL DECK SHEET Type-II, Transportataion from MS deck sheets from BHEL Storage yard to erection site, erection and fixing of permanently color coated galvanised MS troughed metal sheet decking plate of approved colour over floor beams for cast-in-situ roof slab as per relevant IS code and Grade as per specification. Bare metal thickness(BMT) of deck plate shall be minimum 0.8mm with minimum trough depth of 51 mm of grade G250 as per AS1397/grade SS255 as per ASTM A653M/grade S250GD as per EN 10326 with zinc coating to class Z275 and shall serve as permanent shuttering to the roof/floor slab 150mm thick measured over crest of metal decking & shall have adequate strength to support weight of green concrete and imposed loads of min 100 kg/sqm (for two span condition) during construction between beams as per manufacturer's recommendations/ calculations/ test certificates for approval including fixing of plates to beams, side lapping, end lapping etc. all complete for below mentioned spans. The sheet shall be permanently coated with silicon modified polyster(SMP silicon content 30%-50%) paint or super polyster paint of minimum 20 micron DFT on exposed surface (facing operating floor) and minimum 5 micron on other face over epoxy primer of 5 micron applied over coating (deginated class Z275), including fixing of sheet to top flange of beam with drawn arc welding of headed shear anchor studs @ 260mm c/c in the trough and stich screws between two adjacent sheets and sealing with epoxy sealant.The shear anchor studs shall confirm to type B studs specified in AWS D1.1/D1.1M or equivalent as shear connector of 19 mm dia & 100 mm length manufactured from cold drawn round steel bars confirming to ASTM A 29 of grade designation 1010 through 1020 of standard quality with either semi killed or killed welded by drawn arc stud welding through metal deck sheet. Measurement of profile sheeting shall be of the plan area of roof/floor covered by MS trough metal decking. The SMP and polyster paint shall confirm to product type 4 as per AS/NZS 2728.(Deck Sheets shall be provided by BHEL)		
a	Span Upto 1800mm	SQM	3,195
b	Span Exceeding 1800mm and upto 2500 mm	SQM	3,195
A1503	Providing and fixing shear connectors of mild steel studs having 16 mm dia and minimum 65 mm projected length above purlin passing through metal decking as per relevant IS codes and specification.	QUINTAL	1
B1503	Providing and fixing shear connectors of mild steel studs having 19 mm dia and minimum 100 mm projected length above purlin passing through metal decking as per relevant IS codes and specification.	QUINTAL	5
C1503	Providing and fixing special coated fastener conforming to corrosion resistant Class 3 AS3566 and tested 1000 hrs salt spary test to be used for fixing pre-fabricated insulated Metal sandwich Panels with the structural members below.	QUINTAL	5

TECHNICAL CONDITIONS OF CONTRACT (TCC)
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A1504	Transportation of cladding sheets from BHEL storage yard to erection site and fixing of External sheet of Permanent colour coated metal cladding with troughed M.S. sheets of minimum 0.6mm bare metal thickness of grade G250 as per AS1397/grade SS255 as per ASTM A653M/ grade S250GD as per EN 10326 with zinc coating to class Z275/ aluminium zinc alloy coating to class AZ150 on both sides including fixing to supports / rails by concealed fixing system, corrosion resistant self tapping / self drilling type fasteners with suitable cap, flashing etc. all complete. The exposed face of the sheet shall be permanently coated with silicon modified polyester(SMP silicon content 30%-50%) paint of 40 micron minimum DFT or super polyester paint of minimum 20 micron DFT on exposed surface over primer coat of minimum 5 micron(nominal) and minum 10 micron (nominal) SMP or super polyester paint over primer coat of minum 5 micron (nominal) on other face. SMP and polyester paint system shall be of industrial finish of product type 4 of AS/NZS2728. (Sheets shall be provided by BHEL)	SQM	3,825
B1505	Transportation from BHEL Store and erection of prefabricated permanent colour coated sandwiched insulated metal cladding of approved color comprising of top sheet as troughed permanently colour coated sheet and bottom sheet as plain permanently colour coated with 50 mm thick insulation sandwiched between the two sheets.(payment shall be made on surface area of the cladding including flashings) fixing screw shall be agency scope.(Sheets shall be provided by BHEL)	SQM	1,645

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A 1508	Transportation of sheets from BHEL Storage yard to erection site ,erection and fixing of Inner sheet of Permanent colour coated metal cladding with troughed M.S. sheets of minimum 0.6mm bare metal thickness of grade G250 as per AS1397/grade SS255 as per ASTM A653M/ grade S250GD as per EN 10326 with zinc coating to class Z275/ aluminium zinc alloy coating to class AZ150 on both sides including fixing to supports / rails by concealed fixing system (Z purlin), corrosion resistant self tapping / self drilling type fasteners with suitable cap, flashing etc. all complete. The exposed face The sheet shall be permanently coated with silicon modified polyster(SMP silicon content 30%-50%) paint of 40 micron minimum DFT or super polyster paint of minimum 20 micron DFT on exposed surface over primer coat of minimum 5 micron(nominal) and minum 10 micron (nominal) SMP or super polyester paint over primer coat of minum 5 micron (nominal) on other face. SMP and polyster paint system shall be of industrial finish of product type 4 of AS/NZS 2728. 'Z' spacers of atleast 2mm thick galvansied steel sheet of grade 350 as per IS 277 would be fixed the inner sheeting on face side at runner locations all complete as per specification.	SQM	100
2311	Providing and fixing in position of permanent mild steel bolts (class 4.6 as per IS : 1367 and grade 'C' as per IS: 1363) and nuts, washers etc. up to and inclusive of 39 mm diameter and upto 300mm long for structural steel work etc all complete.	KG	11,160
2312	Providing and fixing in positing of high strength structural bolts (of property class 8.8 and product grade 'C' as per IS: 1367) and conforming to IS: 3757 and high strength structural hardened and tempered nuts (of property class '8' as per IS:1367) conforming to IS:6623 with hardened and tempered washers as per IS:6649 etc. up to and inclusive of 39 mm diameter and upto 300 mm long for structural steel work etc all complete.	KG	44,640
2313	Dismantling of steel structure , lowering of material and carriage of the dismantled material up to field fabrication shop / projects storage including temporary dismantling, cutting, re-welding, supporting, and restoring to correct position all temporarily dismantled members, re-alignment of all adjacent connected members to their correct positions (weight of such adjacent members and temporarily dismantled members not payable), scaffolding, staging, tools & tackles, gas cutting, welding, consumables etc all complete.	MT	85

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IN SCOPE OF WORK (BOQ)

2314	Addition to, alterations in and/or modification of "Erection Marks" including cutting of parts, gauging of welds, cutting, grinding, fabrication, welding, drilling holes, straightening, removal of bends, raising to the required level, painting, transportation, return of unutilised steel pieces to the project store, temporarily dismantling, cutting, re-welding, supporting and restoring to correct position of all the temporarily dismantled members, realignment of adjacent connected members (weight of such temporarily dismantled and adjacent members not payable) etc all complete for the following:		
a	In erected position	MT	43
b	In fabrication yard	MT	43
2315	Re-erection of dismantled fabricated structural steel members including carriage of modified "Erection Marks" from the field fabrication shop to erection site, lifting to required position, aligning in position, tack welding, final welding and touch up painting including temporary dismantling and re-erection of temporarily dismantled members, cutting, rewelding, supporting and restoring to the correct position of all temporarily dismantled members, re-alignment of adjacent connected members (weight of such temporarily dismantled members and adjacent members not payable), scaffolding, staging, tools & tackles, gas cutting, welding, consumables etc all complete.	MT	85
2323	Conducting radiography test on welds wherever specified including equipments, measuring devices, gauges, test report etc. all complete.	RM	288
2324	Conducting ultrasonic test on welds wherever specified including equipments, measuring devices, gauges, test report etc. all complete.	RM	288
2325	Conducting ultrasonic test on steel plates as per ASTM-A435 or equivalent wherever specified including equipments, measuring devices, gauges, test report etc. all complete.	SQM	288
2326	Conducting magnetic particle test on welds wherever specified including equipments, measuring devices, gauges, test report etc. all complete.	RM	145
2327	Conducting dye penetration test on welds wherever specified by the engineer including provision of necessary equipments, measuring devices, gauges etc. all complete (over and above the work already specified in the specifications.)	RM	288

Note:

- List of PG MA wise (weight) work to be executed is attached with this tender document and part of this TCC – Annexure A**

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-X General

10.1 GENERAL

Site Visit by the Bidder

- 10.1 The bidder shall, prior to submitting his tender for the work, visit and examine the site of works and its surroundings at his own expense, and obtain and ascertain for himself on his own responsibility all information that may be necessary for preparing his tender and entering into a contract, and take the same into account in the quoted contract price for the work.**
- 10.2 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 over the entire duration of the contract, and All other information pertaining to and needed for the work including information as to the risks, contingencies and other circumstances which may influence or affect the work or the cost thereof under this contract.
- 10.3 Contractor shall execute the work as per sequence and procedure prescribed by BHEL at site. The applicable erection manuals which are available with BHEL site office are to be referred for compliance and guidance before taking up the work. Any rework on this failure to comply with will be to account of contractor only. BHEL engineer, depending upon the availability of materials, fronts etc., will decide the sequence of erection and methodology. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the method of erection adopted in erection of similar jobs in other projects or for any reason whatsoever.
- 10.4 Contractor has to work in close co-ordination with other erection agencies at site. BHEL engineer will co-ordinate area clearance. In a project of such magnitude, it is possible that the area clearance may be less / more at a particular given time.

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Activities and erection program have to be planned in such a way that the milestones are achieved as per schedule / plans. Contractor shall arrange & augment the resources accordingly.

- 10.5 The contractor is strictly prohibited from using BHEL's regular components like angles, channels, beams, plates, pipe / tubes, and handrails etc. for any temporary supporting or approach platforms or scaffolding works or as bed for pre-assembly works. Contractor shall arrange himself all such materials. The Contractor shall make all fixtures, temporary supports, steel structures required for jigs & fixtures, anchors for load and guide pulleys required for the work. Contractor shall arrange necessary steel (angles, channels, beams, plates etc) for such usage as normal scope of work without any cost implication on BHEL.
In case of such misuse of BHEL materials, a sum as determined by BHEL engineer will be recovered from the contractor's bill. The decision of BHEL engineer is final and binding on the contractor.
- 10.6 All the works such as cleaning, levelling, aligning, trial assembly, dismantling of certain components for checking and cleaning, surface preparation, fabrication of sheets, tubes and pipes as per general engineering practice and as per BHEL Engineer's instructions at site, cutting, weld depositing, grinding, straightening, chamfering, filing, chipping, drilling, reaming, scrapping, lapping, fitting-up etc., as may be applicable in such erection works and are necessary to complete the work satisfactorily, shall be carried out by the contractor as part of the work within the quoted rate. Major machining work, which is only to be carried out in workshops, will be arranged by BHEL.
- 10.7 The contractor will be responsible for the safe custody and proper accounting of all materials in connection with the work. If the contractor has drawn materials in excess of design requirements, recoveries will be effected for such excess drawls at the rate prescribed by manufacturing units.
- 10.8 No member of the already erected structure, platform, pipes, grills, other component and auxiliaries should be cut without specific approval of BHEL engineer. In case it is necessary to cut, the contractor shall rectify / repair in a manner acceptable to BHEL / customer without any additional cost.
- 10.9 No temporary supports shall be welded on the pressure parts of piping. Welding of temporary supports, cleats, etc. on the boiler columns shall be avoided. In case of absolute necessity contractor shall take prior approval from BHEL Engineer. Further, any cutting or alternation of member of the structure of platform or other equipment shall not be done without specific prior approval of BHEL Engineer.
- 10.10 Contractors shall ensure that all their Staff / Employees are exposed to periodical training programme conducted by qualified agencies / personnel on ISO 9001 – latest Standards.
- 10.11 Contractor has to clear the front, expeditiously and promptly as instructed by BHEL Engineer for other agencies, like piping, Turbine, Generator erection, Cabling, instrumentation, insulation etc., to commence their work from / on the equipments coming under this scope. Sometimes, more than one agencies may have to work in

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Chapter-X General

- same location. Sometimes it may be required to re-schedule the activities to enable other agencies to commence / continue the work so as to keep the overall project schedule.
- 10.12 The terminal points decided by BHEL are final and binding on the contractor for deciding the scope of work and effecting the payment for the work done up to the terminals.
- 10.13 For the purpose of planning, contractor shall furnish the estimated requirement of power (month wise) for execution of work in terms of maximum KW demand.
- 10.14 The boiler shall be erected as per relevant provisions of latest Indian Boiler Regulations (IBR) and amendments/addendums thereof, if any. Contractor shall submit a copy of license to undertake construction / repair of Boilers & Piping issued by Boiler inspectorate before commencement of Pressure Parts / Piping Erection
- 10.15 Contractor should obtain the formal statutory clearance from Chief Inspector of Boilers to carry out erection & Welding of piping (Power cycle piping, special tanks, IBD Tanks, CBD tanks any other tanks applicable) under IBR purview. Arrangement for the visit of Boiler inspector for field inspection, hydraulic test etc., is in the scope of contractor, and necessary drawing / details only will be given by BHEL. If applicable/required, all boiler, piping layout drawings received from BHEL for pipeline erection to be submitted to Boiler Inspector for approval. After approval of the above drawing, Erection of pressure parts, pipe line to be started
- 10.16 All necessary certificates and licenses, permits & clearances to carry out this work from the respective IBR authorities/statutory/ local authorities/ Electrical Inspectorate are to be arranged by the Contractor at his cost in time to ensure smooth progress of work and render all assistance, service required in this regard.
- 10.17 All registration and statutory inspection fees, if any, in respect of his work pursuant to this Contract shall be to the account of the Contractor. However, any registration, statutory inspection fees lawfully pay-able under the provisions of the Indian Boiler Regulations and any other statutory laws and its amendments from time to time during erection in respect of the plant equipment ultimately to be owned by the PVUNL, shall be to the account of the PVUNL. Should any such inspection or registration need to be re-arranged due to the fault of the Contractor, the additional fees for such inspection and/or registration shall be borne by the Contractor. Inspection fee and registration fee as mentioned in Chapter VIII of Special Conditions of contract (Volume-IB in (Vol I BCD)) shall be paid by BHEL.
- 10.18 The contractor must obtain the signature and permission of the security personnel of the customer for bringing any of their materials inside the site premises. Without the Entry Gate Pass these materials will not be allowed to be taken outside.
- 10.19 Upon completion of daily work, the contractor shall remove from the vicinity of work all scrap packing materials, rubbish, unused and other materials and deposit them in places to be specified by BHEL Engineer.
- 10.20 During the course of erection, if the progress is found unsatisfactory, or if the target dates fixed from time to time for every milestone are to be advanced, or in the opinion of BHEL, if it is found that the skilled workmen like fitters, operators, technicians

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- employed are not sufficient BHEL will induct required additional workmen to improve the progress and recover all charges incurred on this account including all expenses together with BHEL overheads from contractor's bills.
- 10.21 On completion of work, all the temporary buildings, structures, pipe lines, cables etc. shall be dismantled and levelled and debris shall be removed as per instructions of BHEL by the contractor at his cost. In the event of his failure to do so, the expenditure towards clearance of the same will be recovered from the contractor. The decision of BHEL Engineer in this regard is final.
- 10.22 The intent of specification is to provide services according to the most modern and proven techniques and codes. The omission of specific reference to any method, equipment or material necessary for proper and efficient execution of this work shall not relieve the Contractor of the responsibility of providing such facilities to complete the work without any extra compensation.
- 10.23 The work shall be executed under the usual conditions affecting major power plant construction and in conjunction with numerous other operations at site. The Contractor and his personnel shall cooperate with personnel of BHEL, BHEL'S Customer, Customer's consultants and other Contractors, coordinating his work with others and proceed in a manner that shall not delay or hinder the progress of work of the project as a whole.
- 10.24 Contractor shall erect and commission all the equipments and auxiliaries as per the sequence & methodology prescribed by BHEL depending upon the technical requirements. Availability of materials and fronts will decide this. BHEL Engineer's decision regarding correctness of the work and method of working shall be final and binding on the Contractor. No claims for extra payment from the Contractor will be entertained on the ground of deviation from the methods / sequence adopted in erection of similar sets elsewhere.
- 10.25 The work shall conform to dimensions and tolerances specified in the various drawings / documents that will be provided during various stages of erection. If any portion of work is found to be defective in workmanship, not conforming to drawings or other stipulations due to Contractor's fault, the Contractor shall dismantle and re-do the work duly replacing the defective materials at his cost, failing which the work will be got done by BHEL and recoveries will be effected from the Contractor's bills towards expenditure incurred including cost of materials and departmental overheads of BHEL as per GCC.
- 10.26 The Contractor shall perform any services, tests etc. which may not be specified but nevertheless, required for the completion of work within quoted rates.
- 10.27 The Contractor shall execute the work in the most substantial and workman like manner. The stores shall be handled with care and diligence.
- 10.28 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.

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- 10.29 All cranes, transport equipment, handling equipment, tools, tackles, fixtures, equipment, manpower, supervisors/engineers, consumables etc, except otherwise specified as BHEL scope of free issue, required for this scope of work shall be provided by the Contractor. All expenditure including taxes and incidentals in this connection will have to be borne by Contractor unless otherwise specified in the relevant clauses. The Contractor's quoted rates should be inclusive of all such contingencies.
- 10.30 During the course of erection, testing and commissioning certain rework / modification / rectification / repair / fabrication etc may become necessary on account of feedback / revision of drawing etc. This will also include modifications / re-works suggested by BHEL / customer / other inspection group. Contractor shall carry out such rework / modification / rectification / fabrication / repair etc promptly and expeditiously. Daily log sheets signed by BHEL engineer and indicating the details of work carried out, man-hours etc shall be maintained by the Contractor for such reworks. Claim of Contractor if any, for such works will be governed by relevant clauses of 'General Conditions of Contract'.
- 10.31 All works such as cleaning, leveling, aligning, trial assembly, dismantling of certain equipments / components for checking and cleaning, surface preparation, fabrication of structures, tubes and pipes as per general engineering practice and as per BHEL Engineer's instructions at site, cutting, gouging, weld depositing, grinding, straightening, chamfering, filing, chipping, drilling, reaming, scrapping, lapping, fitting up etc as may be applicable in such erection works and which are treated incidental to the erection works and necessary to complete the work satisfactorily, shall be carried out by the Contractor as part of the work within the quoted rates.
- 10.32 The Contractor shall take delivery of the components, equipments, chemicals, and lubricants etc from the BHEL stores/ storage area after getting the approval of BHEL Engineer on standard indent forms of BHEL. Complete and detailed account of the materials and equipments after usage shall be submitted to the BHEL and reconciled periodically
- 10.33 **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.**
- 10.34 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. No claim for extra payment for such work will be entertained.

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- 10.35 Plant materials should not be used for any temporary supports / scaffolding/ preparing pre-assembly bed etc. The details of equipments to be erected under this contract are generally as per the schedule given in relevant appendices. These details are approximate and meant only to give a general idea to the tenderer about the magnitude of the work involved. Actual quantum and type of equipments will be based on the relevant erection documents which will be furnished to the Contractor in due course of erection and the weight and quantity as per the relevant engineering documents will only be admissible for the billing purpose.
- 10.36 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 with in the quoted cost.
- 10.37 Spring suspension / constant load hangers may have to be pre-assembled for required load and erection carried out as per instructions of BHEL. Adjustments, removal of temporary arrests/locks, cutting of excess thread length of hanger tie-rod etc have to be carried out as and when required. Load setting of spring hangers, as per BHEL's documents/instructions, during various stages of erection & testing and after floating of piping/ducting during cold and hot condition will have to be done as part of work. This exercise may have to be repeated till satisfactory results are achieved.
- 10.38 Layout of field routed, fine fittings, boiler trim piping, oil system and other small bore piping have to be routed according to site conditions and hence shall be done only in position as per the site requirement. As such, layout of small bore piping in boiler and oil system shall be done as per the site requirement. Necessary sketch for routing these lines shall be prepared and got approved from BHEL by the contractor. There is a possibility of slight change in routing the above pipelines when after completion, to suit the site conditions. The contractor should absorb this cost in his quoted rate.
- 10.39 Erection and Welding of necessary instrumentation tapping points, thermowell, thermocouple pad, metal temp pad and clamps, root valve, condensing vessel, flow metering & measurement devices, and control valves to be provided on boiler & its auxiliaries 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.

- 10.40 Certain instrumentation like pressure switches, air sets, filters, regulators, pressure gauges, junction boxes, power cylinders, dial thermometers, flow meters, valve

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- actuators, flow indicators, centrifugal/speed switches of motors, accumulators etc are received in assembled condition as integral part of equipments. Contractor shall dismount such instruments for calibration and hand over the same to BHEL. C & I erection agency will do storage / re-erection calibration etc.
- 10.41 Fixing and seal welding of thermowells & plugs before Hydro test/ steam blowing of equipment or other piping system is within the scope of work. Contractor shall also remove the seal welded plugs by process of grinding and fix and seal weld thermowells after hydro test/steam blowing of lines as part of work.
- 10.42 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. Assistance for calibrating / testing the power cylinders / valves, gauges, instruments, etc. and setting to actuators coming under various groups shall be provided by contractor within the quoted rates.
- 10.43 All electrical motors have to be tested for IR & PI values prior to the trial run. Where required, dry out may have to be carried out by using external heating source. Contractor shall make all arrangements in this regard and complete the work as instructed. BHEL will provide the motorized insulation testers.
- 10.44 In installation of various equipments it may become necessary to install these on temporary supports/ hanger due to various reasons including non-availability of suspension materials. Contractor shall install such temporary suspensions/hangers and later on shift the relevant equipments to their respective permanent hangers/ suspensions/ supports as incidental to work. Requisite materials for such temporary arrangements will be provided by BHEL on free -returnable basis which shall be returned to BHEL after the use.
- 10.45 The work shall be carried out strictly in accordance to the "Field Quality Plan" approved by BHEL/client. Contractor, jointly with BHEL, shall prepare all necessary records of measurements/readings/ protocols etc.
- 10.46 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.
- 10.47 Contractor shall regulate flow of material to and from site in such a manner and sequence that material accumulation at site does not lead to congestion at site. In case it is necessary to shift and restack the materials kept at work areas / site to enable other agencies to carry out their work or further any other reason, it shall be done by the Contractor most expeditiously. No claim for extra payment for such work will be entertained.
- 10.48 It may so happen that certain components like manhole doors, hanger etc may be supplied in loose items. They need to be assembled as per relevant drawings or as per advice of BHEL engineer prior to erection. This forms the part of the scope of work.

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- 10.49 The Contractor shall have total responsibility for all equipment and materials in his custody at Contractor's stores, loose, semi-assembled, assembled or erected by him at site. He shall effectively protect the finished works from action of weather and from damages or defacement and shall also cover the finished parts immediately on completion of work as per BHEL engineer's instructions. The machine surfaces/finished surfaces should be greased and covered.
- 10.50 BHEL is operating web based computerized E-store system that includes, inter-alia, issue of materials, daily progress reporting, Contractor's running monthly billing and material reconciliation through a computerized data management system. Contractor shall install necessary hardware to hook-up with the BHEL's system and use the same for his scope of work.
- 10.51 In the event the computerized E-store/SOMS is inoperative for any reasons, the Contractor shall take delivery of materials from the storage area/sheds of BHEL/customer after getting the approval of the engineer/customer on standard indent forms to be specified by BHEL/customer. All these records however shall be updated in the E-store/SOMS as and when the E-store/SOMS is reactivated/normalized.
- 10.52 Gases like argon, oxygen, acetylene etc that are required for erection related activities shall be arranged by the Contractor at his cost. For T-91 material site weld joints argon as per grade-3 of is 5760: 1998 with oxygen and water vapour restricted to max 6 ppm each and with argon purity level of minimum 99.99% shall be arranged and used by the Contractor. The supply should accompany test certificate for the batch indicating individual element 'ppm' level and overall purity level.
- 10.53 It shall be the responsibility of the contractor to preserve the boiler as per BHEL's requirement. Nitrogen gas, if required, for preservation of boiler and nitrogen capping during chemical cleaning process, will be provided by BHEL free of charge. Contractor shall arrange necessary connector, nipple, regulator, header and piping for usage of such gas from cylinders.**
- 10.54 All lubricants and chemicals required for testing, preservation, chemical cleaning / acid cleaning, oil flushing, and the lubricants for trial runs of the equipments and trial operation of the unit will be supplied by BHEL free of charges.**
- 10.55 It is not the intent to specify herein all details of all material. Any item related this work not covered by this but necessary to complete the system will be deemed to have been included in the scope of the work.
- 10.56 Site testing wherever required shall be carried out for all items / materials installed by the contractor to ensure proper installation and functioning in accordance with drawings, specifications and manufacturer's recommendations
- 10.57 The contractor shall carryout additional tests if any, which the Engineer feels necessary because of site conditions and also to meet system specification

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- 10.58 The work shall be executed under the usual conditions without affecting power plant construction / operation and in conjunction with other operations and contracting agencies at site. The contractor and his personnel shall co-operate with the personnel of other agencies, co-ordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.
- 10.59 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.
- 10.60 Wherever Construction sequences are furnished by BHEL, the contractor shall follow the same sequence.
- 10.61 Contractor shall, transport all materials to site and unload at site / working area for inspection and checking. All material handling equipment required shall be arranged by the contractor.
- 10.62 Contractor shall retain all T&P / Testing instrument / Material handling equipment's etc. at site as per advice of BHEL engineer and same shall be taken out from site only after getting the clearances from engineer in charge. The contractor at his cost shall arrange necessary security measures for adequate protection of his machinery, equipment, tools, materials etc. BHEL shall not be responsible for any loss or damage to the contractor's construction equipment and materials. The contractor may consult the Engineer-in-Charge on the arrangements made for general site security for protection of his machinery equipment tools etc.
- 10.63 The consumables (welding electrodes, special T&Ps etc), commissioning spares and erection material spares released in PG-MA XX-991, XX-992, XX-993, XX-988, XX-997 and other similar items are not billable. However, certain spare items when actually erected as a part of permanent equipment shall be paid as per agreed payment terms as applicable. The decision of BHEL Engineer in this regards shall be final and binding on contractor.
- 10.64 Effluent has to be disposed off safely from neutralizing pit to a safe area as per instruction of BHEL Engineer. Neutralisation pit for EDTA cleaning/Acid cleaning is to be made by the Contractor. After completion of job pit has to be dismantled and area is to be levelled before handing over of area to owner. The pit size shall be approx. 30x30x1.5m, however it shall suitably decide jointly at site as per site requirement. Cost incurred in construction of neutralization pit shall be borne by the contractor.
- 10.65 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.
- 10.66 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

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accidents and as such BHEL reserves the right to collect and remove the scrap at contractor's cost with applicable overheads if there is any failure on the part of contractor in this respect.

- 10.67 The contractor shall ensure that his premises are always kept clean and tidy to the extent possible. Any untidiness noted on the part of the contractor shall be brought to the attention of the contractor's site representative who shall take immediate action to clean the surroundings to the satisfaction of the Engineer in- Charge.
- 10.68 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.
- 10.69 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.
- 10.70 The contractor's work shall not hinder other work, either underground or over ground, such as electrical, phone lines, water or sewage lines, etc. In areas of overlap, the contractor shall work in coordination with other related contractors.
- 10.71 Any damage by the landscape contractor's team to such utilities will be penalized and contractor shall be responsible for cost for such damages.
- 10.72 Contractor at his cost shall lay all necessary temporary piping including cutting and edge preparation, install the pumps, blanks, valves required for the test, pressure gauges etc. Required pipes, valves, plates etc., will be given by BHEL. Temporary piping, pumps, valves, flanges, blanks etc shall be removed by him and returned to BHEL. All thermo well points are to be seal welded, with plug in position. All Temperature Element points are to be provided with blanks and welded. Necessary blanks will be provided by BHEL.

10.73 SITE INSPECTION

- 10.73.1 The owner / employer or his authorized agents may inspect various stages of work during the currency of the contract awarded to him. The contractor shall make necessary arrangements for such inspection and carry out the rectification pointed out by the owner / employer without any extra cost to the owner / employer. No cost whatsoever such duplication of inspection of work be entertained.
- 10.73.2 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.

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10.73.3 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

10.74 UTILITY POINTS

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

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

10.75 DOCUMENTATION

10.75.1 Contractor shall be supplied with two extra copies of the layout & isometrics drawings. Contractor to incorporate in one of the copy with Red ink all the changes / deviations / alterations etc. carried out at site due to various reasons, with site engineer's endorsement. Marked up drawings shall be submitted to BHEL for approval.

10.75.2 After successful completion, testing and commissioning of installation work, as built drawings / documents if any, in line with the actual work carried out as per site routing drawing shall be submitted by the contractor as agreed for the project.

10.75.3 The contractor shall maintain a record in the form as prescribed by BHEL for all operations carried out on each weld and maintain a record indicating the number of welds, the name of welders who welded the same, date and time of start and completion, preheat temperature, radiographic results, rejections if any, percentage of rejection, etc. and submit copies of the same to the BHEL Engineer as required.

10.75.4 Other documents as specified in of Chapter – XI of Technical Conditions of Contract

10.76 AS BUILT DRAWING:

After successful completion, testing and commissioning of installation work, Purchaser's drawings / documents shall be updated in line with the actual work carried out and as built drawings / documents shall be submitted by the contractor as agreed for the project. Contractor shall be supplied with one extra copies of the layout & isometrics drawings. Contractor to incorporate in one of the copy with red

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ink all the changes / deviations / alterations etc., Carried out at site due to various reasons, with site engineer's endorsement. Marked up drawings shall be submitted to BHEL for approval.

10.77 PLATFORMS, CROSSOVERS & CANOPIES

Platforms, ladders, crossovers and canopies shall also be provided at places where it has not been shown in drawings but if felt necessary by site engineer.

Contractor has to fabricate and install canopies for all outdoor pumps and motors, actuators, lub oil units, control valves and at places as instructed by BHEL Engineer etc. Platforms, ladders, crossovers and canopies shall have to be fabricated from raw materials supplied by BHEL and erected by contractor as per instruction of BHEL and shall be paid as per accepted tonnage rate for "structures" i.e, Rate schedule Id. (1A)

10.78 Fin /attachment/scallop plates & associated items Cutting , restoration of Tubes, panels of Boiler

During course of erection in boiler pressure parts fin/attachment/scallop plates & associated items cutting to align difference tubes, panels will be required in boilers and this type of activity will be treated as normal scope of work without any commercial implication on BHEL. Even activity may have to be repeated as per job/Site requirement and for this also no extra work payment will be given to vendors as this type of job will be treated as normal scope of work.

10.79 Buck Stay Checking & Rectification

Vendor has to carry out inspection, rectification, Cleaning of buck stays along with adjoin areas during erection, commissioning, Operation, trial run has to be done from time to time. Buckstay corner link correction after initial erection has to be done and if changes noticed during operation of Unit has to be rectified. For this vendor has to arrange manpower and resources without any extra cost implication on BHEL treating it as normal scope of work. Any surrounding work in connection with inspection, rectification, cleaning of the same will be treated as normal scope of work.

10.80 Inspection, cleaning of pressure parts, Furnace, Pent House ,Burners ,ducts/and subsequent restoration, rectification, normalization.

During erection, pre-commissioning, commissioning, operation ,Stabilisation period trial Run - Inspection, cleaning of pressure parts, Furnace, Burners ,Pent House ,ducts, hoppers, and allied areas are to be carried out. For this vendor has to arrange manpower, T&P, other resources for inspection , cleaning of ash /oil shoots , coal rejects /clinkers and other foreign materials ,associated items from boiler, &

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surrounding areas. For this installation of sky climbers, scaffoldings and other requirement/resources/consumables as required are to be arranged by vendors for inspection, cleaning, testing followed by restoration/rectification/normalization. Vendor has to repeat this type of activity no. of times till handing over Unit to customer without any cost implication on BHEL treating this types of jobs as normal cope of vendor's work.

10.81 Statutory approval for Lifts, hoists, Cranes

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

Contractor has to arrange sufficient manpower (fitters, electricians with supporting helpers) and T&P /other resources with sufficient testing instruments, IMTE/MMD for erection and commissioning of these systems without any extra commercial implication on BHEL treating as normal scope of work. D.S.L / equivalent system for hoisting equipments are also to be erected and commissioned within the quoted rates.

Weight/loads required for load test of hoists shall be provided by BHEL free of cost.

10.82 Mill Reject Handling Systems (MRHS)

Erection ,Testing& Commissioning of MRHS is to be included in Boiler agency's scope. BHEL will arrange supervision of Erection, Commissioning activities of MRHS & for this supervision of OEM Engineers/Supervisors will be arranged by BHEL from time to time free of cost. Mill reject Disposal till establishment in manual mode is to be done by boiler agencies till handing over to customer. For this vendor has to keep manpower, tractors, trailers of suitable capacity to dispose mill rejects, foreign materials till handing over of Unit to Customer. This is treated as normal scope of work without any cost implication to BHEL.

10.83 HFO/LDO Strainers ,HFO/LDO Cleaning, HFO/LDO Pumps Commissioning/servicing/Rectification

HFO/LDO Strainers, HFO/LDO Guns cleaning, HFO/LDO Pumps and associated items servicing, rectification, commissioning in HFO/LDO Pump house & in Boiler are to be done by Boiler vendor. Vendor has to arrange the scaffolding, Consumables, Diesel, petrol, Cleaning agents ,tools, T&Ps for these purposes. For carrying out above activities , draining ,cleaning of HFO/LDO from Pumps, Strainers, HFO Heaters and

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associated items are to be done and contaminated HFO/LDO is/are to be collected in drums/containers/dirty oil tanks and for this vendors has to arrange facilities for disposal of the same. Emptying of dirty oil tank/drums/containers, cleaning and disposal of contaminated oil is in boiler vendor's scope. Extra pumps for disposal of contaminated HFO/LDO are to be arranged by boiler vendors. All above activities are required to be repeated in no. of occasions till handing over of Unit(s) and are treated as normal scope of work without any extra commercial implications on BHEL.

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

Vendor will assist in handing over of Special T&Ps for Erection/commissioning which were issued to them free of charge for returning to BHEL /Customer store.

10.85 Dewatering

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

10.86 Housekeeping/Area Cleaning

The contractor has to do area cleaning on every date on daily basis. Noncompliance of the above cleaning shall call for penal recovery of Rs.2000.00 on each instance and at the same time, cleaning of the area shall be done by BHEL at cost recovery basis (with applicable overheads) of the contractor. No excuses on this above account shall be entertained by BHEL on whatsoever account.

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

10.87 Approach platforms , fixtures

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

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

Agency has to give assistance for commissioning during initial period and subsequently during unit operation during stabilization period/trial run/PG Test. For this purpose items erected by agency has to provide manpower, other resources, diesel, other consumables, scaffoldings, Other T&Ps as required from time to time. These types activities will be repetitive in natures for no. of times and in cases dismantling, reinstallation of items/parts has also to be done till handing over of unit to customer. During case of dismantling /reinstallation logistic supports like Tyre mounted crane/Crawler Crane/crane/truck/trailers as applicable including manpower are to be arranged by vendor. These types of activity is treated as vendor's normal scope of work without any extra commercial implication on BHEL.

10.89 Sky Climber

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

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

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Chapter-XI PROGRESS OF WORK

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

- 11.1 Refer forms F -14 to F-18 of volume I D (Forms & Procedure) of volume - I BCD. Plan and review will be done as per the formats.
- 11.2 The progress reports shall indicate the progress achieved against plan, indicating reasons for delays, if any. The report shall also give remedial actions which the contractor intends to make good the slippage or lost time so that further works can proceed as per the original plan the slippages do not accumulate and affect the overall programme.
- 11.3 It is the responsibility of the contractor to provide all relevant information on a regular basis regarding progress of work, labour availability, equipment deployment, testing, etc.
- 11.4 Contractor is required to draw mutually agreed monthly work programs in consultation with BHEL well in advance. Contractor shall ensure achievement of agreed program and shall also timely arrange additional resources considered necessary at no extra cost to BHEL.
- 11.5 Progress review meetings will be held at site during which actual progress during the week vis-a-vis scheduled program shall be discussed for actions to be taken for achieving targets. Contractor shall also present the program for subsequent week. The contractor shall constantly update / revise his work program to meet the overall requirement. All quality problems shall also be discussed during above review meetings. Necessary preventive and corrective action shall be discussed and decided upon in such review meetings and shall be implemented by the contractor in time bound manner so as to eliminate the cause of nonconformities.
- 11.6 The contractor shall submit daily, weekly and monthly progress reports, manpower reports, materials reports, consumables (gases / electrodes) report, cranes availability report and other reports as per Performa considered necessary by the Engineer. The periodicity of the reports will be decided by BHEL Engineer at site.
- 11.7 The contractor shall submit weekly / fortnightly / monthly statement report regarding consumption of all consumables for cost analysis purposes.
- 11.8 The contractor shall submit a report of any damage, shortage, discrepancy etc., every week detailing in this regard.
- 11.9 The manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.
- 11.10 The monthly report as a booklet shall be submitted at the end of every month and shall contain the following details :-
 - a) Progress photographs in colour.
 - b) Erection progress in terms of tonnage, welding joints, radiography, stress relieving, etc., completed as relevant to the respective work areas against planned.
 - c) Site Organization chart of engineers & supervisors as on the last day of the month with further mobilization plan.

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- d) Category- wise man hours engaged during the previous month under the categories of fitters, welders, riggers, khalasis, grinder-men, gas cutters, electricians, crane operators and helpers. Data shall be split up under the work areas like Boiler (pressure parts, structures), Auxiliary boiler, Rotating machines, Electro static precipitator, Bunker structure etc.
- e) Consumables report giving consumption of all types of gases and electrodes during the previous month.
- f) Availability report of cranes.
- g) Safety implementation report in the format.
- h) Pending material and any other inputs required from BHEL for activities planned during the subsequent month.

11.11 The under mentioned Records/ Log-books/ Registers applicable to be maintained.

- I. Hindrance Register.
- II. Site Order Book.
- III. Test Check of measurements.
- IV. Records of Test reports of Field tests.
- V. Records of manufacture's test certificates.
- VI. Records of disposal of scraps generated during and after the work completion.

11.12 Site Data Digitalisation: Daily Activity Log, M-Book and Subcontracting Billing Module: -

1. Refer Vendor Portal System with links: for ref. <https://pshq.bhel.in/sddvp/>
2. Login ID and Password shall be provided by respective package manager.
3. Contractor by clicking 'Daily Work Photos', shall upload area wise photos on daily basis.
4. Contractor by clicking 'Daily Activity Log', shall update site activities on daily basis.
5. Contractor by clicking 'Measurement Book', shall enter Measurement Book in Format and BOQ.
6. Contractor shall raise their RA Bills along with supporting documents (such as Quality and HR Document – Vetted by Customer Etc.) and checklist through SDD portal only.
7. Contractor shall comply the system requirement.
8. Refer Vendor Manual for further details.

Note: The contractor shall be required to provide all facilities including manpower for the aforementioned activities, without any cost implications to the BHEL.

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

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Chapter-XII FOUNDATIONS & GROUTINGS

12 PREPARATION OF FOUNDATIONS, AND GROUTING OF EQUIPMENT OF BOILER , SCR & AUXILIARIES

- 12.1 Building foundations and other necessary civil works for supporting structures, equipments etc will be provided by BHEL / Customer. The checking of dimensional accuracy, axes, elevation, levels etc, with reference to bench marks of foundations and anchor bolt pits have to be checked and logged by the Contractor. The permanent benchmark / reference marks will have to be transferred to new locations with sufficient care to maintain the accuracy and protected / preserved with adequate care (to enable rechecking at later dates) as per BHEL instruction.
- 12.2 Minor adjustment of foundation level, dressing and chipping of foundation surfaces and blue-matching (wherever required) for of all equipments as per BHEL Engineers instructions, should be done by the Contractor as part of the work. Contractor/BHEL shall prepare protocols before taking over the foundations. Dressing and chipping of foundations up-to **30 mm** for achieving proper levels will be within the scope of work/specification.
- 12.3 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-enforcement bars, grits cements etc for such temporary foundations shall have to be arranged by the Contractor within the quoted rates. All such foundations shall be demolished and normal ground conditions restored after the usage.
- 12.4 It shall be contractor's responsibility to check the various equipment foundations for their correctness with respect to level, orientation, dimensions etc., and ascertained dimensions shall be measured and submitted to BHEL for approval before erection. Foundation pockets are to be cleaned thoroughly before placing the supports / columns / equipments. Verticality of foundation bolts to be checked along with correctness of the threads and freeness of the nuts movement. If required cleaning of the threads to be done with proper dies.
- 12.5 The concrete foundation, surfaces shall be properly prepared by chipping, as required to bring the top of such foundation to the required level to provide the necessary roughness for bondage and to ensure enough bearing strength. All laitance and surface film shall be removed and cleaned and the packers placed with suitable mortar prior to erection of the equipment. Packer plates should not only be blue matched with foundation but also inter-packer contact surfaces between the packers and foundation frame etc., shall also be blue matched by Prussian Blue match checks and required percentage contact shall be achieved by chipping and scrapping as per BHEL Engineer's instructions.
- 12.6 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-enforcement bars, grits cements etc for such temporary foundations shall have to be arranged by the

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Chapter-XII FOUNDATIONS & GROUTINGS

- Contractor within the quoted rates. All such foundations shall be demolished and normal ground conditions restored after the usage.
- 12.7 The surface of foundations shall be dressed to bring the surface of the foundations to the required level and smoothness prior to placement of equipments / equipments based on the foundations including shear lug provisions / openings.
- 12.8 Neutralisation pit for EDTA cleaning is made by the Boiler U#1 agency and same shall be used for Boiler#3 also. After completion of job pit has to be dismantled and area is to be leveled before handing over of area to owner . Pit Size shall be approx. 30x30x1.5m. (Dismantling of EDTA pit is in the U#3 boiler erection agency scope).
- 12.9 Effluent has to be disposed off safely from neutralizing pit to a safe area as per instruction of BHEL Engineer.
- 12.10 Contractor shall carry out scrapping and blue matching of embedded plates/ packers of rotating equipments. Chipping and the leveling of concrete surfaces, fine dressing up to the extent required to obtain contact between packer and concrete, is also covered in the scope of this work. Scrapping, chipping and matching shall be done so as to achieve prescribed percentage of contact between the two surfaces.
- 12.11 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.
- 12.12 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.
- 12.13 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.
- 12.14 The concrete foundation, surfaces shall be properly prepared by chipping, as required to bring the top of such foundation to the required level to provide the necessary

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- roughness for bondage and to ensure enough bearing strength. All laitance and surface film shall be removed and cleaned and the packers placed with suitable mortar prior to erection of the equipment. Packer plates should not only be blue matched with foundation but also inter-packer contact surfaces between the packers and foundation frame etc., shall also be blue matched by Prussian Blue match checks and required percentage contact shall be achieved by chipping and scrapping as per BHEL Engineer's instructions.
- 12.15 Total grouting of the columns / equipments including pocket grouting, grouting at the gap between foundation and base plates top surface of column / equipments is in the scope of the contractor. All the grouting should be carried out by non-shrink cement like conbextra GPI / Conbextra GP II / Shrinkkomp or its equivalent etc. This special nonshrink cement shall be arranged by the contractor at his cost. The quoted rate shall be inclusive of the same.
- 12.16 All equipment bases and structural steel bases and foundations pockets shall be grouted and finished as per these specifications after surface preparation unless otherwise recommended by the equipment manufacturers. The surface preparation includes soda washing of the foundations to remove oil, grease etc. to ensure proper grouting.
- 12.17 The certificates of the grout are to be submitted to BHEL. If necessary test cubes are to be made and tested at site to ensure the quality of the grout as per relevant IS standards. In case grouting with Portland cement is approved, necessary cement, sand etc. to be arranged by the contractor including the fine aggregates.
- 12.18 All the materials required for grouting including special cements as approved by BHEL and other materials like Portland cement, sand chips, gravel etc., are to be arranged by the contractor at his cost. It shall be the responsibility of the contractor to obtain prior approval of BHEL, regarding suppliers, type of grouting cements before procurement of grouting cements.
- 12.19 Certain packer plates and shims over and above the quantity received as part of supplies from manufacturing units of BHEL will have to be cut out from steel plates / sheets at site by the contractor to meet site requirement. However machining of the packers, wherever necessary, will be arranged by BHEL at free of cost.
- 12.20 **PROCEDURE FOR GROUTING:** Contractor has to carry out the grouting as per the work instructions for grouting available at site or the grouting is to be carried out as per the supplier's recommendation / IS standard. Copy of those recommendations is to be submitted to BHEL for records.

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Chapter-XIII MATERIAL HANDLING, TRANSPORTATION AND SITE STORAGE

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

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

- 13.1 Loading at BHEL / Customer stores and storage yard, transport to site, unloading at site / working area of equipment, placement on respective foundation / location, fabrication yard, pre-assembly bay or at working area are in the scope of work. The scope includes taking materials / Equipments from customer stores / storage yard also. Contractors Quoted / Accepted rate shall be inclusive of the same. Required cranes, tractors, trailer or trucks/ slings/ tools and tackles / labour including operators, fuel, lubricants etc. for loading & unloading of materials will be in the scope of contractor.
- 13.2 The 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.
- 13.3 Transportation of all items including ODC items from BHEL Store/Yard to Erection site shall be in the contractors scope. However, in some cases, consignments including ODC may be unloaded near erection site as per space availability and site requirements.
- 13.4 Loading at storage yard and transporting to site, unloading at site / pre assembly area or at working area, is in the scope of work. Required cranes for loading & unloading of materials, trailer shall be in the scope of contractor. The contractor shall provide any fixtures, concrete blocks & wooden sleepers, sandbags which are required for temporary supporting of the components at site.
- 13.5 The equipments / materials from the storage yard shall be moved in sequence to the actual site of erection / location at the appropriate time as per the direction of BHEL Engineer so as to avoid damage / loss of such equipment at site.
- 13.6 Contractor shall plan and transport equipments, components from storage yard to erection site in such a manner and sequence that material accumulation at site does not lead to congestion at site of work.
- 13.7 The contractor shall satisfy himself of the quality and quantity of the materials at the time of taking delivery from BHEL stores. No claims whatsoever will be entertained by BHEL because of quality or quantity after the materials are taken by the contractor from BHEL stores.
- 13.8 Sometimes it may become necessary for the contractor to handle certain unrequited components in order to take out the required materials. The contractor has to take this contingency also into account. No extra payment is payable for such contingencies.
- 13.9 Contractor shall plan and transport equipments, components from storage yard to erection site in such a manner and sequence that material accumulation at site does not lead to congestion at site of work. However, in specific cases **“as a special case to expedite the job”** the consignment received at BHEL stores can directly be diverted

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- to the work site, as decided by BHEL, following issuance procedure of BHEL. Such direct issues shall be as per the Challan/dispatch document/LR received with the consignment. In such cases, contractor shall do unloading of materials from trucks/lorry at their own cost.
- 13.10 All materials issued by BHEL shall be stacked neatly, preserved, stored in the contractor's shed / work area above ground level by use of concrete or wooden sleepers. No materials shall remain on ground at any time. All concrete or wooden sleepers required for stacking the materials shall be arranged by contractor at his own cost within the quoted rates. In case it is necessary to shift and re-stack the materials kept at work area / site to enable other agencies to carry out their work, same shall be done by the contractor at no extra cost.
- 13.11 All pipe and tube ends shall be covered with plastic caps or will be closed with wooden plugs as the case may be.
- 13.12 The contractor shall take care of material issued by BHEL and shall protect the same from damage and weathering. The contractor shall take necessary measures to see that all the machined surfaces are preserved and covered. Contractor has to arrange required fire proof tarpaulins to protect the machined components / assembled parts drawn from BHEL store before and after erection as required at their cost.
- 13.13 The contractor shall take all such measures as may be reasonably necessary to ensure that its arrangements and those of its sub-contractors with respect to the transport of Goods, Materials and Labour to the site do not interfere with local traffic in the vicinity of the site and where such interference is unavoidable shall make such special arrangements as may be reasonably required to minimize the effect of such interference.
- 13.14 The contractor shall take all such measures as may be reasonably necessary to ensure that its arrangements and those of its sub-contractors with respect to the transport of Goods, Materials and Labour to the site do not interfere with local traffic in the vicinity of the site and where such interference is unavoidable shall make such special arrangements as may be reasonably required to minimize the effect of such interference.
- 13.15 The contractor shall in no case be entitled for any compensation on account of any delay in supply or non-supply thereof for all or any such materials. However in case of non-availability of any specific materials which delays the completion of work, such cases shall be recorded separately in monthly planning format (F 14) and shall be considered for time extension of contract.
- 13.16 The contractor shall solely be responsible for the safety & security of material after it is handed over and issued to contractor by the BHEL. BHEL reserves the right to recover from the contractor any loss arising out of damage/ theft or any other causes or during verification/stacking or at any time under the custody of the contractor.
- 13.17 Contractor shall also carryout in complete association with BHEL, the material management functions and execution like day-to-day update of materials, issued to contractor, accounting for surplus/scrap material returned etc. These functions shall

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also be carried out through computerized system utilizing suitable software. Contractor shall engage experienced software personnel to associate on dedicated basis for efficient discharge of the same in time.

- 13.18 Open land for storage purposes shall be provided by BHEL on free of cost/as available basis. Temporary barbed wire fencing, as required, of the open storage yard is to be done by the contractor and is included under the scope of his work. Contractor shall also remove grass, bushes, trees etc wherever required off the land provided to him and shall make proper continuous up keeping of the open yard /land by removing grass, bushes trees etc and same is included under the scope of his work & No extra payment shall be made to the contractor in this regard. The bidder shall make complete arrangement of necessary security personnel's to safeguard all such materials in his custody. The contractor shall take care of material issued by BHEL and shall protect the same from theft, damage and weathering. In case, loss of any materials for whatsoever reasons attributable to the contractor, then cost of such materials shall be recovered from the running bill payment with applicable overheads.
- 13.19 All surplus materials shall be returned to BHEL store. All wastage / scrap (including melting scrap, wastage, and unusable scrap) shall be returned to the stores on weightment basis in consultation with BHEL Engineer and a receipt obtained for material accounting purposes. Scrap materials shall be sorted section-wise and returned separately at a place directed by BHEL Engineer within the project area. Return of such materials will not be entitled for any handling and incidental charges.

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Chapter-XIV ERECTION

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

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

14.1 Erection

- 14.1.1 The contractor will have to follow the instructions provided in the technical manuals, drawings, and specifications provided by BHEL, to the contractor from time to time. In case of ambiguity or deviation the decision/clarification of BHEL engineer will have to be followed.
- 14.1.2 In case of any class of work for which there is no such specifications as laid down in the contract such as blue matching, welding of stainless steel parts etc., the work shall be carried out in accordance with instructions and requirements of the BHEL engineer at the quoted rates only.
- 14.1.3 The contractor is strictly prohibited in using any of the Boiler components like angles, channels, hand-rails for any temporary supporting or scaffolding work. In case of such misuse, a sum as determined by BHEL shall be recovered from contractor's bills. Also the contractor will be responsible for the safe custody and proper accounting of all materials in connection with the work. If the contractor has drawn materials in excess of design requirements, recoveries will be effected for such excess drawls at the rate prescribed by manufacturing units.
- 14.1.4 Any fixtures, scaffolding materials, approach ladders, concrete block supports, steel structures required for temporary supporting, pre assembly, checking, welding, lifting & handling during pre-assembly and erection shall be arranged by the contractor at his cost.
- 14.1.5 The temporary structures/ items welded to permanent members/pipes are to be cut and removed without any damage. Any damage so to permanent members/ pipes to be made good by the contractor at his cost.
- 14.1.6 In the case of structural members / ducts in certain cases, the raw material will be supplied in random lengths and the contractor will have to make up the length / prepare the edges to suit the matching profiles, weld / bolt connect the joints at no extra cost.
- 14.1.7 Fine fittings and other small bore piping have to be routed according to site conditions and hence shall be done only in position as per the site requirement. Necessary sketch for routing these lines should be got approved from BHEL by the contractor. There is a possibility of slight change in routing the above pipelines when after completion, to suit the site conditions. The contractor should absorb this cost in his quoted rate.
- 14.1.8 All welded joints should be painted with anti-corrosive paint, once NDE works are over.
- 14.1.9 All welded joints shall be subjected to acceptance by BHEL Engineer.

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- 14.1.10 Work such as minor rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin, etc. are covered in the scope of work.
- 14.1.11 All piping items including pipes, valves, flanges, fittings etc. shall be supplied as commercially available. Hence Fit-ups, edge preparation including welding of stubs, shall be included in the contractor's scope. No separate payment will be made for the edge preparation of pipes, Standard fittings such as bends, Tees etc
- 14.1.12 Pipes above 2" diameter have to be cleaned by means of wire brush as per the instruction of BHEL Engineer and subsequently flushed with air before lifting them into position. For pipes below 2" diameter, shall be sponge cleaned with air flushing. After cleaning is over, the end caps shall be put back in tube openings till such time they are welded to other tubes. Required compressors shall be arranged by the contractor at his cost.
- 14.1.13 In case of piping connected to equipment, matching of flanges for achieving the parallelism and alignment at equipment end by suitably resorting to heat correction or other method as instructed by BHEL Engineer is within scope of work.
- 14.1.14 Wherever elbows of 45 deg. or any other angle are required, the same shall be cut from 90 deg. elbow supplied and used as per BHEL engineer nstruction. No extra cost shall be paid.
- 14.1.15 Erection of flow switches, filters, flow meters, other metering elements, flow orifices, flow indicators, control valves supplied either by BHEL or customer forming part of the system is in the scope of work. This will include collecting from BHEL/Customer stores, transportation to site, suitably cutting the erected piping, cleaning, erection, welding, radiography and stress relieving and commissioning.
- 14.1.16 Contractor shall also weld small length of piping with root valve to the pressure, flow and level tapping points on piping or flow nozzles/orifices/ metering elements fixed on piping as per the instructions of BHEL Engineer.
- 14.1.17 Welding of all thermo wells, draft, pressure and temperature instrumentation points and all other instrumentation points on piping and auxiliaries and welding of thermocouple pads for permanent system as well as for performance guarantee test is in the scope of work.
- 14.1.18 Plate / Pipe shoes for piping supports shall be fabricated at site by the contractor at no extra cost. Other supports namely Hangers, U-clamps etc., shall be supplied by BHEL duly bent and threaded. Assembly and necessary cutting work etc., shall be carried out at site by contractor within the quoted rate.
- 14.1.19 Wherever hanger and support materials are not received from manufacturing unit in time to suit the erection schedule, contractor shall erect the system on temporary supports to ensure the progress of work. The required structural

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steel materials will be issued on free of charges by BHEL, either from scrap/spare materials. The same shall be removed and returned to BHEL store after erection of permanent supports.

- 14.1.20 Contractor has to carryout fabrication works such as welding of stubs / nipples, attachments etc., preparation of surface for rust preventive coating and application of rust preventive is within the quoted / accepted rate.
- 14.1.21 All the equipments /material to be taken inside the plant building shall be cleaned thoroughly before taking them inside. The contractor shall clean, wherever necessary and paint inside surfaces of the equipments like coolers, oil tanks, Rubber expansion joints and other components as per instruction of BHEL Engineer during erection within the quoted rate.
- 14.1.22 Contractor shall cut / open works if needed, as per BHEL Engineer's instructions during commissioning for inspection, checking and make good the works after inspection is over. This contingency shall be included within the quoted value. During commissioning, opening of valves, changing of gaskets, attending to leakages, minor modification, and rectification works may arise. The contractor has to carry out these works at his cost by providing required manpower with T & Ps in all the three shifts. In case any rework is required because of contractor's faulty erection and which is noticed during commissioning, the same has to be rectified by the contractor at his cost.
- 14.1.23 Contractor shall engage separate gangs throughout the contract period, exclusively for proper housekeeping of the site. The contractor has to make necessary arrangements for collection and for bringing down the scrap from all locations and taking them away from the erection areas to various locations as indicated by BHEL Engineer. The house keeping must be a routine and continuous activity.
- 14.1.24 The contractor shall take all reasonable care to protect the materials and equipment during erection. Touch up painting required to be done on any equipment or part during the course of erection will have to be done by the contractor.
- 14.1.25 Prior to erection of any components inspection to be done for any foreign materials and damages and they are to be removed / attended as per BHEL engineer.
- 14.1.26 Field Quality Assurance Formats:-It is the responsibility of the contractor to collect and fill up the relevant FQA log sheets of BHEL and present the same to BHEL after carrying out the necessary checks as per the log sheets and obtaining the signature of BHEL and customer as token of their acceptance. Payment to the contractor will be linked with the submission of these FQA log sheets.
- 14.1.27 All test require as per FQP (Field Quality Plan) will be in bidders scope. FQP shall be provided during execution time.

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14.2 ERECTION OF BOILER & ITS AUXILIARIES AND ROTATING MACHINES

- 14.2.1 Brief list of System / sub-system to be erected by the contractor & approximate weight of individual PGMA's and number of welding joints mentioned in this Tender Specification are meant for giving general idea to the tenderer only about magnitude of the work involved. This should not be taken for billing or any other claims. All weights for such purposes will have to be taken from design documents only (shipping list). This section also gives general idea about various components to be erected with expected accuracy level. However the contractor shall get the correct details from the engineer to avoid mistakes and rework.
- 14.2.2 Preparation of preassembly bed is very much essential for preassembly of MBLs, columns, ceiling girders, panels, coils etc. on consolidated ground and to avoid sagging and shrinking the temporary supports are to be provided. The preassembled component should have minimum three supports to avoid sagging.
- 14.2.3 The column and girder pieces are to be measured individually to check for camber, sweep etc. The level markings on the columns to be checked before erection. The verticality stickers are to be fixed over individual column pieces on both the flanges (90 degree apart in two places). Arranging these stickers shall be done by the contractor.
- 14.2.4 Tier by tier erection method is to be followed. Columns are to be tied up with horizontal and diagonal bracing in each tier before proceeding to next level. Log sheets are to be maintained in line with log sheets which are available with BHEL. After grouting the first tier columns, second tier erection is to be taken up. Adequate curing of the grout is to be ensured. Verticality of the columns is to be ensured either by plumb bob or theodolite. The tolerance shall be as indicated in BHEL's erection drawings. Care should be taken while erecting the vertical and diagonal bracings to maintain the work points as per drawing. Necessary lubricant for the girder pin assembly should be applied as per drawing within the quoted rates.
- 14.2.5 The following measuring and test equipments with proper calibration certificates are to be made available by the contractor before taking up the structural and other pressure parts erection. Steel tapes minimum 5M,30M in sufficient numbers, torque wrench 650-1000 ft pounds, bolt tension calibrator, torque wrench with calibration, temperature recorder, two theodolite with one second accuracy etc. Periodic calibration of the measuring instruments is to be done once in six months and certificate for the same to be submitted to BHEL for records.
- 14.2.6 Detailed procedure available with BHEL site office should be collected before taking up the job by the contractor for preassembly of ceiling girders. Each ceiling girder will be supplied in maximum 3 pieces and welding & NDT test are to be carried out, including 100% radiography and the required UT for the welded joints in ceiling girders. The heaviest assembled ceiling girder will be around **170 mt** approx. And maximum elevation of ceiling girder is 104 m and top of silencer is **115m** maximum.

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- 14.2.7 Camber, sweep and twist are to be checked. The tolerances for individual piece camber and sweep, individual length, level of girder assembly, flatness of the web, out of squareness of assembly, overall length of the assembly etc. to be ensured before taking up the job. Major deviation if any observed should be intimated to BHEL for getting the resolution before proceeding further.
- 14.2.8 Suitable crane to be used for handling / lifting the ceiling girder will be provided by BHEL. Leveled area will be provided by BHEL for erection. However, backfilling and consolidation, if required, shall be carried out by the contractor, at no extra cost. Necessary plates/sleepers required for marching and operation shall be provided by the BHEL for BHEL owned/deployed cranes. Positioning of the crane is to be decided in consultation with BHEL.
- 14.2.9 The erection of the welded beams, rolled beams, boiler roof frame assembly etc. to be taken up along with ceiling girders immediately as the crane moves from first girder to the last. The silencers of various safety valves also to be erected in the respective bays. The completion of the roof sheeting should follow to create a comfortable working space in the boiler cavity giving protection to all work men from rains and sun. It is expected that the contractor will complete the same before drum lifting/pressure parts erection. The materials for boiler roofing and side cladding etc. will be supplied by BHEL and contractor has to erect the same at the quoted /accepted tonnage rate.
- 14.2.10 The tightening procedures for HSFG bolts are to be obtained from BHEL at site before taking up the work. Normally it is done by turn of nut method. Torque wrenches also can be used .The bolted joints will be checked jointly by BHEL/Customer engineers for required tightness and retightening is to be done as per requirement. The tightened bolts will be marked with colour paints. Facility for random checking by torque wrench will have to be done. The required calibrated torque wrench will be provided by the contractor.
- 14.2.11 Some platform materials in PG 36 and PG 38, approach ladders, suspension materials etc. will be supplied in running meters. The contractor has to fabricate these materials wherever they are supplied in running meters to the required size / shape, to be welded and erect them within the quoted rates.
- 14.2.12 It shall be the responsibility of the contractor to provide ladders on column for initial works till such time stairways are completed. For this the ladder should not be welded on the column and should be fabricated clamping type ladders. No temporary welding on any structural members is permitted except under special circumstances with the approval of BHEL. The necessary materials for the ladders are to be arranged by bidder within quoted rate. Any ladder supplied by the manufacturing unit for this purpose will be issued to contractor free of cost and the same is to be returned once the platforms are completed.
- 14.2.13 Scrap disposing chutes are to be provided by the contractor within the quoted rate at different areas like along the boiler main column, bunker structure and duct supporting structures. Material for the scrap chute will be provided by BHEL.
- 14.2.14 All normal erection and assembly techniques necessary for completion of works under this specification and magnitude have to be carried out. It is not possible to

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specifically list out all of them. Absence of any specific reference will not absolve the contractor of his responsibility for the particular operation. These would include

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

- 14.2.15 Certain adjustments in length of steel /pipe/tube members may be necessary while erecting high pressure pipelines of boiler and piping (pre-fabricated lines) and the contractor should remove the extra lengths to suit the final layout after preparing edges afresh and adopting specified heat treatment procedures at no extra cost, wherever indicated. Depending upon the type of deviation BHEL will consider the reimbursement at man hour rates.- If the drawing provides for erection allowance, then it becomes part of the work and no compensation is payable. The prepared edges in pressure parts shall be applied with weldable primer as preservation and supply of the primer is in contractor scope.
- 14.2.16 Ducts / expansion pieces are dispatched to site in loose walls / plates and these are to be assembled at site before erection.(Walls with stiffeners in welded condition will be provided).
- 14.2.17 All the dampers, valves, lifting equipments, power cylinders, etc., shall be serviced and lubricated to the satisfaction of BHEL engineer before erecting the same and also during pre-commissioning. The bearings of dampers shall be properly cleaned, serviced and lubricated before commissioning at no extra cost. Even after commissioning, if there are problems in the operation they have to be attended by the contractor during the tenure of the contract.
- 14.2.18 In case of any class of work for which there is no such specifications as laid down in the contract such as blue matching, welding of stainless steel parts etc., the work shall be carried out in accordance with instructions and requirements of the BHEL engineer at the quoted rates only.
- 14.2.19 Spring suspensions / constant load hangers have to be pre-assembled and adjusted for the required loading and erected as per instructions, of BHEL Engineer. Any adjustments, removal of temporary arrestors / lockers, etc., have to be carried out as and when required at no extra cost to BHEL.
- 14.2.20 No temporary supports shall be welded on the pressure parts of piping. Welding of temporary supports, cleats, etc. on the boiler columns shall be avoided. In case of absolute necessity contractor shall take prior approval from BHEL Engineer. Further, any cutting or alternation of member of the structure of platform or other equipment shall not be done without specific prior approval of BHEL Engineer.
- 14.2.21 The contractor shall fabricate piping, install lube oil systems and carry out the acid cleaning of fabricated piping. The contractor shall also service the lube oil system,

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- carry out the hydraulic test of oil coolers. etc.
- 14.2.22 All hangers, supports and anchors (including concreting or welding) shall be installed as per drawing to obtain a reliable and complete pipe installation as per instructions of BHEL Engineer. Normally supports are issued in running meters. Any additional supports as called for by BHEL Engineer shall be fabricated by the contractor and provided at no extra cost. However, the raw material required for fabrication of such supports shall be supplied by BHEL free of cost. (Any machining or threading is involved will only be done by BHEL).
- 14.2.23 Normally the high pressure valves will have prepared edges for welding. But if it becomes necessary the contractor shall prepare new edges or recondition the edges by grinding or chamfering to match the corresponding tubes and pipes. All fittings like "T" pieces, weld neck flanges, reducers etc., shall be suitably matched with pipes for welding. Edge preparation becomes the part of erection work. No extra payment shall be made for this.
- 14.2.24 All valves will have to be checked, cleaned, lapped or overhauled in full or in part before erection, after chemical cleaning and during commissioning as may be necessary. After the chemical cleaning has been successfully completed, removing all temporary piping, fittings of tanks etc. checking all the valves for any accumulation of foreign materials, welding the valves, pipes which were cut and cleaning, over hauling, re-fixing as per BHEL Engineer's instructions is within the scope of work/specification. The contractor, at his own cost, shall arrange experienced technicians for the above work, including required consumables.
- 14.2.25 Adjustments like removal of ovalities in pipes and opening or closing the fabricated bends of all piping including high pressure piping to suit the layout shall be considered part of work and the contractor is required to carry out such work free of cost, as per instructions of BHEL, which shall include specific heat treatment procedures etc.,
- 14.2.26 Pipes are sent in standard length and will be cut to suit the site conditions and the layouts. Tubes or pipes wherever deemed to be convenient will be sent in running lengths with sufficient bends. Bends up to NB 65 mm will have to be fabricated at site adopting specified heat treatment procedures, wherever required at no extra cost. 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 as per instruction of BHEL Engineer.
- 14.2.27 **The enclosed welding schedule for Boiler & PCP in "Chapter-XXI Welding Schedule" is tentative and for reference only. The applicable welding schedules will be issued during erection of work at site.**
- 14.2.28 Attachment, welding of necessary instrumentation tapping points, thermocouple pads, root valves, condensing vessels, flow nozzles and control valves etc., both for regular measurements and performance testing to be provided on boiler / its auxiliaries or pipelines covered within scope of this tender, will also be the responsibility of the contractor and the same will be done as per the instructions of BHEL Engineer. The erection and welding of all above items will

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be contractor's responsibility even if, (a) Product group (PG) under which these items are released are not covered in the scope of this tender, (b) Items are supplied by an agency other than BHEL if they are integral to the scope envisaged under this package. Payment will be regulated as per the agreed terms and conditions.

- 14.2.29 The contractor shall fabricate piping, install lub oil systems and carry out the acid cleaning of fabricated piping. The contractor shall also service the lub oil system, carry out the pressure test of oil coolers etc.,
- 14.2.30 All the tubes and pipes shall be cleaned and blown with compressed air and shown to the Engineer before lifting. Sponge ball test shall be carried out for all tubes before erecting the same. Bigger size pipes should be cleaned with flexible wire brush, wherever necessary. After cleaning is over, the end caps shall be put back in tube openings till such time they are welded to other tubes. Required compressors shall be arranged by the contractor at his cost.
- 14.2.31 All attachment welding including those for insulation and refractory work coming on the pressure parts shall have to be done by the contractor. The hooks are suitable for stud welding machines. Contractor's quoted rate shall include all these contingencies. Attachment welding on pressure parts shall be done by qualified and certified welders only. Welding of Insulation hooks at site shall be welded on the fins by manual welding / stud welding machines.
- 14.2.32 It is the responsibility of the contractor to do the alignment, checking, etc., if necessary, repeatedly to satisfy BHEL Engineer / customer Engineers with all the necessary tools and tackles manpower, etc., without any extra cost. The alignment will be complete only when jointly certified so, by the BHEL Engineer & customer. Also the contractor should ensure that the alignment is not disturbed afterwards.
- 14.2.33 Burner tilt mechanism will be checked for freeness, serviced and adjusted, if necessary to obtain optimum tilt before and after installation.
- 14.2.34 Fine fittings, boiler trim piping, oil system and other small bore piping have to be routed according to site conditions and hence shall be done only in position. As such, layout of small bore piping in boiler and oil system shall be done as per the site requirement. Necessary sketch for routing these lines should be got approved from BHEL by the contractor. There is a possibility of slight change in routing the above pipelines when after completion, to suit the site conditions. The contractor should absorb this cost in his quoted rate.
- 14.2.35 Additional platforms for approaching different equipments as per the site requirement, which may not be indicated in drawings, shall be assembled and erected by contractor. However, the contractor shall be paid for this work on accepted tonnage rate for erection of structures (Rate schedule identifier - 1A). The steel materials required for these works shall be supplied by BHEL free of cost and the contractor will have to install them to suit the requirement. Works of major nature not covered under this clause.
- 14.2.36 Complete penetration of water wall (Panel to panel) tube to tube and fins welding shall be achieved either by single side or double side welding. The decision of BHEL Engineer is final.

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NOTE: The water wall/spiral wall panels will be supplied with fin cut to a length of 300 mm on ends for alignment and welding of tube to tube of panels at site.

The bidder may require to cut fins further to a maximum length of 1000 mm for alignment and welding of tube to tube in water wall/spiral wall panels and welding of fins on both sides after completion of panel to panel welding within the quoted rate. No extra payment will be made for the above works.

- 14.2.37 Work such as minor rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin, etc. are covered in the scope of work.
- 14.2.38 Certain extra lengths of various tubes/pipes and fabricated ducts are provided as erection allowance and the same have to be cut/adjusted to suit the site conditions and layouts or certain small lengths may have to be added for adjustments to suit the site conditions. For any mismatch while matching the joints in tubes, the cutting, adjusting, re welding, addition spool pieces should be done by the contractor to match site conditions without any extra payment.
- 14.2.39 Assistance for calibrating / testing the power cylinders / valves, gauges, instruments, etc. and setting to actuators coming under various groups shall be provided by contractor within the quoted rates.
- 14.2.40 Hanger rods are shown in the pressure parts arrangement drawing for boiler. Any cutting / welding and required heat treatment and necessary NDT of such hanger rods will be done by the contractor. The hangers for pressure parts will be tested for even distribution of load with the help of torque wrench.
- 14.2.41 Skin casing sheet for covering the boiler roof panels, and other areas will be supplied as fabricated items. Any cutting and re-fabrication to suit the site conditions shall be carried out within the quoted rates.
- 14.2.42 For all the site routed piping as built drawings are to be submitted by the contractor immediately after erection. The Number of site welds indicated for site routed piping under the heading "Quantum of HP joints" is approximate. It is to be noted that piping for fine fittings, trim piping, oil system (PG 42) soot blower system shall be supplied mostly in running meters which will be erected and all joints are to be welded as per the drawings/site routing within the quoted rates by the bidder.
- 14.2.43 Hydraulic test of SCAPH has to be carried out on the ground before lifting it to the position.
- 14.2.44 Seal boxes should be reinforced with insulation pins as per drawing releases in attachment drawings and after that all seal boxes to be painted with bituminous paint of IS158 by the bidder. The required paint shall be supplied by the bidder within the quoted rate.
- 14.2.45 Grab Bars for accessing into the furnace area shall be provided in each seal box as per drawings.
- 14.2.46 **Heavy component lifting:** Before lifting the heavy components like header,

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

1. While Lifting the headers lifting lugs or shell portion of the headers only to be used. The temporary supports to be removed prior to hydraulic test. While erecting the temporary supports, care should be taken so that they do not affect the erection of permanent supports. Tack welding of suspension rods with bearing plates to be done after final adjustment. Details for welding of bearing plates can be referred in the drawings/check list.
2. Precautions to be used while erecting the collector channel supports. Equal loading of the hangers is to be ensured. Ring headers are erected before erection of water wall bottom hopper panels. Headers are to be arrested before welding to panels/headers/tubes/coils as the case may be. Sequence of welding to be followed while welding higher size joints.
3. Each water wall tube is provided with an orifice assembly in the bottom ring header. Orifice adopter is welded inside the header and welded at shop. After chemical cleaning operations, the orifice assemblies are to be erected at site as per directive of engineer and drawings.
4. Erection of various components is taken up from top to bottom. Planning has to be done every month in consultation with the engineer. Pre assembly of seal boxes for the peep hole openings, pressure tapping, soot blowers etc. can be done on the ground before erection, if feasible. The burner blocks are to be erected in convenient position before closing the furnace with panels. For panel to panel erection and welding panels erection attachments are supplied by units. Furnace alignment with respect to boiler /furnace axis is very vital and important. The alignment is to be achieved. Details to be checked with engineer.
5. The gaps between coils and steam cooled / WW panels /between coils etc. to be maintained in line with drawing. Please check up the permissible tolerance before taking up the work.
6. Preassembly of end bars with crown plates including stress relieving for coil assemblies.
7. Pump case / volute is welded with suction manifold in line with procedures available with site office.
8. The required accuracy level to be ensured before welding as per drawing. Necessary radiography/NDT along with heat treatment to be done.
9. CC pump motor installation is taken up only after completion of system pipe work supports. When mounted the pump should accommodate movement in the pipe without imposing excessive loads on the casing and branches. Sufficient clearance should be available beneath the motor to facilitate removal during maintenance. It is to be assembled as per the directions available with engineer.

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10. Ensure completion of the maintenance hoists meant for CC pumps immediately else the area may be used by other agencies for laying the cables for various equipments coming in that area, inadvertently and they have to be removed later. Heat exchanger installation is also to be completed and necessary cooling water lines, thermocouples, pressure gauges etc. to be completed. The power cable connection made to the pumps should ensure free down ward expansion of the boiler at the level.
11. Down comer pipes erection can be done by carrying out preassembling the pipes whatever feasible as per availability. The suction manifold received in loose pieces and to be pre-assembled in the floor nearby. After welding the suction manifold, it is to be positioned, aligned and then only the down comers from the steam separator/ drum are to be connected. Erection of suction spool pieces, and hand operated valves for the system to be erected. The CC pump volute without impeller is fitted to the bottom of the suction spool. Bottom flange of the volute is carefully levelled and aligned before welding the suction spool. After completion of welding in all respects cutting and trimming of erection attachment to be done. CC pumps volute is to be blanked for carrying out hydro test. After hydro test, the blanks are removed and pump erection taken up. The tightening of the bolts to be done with torque wrench as per the instructions of the supplier.
12. Before taking up the erection of coils, pre erection checks to be carried out like width and length of the coil, availability of flexible connectors, damages on the coils, permanent bows if any, sponge test for the coil and completion of ground inspection by inspector of boilers as deemed. Ensure the removal of the transportation supports in each coils prior to erection.
13. Erection of LTRH/ Economizer coils as applicable can be done by preassembling the upper and lower coils. Pre erection checks like width, length etc., and sponge test of coils for thoroughness to be done before erection. Required hanger tubes erection to be completed before LTRH / Economizer coils erection. **The preassembly of cassette baffles of LTRH and Eco coils can be carried out before their erection.**
14. Check for the gaps between SH steam cooled front wall and Eco/SH horizontal assemblies, gap between SH steam cooled rear wall and SH horizontal assemblies/ eco assemblies, spacing between rear WW arch and pendant assemblies and finish SH coils. Detailed drawings are to be referred during execution. The items indicated are suggestive only.
15. Check for the inner space between eco coils, LTRH, RH and SH coils as per drawing
16. Ensure proper completion of steam cooled spacers. Check for clearances for soot blower lance tubes.
Ensure that soot blower lance tube in 0 dead travel position unless until charged. Radiant roof skin casing sheets are to be welded after application of castable refractory.

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17. Before erecting the valves and other mountings, check for the tag for correct rating with valve schedule. Ensure correct flow direction. Ensure easy accessibility for operation and maintenance of valves.
18. While erecting the safety valves, check for the set pressure and type. The lever arrangement, blow down ring approach for floating should be ensured. Drip pan drains with proper slope to be given to safe location. Check the exhaust pipe arrangement for expansion and proper guides to be given. Ensure anchor points for the above pipes.
19. Ensure removal of drains plugs provided in the silencers, the gap between exhaust pipe and roof is sealed properly.
20. DWLGs to be erected as per drawing. Joint protocol to be made for its correct erection with supports.
21. Other tapping points meant for monitoring the level should be erected and protocol is to be made. Maximum use of the pads and lugs welded on the steam separator/drum to be used for giving supports.
22. Sample coolers are to be erected preferably in clean area. All the lines should be air blown before termination on both ends. Sockets are to be used for sampling lines. **Tig welding must be used for sampling lines instead of arc welding.**
23. All the drain lines should have sufficient slope towards drain. Provide expansion loops in all the vents and drains as per the drawings. Electromatic relief valve controller is supported separately in column so that the vibration from boiler is not transmitted. Provide pre compression springs where required to take care of the load. All the motor operated valve stems should be vertical preferably. All the valve packing with asbestos base to be lubricated once in 6 months till handing over. Necessary gland packing will be supplied by BHEL.
24. Prior to erection of any pressure part like headers, pipes, tubes, panels etc. inspection to be done for any foreign materials and damages and they are to be removed/ attended as per BHEL engineer.
25. Transport binders on all coils are to be removed.
26. Gas distribution baffles and vibration snubbers, mechanical spacer bars etc. are to be erected as per drawings.
27. Buck stays are preassembled and raised to their respective elevations and hung prior to erection of furnace walls. Before fixing them to furnace walls, ensure completion of panel to panel welding and voids in the buck stay region. The necessary scalloped bars/plates/pads are to be welded after leveling. Ensure completion of vertical buck stays including support hangers, links. The erection of leveler channels with guides to be completed.
28. All the furnace guides to be erected as per drawing keeping gap of about 3 mm for free boiler expansion.
29. The necessary connection to the wind box is to be completed in all respects as per drawing. If any drain holes are envisaged, the same to be provided. No pipe line supports should be taken from the buck stays without getting the approval from engineer.

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30. Sagging of roof tubes results in condensate stagnation during shut down. Hence ensure that radiant roof and back pass roof tubes are erected without sagging.
31. Total boiler is to be examined in all levels for free expansion. All the arrestors are to be removed. Expansion indicators are to be erected in various levels as per drawing / instruction of engineer.
32. Some of the few important locations for voids filling:-
 - Around penetration for pendent surfaces and radiant roof/SH screen tubes/second pass roof tubes
 - Between loose front ww tubes above front upper panels and below radiant roof
 - Gap between radiant roof tubes at the junction of front wall
 - Extreme rear arch tubes and side ww/extended ww panels
 - Extreme SH screen tubes and SH extended steam cooled walls
 - Gaps between tubes /nipples in the steam cooled rear, side and front wall and respective headers
 - Extreme tubes of front and side ww lower panels
 - Side ww/extended side ww and extreme tubes of radiant roof
 - Extended side steam cooled wall and extreme tubes of SH screen tubes
 - Steam cooled side wall and extreme tubes of second pass roof
 - Between tubes in upper corner tubes
 - Between tubes in lower transition tubes
 - Gap between tubes/nipples of side ww lower header at the ash hopper throat region
 - Voids due to lifting slots in fusion/fin welded panels
 - Voids due to erection slots in fusion/fin welded panels
 - Fusion/fin welded panel fin slits at the panel tube-tube butt joint locations
 - **The above list is suggestive only. Voids are to be closed suitably to retain refractory in position and to achieve the gas tightness**

14.2.47 Erection of Boiler structures and points to be taken care of for achieving verticality of Boiler columns.

- a. The column pieces are pre-assembled and site match marks to be provided.
- b. Pre assembly checks to detect and deviations in the columns like length, camber sweep, twist etc.
- c. Checking of foundations for its levels distance, diagonal, distance etc.
- d. Proper tightening of the foundation bolts.

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- e. Erection of columns tier by tier and box by box. Grouting to be done immediately after 1st tier erection.
 - f. Ensuring the availability of guy ropes, etc. during column erection and removal of guy ropes after ensuring the verticality of columns.
 - g. Using calibrated theodolite for verticality measurement of columns.
 - h. Tightening of HSFG bolts to be done by turn of nut method only after ensuring the verticality of the columns.
 - i. Measuring adjacent diagonals of the ceiling girders after its erection.
 - j. Ensuring the verticality of the columns before and after the steam separator erection.
- 14.2.48 All Rotating machineries and equipment shall be cleaned, lubricated, checked for their smooth rotation, if necessary dismantling and refitting before erection. If in the opinion of BHEL Engineer, the equipment is to be checked for clearance, tolerance at any stage of work or during commissioning period, all such works are to be carried out by contractor at his cost.
- 14.2.49 The fans shall be checked for blade clearance and other vital tolerances. The Flow control devices in fans like IGV/Damper units shall be serviced. Necessary assistance for balancing of equipment during trial run shall be provided by the contractor.
- 14.2.50 Vital clearance of mill should be checked at site and adjusted if required.
- 14.2.51 The HT motor bearings shall be blue matched at site and checked for bearing clearance. Scrapping of bearing housing, if required shall be carried out by the contractor. No extra claim for blue matching of any two surfaces will be entertained. The HT motors will be checked for air gap and adjustment of stator / rotor to magnetic center shall be carried out as part of erection.
- 14.2.52 D.S.L / equivalent system for hoisting equipments are also to be erected and commissioned including load testing by the contractor within the quoted rates. Required manpower including electricians is to be arranged by the contractor for carrying out commissioning of electrical hoist and load testing of the above electrical hoist. Required loads will be provided by BHEL free of cost.
- 14.2.53 The contractor shall take all reasonable care to protect the materials and equipment during erection. Touch up painting required to be done on any equipment or part during the course of erection will have to be done by the contractor.
- 14.2.54 All Rotating machineries and equipment shall be cleaned, lubricated, checked for their smooth rotation, if necessary dismantling and refitting before erection. If in the opinion of BHEL Engineer, the equipment is to be checked for clearance, tolerance at any stage of work or during commissioning period, all such works are to be carried out by contractor at his cost.
- 14.2.55 All the shafts of rotating equipment shall have to be properly aligned to those of matching equipment to perfection, accuracy as required and the equipment shall be free from excessive vibration so as to avoid overheating of bearings or other conditions which may tend to shorten the life of the equipment.

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- 14.2.56 All the bearings, gearboxes etc., of the equipment / actuators and electrical motors to be erected are provided with protective greases only. Contractor shall arrange as and when required by the engineer for cleaning the bearing / gear boxes etc., with kerosene or some other agent if necessary by dismantling some of the parts of the equipment during erection and shall arrange for regreasing / lubricating them with recommended lubricants and assembling back. Lubricants will however be supplied by BHEL at free of cost.
- 14.2.57 The actuators / motors of valves may be supplied in loose parts, contractor shall have to match / assemble and align at site as per instructions BHEL Engineer including placement on foundation.

14.3 MILL BUNKER STRUCTURE, COAL BUNKER, TRANSFER POINTS, GALLERIES, SILOS ETC.

- 14.3.1 Erection, alignment, welding, bolting, grouting and painting as applicable for fabricated structures (supplied from BHEL units) related to Mill bunker structures, Coal bunkers, Transfer points, Trestles, Conveyor galleries etc. as per BOQ quantity.
- 14.3.2 Supply and installation of items as per BOQ for Bunker structural works in Mill Bunker structures, Transfer points, Trestles, Galleries etc.
- 14.3.3 Where ever the design & supply together is covered in the scope of bidder necessary approvals from BHEL / PVUNL shall be taken by bidder for the design, inspection procedure & vendor. List of items for which such approvals required will be frozen during execution of the contract.
- 14.3.4 Contractor shall procure and supply the items to PVUNL Patratu project site as per the BOQ for structural works from BHEL / PVUNL approved vendors, meeting the specification (enclosed), Drawings and instructions of the Engineer.
- 14.3.5 The structures of Bunker, Fuel bunker, Junction tower and Trestles & galleries are supplied in respective PGs as mentioned in elsewhere in this Tender.
- 14.3.6 Total no. of bunker per Boiler is Nine. The bunkers will be supplied in segments. Contractor has to carry out longitudinal welds for joining segments in staggered arrangement and circumferential weld for forming the shell & Hopper. The ring stiffeners will be welded with the shell and will have a site joint at the shell joint location.
- 14.3.7 SS liners will be fixed in the shells and for site joint location it will be supplied as loose, which has to be fixed by the contractor by welding.
Minimum 4.0 mm thick stainless steel liner of grade SS:304(as manufactured by SAIL Finish Grade 2B (Cold rolled, Annealed & Pickled and Skin passed)) on M.S. plate for inside surfaces of bunkers including fixing with stainless steel studs, bolting (including countersunk), welding with electrode classification E308L for welding of stainless steel to stainless steel and E309 for stainless steel to mild steel etc. all complete.
- 14.3.8 Contractor shall provide the temporary structures like scaffolding, Access ladders, working platforms etc. and removal of the same after completion of Bunker erection.

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14.4 Reconciliation of materials issued by BHEL (free of cost):

- a) All materials as specified in relevant BOQ shall be issued free of cost by BHEL for use in the work covered in this contract from BHEL stores/storage yard. The contractor shall collect these materials from BHEL stores/storage yard at specified places at his own cost and store the same at his stores as per standard norms. Materials issued will be used only for construction of permanent works.
- b) The contractor shall in no case be entitled for any compensation (other than explicitly mentioned in the tender conditions) on account of any delay in supply or non-supply thereof for all or any such materials. However, in case of non-availability of any specific section(s) which delays the completion of work, such cases shall be recorded separately in monthly planning format (F 14) and shall be considered for time extension of contract in line with GCC.
- c) Contractor will have to make his own arrangement at his own cost for procurement of any other materials except as mentioned above/ BOQ, as required for the works and of such quality as acceptable to BHEL.
- d) The contractor shall maintain proper store account for all the BHEL issued materials and shall give Three (03) copies of monthly-computerized reconciliation statement of such account showing total receipt, consumption and balance at site to the BHEL. BHEL Engineer's certification for the reconciliation of steel shall be final. The detailed reconciliation (dia. Wise or Wt. wise or as required) shall be done at least once in three months (03) or before submission of final bill which comes earlier.
- e) Contractor shall also carryout in complete association with BHEL, the material management functions and execution like day-to-day update of materials, issued to contractor, accounting for surplus/scrap material returned etc. These functions shall also be carried out through computerized system utilizing suitable software. Contractor shall engage experienced software personnel to associate on dedicated basis for efficient discharge of the same in time.
- f) BHEL issued materials, shall not be under any circumstances whatsoever, and shall be taken out of the project site unless otherwise permitted by BHEL for outside job.
- g) BHEL reserves the right to recover from the contractor any loss arising out of damage/ theft or any other causes or during verification/stacking or at any time under the custody of the contractor.
- h) The contractor shall take care of material issued by BHEL and shall protect the same from damage and weathering.
- i) The contractor shall solely be responsible for the safety & security of material after it is handed over and issued to contractor by the BHEL.

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

14.5 ERECTION OF SCR (SELECTIVE CATELETIC REDUCTION) SYSTEMS

The contractor's scope includes the material transportations from BHEL Storage yard to site, erection and commissioning erection, commissioning and testing of complete system for Selective Catalytic Reduction (SCR) System along with ammonia unloading, storage and handling system, Cyclone Separators complete in all respects with all components and accessories etc., The SCR System is intended to reduce the emission of NOx in flue gas produced by coal being fired in boiler to the limits specified elsewhere in the technical specification.

SCR System includes the following Systems:

Note : Common systems of SCR & Its auxiliaries excluded from the scope of work.

- 14.5.1** SCR System along with ammonia injection system and cyclone separators shall be individual for each unit. Ammonia unloading, storage and handling system shall be common for three (03) units. Erection and commissioning of the Common systems are in the scope of Boiler#1 erection agency.
- 14.5.2** The scope of contractor for SCR System along with ammonia unloading, storage and handling system, Cyclone Separators shall include All ducting, dampers, expansion joints, valves, pumps, supports, structure, trestle etc as required for completeness of this system shall also be in the scope of contractor.
- 14.5.3** The scope of E & C for SCR System along with ammonia unloading, storage and handling system, Cyclone Separators for each unit shall include all items indicated below but will not be limited to that.
- 14.5.4 Statutory Approval**
It shall be the responsibility of the Contractor to obtain the all necessary approvals/permits from the inspection/regulatory authorities etc. on behalf of the Employer, as may be required for design/calculations, manufacturing and erection procedure, testing etc. As called for under the statutes, regulations and the safety codes. All such documentation required to be submitted to the statutory authorities shall be submitted to the Employer for its review

System Description

- 14.5.5** Flue gas from downstream of economizer shall be taken through two (02) independent streams. Each stream shall have
- one (01) number of cyclone separator
 - one (01) number of SCR Reactor.

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Cyclone Separator shall be used to reduce inlet dust concentration at the inlet of SCR reactor. Air diluted gaseous ammonia shall be injected before SCR reactor and the mixture of flue gas & ammonia shall be passed through the catalyst placed in layers inside reactor for reduction of NO_x present in flue gas to nitrogen. Flue gas after NO_x removal shall be taken to the Air Pre-heater. SCR bypass duct i.e. Economizer to APH shall be provided for facilitating operation of unit without SCR in case of any emergency requirement. This shall also facilitate the online maintenance of SCR system and associated equipment. Economizer flue gas bypass shall also be provided to maintain required flue gas temperature at the SCR reactor inlet at partial load conditions.

Anhydrous ammonia shall be supplied through tank truck and unloaded in ammonia storage tanks with the use of ammonia unloading compressors. Liquid ammonia from the storage tank is sent through ammonia vaporizer and diluted with air before injection on upstream of SCR reactor.

Each SCR System serving one (01) steam generator, shall have two (02) numbers of independently operated SCR reactors (gas streams) along with catalyst modules housed in SCR reactor casings including outside shell, structural steel supports & frame work, access doors & ladders, platforms, safety rails, stairways, walk ways etc. SCR System will be complete in all respects including all components and accessories.

14.5.6 SCR Reactor and auxiliary system

- a. Each SCR reactor shall have three (03) working catalyst layers and one (01) spare (future) catalyst layer
- b. Catalyst modules with test sample for all working layers along with sealing system.

14.5.7 Each SCR reactor shall include, but not limited to the following:

- a. Inlet and outlet hood with guide vanes
- b. Static Mixer (if required)
- c. Flue gas flow straightener / rectifier at inlet of SCR reactor
- d. Connection nozzles for media (e.g. flue gas, steam, pressurized air etc.),
- e. Ash hoppers for SCR reactors/duct (if required) complete with level monitors and indicators, poke holes, access doors, walkways beneath the hoppers along with associated ash handling system.
- f. Catalyst module support structure
- g. Access for Catalyst module loading/ unloading for each catalyst layer.
- h. Control & instrumentation
- i. Inspection opening(s) for every catalyst layer.
- j. Gas sampling system including online gas analysers at inlet and outlet of SCR reactor for measurement of NO_x, SO_x, O₂, CO₂ etc
- k. In-situ type or extraction type ammonia analyser at the outlet of SCR reactor.
- l. NO_x grid measurement (if applicable)

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14.5.8 Catalyst De-dusting System

Catalyst De-Dusting System includes the Minimum 4 nos of Sonic horns & 6 nos of Air Cannons shall be provided for each catalyst layer (including future layer) complete with structural supporting frame, access platform, compressed air storage vessel, piping, control & instrumentation, insulation, acoustic enclosures etc.

OR

Minimum four (04) nos of Rake retractable type steam operated Soot blowers shall be provided for each catalyst layer (including future layer) complete with structural supporting frame, access platform, motors, piping, control & instrumentation, insulation etc.

14.5.9 Handling System

- a. Complete catalyst handling system including platforms for temporary storage of catalyst, monorails with electrically operated hoists including monorail beams for each catalyst layer (including future layer) for lifting of catalyst module from grade, storage & placement inside the reactor.
- b. Handling system with monorail and electrical hoist for other equipments which are weighing more than 500kg and requires to be handled for maintenance/replacements.

14.5.10 Ducts and Dampers

The scope of ducting and damper as below but not limited to the following for SCR system for each steam generator:

- a) Inlet duct from economizer outlet to each SCR reactor inlet
- b) Outlet Duct from SCR reactor outlet to APH Inlet
- c) SCR bypass duct i.e. Economizer to APH
- d) Economizer bypass duct from economizer inlet/intermediate position to SCR inlet duct
- e) Flue gas ducting system shall be complete with adequately sized turning vanes, deflector plates, flow splitters, guide vanes and all necessary gas flow control devices of suitable erosion resistant material, metallic type expansion joints, complete duct stiffening devices, interior bracings, slide plates, access doors, brackets, supporting structures, hangers, sampling connections, etc.
- f) Isolation gates at inlet of each cyclone separator, SCR outlet and SCR bypass duct of each SCR reactor and isolation gate & control damper in economizer bypass duct to each SCR inlet duct.
- g) Ash hoppers for duct, if required based on layout, complete with low and high ash level switches etc.

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14.5.11 Cyclone Separators

- a. Two (02) nos. of independently operated Cyclone Separators housed in independent casings shall be provided including outside shell, structural steel supports and frame work, stiffeners, bracings, access ladders, platforms, safety rails, stairways, walk ways, access doors, insulation etc. One (01) cyclone separator shall be provided in each stream of flue gas duct from economizer outlet to SCR reactor inlet.
- b. Ash hoppers complete with level monitors and indicators, poke holes, access doors, walkways beneath the hoppers along with associated ash handling system shall be in the contractor's scope.
- c. Installation of Sampling ports for off-line measurement of ash concentration in flue gas at the inlet and outlet of Cyclone separators.

14.5.12 AMMONIA INJECTION AND DILUTION AIR SYSTEM

- a. Complete Ammonia Injection system for each SCR system consisting of, but not limited to, nozzle lances or ammonia injection grid, ammonia-air mixer, piping for distribution of ammonia/air mixture, valves etc.
- b. 2x100% dilution air fans with drive motors, coupling, coupling guard, silencer, filter and suitable arrangement to prevent rain water entry to fan motor, air heating system (electrical) if required, dampers etc. for each SCR System. Alternatively, dilution air may be tapped of from Secondary air duct in place of dilution air fans.

14.5.13 AMMONIA UNLOADING, STORAGE AND HANDLING SYSTEM (COMMON FOR ALL THREE UNITS)- – *(Not in agency Scope. Already covered In Unit#1 agency Scope)*

14.5.14 Thermal Insulation, Lagging, Cladding & Refractories

14.12.14.1 Thermal Insulation along with aluminum cladding, lagging, reinforcement wire mesh, cleats and supports, shall be provided for all the equipments/surfaces having skin temperature more than 60 degree Celsius.

14.12.14.2 ~~Corrosion protection painting for structures and equipments/system as described in the specification.~~

14.12.14.3 Sheathing work for roof/ canopy/ side cladding of SCR system.

14.5.15 Necessary access, platforms, walkways, handrails, staircase, ladders and gratings etc. for access/approach and safe mobility shall be provided for all equipment and accessories in the scope agency so that operators and maintenance personnel can function conveniently and safely.

14.5.16 Necessary approval is required from statutory authorities for the entire Ammonia unloading, storage and handling system will be in the scope of agency

14.5.17 Fencing work of Complete ammonia unloading, storage & forwarding system shall be in the scope of agency.

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14.6 MAIN SUPPORTING STRUCTURES, EXTERNAL STRUCTURES, ELEVATOR STRUCTURES, STAIRWAYS, GALLERIES & PLATFORMS & HANDLING ARRANGEMENT

- 14.6.1 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.
- 14.6.2 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.
- 14.6.3 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.
- 14.6.4 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.
- 14.6.5 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.
- 14.6.6 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.
- 14.6.7 All relevant provisions as above shall apply, mutatis-mutandis, to the work of external structures, interconnecting structures, elevator structures & equipment handling system etc.

14.7 Flue gas desulfurization(FGD)

14.7.1 BRIEF DESCRIPTION OF THE FGD SYSTEM

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- 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, Scaffolding and rigging operations, Machine / flame / electric cutting, grinding, welding, radiography and stress relieving, Fitting, fettling, filing, straightening, chamfering chipping, scrapping, reaming, as cleaning, checking, levelling, blue matching, aligning and assembly. Machining, surface grinding, drilling, doweling, shaping, Temporary erections for alignment, dismantling of certain equipment for checking, cleaning, servicing and site fabrication, Insulation and Final painting etc
- Following major erection activities are involved in FGD works. It is indicative only and to give the general idea to the contractor;
Marking and packer liner setting, Bottom plate installation, casing panel installation, Baffle panel installation, Scaffolding and Structure, Inlet duct panel installation, spary pipe installation, remaining structure erection, Ceiling panel installation, Rubber lining, mist eliminator, Absorber internals Spray pipe & nozzle installation, Agitator installation etc.

1. The FGD system shall be based on Wet Limestone Forced Oxidation process. Each unit shall be provided with an independent absorber.
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.
3. Compressed oxidation air shall be blown through the slurry in the oxidation tank, to oxidize the Calcium sulphite to gypsum.
4. Clean gas from the absorber shall be taken to the Wet Chimney through three stage mist eliminators.
5. Limestone to the absorbers of the units shall be supplied by a wet limestone grinding system, common for all 3 units(Excluded from Contractors Scope). Limestone shall be fed to the Limestone day silos which in turn will feed the Limestone to wet ball mill through a gravimetric feeder.
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 vaccum 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.

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

- i. Absorber System along with supporting structures

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- ii. Isolation gates
- iii. 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.
- iv. Lime stone grinding and slurry preparation system consist of lime stone silos,
- v. Bunker, Gravimetric feeder, wet ball mills, Hydro-cyclones
- vi. Slurry pumps (Absorber Slurry recirculation pumps, Gypsum Bleed pumps, limestone Slurry feed pumps)
- vii. Gypsum Dewatering system consists of Vacuum belt filter, hydrocyclones
- viii. Process water and cooling water storage system
- ix. Thermal Insulation and cladding sheets
- x. Sump Pumps
- xi. Piping system
- xii. Equipment Cooling water System (PHEs, DMCW pumps)
- xiii. Misc. platforms, galleries, handrails
- xiv. Fire Protection System including hydrant, MVWS, HVWS
- xv. Equipment Handling System.
- xvi. Agitators.
- xvii. EOTs & Hoists.

14.7.3 TENTATIVE WEIGHT TO BE ERECTED FOR THE FGD SYSTEM SHALL BE AS DETAILED BREAK UP INDICATED IN CHAPTER-XI "ESTIMATED WEIGHT FOR VARIOUS SYSTEMS IN SCOPE OF WORK (BOQ)".

- 14.7.3.1 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.

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14.7.3.2 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.

14.7.4 Detailed description of major equipment 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.

14.7.4.1 Absorber System:

An independent Limestone Forced Oxidation (LSFO) type absorber system shall be provided. Absorber system shall be comprises of:

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. 2X100% absorption oxidation blower.
3. 2x100% re-circulating slurry pump for each level of spray.
4. Complete Ducting System from ID fan common outlet duct to absorber tower & from absorber outlet to wet stack chimney.
5. 2x100% Centrifugal/ positive displacement type oxidation blowers / compressors
6. 1 No. Emergency water tank for spraying water at inlet of Absorber for upset condition.
7. 2x100% gypsum bleed pumps.
8. Auxiliary Absorbent tank.
9. Passenger cum Goods elevator for each Absorber of minimum capacity of 1000 kgs.

14.7.5 LIMESTONE GRINDING AND SLURRY PREPARATION SYSTEM (COMMON SYSTEMS FOR ALL THREE UNITS – *(Not in agency Scope. Already covered In Unit#1 agency Scope)*)

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14.7.6 GYPSUM DEWATERING SYSTEM (COMMON SYSTEMS FOR ALL THREE UNITS – Not in agency scope – Already Covered in ESP#1 Agency's scope)

14.7.7 PROCESS WATER STORAGE TANKS AND PUMPS

1. Two (2) Process water Storage tanks along with two numbers of 2x100 % Booster water pumps, if required.
2. 2x100% Process Water Pumps for each unit connected to each of the Process water Storage tanks along with all necessary piping, valves.
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.
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.
5. Emergency water storage tanks.
6. 2x100% horizontal centrifugal pumps shall be provided for recirculation of filtrate water to absorber.
7. 2x100% horizontal centrifugal pumps shall be provided for wash water requirements of belt filter.

14.7.8 PIPING

Slurry Piping

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. 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.
3. Oxidation Air piping
4. Service Water
5. Service Air & Instrument Air
6. Process water piping
7. Equipment Cooling water system piping
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.

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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.

14.7.9 Equipment Cooling Water System (COMMON SYSTEMS FOR ALL THREE UNITS) Not in agency scope – Already Covered in ESP#1 Agency's scope)

14.7.10 Waste water System:

1. 2x100% horizontal centrifugal pumps.
2. 1x100% Waste water tank shall be provided which shall be sized for 12 hrs storage of waste water.
3. 2x100% horizontal centrifugal pumps shall be provided for pumping the waste water from waste water tank.
4. 2x 100% Lime Neutralization tanks.
5. 2x100% Lime storage silos.

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

1. Absorber tower have top elevation of approx. 47 mtr with 7 tier structure and average casing panels have size (6 mx4m x05 mm). 5mm- thickness of casing panels.
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.
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
1	Belt filter washing tank	5500	5900	2

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2	Filtrate Water Tank	8000	8900	1
3	Secondary Hydrocyclone Tank	9000	10300	1
4	Waste Water Tank	12000	13600	1
5	Lime stone Slurry Storage Tank	17500	19800	2
8	Auxiliary absorbent tank	17500	20400	1
9	Process Water tank	7000	7400	2
10	Clarified Water Tank (cake washing)	3000	3800	2
11	Emergency quench tank	5500	6000	3

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

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.
- Absorber Elevator
 - Rubber lining of tanks and absorber
 - 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.**
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.
- Slurry Recirculation Pump System
 - Mist Eliminator & Accessories
 - Air Oxidation System
 - Slurry Pumps & Accessories

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- 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.

14.8 OTHER PRODUCTS AND SYSTEMS AND REQUIREMENTS

- a) The ducting covered under this scope of work is flue gas ducting up to boiler outlet flange, boiler outlet flange to ESP Inlet , hot and cold secondary air ducting from FD fans outlet to wind box, hot and cold primary air ducting from PA fans to mills including interconnections, flowmeters, dampers/gates and their drives, supports and suspensions etc for these systems.
- 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 similar 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 silencer supports, 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, actuators, lub oil units, control valves, etc. material for this will be supplied in random lengths / sizes. No separate payment for fabrication is envisaged. Only the erection tonnage rate applicable for 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, piping etc will be supplied in running/random lengths/ sizes, which shall be cut to suitable sizes and adjusted as required.

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- 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.
- 14.9 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.
- 14.10 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.
- 14.11 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.
- 14.12 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.
- 14.13 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.
- 14.14 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 wall 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.
- 14.15 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.
- 14.16 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.
- 14.17 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

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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.

- 14.18** 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.
- 14.19** 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.
- 14.20 Critical piping (Power Cycle Piping)** - The piping components are sent in parts for convenient transportation / layout requirements. They are to be cleaned, pre-assembled in stage by stage, welded, erected and aligned as per the drawing dimensions / tolerance and instructions of BHEL Engineers.
- 14.20.1** The work on piping systems (air, water, oil, steam, gas etc.,) will include laying, edge preparation, fixing and welding of the elbows / fittings / valves etc., welded on the lines, fixing and adjustment of supports / hangers / shock absorbers and carrying out all other activities / works to complete the erection and also carrying out all pre-commissioning / commissioning operations mentioned in the specification as per BHEL Engineer's instructions and / or as per approved drawings / documents.
- 14.20.2** Pre Assembly joints to be marked in isometrics drawings in consultation with BHEL Engineers and submit to BHEL before starting work. Contractor to maintain Line History sheet (LHS) of all Pipe lines as per BHEL Format and submit before HT to BHEL/Customer for getting HT Clearance.
- 14.20.3** Erection of all drains / vents / relief / escape / safety valve, piping to various tanks/ sewage / drain canal / flash box / flash tank / condenser / sump / atmosphere etc. from the stubs on the piping to the equipments erected by the contractor is completely covered in the scope of work.
- 14.20.4** Contractor has to carryout fabrication works such as welding of stubs / nipples, attachments etc., preparation of surface for rust preventive coating and application of rust preventive within the quoted / accepted rate.
- 14.20.5** Pipes shall not be dropped to avoid impact or bump.
- 14.20.6** The scope of work includes marking of labelling & flow direction on the piping over insulation/other parts at the one place or number of places as instructed by BHEL Engineer. All consumable required for this work shall be in the scope of contractor.
- 14.20.7** Normally weld neck valves will have prepared edges for welding. But if it becomes necessary the contractor shall prepare new edges or recondition the edges by grinding or chamfering to match the corresponding tubes and pipes. All fittings like tees, weld neck flanges, reducers, elbows, flanges, inserts etc., shall be suitably edge prepared and matched with pipes for welding. No extra cost shall be paid for this.
- 14.20.8** In case of any class of work for which there is no such specifications as laid down in the contract such as blue matching, welding of stainless steel parts etc., the work shall

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- be carried out in accordance with instructions and requirements of the BHEL engineer at the quoted rates only.
- 14.20.9 Erection of platform and supporting structures around the equipments / valves / filters etc., is covered in the scope of contract and shall be erected by the contractor as per accepted tonnage rate for structure.
- 14.20.10 The Contractor shall carry out the reaming and honing of coupling holes with his own reamers, honing machine and honing accessories etc at his own cost.
- 14.20.11 Wherever pipes / bends / equipments are supplied in pre-fabricated / assembled packages, there may be necessity to make minor changes, including strengthening by additional welds. This shall be treated as part of the contractor's scope.
- 14.20.12 All the oil & gas piping flanges, wherever provided are to be blue matched using surface plates for at least 80% contact area to attain leak proof of joints, as per the instruction of BHEL Engineer.
- 14.20.13 All piping supplied in running meter has to cut and edge prepare as per the standards / drawings and as per the instruction of BHEL Engineer within the quoted rate.
- 14.20.14 Wherever drawings indicate site routing and site fabrication, such pipes (in general equal to and less than 2" dia) will be issued in running meters as straight length. These are to be cut and edge prepared at site to required length to suit layout as given in the erection drawing. In some cases attachments like lugs, stoppers, cleats etc., will be supplied as loose items and to be cut and welded to the pipes at site as per erection drawing necessary drilling of holes on main pipe for welding stubs shall also be done at site by the contractor.
- 14.20.15 Fittings like bends, tees, elbow, mitre bends, reducers, flanges, thruster blocks, etc., will be supplied as loose items and edge preparation if required shall be carried out by the contractor.
- 14.20.16 Certain adjustments in length may be necessary while erecting pipelines. Removing / adding extra lengths / to suit the final layout, preparing edges afresh and adopting specified heat treatment procedure are in the scope of work.
- 14.20.17 For pipes nominal size 2" and below routing shall not be shown in piping layouts or in isometrics and the same to be routed / connected as shown in schematics. For the above sizes if the routing is shown in layouts it is only for guidance and the same shall be routed and supported as per site requirement / convenience as per BHEL Engineer's advice.
- 14.20.18 Piping below size 2", valves, flanges, fittings etc. shall be supplied as commercially available. Hence fit-ups, edge preparation including welding of stubs, shall be included in the contractor's scope.
- 14.20.19 Contractor should fabricate bends of $\leq 2\parallel$ diameter size at site from running meters of piping for the above and cut, edge prepare and lay the piping as per BHEL Engineer's instructions.
- 14.20.20 Minor adjustment like removal of ovalities in pipes and opening or closing of the fabricated bends by process of heat correction or any other method approved by BHEL Engineer to suit the layout, with specified heat treatment procedure shall be carried out by the contractor within the quoted rate.
- 14.20.21 Contractor shall use only bolted clamps for achieving alignment of piping. Wherever "L" shaped stoppers and wedges are to be used for aligning piping and equipments, the same shall be subject to the approval of BHEL Engineer. Contractor shall

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remove the bridge, stopper etc., by grinding / gouging and not by hammering. Any burrs left on the equipments / piping, after welding, shall be ground off or any scar or cavity made good by welding and grinding. NDT tests shall be carried out if necessary to detect surface and sub-surface cracks in these ground areas.

- 14.20.22 The surface of the pipes to be joined shall be suitably prepared as per instructions of BHEL Engineers. Edge preparation shall be done by chamfering machine, whenever required and all welding surfaces must be cleaned thoroughly. All works due to the mistake of the contractor shall be repaired / redone at contractor's cost. Instrumentation drains, stubs which are sent in loose from manufacturing units are to be welded at site as per BHEL Engineer's instructions.
- 14.20.23 All the weld joints on equipments and piping shall be ground or filed after completion of welding and before radiography as per instructions of BHEL Engineer so as to achieve smooth surface to avoid of ripples, undulations etc.,
- 14.20.24 Flow nozzles, orifice, spray nozzles etc., shall be mounted / erected after chemical cleaning / flushing / or steam blowing at site.
- 14.20.25 Erection of Flow nozzles, flow switches, steam traps, filters, flow meters, other metering elements, spray nozzles, steam traps, flow orifices, flow indicators, control valves, aux. control valves, NRVs, suction strainers, servomotors, CRH NRV, HPBP Valve and suction strainers of BFP, CEP & Booster pumps etc forming part of the system (under this scope of work) irrespective of the suppliers is also to be carried out by the agency without any extra cost after chemical and / or steam blowing / oil flushing at site. This will include collecting from BHEL / Customer stores, transport to site, suitably cutting the erected piping, cleaning, erection, welding, radiography and stress relieving and commissioning.
- 14.20.26 Certain instruments like pressure switches, gauges, air sets, regulators, filters, junction boxes, power cylinders, dial gauges, thermometers, flow meters, valve actuators, flow indicators etc., are received in assembled conditions as integral part of equipments. Contractor shall dismount such instruments and re-erect whenever required prior to commissioning. Sometime this may have to be handed over to store or instrumentation contractor.
- 14.20.27 The contractor has to fabricate stainless steel orifice plate within the quoted rate. No extra payment will be made for fabrication of above orifice plates. The required stainless steel plate will be supplied by BHEL.
- 14.20.28 Fixing, fitting, welding of thermo wells, stubs, hoses, tapping points, root valves and instruments etc., on different lines / equipments (which will be supplied by BHEL) is within the scope of work. Fixing of Pick-Ups, Probes & Accessories for vibration monitoring system for the erected equipments / pipe lines is the scope of this specification.
- 14.20.29 The contractor shall also weld all thermo wells, small length of pipes to all pressure, flow and level tapping points, isolating valves and root valves on all equipment under scope of erection of this contract. All embedded temperature measuring elements provided in the bearings will have to be terminated at the junction box by the contractor. Thermo wells tapping point connections incorporated shall be plugged during the pressure testing and steam blow out of piping systems. Upon completion of blow out operation all thermo wells and flow elements with branch pipes be installed and welded.

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- 14.20.30 For hangers and supports the instruction given in the drawings and documents must be followed for handling, erection and setting of cold / hot valves and locking etc.
- 14.20.31 The hangers and supports for pipelines and pressure parts may be supplied in dismantled / knocked down condition. It is the responsibility of the contractor to assemble them as per approved drawings and install them in position as per site engineer instructions.
- 14.20.32 Contractor has to fabricate and erect temporary spool pieces wherever required due to non receipt of valves in time and after receipt of valves the spool pieces are to be replaced with regular valves at free of cost. For spool pieces materials will be supplied free of cost by BHEL.
- 14.20.33 All welded joints should be painted with anti-corrosive paint, once radiography and stress relieving works are over.
- 14.20.34 Welding, non-destructive testing and heat-treatment as prescribed in BHEL Welding / Heat treatment manual is to be carried out by the contractor. The contractor shall conduct non-destructive tests like radiography, ultrasonic test for weld defects etc., ultrasonic test for finding thickness, dye penetrant tests, magnetic particle test etc. on weld joints, castings, valve bodies and other equipments etc. as per BHEL Engineer's instructions within the quoted rate.
- 14.20.35 Contractor shall arrange all equipments, alignment bolts, tools, Consumables like welding electrodes in their scope (all types except those supplied by BHEL), and argon gas cylinders etc., for welding of pipes at his cost. Consumables like jute, cotton waste, hacksaw blades, petrol, Kerosene oil etc. are in contractor's scope. Only filler wires as stipulated by manufacturing units and identified in relevant shipping list will be supplied to the contractor free of cost. Any excess requirement shall be arranged by the contractor / BHEL at contractor's cost. Argon / Nitrogen gas for stainless steel tubes purging during welding to be arranged by contractor within the quoted rates.
- 14.20.36 The Matching Pieces / Nozzles / Reducers (including the reducers to be connected with HP Heaters) supplied for connecting BFP discharge piping with the Heaters are forming part of the systems and are also in the scope of work including issue, transportation, suitably cutting the erected piping, cleaning, erection, welding, radiography and stress relieving and commissioning.
- 14.20.37 Cutting and removal of dummies for all the shop welded stubs (irrespective of the equipments supplier for the above) for all the terminal points and preparation of edge where the piping is to be terminated is also in the scope of the contractor without any extra payment.
- 14.20.38 For skid mounted equipment, the checking and re-alignment required at site is in the scope of work.
- 14.20.39 All the shafts of rotating equipment shall have to be properly aligned to those of matching equipment to perfection, accuracy as required and the equipment shall be free from excessive vibration so as to avoid overheating of bearings or other conditions which may tend to shorten the life of the equipment.
- 14.20.40 The actuators / motors of valves may be supplied in loose parts, contractor shall have to match / assemble and align at site as per instructions of BHEL Engineer including placement on foundation.
- 14.20.41 All dimensions / elevations refers to centerline of pipe unless otherwise specified, the pipe routing shall be carried out as per the drawing. Wherever the dimensions are

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not specified / shown as approximate the same may be routed as per site requirement / convenience as per site engineer's advice.

- 14.20.42 Pipelines shall be cleaned off welding slag and burrs by hand files, wire brushes and flexible grinders wherever required and using cloth.
- 14.20.43 Contractor has to arrange required fire retardant covering material at their cost to protect the machined components, assembled parts and insulation materials drawn from BHEL before and after erection.
- 14.20.44 Prior to erection of any components, inspection to be done for any foreign materials and damages and they are to be removed / attended as per instructions of BHEL engineer.
- 14.20.45 The temporary structures / items welded to permanent members / pipes are to be cut and removed without any damage. In case of any damage, the same has to be made good by the contractor at his cost.
- 14.20.46 Erection of all the items/piping systems, supplied by BHEL's Manufacturing units or Vendor as integral part of the systems covered under this scope of work, shall be done by the contractor as per the accepted tonnage rate.

14.21 GALVANISED STEEL PIPING

- a. Galvanized pipe shall be joined by screwing in to socket and screwed ends of GI pipes shall be thoroughly cleaned and painted with a mixture of red and white lead before joining. The exposed threaded portion on either side of the socket joint shall be applied with Zinc Silicate Paste. All these consumables are in the scope of contractor and shall carry out within the quoted rate.
- b. GI pipe with flanged joints shall have screwed flanges. Flanged joints faces shall be painted with red lead and bolting up evenly on all sides with compressed asbestos gaskets in between two flanges.
- c. Teflon tapes shall be used to seal out screwed joints and shall be applied to the male threads only. Threaded parts shall be wiped clean of oil or grease with appropriate solvent if necessary and allowing proper time for drying before applying the sealant. Pipe ends shall be attached by screwing the pipe through the flange and pipe and flange shall be refaced accurately. Required Teflon tapes are to be arranged by the contractor at his cost.
- d. Required threading should be done by the contractor at site as specified in the drawing. The pipes shall be cut only by Hacksaw / Machining. Required Teflon tapes are to be arranged by the contractor within the quoted rate.
- e. ALL THE SCREWED JOINTS ARE TO BE SEAL WELDED IF REQUIRED BY CUSTOMER, SUITABLE ELECTRODES FOR FULL SEAL WELDING ARE TO BE ARRANGED BY THE CONTRACTOR AT HIS COST.
- f. PVC WELDING: For PVC welding required solvent cement and cleaning agent / consumables will be supplied by BHEL. Necessary storage and application procedure to be followed as per supplier recommendation. Contractor shall take adequate care in handling, usage of these consumables to avoid wastage.

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- 14.22 Rotary machines:** 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.
- 14.22.1 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.
- 14.22.2 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.
- 14.22.3 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
- 14.22.4 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.
- 14.22.5 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.
- 14.22.6 Whenever required the contractor shall arrange for pre-qualification of process task Performers.
- 14.22.7 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.
- 14.22.8 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.
- 14.22.9 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.
- 14.22.10 All rotating machines and equipment shall be cleaned, lubricated, checked for their smooth rotation, if necessary by dismantling and refitting before erection. If, in

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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.

- 14.22.11 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.
- 14.22.12 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 to be machined by the contractor at his own cost. However the materials for dowel pins shall be issued by BHEL free of cost.
- 14.22.13 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.
- 14.22.14 The contractor at no extra cost to BHEL shall carry out servicing and realignment of skid mounted equipment.
- 14.22.15 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.
- 14.22.16 All electrical panels, control gears, motors and such other devices shall be properly dried by heating to improve IR value, 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.
- 14.22.17 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 touch up painting. System shall be demonstrated in condition to operate continuously in a manner acceptable to the Engineer. Welding shall be used throughout for joining pipes except where flanged, screwed or other type joints are specified or shown on the drawings. All piping shall be erected true to the lines and elevation as indicated in the drawings.
- 14.22.18 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.

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- 14.22.19 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.
- 14.22.20 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.
- 14.22.21 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.
- 14.22.22 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.
- 14.22.23 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.
- 14.22.24 Suspension for piping, etc., will be supplied in running lengths, which shall be cut to suitable sizes and adjusted as required.
- 14.22.25 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.
- 14.22.26 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.
- 14.22.27 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.
- 14.22.28 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.
- 14.22.29 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.
- 14.22.30 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

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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.

14.22.31 The contractor shall prepare as built piping drawing & submit to BHEL Engineer for approval & verification of material used.

14.22.32 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.

14.22.33 Contractor has to make canopies for motors, actuators, lub oil units, control valves etc. Material for this will be supplied in random lengths / sizes. No separate payment for fabrication is envisaged. Only the erection tonnage rate applicable for Misc eqpt. / structure steel of rate schedule will be paid for this work (Payment ID 1A).

14.22.34 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/machining and de-burr the same. However, machining of the packers wherever necessary shall be arranged by the contractor.

14.22.35 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.

14.22.36 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.

14.23 **Electrostatic Precipitator (ESP):** Wherever called for, pre-assembly of supporting structures, casing walls, inlet outlet funnels, hoppers etc have to be done, on ground.

14.23.1 **Loading** of collecting electrodes either from top or bottom, to be decided suiting site conditions, shall be done with due care as per instructions.

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- 14.23.2 Straightness of all collecting electrodes has to be checked on ground prior to loading in to the field.
- 14.23.3 Bundle of collecting electrodes should be handled only with special lifting beam and slings supplied for the purpose.
- 14.23.4 Huck bolting M/c with necessary auxiliaries is provided by the BHEL. Electrical connections, operation etc shall also be arranged by the Contractor.
- 14.23.5 Clearances as prescribed amongst collecting electrodes and with casing walls have to be maintained. spot heating of collecting electrodes, wherever called for, shall be done as part of work to achieve the required clearances.
- 14.23.6 Erection, alignment/ fixing in final position, of high voltage rectifiers of ESP is in the scope of work. However testing & commissioning will be done by other agency.
- 14.23.7 Installation of high voltage interlocks (excepting rotary switch interlock of switchgear panels) is in the scope of work.
- 14.23.8 Complete erection, alignment, testing, pre-commissioning and commission etc for drive motors of collecting electrodes and emitting electrode rapping mechanism is in the scope of work.
- 14.23.9 Additional platforms of permanent nature for approaching different equipments, as per site requirement which may not be indicated in drawings shall be fabricated and installed by the contractor. However the contractor will be paid (as per Rate Schedule IA) for this work on accepted tonnage rate for erection. The material required for platform will be supplied by BHEL free of cost.
- 14.23.10 All the bearings, Gearboxes etc., of the equipment and electrical motors to be erected are provided with protective greases only. Contractor shall arrange as and when required by the engineer for cleaning the bearing/gear boxes etc., with kerosene or some other agent if necessary by dismantling some of the parts of the equipment during erection and shall arrange for regressing/ lubricating them with recommended lubricants and assembling back.
- 14.23.11 Any fixtures, concrete block supports, steel structures required for temporary supporting for pre-assembly or checking and welding for lifting and handling during pre-assembly and erection shall be arranged by the contractor.
- 14.23.12 Fixing, welding of necessary instrumentation tapping points for regular measurements as well as performance testing, to be provided on auxiliaries covered within the scope of this specification will also be the responsibility of the contractor and will be done as per the instructions of BHEL Engineer. The fixing / welding of all the above items will be contractor's responsibility even if the Product groups under which these items are supplied are not specifically indicated in the Tender Specification.
- 14.23.13 Items are supplied by an agency other than BHEL.
- 14.23.14 Suspension for pipes/Ducts will be supplied in running lengths which shall be cut to size and adjusted as required. All joints connecting ducts, expansion pieces shall be seal welded on inside and as well outside. Also it may sometime become necessary to remove any of the erected members to facilitate erection of bigger / pre-assembled equipment. In such as the removal and re-erection of such members,

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which are essential will have to be carried out by the contractor without any extra payment.

- 14.23.15 In the case of structural members / ducts, in certain cases, the raw material will be supplied in random lengths and the contractor will have to make up the length/prepared the edges to suit the matching profile weld/bolt connect the joints at no extra cost.
- 14.23.16 Normally, the matching profile will be cut out for the structural members but the contractor will have to carry out suitable alterations / adjustments at site, without any extra payment, in case it becomes necessary.
- 14.23.17 Contractor has to arrange required fire proof tarpaulins to protect the machined components / assembled parts drawn from BHEL before and after erection at their cost.
- 14.23.18 It is the responsibility of the contractor to do the alignment, checking, etc. if necessary, repeatedly to satisfy BHEL Engineer / Customer Engineers with all the necessary tools and tackles, manpower etc. without any extra cost. The alignment will be completed only when jointly certified so, by the BHEL Engineer & Customer. Also the contractor should ensure that the alignment is not disturbed afterwards.
- 14.23.19 Works such as minor rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin etc. are covered in the scope of work.
- 14.23.20 Contractor shall engage separate gangs throughout the contract period, exclusively for proper housekeeping of the site. The contractor has to make necessary arrangements for collection and for bringing down the scrap from various locations as indicated by BHEL Engineer. The housekeeping must be a routine and continuous activity in the various work fronts. If the contractor does not do this job satisfactorily, BHEL will arrange for the same at the cost of the contractor. Periodical payments to the contractor for the work done will be considered only if the housekeeping is certified as satisfactory by the customer.
- 14.23.21 It is the responsibility of the contractor to engage his workmen in shifts or on overtime basis for achieving the desired progress and target set by BHEL. The contractor's quoted rate shall include all these contingencies.
- 14.23.22 All the valves, lifting equipments, etc. shall be serviced and lubricated to the satisfaction of BHEL Engineer before erecting the same and also during pre commissioning. The bearings shall be properly cleaned, serviced and lubricated before commissioning at no extra cost. Even after commissioning the equipment, if there are problems in the operation they have be attended to by the contractor during the tenure of the contract. Welding or joining of

14.23.23 **AIR LEAK TEST**

After erection of ESP and before clearing for insulation, air leak test has to be carried out. Necessary equipment like, air blower, ventury and instrumentation etc. will be provided by BHEL free of charges. Handling at stores, transport, erection, commissioning and carrying out the leakage test, attending to the leakages till

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satisfactory sealing / leak proofness shall be in scope of the work. Contractor shall dismantle the test equipments and return to BHEL stores in good condition after due reconciliation, cleaning and servicing. No separate/ additional payment is envisaged for the above.

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Chapter-XV Welding, Heat Treatment & Radiography and Non-destructive Testing

WELDING, HEAT TREATMENT & RADIOGRAPHY AND NON-DESTRUCTIVE TESTING

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

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

- 15.1 The pressure parts, equipments and piping shall be erected in conformity with the provisions of Indian Boiler Regulations and as may be directed, as per other standard / specification in practice in BHEL. The method of welding (viz) ARC, TIG or other methods as indicated in the detailed drawing or as instructed by BHEL Engineer shall be followed. BHEL Engineer will have the option to change the method to suit site conditions.
- 15.2 Welding of pressure parts, high tensile structural steel, Piping shall be done by certified high-pressure welders who possess valid certificate and who are approved by BHEL Engineer.
Links & Pipes for interlinking SH headers & RH headers are supplied with P91 materials
- 15.3 All welders including tack welders, structural and high-pressure welder shall be tested and approved by BHEL Engineer before they are actually engaged on work even though they may possess a valid certificate. BHEL reserves the right to reject any welder if the welder's performance is not found to be satisfactory. The contractor shall maintain the records of qualification and performance of welders. BHEL Engineer will issue all the welders qualified for the work, an identity card. The welder will keep the same with him at work place at all times. He may be stopped from work if he is not found in possession of the same.
- 15.4 Engineer may stop any welder from the work if his performance is unsatisfactory for any technical reason or if there is a high percentage of rejection in the joints welded by him. The welders having passed qualification tests does not absolve the contractor of contractual obligation to continuously check the welder's performance.
- 15.5 Faulty welds caused by the poor workmanship shall be cut and re-welded at the contractor's expense. The Engineer prior to any repair being made shall approve the procedure for the repair of defective welds. After the repair has been carried out, the compliance shall be submitted to the quality engineer.
- 15.6 The contractor shall carry out the root run welding of all PP, 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.
- 15.7 All expenses for testing of contractor's welders including destructive and Non-destructive tests conducted by BHEL at site or at laboratory shall have to be borne by the contractor only. Limited quantity of tube and pipe material required for making test pieces will be supplied by BHEL free of cost.

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- 15.8 Only BHEL approved electrodes and filler wire will be used. All electrodes shall be baked and dried in the electric electrode-drying oven to the required temperature for the period specified by the Engineer before these are used in erection work. All welders shall have electrodes drying portable oven at the work spot. The electrodes brought to the site will have valid manufacturing test certificate. The test certificate should have a co-relation with the lot number / batch number given on electrode packets. No electrodes will be used in the absence of above requirement. The thermostat and thermometer of electrode drying oven will be also calibrated and test certificate from Govt. approved / accredited test house traceable to National / International standards will be submitted to BHEL before putting the oven in use. The contractor shall also arrange periodical calibration for the same. Separate ovens shall be used for baking and holding.
- 15.9 All butt / fillet welds shall be subject to Non -Destructive testing as per the Drawing/Procedures/Welding Schedules/Documents at no additional cost. **100% RT will be applicable to all the circuits however applicable percentage of RT shall be guided by the field welding schedule.**
- 15.10 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 otherwise of the welds shall be final.
- 15.11 The contractor shall carry out the edge preparation of weld joints at site in accordance with the details acceptable to BHEL Engineer. Wherever possible machining or automatic flame cutting should be done. Gas cutting will be allowed only wherever edge preparation otherwise is impractical. All slag / burrs shall be removed from the edge and all the hand cuts shall be ground smooth to the satisfaction of engineer. Prepared edges to be preserved / applied with weldable primer.
- 15.12 All welds shall be painted with anticorrosive red oxide paint once radiography and stress relieving works are over. Necessary consumables and scaffolding etc including paints shall be provided by contractor at his own cost.
- 15.13 Pre-heating, radiography and other NDT tests, post heating and stress relieving after welding of tubes, pipes, Non Pressure Parts like Crown Plate support assy, including attachment welding wherever necessary, are parts of erection work and shall be carried out by the contractor in accordance with the instructions of the Engineer. Contractor at his cost shall arrange all equipment and consumables essential for carrying out the above process.
- 15.14 Contractor shall arrange all necessary stress relieving equipment with automatic recording devices. The contractor shall arrange for labour, heating elements, thermocouples, thermo-chalks, temperature recorders, thermocouple attachment units, graphs, sheets insulating materials like asbestos cloth, ceramic beads, asbestos
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- ropes etc. required for heat treatment/ stress-relieving operations. The contractor should take a note of the following,
- Temperature shall be measured by thermocouple and recorded on a continuous printing type recorder. All the recorded graphs for heat treatment works shall be the property of BHEL.
 - All stress relieving equipment will be used after due calibration and submission of test certificate to BHEL. Periodic calibration from Govt. Approved / accredited Test Houses traceable to National / International standards will also be arranged by the contractor for such equipment at his cost.
- The contractor shall obtain the signature of Engineer or his representative on the strip chart of the recorder prior to the starting of SR operations.
- 15.15 The contractor shall also be equipped for carrying out other NDT like LPI /MPI / Hardness test etc. as required as per welding schedules / drawings within the finally accepted price / rates. Ultrasonic testing, wherever required, will be arranged by contractor within the quoted rate.
- 15.16 The technical particulars, specification and other general details for radiography work shall be in accordance with ASME, IBR or ISO as specified by BHEL.
- 15.17 The contractor for radiography work shall use iridium-192/ ~~Cobalt 60~~; 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).
- 15.18 Low speed high contrasts, fine grain films (D-7 or equivalent) in 10 cm width only are used for weld joint radiography. Film density shall be between 1.5 and 2.0.
- 15.19 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.
- 15.20 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.
- 15.21 Lead intensifying screens for front and back of the film should be used as per the above-referred ASME specification. The joint is to be marked with permanent mark A, B, C to identify the segments. For this a low stress stamp shall be used to stamp the pipe on the down streamside of the weld. For multiple exposures on pipes, an overlap of about 25-mm of film should be provided.
- 15.22 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.
- 15.23 All arrangements for carrying out radiography work including dark room and air conditioner and other accessories shall be provided by contractor within the space allotted for office at his cost. As an alternative the contractor may deploy an agency having all above facilities and who are duly approved / accredited by BARC and / or
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- other Regulatory authorities. Detailed particulars of such agencies will be submitted and got approved by BHEL Engineer before the actual deployment of agency for radiography work.
- 15.24 The contractor shall have a dark room & pit room fully equipped with radiography equipment, film (un-exposed), chemicals and any other dark room accessories. All radiography films shall be developed in the dark room at site.
- 15.25 In case of radiography of less than 100%, the joints identified by BHEL at random shall be radiographed.
- 15.26 Contractor shall note that 100% radiography will be done at the initial stages on all the piping welding joints. Subsequently radiographic inspection will be done on the basis of quality of welding. However minimum percentage of joints to be radiographed shall not be less than the requirement of BHEL welding schedule / IBR / Customer's requirements. The percentage may be increased depending upon the quality of joints and at the discretion of BHEL. Radiography on LP piping joints is not envisaged. However other NDT test as called for in the FQP including LPI, MPI and HT will have to be carried out.
- 15.27 All the Radiographs shall be properly preserved and shall become the property of BHEL. They are to be reconciled with the work done, joints radiographed and submitted to BHEL / customer.
- 15.28 Since radioisotopes are being used, all precautions and safety rules as prescribed by BHEL/BARC/ Customer shall be strictly followed. BARC /DRP certificate to be provided before taking up the work.
- 15.29 Radiography of joints shall be so planned after welding, that the same is done either on the same day or next day of the welding to assess the performance of HP welders. If the performance of welder is unsatisfactory, he is to be replaced immediately.
- 15.30 Wherever radiographs are not accepted, on account of bad shot, joints shall be re-radiographed and re- submitted for evaluation.
- 15.31 However, if the defect persists after first repair, further repair work followed with radiography shall be repeated till the joint is made acceptable. In case the joint is not repairable, the same shall be cut, re-welded and re-radiographed at contractor's cost.
- 15.32 Heat treatment and radiography may be required to be carried out at any time (day and night) to ensure the continuity of the progress. The contractor shall make all necessary arrangements including labour, supervisors/ Engineer required for the work as per directions of BHEL.
- 15.33 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.
- 15.34 The contractor shall deploy required number of H.P. welders to carry out the H.P. weld joints. The welding works should not be held up due to shortage / want of I.B.R./H.P. welders.
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- 15.35 All welded joints shall be subjected to acceptance by BHEL Engineer.
 - 15.36 The technical particulars, specifications and other general details of work shall be in accordance with BHEL welding, Heat treatment and NDE manuals or equivalent as decided by BHEL Engineer.
 - 15.37 Contractor shall carryout Radiography as per welding Manual booklet applicable as per IBR, enclosed. However percentage radiography shown in the respective drawings shall be final and binding on the contractors.
 - 15.38 The field joints are to be radiographed and preheating and post weld heat treatment to be done as per BHEL procedure and manuals.
 - 15.39 The percentage of Radiography are tentative, which may be increased depending upon the quality of joints at the discretion of BHEL.
 - 15.40 Penetrometer as per ASME/ISO shall be used for all exposures.
 - 15.41 Lead numbers and letters (generally of 6mm size) are to be used for identification of radiographic contract No., joints identification, sources used welders identification, SFD used are to be noted down in the paper cover of radiography. Lead intensifying screens for front and back of the film shall be used as per the instructions of BHEL Engineer
 - 15.42 The contractor shall be fully equipped with radiography equipments, films, chemicals and other dark room facilities. There must be a number of radiographic personnel with sufficient experience and certified by BARC for field radiographic inspection. Further, the contractor must follow strictly the safety rules laid down by BARC, from time to time, contractor's radiographers shall also be registered with BARC for film badge service.
 - 15.43 Contractor shall provide all skilled, unskilled work men required for the job, which will include Engineers, supervisors, operators, as required for timely and satisfactory execution of radiography work.
 - 15.44 All the radiographs shall be properly preserved in air-conditioned rooms and shall become the property of BHEL.
 - 15.45 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 high pressure welders. If the performance of the welder is unsatisfactory, he shall be replaced immediately.
 - 15.46 The defects as pointed out by the Engineer shall be rectified immediately to the satisfaction of Engineer and Re-radio graphed. The decision of Engineer regarding acceptance or otherwise of the joint shall be final and binding on the contractor.
 - 15.47 Wherever radiographs are not accepted on account of poor exposure, joints shall be re-radiographed and new film submitted for evaluation. Radiographs shall be taken again on joints after carrying out repairs. However, if the defect persists after first repair as per radiograph, carrying out radiography shall be repeated till the joint is made acceptable. In case the joint is not repairable, the same shall be cut, re-welded and re-radio graphed at contractor's cost.

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- 15.48 The contractor shall also be equipped for carrying out other NDT like liquid penetrant inspection, magnetic particle inspection, etc. as and when required in the interest of work within the quoted rates.
- 15.49 For carrying out ultrasonic testing of welded joints of large size tubes and pipes, it will be necessary to prepare the surface by grinding to a smooth finish and contour as desired by BHEL Engineer. The contractor's scope of work include such preparation and no extra charges are payable for this.
- 15.50 It may also become necessary to adopt inter layer radiography / MPT / UT depending upon the site/technical requirement necessitating interruptions in continuity of the work and making necessary arrangements for carrying out the above work. The contractor shall take all this into account and quote the price inclusive of all such work and radiography.
- 15.51 The welded surface irrespective of place of welding shall be cleaned of slag and painted at the center with primer paint to prevent corrosion at no extra cost towards this.
- 15.52 All welders shall be tested and approved by BHEL Engineer before they are actually engaged on work though they may possess the required certificate. BHEL reserves the right to reject any welders without assigning any reason. The welder Identification code as approved by the BHEL Engineer shall be stamped by the welder on each joint done by them. The contractor will be responsible for the periodic renewal, retesting of the welders as demanded by BHEL.
- 15.53 BHEL Engineer is entitled to stop any Welder from the work if his work is unsatisfactory for any technical reasons or there is a high percentage of rejection of joints welded by him, which in opinion of the BHEL Engineer will adversely affect the quality of the welding though the Welders, has earlier passed the tests prescribed by BHEL Engineers. The welders having passed qualification tests do not relieve the contractor of a contractual obligation to check the welder's performance.
- 15.54 All charges towards testing of Welders for destructive and non-destructive test, testing and approval of welders for engaging in the erection work shall be borne by the contractor.
- 15.55 The welding process, weld joint details, joint configuration and material specification may change to suit the design requirements. The contractors quoted rates shall be inclusive of each contingency. All welds involved in the erection of temporary pipe lines for hydraulic test, chemical cleaning, steam blowing etc. to be carried out within the quoted rates. The number of joints to be welded as mentioned in the welding schedule consists of butt welds. All other welds viz. attachment welds on pressure parts/non-pressure parts, fillet welds in non-pressure parts welding in the boiler and Rotating Machines has to be carried out by the bidder within quoted rates.
- 15.56 **For uniform heating and better closed loop control, pre heating, post heating, controlled rate of heating & cooling and post weld heat treatment cycles for tube specifications SA213T91 & SA213T92 should be carried out using flexible ceramic pads with suitable heating machine.**
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15.57 MPI must be done on joints, those are undergone ultrasonic testing.

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

Where ever technically required BHEL will provide the Induction Heating Equipment set for SA 335 P-91 materials piping only. At present BHEL is having two types of Induction Heating Equipment i.e. Old Model and Compact Induction Heating Equipment. Type of equipment to be provided shall depend on the availability of equipment at the time of requirement. The set will comprise of following:

(A) In case of Old model Induction Heating Equipment

(i) Main panel

(ii) Capacitor panel

(iii) Interconnection power (185 sq mm) & control cables between above panels

(iv) Output connecting cable (185 sq mm) from capacitor panel output – 5m length.

(v) Junction Box

Contractor shall provide the input electrical power connection including arrangements such as DB, cables etc., thermocouple attachment unit, thermocouple and compensating cables with male female plugs, induction heating annealing cables (from the capacitor panel to joint and for wrapping around the weld joint) (spec: single core 240 sq mm, 1200a, 3khz), Supercera Ceramic Fibre Blanket (25mm thick, Roll Size-7.62x0.61mtr), Cloth Fibre Glass (1mm thick, 1 mtr width), Ceramic Fibre Rope (12mm dia.), Cord Glass Fibre (3 mm dia.), Six Nib Pen Cartridge, Z-Fold Chart Paper, stainless steel nut bolts for connecting interconnection, output and annealing cable and other consumables as may be required. Quantum of annealing cable requirement will depend on many parameters e.g. weld joint size, heat input, type of connection i.e. series or parallel etc.

(B) In case of Compact Induction Heating Equipment

(i) Main panel

(ii) Output connecting cable (160 sq mm) from main panel output – 5m length.

(iii) Input Power Cable with male plug

(iv) Junction Box

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Contractor shall provide the input electrical power connection including arrangements such as DB, cables etc., thermocouple attachment unit, thermocouple and compensating cables with male female plugs, induction heating annealing cables (from the main panel to joint and for wrapping around the weld joint) (spec: single core 160 sq mm, 860amps, 10khz), High Temperature Ceramic Fibre Cloth Bed Role (25mm thick, 500mm width, 7500mtr length), Fibre Glass Cloth (1mm thick, 600mm width), Ceramic Fibre Rope (12mm dia.), Cord Glass Fibre (3 mm dia.), stainless steel nut bolts (M10x40, M10x50) for connecting output cable, annealing cable and other consumables as may be required. Quantum of annealing cable requirement will depend on many parameters e.g. weld joint size, heat input, type of connection i.e. series or parallel etc.

Likely supplier of Annealing cables: Mansfield Cable Co. Noida (UP).

15.59 List of Penalties on Violations on Quality Provisions

Sr no	Violation	Penalty in Rs
1	Mother oven not working	500 per day & ban on its use
2	Slackness in control over baking of welding electrodes(Doc.)	200 per incident
3	Holding oven not working/plugged in	500 per incident/day & ban its use
4	Portable oven not working/Plugged in	100 per incident & welder to be sent home
5	Use of cold electrodes(Except E6013)	1000 per incident & welder to be sent home
6	Unauthorized welder on job	5000 per incident & welder to be sent home
7	Delay in NDT Agency deployment w.r.t jointly agreed Ere. Prog	500 per incident & welder to be sent home
8	Failure to monitor Welder's Performance (RT, SR, Penalty Joint etc.)	5000 per week
9	Improper acts w.r.t maintain SR Charts	10000 per incident
10	Site Welding/QLY Engineer not deployed w.r.t mutually agreed Ere. Plan	500 per day
11	Delay in (RT, SR, UT) report submission & customer acceptance Log sheets esp. for Billed qty. from dt. of Billing (Vendor)	10,000 per week
12	Lack of safe approach Scaffolds/Platform for inspection & non-availability of calibrated MMDs –	1001 incident.

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15.60 GUIDELINES FOR WELDING, NDE AND HEAT TREATMENT

- *For NDT & Heat Treatment agencies has to follow the guidelines as per Annexure-4.*

15.60.1 RECEIPT INSPECTION OF WELDING ELECTRODES / FILLER WIRES

1. All electrodes / filler wires received at site stores shall be segregated for type and size of electrode.
2. Ensure that electrode packets received are free from physical damage.
3. Where electrodes are damaged, the same shall be removed from use.
4. Only electrodes identified in the "Rationalized List of Electrodes" are to be accepted.
5. Where filler metals are supplied by manufacturing unit, inspect for damages, if any.
6. Ensure availability of relevant test certificates. Refer tables of chemical compositions and mechanical properties for acceptance.
7. Endorse acceptance / rejection on the test certificate.

15.60.2 STORAGE & IDENTIFICATION OF WELDING ELECTRODES / FILLER WIRES

1. **Scope**
 - 1.1 This procedure is applicable for storage of welding electrodes / filler wires used at sites.
2. **Procedure:**
 - 2.1 Only materials accepted (based on receipt inspection) shall be taken into account for storage.
 - 2.2 Storage Facility:
 - 2.2.1 The storage facility shall be identified.
 - 2.2.2 Access shall be restricted to authorized personnel.
 - 2.2.3 The storage area shall be clean and dry.
 - 2.2.4 Steel racks may be used for storage.
 - 2.2.5 Avoid storing wood inside the storage room.
 - 2.2.6 Maintain the temperature of the storage facility above the ambient temperature.
 - 2.2.7 This can be achieved by the use of appropriate heating arrangement .
 - 2.3 The electrodes / filler wire shall be segregated and identified for
 1. Type of electrode e.g. E7018.
 2. Size of electrode e.g. Dia 3.15 mm.
 - 2.4 Colour coding for filler wires:
 - 2.4.1 On receipt of GTAW filler wires, codify the filter wires as per table I below . Both ends shall be coloured.

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Table - 1

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

(* or other approved equivalents)

- 2.4.2 Where another set of colour code is followed, maintain a record of coding used
- 2.4.3 Where the filter wire is cut, apply the appropriate colour code at both ends of the piece.
- 2.4.4 For other filler wires, a suitable colour distinct from table 1 shall be applied

15.60.3 BAKING AND HOLDING OF WELDING ELECTRODES

A. Purpose:

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

B. Procedure:

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

C. GTAW Filler Wires:

- 1. These wires do not require any baking.

D. Covered Electrodes:

- I. Baking and holding
- II. Identify baking oven and holding oven.
- III. They shall have a temperature control facility upto 350 °C for baking oven and 200 Deg. C for holding oven.
- IV. A calibrated thermometer shall be provided for monitoring temperature.
- V. On opening a packet of electrodes, segregate and place them in the baking oven. Avoid mix up.
- VI. After loading, raise the baking oven temperature to the desired range as per Table below.

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- VII. Note the time when the temperature reaches the desired range. Maintain this temperature for the duration required as per Table below.
- VIII. On completion of baking, transfer the electrodes to holding oven, maintain a minimum temperature of 100°C till issue.
- IX. The electrode shall not be subjected to more than two cycles of baking. Maintain a register containing following details:
- Brand name (e.g. Supratherme)
 - Size (e.g. Dia 4.0 mm)
 - Quantity (e.g. 110 pieces)
 - Time at required temperature ie. Above 2500C
 - Time of Transfer to holding oven. Activities a, b, c to be recorded before loading into the oven.

Baking and Holding Parameters

AWS Classification (*)	Baking		Holding Temperature °C (@)
	Temperature °C	Time (Hours)	
E7018	250 – 300	2	100 min
E7018-1	250 – 300	2	100 min
E7018-A1	250 – 300	2	100 min
E8018-B2	250 – 300	2	100 min
E9018-B3	250 – 300	2	100 min
E8018-B2L	250 – 300	2	100 min
E9018-B3L	250 – 300	2	100 min
E309 & E347	250 - 300	1	100 min

Note : (*) For other electrodes, supplier's recommendations shall be followed.

(@) Maintain the temperature in the oven till issue.

15.61 Steel Structure of Boiler, Mill Bunker building including Coal bunkers, Coal transfer points. Coal conveyor galleries and supporting trestles, Ducts, Hoppers, etc.

- (a) Only material which has been identified against mill sheet or test certificates shall be used for construction. All plates above 40mm thickness shall be 100% ultrasonically tested.
- (b) Visual inspection of all welds shall be performed in accordance with AWS D.1.1.
- (c) NDT requirements of structural steel welds (other than Coal Bunkers) shall be as under:-

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- (i) 100% RT/UT on butt-welds of plate thickness > 32 mm.
- (ii) For plates of 25mm < thickness < 32mm - 10% RT/UT and 100% MPI
- (iii) For plates of thickness < 25mm - 10% MPI/LPI.
- (iv) All fillet welds of built up plate girders shall be inspected 100% by MPI.

15.62 NDT and PWHT of Pressure part and integral piping shall be guided by the site erection welding schedule.

15.63 Non-destructive examination of welds shall be carried out in accordance with the relevant design/manufacturing codes. However, as a minimum, the following requirements shall be met. Further, statutory requirement, wherever applicable, shall also be complied with.

(1) Temperature > 400 Deg, C or pressure exceeding 71 bar.

- (i) 100% RT/UT on butt welds and full penetration branch welds.
- (ii) 100% MPE.

(2) Temperature > 175 Deg, C upto 400 Deg. C or pressure exceeding 17 bar and upto 71 bar.

- i. 100% RT/UT on butt welds and full penetration branch welds for pipe dia more than 100 NB.
- ii. 10% RT/UT on butt welds and full penetration branch for pipe dia upto 100NB.
- iii. 100% MPE.

(3) For all other pipes not covered above, shall be subjected 100% MPE/ DPT in case of under ground pipes and 10% MPE/DPT in case of piping above the ground. Further, 10% of butt welds of underground piping shall be subjected to RT.

15.64 Quality Check OF Electrostatic precipitator

ESP Structure

- a) Only material which has been identified against mill sheet or test certificates shall be used for construction. All plates above 40mm thickness shall be 100% ultrasonically tested.
- b) Visual inspection of all welds shall be performed in accordance with AWS D.1.1.
- c) NDT requirements of structural steel welds shall be as under:-
 - I. 100% RT/UT on butt-welds of plate thickness > 32 mm.
 - II. For plates of 25mm < thickness < 32mm - 10% RT and 100% MPI
 - III. For plates of thickness < 25mm - 10% MPI/LPI.
 - IV. All fillet welds of structural members shall be inspected 100% by MPI.
- d) Edge for shop & field weld shall be examined by MPI for plate thickness > 32mm.

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15.65 Quality Check OF FGD Systems

A. Tanks / Vessels:

- 1 Atmospheric tanks:
 - 1.1 All welds joints shall be DP tested and complete tanks shall be water fill tested.
 - 1.2 All atmospheric storage tanks fabricated and erected at site shall be subjected to tests (Hydro, NDT and Vacuum) according to design code as applicable.
 - 1.3 Rubber lining shall be tested for hardness and spark test, as applicable.

B. Pressure vessels:

- a) NDT on weld joint shall be as per respective code requirements or the minimum as specified as below:
 - i. DPT on root run of butt weld, nozzle welds and finished fillet welds.
 - ii. 10% DPT on all finished butt welds.
 - iii. 10% RT (covering all "T"/cross joints) of butt welds.
- b) Butt welds of dished ends shall be stress relieved and subjected to 100% RT.
Each finished vessels shall be hydraulically tested to 150% of the design pressure for a duration of 30 minutes.

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**The scope of the work will comprise of but not limited to the following:
(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)**

- 16.1 The pressure testing for boiler / piping system shall be carried out as per IBR / Customer / customers' consultant specification / BHEL. Customers' consultant specification forms the part of this tender specification.
- 16.2 All pressure parts and PCP (Power cycle Piping) and some of the Low-Pressure parts shall be subjected to hydraulic test as per the Standard / statutory requirements. The contractor shall supply necessary labour and other services and make necessary arrangements to carry out the required tests as per the instructions and directions of the BHEL Engineers.
- 16.3 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.
- 16.4 Soundness of the welds shall be tested hydraulically under the supervision of the BHEL Engineer and Customer, to the pressure indicated in the drawing. Prior to the test, the boiler / piping system shall be inspected by the BHEL Engineer to the extent necessary to ensure compliance with clearance for the test, which will be obtained by the contractor from the Engineer.
- 16.5 Hydraulic testing, as required shall be carried out by the contractor. The servicing, installation, electrical connection, erection, testing and dismantling of Hydraulic Test pump, temporary pipelines, fittings, etc. shall be carried out by the contractor as part of this work.
- 16.6 All the hydraulic tests shall be repeated till all the pipelines / boiler to satisfy the requirements / obligation of BHEL to their customer. As far as the hydraulic pressure test is concerned, the same shall be conducted at various stages to the satisfaction of IBR inspectorate / BHEL / Customer Engineers. Any rectifications required shall have to be done / redone by the contractor at his cost. The contractor shall carry out all the required tests and pre-commissioning and commissioning activities required for successful and reliable operation. These would include hydraulic test of piping, pre-boiler system detergent flushing/chemical cleaning, steam blowing, water washing etc. as instructed by BHEL.
- 16.7 Test records shall be made for pressure testing of above piping system. These records shall contain the following information:
 - a) Date of test
 - b) Identification of piping tested
 - c) Test fluid
 - d) Test pressure
 - e) Approval of the Engineer.

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- 16.8 Contractor has to arrange required pumps with sufficient capacity for filling water in the tubes and pipes for conducting Hydraulic testing of LP lines. Contractor has to arrange Hydraulic Test pump / Hand Pump at his cost for Hydraulic testing of LP lines.
- 16.9 Hydraulic testing pumps for HP lines (Above 400Kg/cm²) shall be provided by BHEL free of hire charges. The testing pumps will be issued to the contractor in working conditions. Installation, electrical connection, erection, testing and dismantling and returning to BHEL stores, etc, shall be carried out by the contractor as part of this work without any extra charges. In case any servicing of the test pump is to be done during the course of the test, the contractor shall provide the necessary labour for the same and spares will be arranged by BHEL.
- 16.10 Contractor shall lay all necessary electric cables and switches etc. required for the hydraulic tests and other tests, flushing etc., and maintain the system till the tests are completed satisfactorily.
- 16.11 In certain places blanking has to be resorted prior to Hydraulic test and spool pieces have to be erected in place of control valves, orifices and other fittings and these spool pieces have to be subsequently replaced with the regular valves/ fittings by the contractor at no extra cost.
- 16.12 For conducting Hydro test / steam blowing of MSL,CRH&HRH internals of valves and NRVs (LP BP, ESV, IV & LP BP Valves & NRVs) are to be removed, Hydro Test devices are to be fixed and after Hydro Test the internals are to be re-assembled by the contractor as instructed by BHEL without any additional cost.
- 16.13 Contractor at his cost shall lay all necessary temporary piping, install the pumps, blanks, valves required for the test, pressure gauges etc. Required pipes, valves, plates etc., will be given by BHEL. Temporary piping, pumps, valves, flanges, blanks etc shall be removed by him and returned to BHEL. All thermowell points are to be seal welded, with plug in position. All Temperature Element points are to be provided with blanks and welded. Necessary blanks will be provided by BHEL.
- 16.14 Welding and stress relieving of temporary blanks or suitably fixing temporary blank flanges with gaskets and fasteners and welding and providing suitable de-aeration / venting / draining points with valves as per BHEL Engineer's instructions, for performing hydro-test of piping and other equipments is within the scope of work. Gaskets, valves, fasteners will be provided free of cost by BHEL. Contractor shall cut steel blanks from steel provided without charging extra. After completion of hydraulic test, welded blanks shall be cut and removed and weld burrs ground finished and cavities/scars of cutting weld filled and ground as per BHEL Engineer's instructions.
- 16.15 The contractor shall make all necessary arrangements including making of temporary closures / dummy on piping / equipment for carrying out the hydro-

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static testing on all piping, equipment covered in the specification at no extra cost. Necessary blanks will be provided by BHEL.

- 16.16 The contractor shall see that the water shall not be allowed to accumulate in open trenches where work is in incomplete stage, precautionary works such as blank flanging the open ends of the pipe line and filling the pipe line with water etc. shall be taken as directed by the engineer. Such works shall be to the contractor's account and no separate payment will be made for the same.
- 16.17 The contractor shall carryout the required test on the pipelines such as Hydraulic Test of various piping systems, Ultrasonic Test for weld defects and finding thickness, Dye penetrant test, Magnetic particles test for Weld defects and materials defects etc. All facilities (manpower, materials, equipment, consumables etc.) including proper approaches wherever required shall be provided by the contractor for satisfactory conduction of above tests. Special equipment such as magnetic particle tester, ultrasonic test kit and engineers required for these tests shall be arranged by the contractor along with Qualified technician within finally accepted rates.
- 16.18 Hanger adjustment / re-adjustment during erection, before and after Hydraulic Test, before and after steam blowing, during and after full load operation, are to be carried out by the contractor within Quoted Rate.
- 16.19 In general Hydraulic testing of piping shall be performed after all eventual pipe branches have been completed and valves installed. Should it be required to hasten erection work, pressure tests may be performed by sections. For this scope of work, the erected pipe lines shall be hydraulically tested as per site requirement in segments. For conducting hydraulic test, both ends of pipe lines shall be blanked by welding of plates. Only one or two set of plates and structural materials for blanking required for one segment will be provided by BHEL free of charge. After completion of hydraulic test in one segment, the same plates are to be cut and removed and utilized / welded on the other segment of the pipe lines, to carry out the hydraulic test for the respective segments. No separate plates for blanking for each segment will be provided. After completion of Hydraulic test, the required edge preparations shall be carried out on the end of pipe lines and to be welded with the respective pipe lines. In such cases joint connection shall be checked during a final and additional test, if required. The contractor shall note this aspect and quote accordingly.
- 16.20 During hydraulic test, the pipes being tested shall be isolated from the equipments to which they are connected.
- 16.21 Openings on piping for pressure / temperature impulse connections shall be fully closed during the test to prevent dust or foreign matter entering into the instrument piping inadvertently.

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- 16.22 The following specifications shall also be completed with during hydrostatic test.
- a. Vent nozzles with valves shall be provided at the highest point of the runs, to eliminate air pockets. At the lowest point drain nozzles, with valves shall be provided to drain water from pipes. The nozzles and valves shall be of the same materials as the pipe.
 - b. The lowest part of the pipe shall always be filled first with water.
 - c. Pressure shall be slowly increased (without shocks) to the stipulated value and maintained as long as required to visually check all joints.
 - d. Following the control specified above the pressure shall be slowly decreased to the design pressure after which the pipe shall be subjected to the peening test, applying knocks every 150 mm approx. especially in the welded joint areas, with a 0.5 – 1.5 kg. Hammer (depending on the pipe wall thickness). The hammer used shall be a round headed one.
 - e. Following the peening test, the pressure shall be increased to the stipulated value and all welded joints shall be visually inspected.
 - f. Following these test, the pipe shall be drained or pumped out to the other section to be hydro test using the drain out pump to be provided by Contractor and wherever necessary shall be flushed with air for all pipes.
 - g. The pressure test is considered satisfactory if no cracks, unjustified pressure reductions, leakages, seepages etc., appear.
 - h. Should defects be found, these shall be repaired in the same manner as these during radiographic examination. Hydraulic test shall be repeated after defects have been repaired.

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

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

- 17.1 The Contactor shall carry out all the required tests and pre-commissioning and commissioning activities required for their successful and reliable operation. These would include Air leak test of Boiler, Ducts, ESP, hydraulic test of boiler, of Piping, and flow test, clean air flow test, Gas Distribution Test, chemical cleaning of piping and boiler, water washing, oil flushing of oil system, Steam blowing etc. as instructed by BHEL using contractors own consumables, labour and scaffoldings etc. Air leak test on pressure parts preliminary to hydraulic test by compressed air shall also be carried out to check and rectify the various leakage and defects etc. All the chemicals required for carrying out these activities will be supplied by BHEL free of cost.
- 17.2 All required tests (Mechanical and electrical) indicated by BHEL and their clients for successful commissioning are included in the scope of these specifications though some of the tests / activities are not listed in these specifications.
- 17.3 After completion of erection of furnace, ducts and air heaters, a test shall be performed on the steam generator by the contractor to establish the tightness of the erected equipment from the outlet of Forced Draught (FD) fan through the steam generator up to stack.
- 17.4 All the tests may have to be repeated till all the equipment satisfy the requirement / obligation of BHEL to their client and also the relevant statutory authority at various stages of work.
- 17.5 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, chemical cleaning, steam blowing 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 offsite disposal of effluents of the tests under the scope of this contract as per instruction of BHEL Engineer.
- 17.6 Chemical cleaning (Acid cleaning of piping / EDTA cleaning / alkali flushing) will involve the installation of temporary piping, valves, cutting of some of the existing valves, placing the rubber, wedges in the valves, gagging of valves, and installation of temporary tanks for chemical and for mixing. Necessary temporary access platforms to mixing tank are to be made by the contractor. The dissolving tank, neutralizing tank etc. required for acid pickling will have to be fabricated by the

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contractor within the quoted rate. Required materials will be provided by BHEL free of cost. Chemicals for chemical cleaning will be provided by BHEL and handling of chemicals & other consumables and other connected activities has to be carried out by the contractor at their cost. All other consumable would have to be provided by the contractor.

- 17.7 Laying of insulation of this temporary piping, tanks are to be carried out by the contractor within quoted rate, and required insulation materials will be provided by BHEL. The welding joints in the temporary pipe lines for acid cleaning and steam blowing are to be welded by HP welders only. Required NDT tests are to be carried out for the above joints as part of work as per customer / BHEL requirement.
- 17.8 All items / material required for conducting hydraulic test, alkali boil out, acid cleaning/EDTA cleaning steam blowing etc., will be supplied by BHEL / its customer. However, servicing, dismantling and returning of the same to stores is the responsibility of the contractor who is erecting the equipment / piping. Broadly the work on temporary systems will be as under:
- Erection etc. of all temporary piping including valves, tanks, effluent pumps, electrical control panel and cabling along with insulation and supports for steam blowing; chemical cleaning and effluent disposal are to be carried out as part of work. Contractor will be responsible for their operation and any servicing required during the pre-commissioning activities. He will also service the equipment and handover the equipment to the other agency for further erection / commissioning activities. All the pumps, motors and electrical control panels/ switch gear, valves and actuators will be furnished to the contractor after due servicing.
 - Erection etc. of blowers and blanks and putty, temporary fixtures & ducts required for conducting air tightness test and GD Test are to be installed. (Putty to be procured by the contractor).
 - Dismantling of the temporary equipment, piping and return the same to the BHEL stores is also included in the scope of work.

The above is only a broad breakup of the temporary works. The engineer at site will make final break up. His decision will be final and binding.

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

- 17.9 Commissioning of the boiler will involve trial run of all the equipment erected. The boiler has to be lighted up for refractory drying, alkali boil out, acid cleaning/ EDTA cleaning, passivation, preservation, steam blowing and floating of safety valves. Flushing of all the lines by air, oil or steam as the case may be, trial run of the boiler,

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- servicing of valves and any other works incidental to commissioning are to be carried out. Contractor shall supply manpower round the clock.
- 17.10 It shall be the responsibility of the contractor to preserve the boiler as per BHEL's requirement. The required N₂ will be provided by BHEL for boiler preservation if required.
- 17.11 It shall be the responsibility of the contractor to provide various categories of workers in sufficient numbers along with Supervisors during pre-commissioning, commissioning and post commissioning of equipment and attending any problem in the equipment erected by the contractor till handing over. The contractor will provide necessary consumables, T&Ps, IMTEs etc., and any other assistance required during this period. Association of BHEL's / Client's staff during above period will not absolve contractor from above responsibilities.
- 17.12 It shall be specifically noted that the contractor may have to work round the clock during the pre-commissioning, commissioning and post-commissioning period along with BHEL Engineers. Hence contractor's quoted rate shall take into consideration of all expenses that will be incurred for such arrangement of personnel including engineers/supervisors.
- 17.13 It shall be specifically noted that the above employees of the contractor may have to work round the clock along with BHEL Engineers and hence overtime payment by the contractor to his employees may be involved. The contractors finally accepted rates should be inclusive of all these factors also.
- 17.14 In case, any rework is required because of contractor's faulty erection, which is noticed during pre-commissioning and commissioning, the same has to be rectified by the contractor at his cost. If any equipment / part is required to be inspected during pre-commissioning and commissioning, the contractor will dismantle / open up the equipment / part and reassemble / redo the work without any extra claim.
- 17.15 During commissioning, opening / closing of valves, changing of gaskets, Re-alignment of rotating and other equipment, attending to leakage and adjustments of erected equipment may arise. The finally accepted price /rates shall also include all such work.
- 17.16 In case any defect is noticed during tests, trial runs and commissioning such as loose components, undue noise or vibration, strain on connected equipment etc., the contractor shall immediately attend to these defects and take necessary corrective measures. If any readjustment and re-alignment are necessary, the contractor at his cost shall do the same as per Engineer's instructions including repair, rectification and replacement work. The parts to be replaced shall be provided by BHEL.
- 17.17 All temporary supports shall be removed in such ways that pipe supports are not subjected to any sudden load. During hydraulic testing of pipes, all piping having variable spring type supports shall be held securely in place by temporary means

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- while constant spring type support hangers shall be pinned or blocked solid during the test.
- 17.18 The contractor shall carry out cleaning and servicing of valves and valve actuators prior to pre-commissioning tests and / or trial operations of the plant. A system for recording of such servicing operations shall be developed and maintained in a manner acceptable to BHEL Engineer to ensure that no valves and valve actuators are left un-serviced. Wherever necessary as required by BHEL Engineer, the contractor shall arrange to lap / grind valve seats.
- 17.19 Cleaning and servicing of all the filters / strainers, in the system shall be done by the contractor within the accepted price. All oils and greases to be filled in the main equipments as first fill and subsequent topping up's will be furnished by BHEL.
- 17.20 At the time of each inspection, the contractor shall take note of the decisions / changes proposed by the BHEL Engineer and incorporate the same at no additional cost. The contractor shall carry out any other test as desired by BHEL Engineer/ Manufacturer on erected equipment covered under scope of this contract during testing and commissioning to demonstrate the physical completion of any part or parts of the work performed by the contractor.
- 17.21 Hydraulic testing pump for Boiler shall be provided by BHEL free of hire charges. The testing pump will be issued to the contractor in working conditions. Installation, electrical connection, erection, testing and dismantling and returning to BHEL stores, etc, shall be carried out by the contractor as part of this work without any extra charges. In case any servicing of the test pump is to be done during the course of the test, the contractor shall provide the necessary labour for the same and spares will be arranged by BHEL.
- 17.22 All pressure parts and some of the Low Pressure parts shall be subjected to hydraulic test as per the Standard / statutory requirements. The contractor shall make necessary arrangements including supplying the Low pressure Hydraulic test pump and other services to carry out the required tests as per the instructions and directions of the BHEL Engineers within the quote rates.
- 17.23 The valves, dampers, actuators etc. will have to be checked cleaned and overhauled in full or in part before erection, after acid cleaning, steam blowing and during commissioning as may be necessary.
- 17.24 Welding and stress relieving of temporary blanks or suitably fixing temporary blank flanges with gaskets and fasteners and welding and providing suitable deaeration / venting / draining points with valves as per BHEL Engineer's instructions, for performing hydro-test of piping and other equipments is within the scope of work. Gaskets, valves, fasteners will be provided free of cost by BHEL Contractor shall cut steel blanks from steel provided within quoted rate. After completion of hydraulic test, welded blanks shall be cut and removed and weld burrs ground finished and

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- cavities / scars of cutting weld filled and ground as per BHEL Engineer's instructions. Seal welding of thermo-wells and blanks of Temperature Element are to be removed by grinding only after steam blowing.
- 17.25 The hydraulic testing of the equipment and piping, covered under this scope of work has to be carried out by the contractor as per instructions of BHEL Engineer. The contractor shall provide all facilities required for hydraulic testing. Before hydraulic test, all the hangers are to be locked by locking pin / plate or temporary support. After completion of Hydraulic test, these are to be removed and all hangers are to be readjusted if required, to the desired value within quoted value.
- 17.26 All the tests shall be repeated till boiler / pipelines / equipments satisfy the requirements / obligation of BHEL to their customer. As far as the hydraulic pressure test is concerned, the same shall be conducted at various stages to the satisfaction of BHEL / Boiler Inspector / Customer Engineers. Any rectifications required shall have to be done / redone by the contractor at his cost.
- 17.27 Transportation of oil drums from customer/ BHEL's stores, filling of lubricants and filling of oil for flushing and first filling and subsequent topping up during commissioning and post commissioning is included in the scope of this contract. The contractor shall have to return all the empty drums to the customer / BHEL stores. Similarly transport of chemicals for various pre-commissioning activities / processes mentioned in the above clauses and returning of remaining and / or the empty containers of the chemicals to customer / BHEL stores is the responsibility of the contractor.
- 17.28 Replacing / cleaning of filters of the erected equipments, piping system etc. during pre-commissioning / commissioning stage are within the scope of work.
- 17.29 Contractor shall lay the temporary pipelines with fittings, accessories and erection / commission pumps, tanks, valves, fittings, hangers and supports and other installations as instructed by BHEL, Engineer for the purpose of chemical cleaning / alkali flushing / steam blowing / steam washing / steam flushing / water flushing / water washing / oil flushing etc. of piping and other equipments are in the scope of work. Necessary, materials for this will be provided by BHEL. Payment will be made at the rate applicable for **Non-pressure parts** (1C) for items. Weight for the same will be based on jointly measured quantity and corresponding standard weights. No payment will be made for the equipments brought by the Contractor such as pumps etc and foundations made by the Contractor for temporary systems. Weight for the same will be based on jointly measured quantity and corresponding standard weights. Overhauling / cleaning / servicing of valves, pumps, fittings in temporary system and acid cleaning tanks etc prior to the above operations / activities will also be carried out by the contractor at his cost. All the chemicals will be supplied by BHEL free of cost.

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- 17.30 Steam blowing lines for Oil piping shall be erected as per the instructions of BHEL Engineer. Necessary pipes and other items will be supplied by BHEL free of cost. All arrangements for erection including welding have to be arranged by the contractor as a part of the work. After completion of steam blowing, all the temporary lines to be dismantled and restoration of piping to be carried out, within quoted rate.
- 17.31 During steam blowing operations the required manpower shall be arranged by the contractor as per the instructions of BHEL Engineer within the quoted rates. The manpower for the above operation may be required round the clock if necessary. The contractor shall carry out the above operation as per the instructions of BHEL Engineer within the quoted rates.
- 17.32 During the initial stages of work, trenches for draining water may not be available for alkali flushing or mass flushing for discharging and draining the system and piping. Necessary low point drains and temporary piping for this will have to be erected by contractor from materials provided by BHEL.
- 17.33 After the chemical cleaning has been successfully completed, removing all temporary piping, fittings of tanks etc. checking all the valves for any accumulation of foreign materials, welding the valves, pipes which were cut and cleaning, re-fixing as per BHEL Engineer's instructions is within the scope of work/specification.
- 17.34 The contractor as per BHEL requirements will suitably make preservation of cleaned surfaces.
- 17.35 Contractor may have to replace old/damaged gaskets / packing etc. for equipments and the same shall be carried out by contractor as per requirement. Materials will be given by BHEL.
- 17.36 In case any erection defect is detected during various tests / operations trial runs as detailed above such as loose components undue noises or vibration strain on connected equipment steam or oil or water leakage etc. the contractor shall immediately attend these defects and take necessary corrective measures. The parts to be replaced shall be provided by BHEL free of cost. If the insulation is to be removed to attend any of the defects the cost of removal and reapplication of insulation should be borne by the contractor.
- 17.37 Necessary scaffolding and approaches for conducting the above shall also be within the scope of the contract.
- 17.38 The contractor shall carryout any other test as desired by BHEL Engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning, commissioning, and operation, to demonstrate the completion of any part or whole work performed by the contractor.
- 17.39 During this period though the BHEL's / Client's staff will also be associated in the work, the contractor's responsibility will be to arrange required tools, man and plants till such time the commissioned units are taken over by BHEL's client.

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- 17.40 Contractor shall cut / open works if needed, as per BHEL engineer's instructions during commissioning for inspection, checking and make good the works after inspection is over. This contingency shall be included within the quoted value. During commissioning opening of valves, changing of gaskets, attending to leakages, minor modification / rectification works may arise. The contractor has to carry out these works at his cost by providing required manpower in all the three shifts. In case any rework is required because of contractor's faulty erection and which is noticed during commissioning the same has to be rectified by the contractor at his cost.
- 17.41 For conducting gas tightness test, it may be required to erect the blowers and connecting ducts and commission the same for tightness test. It is the responsibility of the contractor to erect the blowers & dismantle once the test is over. Contractor shall carry out the work within the quoted rate and BHEL will provide blowers and dummies free of cost for conducting the test.
- 17.42 Contractor has to remove the all temporary supports, structures from inside of ducts and grind the all points after cutting and proper clean the duct and make it free from duct, weldments and burrs.
- 17.43 Contractor to provide necessary commissioning assistance from pre-commissioning state onwards and up to continuous operation of the unit & handing over to customer. The category of personnel to be as per site requirement and to meet the various pre-commissioning and commissioning programs made to achieve the schedule agreed with customer.
- 17.44 After synchronization, the commissioning activities will continue. It shall be the responsibility of the contractor to provide manpower including necessary consumables, hand tools and supervision as part commissioning assistance for a period of six months after synchronization or till handing over of sets to customer, whichever is earlier.
- 17.45 Commissioning of the boiler will involve trial runs of all the equipments erected, lighting up of the boiler for refractory drying, blowing of the steam lines, floating of safety valves, flushing of all the lines by air, oil or steam as the case may be, trial run of the fans, Lub. Oil pumps, Mills, servicing of all equipments like dampers, actuators, valves etc. and any other works incidental to commissioning. Contractor shall provide required workers along with supervisors with all the requisite tools round the clock and material for all these works, which shall form part of the work to be done.
- 17.46 After floating of safety valves, the commissioning activities and trial operations will continue up to handing over of the unit. Contractor shall provide the manpower for three months from trial operation or submission of final bill with material reconciliation whichever is later. It shall be the responsibility of the contractor to provide various categories of workers in sufficient numbers as per the work

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requirement along with supervisors including necessary consumable tools etc., during this period. The rate quoted shall indicate all these contingencies also. The various categories of workers required for pre-commissioning, commissioning and post-commissioning activities are as follows:

- a) Pipe fitters
- b) Millwright Fitters
- c) HP & structural welders
- d) Riggers
- e) Unskilled workers
- f) Supervisors
- g) Electricians
- h) Ladders
- i) Sheet metal fabricator/fitter
- j) Any other category of workers as may be required.

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

- 1. One Engineer in charge for three shifts.
- 2. Two supervisors per shift for three shifts
- 3. Three fitters per shift for three shifts
- 4. Six helpers per shift for three shifts

It shall be specifically noted that the above employees of the contractor may have to work round the clock along with BHEL commissioning Engineers and hence, overtime, may be involved. The contractor's quoted rate shall be inclusive of all these factors also.

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

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- 17.49 Hanger adjustment / re-adjustment during erection, before and after Hydraulic Test, before and after steam blowing, during and after full load operation, are to be carried out by the contractor within Quoted Rate.
- 17.50 The contractor has to provide required man power assistance during pre-commissioning and commissioning checks of motor operated valves, actuators, control valves etc. without any extra charges.
- 17.51 It shall be specifically noted that the employees of the contractor may have to work round the clock along with BHEL Engineers and hence overtime payment by the contractor to his employees may be involved. The contractors finally accepted rates should be inclusive of all these factors also
- 17.52 **Boroscopic examination of headers etc. to be conducted after steam blowing.** This requires cutting of tubes to facilitate the boroscopic examination and re welding etc. are part of work and the same to be carried out with in the quoted rate. Boroscope shall be provided by BHEL free of cost.
- 17.53 D.S.L / equivalent system for hoisting equipments are also to be erected and commissioned including load testing by the contractor within the quoted rates. Required manpower including electricians is to be arranged by the contractor for carrying out commissioning of electrical hoist and load testing of electrical hoist. Required loads will be provided by BHEL free of cost.
- 17.54 All Rotating machineries and equipment shall be cleaned, lubricated, checked for their smooth rotation, if necessary dismantling and refitting before erection. If in the opinion of BHEL Engineer, the equipment is to be checked for clearance, tolerance at any stage of work or during commissioning period, all such works for dismantling, cleaning, lubricating and refitting are to be carried out by contractor at his cost.
- 17.55 No payment will be made for temporary installations made for testing of systems & similarly no payment will be made for electrical installations made for any temporary system.
- All materials, equipment's necessary for installation of temporary system as above will be supplied by BHEL as free returnable issue in random sizes / lengths. However, servicing, fabrication, erection, dismantling of the same after completion of the process, and handing over back to BHEL stores will be the responsibility of the Contractor.
- In accounting of temporary materials following wastage allowances are provided:
1. Structural items : 4%

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- ✓ 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
- 17.56 Contractor shall provide assistance in conducting of performance guarantee test (PG test) of the equipments under the scope of work. Contractor shall install all necessary tapping points; instruments etc and provide necessary assistance within the quoted rates. In case PG test is getting delayed beyond the contract period (normal plus extension if any) due to reasons not attributable to the Contractor, PG test issue will be mutually discussed and decided. However installation of necessary tapping points, impulse pipes, approaches etc are to be completed by the Contractor.
- 17.57 The contractor shall carry out all required tests, pre-commissioning and commissioning activities required for the successful and reliable operation of boiler, rotory machines etc.
- 17.58 The 'Initial Operation'/trial operation of the complete facility as an integral unit shall be conducted for continuous upto period specified . During the period of trial operation, all systems in the scope shall operate continuously at full load at designated fuel 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.
- 17.59 Specialized test equipment, if any, shall be provided by BHEL / its client free of hire charges. However contractor has to take proper care of the equipment issued to him.
- 17.60 Contractor shall conduct the air/gas tightness test of all the ducts, dampers and gates under the scope of work. Erection etc. of blowers and blanks and putty required for conducting air tightness test shall be carried out as part of work. (Putty to be procured by the contractor without any extra cost to BHEL).
- 17.61 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

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Chapter-XVII -TESTING, PRE – COMMISSIONING & COMMISSIONING AND POST COMMISSIONING

additional supports as per instruction of BHEL. This work is a part of the work and no additional payment shall be made on this account.

- 17.62 All the shafts of the equipment shall have to be properly aligned to that of matching equipment to perfection, accuracy as required and the equipment shall be free from excessive vibration so as to avoid over-heating of bearings or other conditions, which may tend to shorten the life of the equipment. All bearings, shafts and other rotating parts shall be thoroughly cleaned and lubricated as per recommendations of BHEL engineer.
- 17.63 Lubricating oil units of the rotating machines are to be cleaned thoroughly before pouring of final lubricating oil. Topping up of lubricants during running of the set till handing over to be done by the vendor. Required lubricants both for first filling and topping up are to be supplied by BHEL free of cost. The empty containers of the lubricating oils should be returned to BHEL stores/place indicated by BHEL from time to time.
- 17.64 The instruction of the motor manufacturer regarding storage of the motors and re conservation must be strictly followed without any deviation.
- 17.65 It shall be the responsibility of contractor to attend all punch points post commissioning and resolve the deficiency as may be necessary for handing over the unit to BHEL's Client.

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18 PAINTING

Touch-up Painting: All Boilers 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 contractor, 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 & deployment of tools e.g wire brush, paint brush, Spray M/c, cleaning agents etc.

Contractor shall carry out surface preparation and touchup painting works as per BHEL/Customer specification and instruction of BHEL engineer at site.

18.1 Primer Painting: (wherever applicable incidental to touchup painting & preventive 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 brushing 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.

18.2 Finish Painting (wherever applicable incidental to touchup painting & preventive painting)

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.

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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° C or below.

18.3 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.

18.4 Painting of welded areas / painting of areas exposed after removal of temporary supports / touch-up painting on damaged areas of employer's structures, where inter-connection, welding / modification etc. has been carried out by the bidder.

Clean the surface to remove flux spatters and loose rust, loose coatings in the adjoining areas of weld seams by wire brush and emery paper.

(Painting procedure to be followed for touch-up painting on damaged areas.

18.5 The scope of work includes touchup painting and 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.

18.6 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.

18.07

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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.

18.08

During the preparation of surface, if the shop coat is damaged by chemical cleaning or by mechanical means, contractor shall repair the same free of cost.

18.9

Specified drying time shall be permitted from one to another coat.

18.10

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.

18.11

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.

18.12

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.

18.13

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.

18.14

Final painting work shall be started after obtaining clearance from BHEL engineers and as per his instructions.

18.15

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Acceptance of Final Painting for required thickness shall be as per the thickness measured by Alcometer by PVUNL/BHEL Engineer. Contractor shall have to carry out painting till the required thickness is achieved.

18.16 Prior to application of refractory, bituminous painting (including supply) on the pressure parts and other area is under Contractor scope.

18.17 Painting two coats of bituminous paint on Insulation cladding sheet inner surface.

PAINTING SCHEME: Attached as File titled “Chapter-XVIII- Painting Scheme”

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19 APPLICATION OF INSULATION AND REFRACTORY

- 19.1 Handling at site stores / storage yard, Transportation to site of work, Application of refractory & Insulation materials and connected works for Boiler, Auxiliary boiler, ducts etc. Rotary machines, SCR and auxiliaries, and binding and cladding with sheets etc., using their own tools plants, tackles, all consumables, supervisor and men as enumerated in the scope of contract at Boiler and auxiliaries, Auxiliary boiler etc.
- 19.2 Application of refractory, wool insulation, sheet metal cladding, welding of hooks / supports to hold insulation and refractory's as wherever necessary for all the equipment covered in this contract are to be carried out as per instruction of BHEL Engineer at site. The systems covers under this contract including but are not limited to the following.
Boiler & its Auxiliaries, ESP and its auxiliaries, Boiler integral piping, Critical Piping (P91,P92, HP/LP piping), Non Pressure Parts, Duct, dampers gates and its support structure, Rotating Equipments, Air Pre Heaters, ID/FD/PA fans, SCR and its auxiliaries, FGD and its auxiliaries etc. It also includes connected ducts, HP&LP piping, temporary acid cleaning and steam blowing piping connected tubes, oil and coal burners, oil and steam tracing lines complete and fuel and draft plants, all drain lines, traps, flanges, fine fittings, sampling lines, fans and other equipment like Vessels, Flash tanks, steam separator, ceiling heat recovery area etc.
- 19.3 The work shall conform to dimensions and tolerances given in various drawings and quality manuals provided by BHEL. If any portion of work is found to be defective in workmanship not conforming to drawings or other stipulations, the contractor shall dismantle and redo the work duly replacing the defective materials at his cost, failing which the job will be carried out by BHEL by engaging other agencies / departmentally and recoveries will be effected from contractor's bill towards expenditure incurred including BHEL's overhead charges.
- 19.4 All insulations and refractory materials including iron components and other sheets casing materials, etc., required as per drawing will be supplied by BHEL and the same have to be erected / applied as per the drawings and specifications of BHEL by the contractor.
- 19.5 Clean the Surface to be Insulated from Rust, Dust, Grease, Loose scale, Oil, Moisture, etc. Care shall be taken that flexible insulation is not unduly compressed. After insulating the equipment the gaps / joints shall be filled with loose wool/ moulded insulation as applicable
- 19.6 Painting of inner side of sheet metal covering over the insulation walls with two coats of anti-corrosive paint (IS-158) to be applied to the entire satisfaction of BHEL Engineer and application of bituminous sealing compound on cladding/ sheet metal

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- joints shall also be carried out by the contractor. Retainer type 'A' must be coated with Aluminium paint. For which the required amount of paint, thinner and other accessories for painting, cleaning the surfaces etc., shall be supplied by the contractor within the quoted rate.
- 19.7 Bituminous sealing compound will be provided by BHEL free of cost which is supplied by the respective Mfg. Units.
- 19.8 It is the responsibility of the contractor to ensure that the insulation and refractory materials and sheet metal covering issued to him for application are well protected against loss or damage or weather conditions tending to affect its quality by the provision of close / semi closed sheds at his cost. All the insulation and refractory materials and sheet metal covering etc., issued to the contractor shall be properly stored and handled before application due the same. If any damage occur to the materials due to improper storage or due to any causes attributable to the contractor except for normal breakage or damaged material shall be to the cost of the contractor.
- 19.9 Contractor is liable for the exact accounting of the materials issued to him and any unaccountable losses shall be made good by him. The necessary accounting of the material issued will have to be furnished by the contractor periodically
- 19.10 The contractor shall provide the required quantity of wire, nails and other materials for centering works at their cost.
- 19.11 Wherever iron components are to be welded on non-pressure parts, the contractor shall employ only approved structural welders. It shall also be the responsibility of the contractor to arrange for welding hooks, flats, plates, supports and other fixtures also. All consumables tools and plants etc., required for the work shall be arranged by the contractor at their cost.
- 19.12 Contractor shall observe all precautions for laying and curing of Castable refractory. Any defective works found shall be re-laid by contractor at his own cost including materials.
- 19.13 Wool insulations are received at site as bonded and un bonded mattresses in standard sizes. These has to be dressed / cut to suit equipment / site work by the contractor.
- 19.14 For the insulation of hot air duct, gas duct, ID duct etc., un faced bonded wool, mattresses is to be used with wire netting (wire netting is supplied separately) on the outside for rigidity.
- 19.15 Dressing of insulation bricks to suit site conditions curing the refractory concrete applied, sheet cladding over insulations, form the part of this work.

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- 19.16 Removal type of insulation to be provided for valves fittings, expansion joints etc., as per the drawings or as directed by BHEL Engineer.
- 19.17 All piping insulations shall be carried out in such a manner as to facilitate removal of bolts nuts and washers from the flanges.
- 19.18 Refractory works at complete combustion chambers, ceiling heat recovery area, oil and coal burner areas and application of castable refractory wherever specified in drawing or as directed by BHEL Engineer have to be carried out.
- 19.19 Fabrication of covering sheets may be necessary like preparing the sheets to the sizes and shapes specified in drawings, beading, swaging, beveling of sheets crowning of the sheets if necessary the same to supports over wool insulation with screws as specified in BHEL drawings or as instructed by BHEL engineer.
- 19.20 Fabrication, fixing or welding of hooks / supports to equipment of boiler parts, piping and other connected equipments to support wool insulation applying of primer paint to welded portion parts welding certain supports on parts other than pressure parts to hold refractory's (by engaging approved welders) as per the drawings or as instructed by BHEL Engineer will have to be carried out by the contractor.
- 19.21 The contractor shall leave certain gap and opening while doing the work as per the instructions of BHEL Engineer to facilitate inspection by Boiler Inspector or doing commissioning to fix gauges, fittings, instruments. Those gaps will have to be finished as per drawings at a later date by the contractor at his cost, as required by BHEL .
- 19.22 Cladding sheets shall be suitably pressed along with diagonals to form diamond shape so as to improve the strength of the sheets, to avoid humpiness and to give aesthetic look.
- 19.23 Plates ,bars, rods and other materials that are to be cut, and re-welded from the fabricated places to suit erection requirements for which no extra payment will be made to the contractor.
- 19.24 A log book shall be maintained by the contractor for the clearance of the area for application of refractory and insulation. If the contractor does the work on his own accord without prior permission the area should be redone at his cost.
- 19.25 The contractor shall draw only one week's requirement of material for their work from BHEL stores and keep them in their semi-closed shed near to the work area. The materials required for a particular space of work only shall be taken to the work spot. At the end of the day's work the leftover or unused materials shall be taken back to their semi-closed shed for keeping the materials safe. Necessary records shall have to

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be maintained by the contractor in respect of the above draws / deposits, on daily basis as instructed by BHEL.

19.26 Wastages allowance for the materials issued are envisaged as follows:

- a) Castable refractory 2%
- b) Insulation bricks & mortar 2%
- c) Wool mattresses 2%
- d) Cladding sheets 5%

19.27 Making structural supporting works for pourable insulation, laying pourable insulation, adhering to all specifications and instructions shall be the responsibility of the contractor

19.28 Upon completion of daily work, the contractor shall remove from the vicinity of work all scrap packing materials rubbish, unused and other materials and deposit them in places to be specified by BHEL Engineer. Also, the contractor will demolish all the hutments, sheds, offices, constructed by him and shall clean the debris after the contract is over. In the event of his failure to do so, the same will be arranged / removed by BHEL Engineer and the expenses incurred with overhead will be recovered from the contractors.

19.29 Welding of hooks as per pitch, non-pressure parts, applying red oxide paint to the welded portion as directed as per drawings before application of mineral wool mattresses will have to be done by the contractor.

19.30 Applying different layers of mineral wool as directed and as per drawings and specifications for boiler and its auxiliaries, pipelines valves and other vessels and after fixing require holdings materials, suitably if necessary, fabrication of rings etc., and fixing as directed and as per drawings and specifications shall also form part of this work.

19.31 If necessary the hooks may have to be made from the rods, raw materials supplied in running lengths. The contractor may have to carry out this work also and use the same hooks.

19.32 In case the contractor is required to dismantle and re-erect certain area as and when required for pre-commissioning / commissioning activities the rate as indicated in the rate schedule shall be paid by BHEL for erection. However, for dismantling no extra charge will be paid under any circumstances.

19.33 Wherever additional / clamps, frame works, etc., are required to be fabricated and installed even though not indicated in the drawings shall be fabricated and installed at their cost. Only steel materials shall be given by BHEL free of cost, consumables like electrodes, gases etc., are to arranged by the contractor at his cost.

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- 19.34 Contractor has to arrange required fire retardant covering material at their cost to protect the insulation materials drawn from BHEL before and after erection.
- 19.35 The contractor shall provide any fixtures, concrete blocks / wooden sleepers, etc., which are required for temporary supporting of the insulation materials at site.
- 19.36 Delay in clearance of mechanical equipment and piping for insulations is unlikely to happen. However, if any delay occurs, the contractor shall not claim anything extra, like idle charges.
- 19.37 Welding of all seal boxes covers after completion of refractory work shall be done by the contractor. No extra charges will be payable for the same
- 19.38 Application of Castable refractory between tubes around burners on ceiling and as directed by Engineers and as per detailed drawings and specifications will have to be done by the contractor
- 19.39 Welding of iron components directly on pressure parts and HP piping is are to be carried out by certified IBR high pressure welders.
- 19.40 Application of insulation and removal of the same for temporary piping under scope of erection of this contract is also included in the scope of the work. However, BHEL will supply the insulation materials free of cost.
- 19.41 Dressing of insulation to suit site conditions, sheet cladding over insulations, form the part of this work.
- 19.42 The temporary structures / items welded to permanent members / pipes are to be cut and removed without any damage. Any damage so to permanent members / pipes to be made good by the contractor at his cost.
- 19.43 The contractor will have to follow the instructions provided in the technical manuals, drawings, and specifications provided by BHEL, to the contractor from time to time. In case of ambiguity or deviation the decision / clarification of BHEL Engineer will have to be followed.
- 19.44 All rectification including painting of Employer's structure which are damaged by contractor during his work.
- 19.45 Special type of insulation wool used in penthouse shall not be cut. Indiscriminately. All chicken mesh, cut bits shall be accounted for.
- 19.46 The Contractor shall provide all the necessary scaffolding materials, temporary structures and necessary safety devices etc, during all stages of work. Scaffolding

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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.

- 19.47 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.
- 19.48 The mineral wool mattresses (bonded / un-bonded) / LRB mattresses are received at site in standard sizes. These are to be dressed / cut to suit site requirements by the contractor.
- 19.49 The number of layers / thickness of mineral wool / LRB mattresses for auxiliaries, pipe lines, valves and other vessels shall be as per various drawings and as directed by Engineer. For applying the mineral wool mattress, the required holding materials, if necessary by fabrication of rings/ hooks shall be fixed as directed and as per drawings and spec.
- 19.50 The contractor should ensure, proper finishing of surface of the insulation, sheeting and cementing.
- 19.51 The contractor should ensure that the finished surface of the insulation works conforms to the dimensions and tolerances given in the drawings. Aesthetic finish and accuracy of work are most important.
- 19.52 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 be 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.
- 19.53 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

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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.

- 19.54 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.
- 19.55 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.
- 19.56 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 applicable departmental charges.
- 19.57 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.
- 19.58 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.
- 19.59 The cladding and outer casing are aluminium sheets. All relevant specifications and procedures with regards to beading, sealing etc for aluminium sheets have to be adhered to.
- 19.60 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.
- 19.61 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,

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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.

- 19.62 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.
- 19.63 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.
- 19.64 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.
- 19.65 Removable type of insulation shall be provided for valves, fittings, expansion joints etc as per the drawings or as directed by BHEL Engineer.
- 19.66 All temporary pipelines required during testing, pre-commissioning and commissioning should be insulated as directed by BHEL at no extra cost to BHEL. However required insulation material shall be issued by BHEL free of cost.
- 19.67 The following works are also included in the scope of this contract.

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.

Cutting of the wool mattresses in the required shape and application of finishing cement of required thickness wherever required.

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Chapter-XX PRESERVATION & PROTECTION OF COMPONENTS

20 PRESERVATION & PROTECTION OF COMPONENTS

- 20.1 At all stages of work, equipments/materials in the custody of Contractor, including those erected, will have to be preserved as per the instructions of BHEL. Necessary preservation agents including the primer & paint, for the above work shall be provided by the Contractor.
- 20.2 The Contractor shall make suitable security arrangements including employment of security personnel and ensure protection of all materials/ equipment in their custody and installed equipments from theft/fire/pilferage and any other damages and losses.
- 20.3 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 and remove the scrap at contractor's cost with applicable overheads.
- 20.4 The entire surplus, damaged, unused materials, packaging materials / containers, special transporting frames, gunny bags, etc shall be returned to BHEL stores by the Contractor.
- 20.5 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.
- 20.6 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.

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Chapter-XXI: Welding Schedule

Chapter-XXI: Reference Welding Schedule is uploaded separately as a file named '**Chapter-XXI: Welding Schedule**'.

Welding schedule is attached with this TCC for reference and understanding purpose and final welding schedule shall be made available during erection by BHEL engineer. However, this does not entitle contractor of any compensation on account of any changes in final ESW issued by BHEL during execution of works at site.

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Chapter-XXII: Weightages / Factor

Balance work of the Erection, Testing and assistance for commissioning & Trial Operation including application of Insulation, Refractory, supply & touch-up painting as and where required including Handling of materials at BHEL / Client's Stores / Storage Yard and transportation to site etc. of

1. Balance work of Erection, Testing and assistance for commissioning & Trial Operation including handling of materials at BHEL / Client's Stores / Storage Yard and transportation to site of; Boiler & its Auxiliaries, ESP and its auxiliaries, Boiler integral piping, Critical Piping (P91, HP/LP piping), Structure for bunker (BHEL Mfg units Supplied items), Non Pressure Parts, Duct dampers and its support structure, Rotating Equipments, Air Pre Heaters, ID/FD/PA fans, SCR and its auxiliaries, FGD and its auxiliaries, Lining and Insulation, Supply and application of touchup painting, (As and wherever required).

And

2. Balance Erection work of Bunker & allied works, including supply & installation of items as per BOQ of Unit-3 at 3x800 MW PVUNL Patratu project

SECTION	DESCRIPTION OF PACKAGES / ITEM OF WORK	Percentage weightage w.r.t Total Price
1	E&C of Boiler & Auxiliaries (Including SCR, FGD, ESP, PCP)	94.80616152%
2	Bunker & Allied works	5.19383848%
	Total Contract Value	100.00%

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Chapter-XXII: Weightages / Factor

Sl No	Area Description	UOM	Balance Qty to execute	Weightage
SECTION 1- BOILER & AUXILIARIES				
1.1 Structure				
1.1.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	13,712	0.03928004
1.1.2	PLACEMENT IN POSITION	MT	13,769	0.02958339
1.1.3	ALIGNMENT	MT	13,833	0.03962683
1.1.4	WELDING / BOLTING / FIXING	MT	14,840	0.04251347
1.1.5	COMPLETION OF NON DESTRUCTIVE EXAMINATION & STRESS RELIEVING, HEAT TREATMENT (IF NOT APPLICABLE, THEN THIS PORTION TO BE PAID ALONG WITH WELDING/BOLTING/FIXING)	MT	14,914	0.02136211
1.1.6	COMPLETION OF SHEET COVERING FOR BOILER ROOF, BURNER ROOF, LIFT SHAFT CLADDING, COMPLETION OF GUTTERS	MT	15,214	0.00653777
1.1.7	PAINTING	MT	33,406	0.00956981
1.1.8	AREA CLEANING, TEMPORARY STRUCTURE CUTTING/REMOVAL AND RETURN OF SCRAP	MT	33,406	0.00478491
1.1.9	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	33,406	0.01913962
1.1.10	MATERIAL RECONCILIATION	MT	13,769	0.00788891
1.1.11	COMPLETION OF CONTRACTUAL OBLIGATION	MT	33,406	0.00478491
	Total Structure>>>			0.22507175
1.2 Pressure Parts				
1.2.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	3,006	0.01040855

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1.2.2	PLACEMENT IN POSITION	MT	5,059	0.00875856
1.2.3	ALIGNMENT	MT	8,180	0.02124454
1.2.4	WELDING / BOLTING / FIXING	MT	6,796	0.02353394
1.2.5	COMPLETION OF NON DESTRUCTIVE EXAMINATION & STRESS RELIEVING, HEAT TREATMENT (IF NOT APPLICABLE, THEN THIS PORTION TO BE PAID ALONG WITH WELDING/BOLTING/FIXING)	MT	7,471	0.01293459
1.2.6	COMPLETION OF ATTACHMENT WELDING, FIN WELDING, SUPPORTS	MT	7,184	0.00621956
1.2.7	COMPLETION OF ROOF SKIN CASING & ALL CLADDING WORKS	MT	12,002	0.00831195
1.2.8	HANGERS & SUPPORTS ETC WHEREVER NECESSARY AS PER DRG.	MT	7,297	0.00126346
1.2.9	COMPLETION OF AIR & GAS TIGHTNESS TEST FOR FURNACE	MT	12,002	0.00415598
1.2.10	BOILER HYDRAULIC TEST(DRAINABLE)	MT	12,002	0.00415598
1.2.11	BOILER HYDRAULIC TEST(NON DRAINABLE)	MT	12,002	0.00207799
1.2.12	REHEATER COILS HYDRAULIC TEST	MT	12,002	0.00415598
1.2.13	BOILER LIGHT UP	MT	12,002	0.00207799
1.2.14	ABO/CHEMICAL CLEANING	MT	12,002	0.00207799
1.2.15	SAFETY VALVE FLOATING	MT	12,002	0.00415598
1.2.16	AREA CLEANING, TEMPORARY STRUCTURE CUTTING/REMOVAL AND RETURN OF SCRAP	MT	12,002	0.00207799
1.2.17	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	12,002	0.00207799
1.2.18	MATERIAL RECONCILIATION	MT	5,059	0.00087594
1.2.19	COMPLETION OF CONTRACTUAL OBLIGATION	MT	12,002	0.00207799
	Total Pressure Part>>>			0.12264292
1.3 Non Pressure Part				

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1.3.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	10,900	0.03953317
1.3.2	PLACEMENT IN POSITION	MT	11,100	0.01610261
1.3.3	ALIGNMENT (As per Amendt.ref no-BHE/PW/PUR/NTPRT-BLR PCP ESP FDG - U3/2314/Corg-02, Dated-21.10.2020)	MT	11,279	0.02454315
1.3.4	WELDING / BOLTING / FIXING	MT	11,351	0.03293304
1.3.5	HANGERS & SUPPORTS ETC WHEREVER NECESSARY AS PER DRG.	MT	11,273	0.02453178
1.3.6	AIR & GAS TIGHTNESS TEST	MT	11,827	0.00857907
1.3.7	ABO/CHEMICAL CLEANING	MT	11,827	0.00171581
1.3.8	STEAM BLOWING	MT	11,827	0.00343163
1.3.9	COAL FIRING	MT	11,827	0.00343163
1.3.10	PAINTING	MT	11,827	0.00171581
1.3.11	AREA CLEANING, TEMPORARY STRUCTURE CUTTING/REMOVAL AND RETURN OF SCRAP	MT	11,827	0.00171581
1.3.12	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	11,827	0.00171581
1.3.13	MATERIAL RECONCILIATION	MT	11,089	0.00160874
1.3.14	COMPLETION OF CONTRACTUAL OBLIGATION	MT	11,827	0.00171581
	Total Non Pressure Part >>>			0.16327389
1.4 Rotating Machines				
1.4.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	1,050	0.00157298
1.4.2	PLACEMENT IN POSITION	MT	1,050	0.00209731
1.4.3	ALIGNMENT	MT	1,454	0.00290454
1.4.4	WELDING / BOLTING / FIXING	MT	1,546	0.00308998
1.4.5	EQUIPMENT TRIAL OPERATION	MT	2,484	0.00248150

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1.4.6	CLEAN AIR FLOW TEST	MT	2,484	0.00024815
1.4.7	BOILER LIGHT UP	MT	2,484	0.00024815
1.4.8	ABO/CHEMICAL CLEANING	MT	2,484	0.00024815
1.4.9	STEAM BLOWING	MT	2,484	0.00024815
1.4.10	COAL FIRING	MT	2,484	0.00049630
1.4.11	FULL LOAD	MT	2,484	0.00024815
1.4.12	TRIAL OPERATION OF UNIT	MT	2,484	0.00049630
1.4.13	PAINTING	MT	2,484	0.00049630
1.4.14	AREA CLEANING, TEMPORARY STRUCTURE CUTTING/REMOVAL AND RETURN OF SCRAP	MT	2,484	0.00024815
1.4.15	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	2,484	0.00024815
1.4.16	MATERIAL RECONCILIATION	MT	1,050	0.00010487
1.4.17	COMPLETION OF CONTRACTUAL OBLIGATION	MT	2,484	0.00024815
	Total RM & Handling Eqpts. Part >>>			0.01572526
1.5 Air Preheater (APH)				
1.5.1	Completion of Support steel squareness and levelling, Expansion arrangement, Housing panel erection and alignment, Erection, alignment and welding of pedestals	MT	1,376	0.00151199
1.5.2	Completion of Erection, alignment and welding of Support Bearing, Guide Bearing, Rotor post, Bottom and Top centre sections, Hot and cold end connecting plates	MT	1,376	0.00233671
1.5.3	Completion of erection and alignment of modules	MT	1,376	0.00206181
1.5.4	Completion of erection, alignment and welding of Pin Rack assembly and Drive assembly	MT	1,376	0.00164945
1.5.5	Completion of seals setting	MT	2,628	0.00446359
1.5.6	Erection, alignment and welding of Lube oil systems, Cleaning Device, Fire sensing device,	MT	2,628	0.00262564

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	Deluge and water wash lines, Observation port and lighting assemblies and other accessories			
1.5.7	Completion of PGMA	MT	2,628	0.00026256
1.5.8	Air preheater Trial Run	MT	2,628	0.00052513
1.5.9	BOILER LIGHT UP	MT	2,628	0.00052513
1.5.10	ABO/CHEMICAL CLEANING	MT	2,628	0.00052513
1.5.11	STEAM BLOWING	MT	2,628	0.00026256
1.5.12	SAFETY VALVE FLOATING	MT	2,628	0.00052513
1.5.13	COAL FIRING	MT	2,628	0.00052513
1.5.14	PAINTING	MT	2,628	0.00026256
1.5.15	AREA CLEANING, TEMPORARY STRUCTURE CUTTING/REMOVAL AND RETURN OF SCRAP	MT	2,628	0.00026256
1.5.16	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	2,628	0.00052513
1.5.17	MATERIAL RECONCILIATION	MT	1,418	0.00014164
1.5.18	COMPLETION OF CONTRACTUAL OBLIGATION	MT	2,628	0.00026256
	Total Air Pre Heater Part >>>			0.01925443
1.6 Insulation - Wool Matress				
1.6.1	PLACEMENT IN POSITION	MT	3,056	0.02034841
1.6.2	ALIGNMENT	MT	3,056	0.00610452
1.6.3	WELDING / BOLTING / FIXING	MT	3,056	0.00610452
1.6.4	COMPLETION OF ROOF SKIN CASING & AI CLADDING WORKS	MT	3,056	0.00203484
1.6.5	BOILER LIGHT UP	MT	3,056	0.00040697
1.6.6	ABO/CHEMICAL CLAENING	MT	3,056	0.00040697
1.6.7	STEAM BLOWING	MT	3,056	0.00040697
1.6.8	SAFETY VALVE FLOATING	MT	3,056	0.00040697
1.6.9	COAL FIRING	MT	3,056	0.00040697

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1.6.10	FULL LOAD	MT	3,056	0.00040697
1.6.11	TRIAL OPERATION OF UNIT	MT	3,056	0.00081394
1.6.12	Area cleaning, temporary structures cutting/removal and return of scrap	MT	3,056	0.00122090
1.6.13	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	3,056	0.00040697
1.6.14	MATERIAL RECONCILIATION	MT	3,056	0.00081394
1.6.15	COMPLETION OF CONTRACTUAL OBLIGATION	MT	3,056	0.00040697
	Total WOOL MATRESS Part >>>			0.04069682
1.7 Insulation - Pourable & Castable				
1.7.1	PLACEMENT IN POSITION	MT	270	0.00181880
1.7.2	ALIGNMENT	MT	270	0.00054564
1.7.3	WELDING / BOLTING / FIXING	MT	270	0.00054564
1.7.4	COMPLETION OF ROOF SKIN CASING & AI CLADDING WORKS	MT	270	0.00018188
1.7.5	BOILER LIGHT UP	MT	270	0.00003638
1.7.6	ABO/CHEMICAL CLAENING	MT	270	0.00003638
1.7.7	STEAM BLOWING	MT	270	0.00003638
1.7.8	SAFETY VALVE FLOATING	MT	270	0.00003638
1.7.9	COAL FIRING	MT	270	0.00003638
1.7.10	FULL LOAD	MT	270	0.00003638
1.7.11	TRIAL OPERATION OF UNIT	MT	270	0.00007275
1.7.12	Area cleaning, temporary structures cutting/removal and return of scrap	MT	270	0.00010913
1.7.13	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	270	0.00003638
1.7.14	MATERIAL RECONCILIATION	MT	270	0.00007275
1.7.15	COMPLETION OF CONTRACTUAL OBLIGATION	MT	270	0.00003638

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	Total POURABLE & CASTABLE INSULATION Part >>>			0.00363760
1.8 Insulation - Iron Parts				
1.8.1	PLACEMENT IN POSITION	MT	1,148	0.00799110
1.8.2	ALIGNMENT	MT	1,148	0.00239733
1.8.3	WELDING / BOLTING / FIXING	MT	1,148	0.00239733
1.8.4	COMPLETION OF ROOF SKIN CASING & Al CLADDING WORKS	MT	1,148	0.00079911
1.8.5	BOILER LIGHT UP	MT	1,148	0.00015982
1.8.6	ABO/CHEMICAL CLAENING	MT	1,148	0.00015982
1.8.7	STEAM BLOWING	MT	1,148	0.00015982
1.8.8	SAFETY VALVE FLOATING	MT	1,148	0.00015982
1.8.9	COAL FIRING	MT	1,148	0.00015982
1.8.10	FULL LOAD	MT	1,148	0.00015982
1.8.11	TRIAL OPERATION OF UNIT	MT	1,148	0.00031964
1.8.12	Area cleaning, temporary structures cutting/removal and return of scrap	MT	1,148	0.00047947
1.8.13	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	1,148	0.00015982
1.8.14	MATERIAL RECONCILIATION	MT	1,148	0.00031964
1.8.15	COMPLETION OF CONTRACTUAL OBLIGATION	MT	1,148	0.00015982
	Total IRON PARTS Part >>>			0.01598219
1.9 Aluminium Cladding Sheet				
1.9.1	PLACEMENT IN POSITION	MT	889	0.00645737
1.9.2	ALIGNMENT	MT	889	0.00193721
1.9.3	WELDING / BOLTING / FIXING	MT	889	0.00193721
1.9.4	COMPLETION OF ROOF SKIN CASING & Al CLADDING WORKS	MT	889	0.00064574
1.9.5	BOILER LIGHT UP	MT	889	0.00012915

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1.9.6	ABO/CHEMICAL CLAENING	MT	889	0.00012915
1.9.7	STEAM BLOWING	MT	889	0.00012915
1.9.8	SAFETY VALVE FLOATING	MT	889	0.00012915
1.9.9	COAL FIRING	MT	889	0.00012915
1.9.10	FULL LOAD	MT	889	0.00012915
1.9.11	TRIAL OPERATION OF UNIT	MT	889	0.00025829
1.9.12	Area cleaning, temporary structures cutting/removal and return of scrap	MT	889	0.00038744
1.9.13	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	889	0.00012915
1.9.14	MATERIAL RECONCILIATION	MT	889	0.00025829
1.9.15	COMPLETION OF CONTRACTUAL OBLIGATION	MT	889	0.00012915
	Total ALUMINIUM CLADDING SHEET Part >>>			0.01291474
	TOTAL BOILER			0.61919960
2.1 ESP & ITS AUXILIARIES				
2.1.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	4,543	0.00658393
2.2.2	PLACEMENT IN POSITION	MT	4,543	0.00877857
2.1.2	ALIGNMENT	MT	5,465	0.00792022
2.2.3	WELDING / BOLTING / FIXING	MT	7,706	0.01489227
2.1.3	COMPLETION OF HOPPERS ALONG WITH ALL DOORS, HEATING ELEMENTS, POKING DOORS, ETC	MT	10,024	0.00484286
2.2.4	COMPLETION OF INNER, OUTER ROOF INSULATOR HOUSING, RECTIFIER TRANSFORMERS, PENT HOUSE MONO RAILS, HOISTS ETC	MT	10,538	0.00509111
2.1.4	ERECTION OF EMITTING AND COLLECTING RAPPING SYSTEM WITH ALL DRIVES	MT	14,346	0.00693083
2.2.5	AIR & GAS TIGHTNESS TEST	MT	14,346	0.00138617

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2.1.5	GAS DISTRIBUTION TEST	MT	14,346	0.00138617
2.2.6	CHARGING OF ESP FIELDS	MT	14,346	0.00554466
2.1.6	FULL LOAD	MT	14,346	0.00277233
2.2.7	TRIAL OPERATION OF UNIT	MT	14,346	0.00138617
2.1.7	Painting	MT	14,346	0.00277233
2.2.8	Area cleaning, temporary structures cutting/removal and return of scrap	MT	14,346	0.00138617
2.1.8	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	14,346	0.00138617
2.2.9	MATERIAL RECONCILIATION	MT	4,565	0.00044110
2.1.9	COMPLETION OF CONTRACTUAL OBLIGATION	MT	14,346	0.00138617
	Total ESP & Its Auxiliaries			0.07488721
3.1 FGD & Its Auxiliaries (Absorber/Structure/Duct Damper)				
3.1.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	3,363	0.01131525
3.1.2	PLACEMENT IN POSITION	MT	3,363	0.00565762
3.1.3	ALIGNMENT	MT	3,363	0.00848644
3.1.4	WELDING / BOLTING / FIXING	MT	3,363	0.00848644
3.1.5	COMPLETION OF NON DESTRUCTIVE EXAMINATION & STRESS RELIEVING/ HEAT TREATMENT (if not applicable, then this portion to be paid along with WELDING/BOLTING/FIXING)	MT	3,363	0.00565762
3.1.6	HANGERS & SUPPORTS ETC WHEREVER NECESSARY AS PER DRG	MT	3,363	0.00565762
3.1.7	HYDRAULIC TEST OR PNEUMATIC TEST	MT	3,363	0.00282881
3.1.8	AIR & GAS TIGHTNESS TEST	MT	3,363	0.00141441
3.1.9	Completion of Trial run of Slurry pumps	MT	3,363	0.00084864

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3.1.10	Trial run of Wet ball mills	MT	3,363	0.00056576
3.1.11	Commissioning of Absorber System	MT	3,363	0.00056576
3.1.12	Trial run of Oxidation Blower	MT	3,363	0.00056576
3.1.13	Trial run of FGD System	MT	3,363	0.00113152
3.1.14	Painting	MT	3,363	0.00113152
3.1.15	Area cleaning, temporary structures cutting/removal and return of scrap	MT	3,363	0.00056576
3.1.16	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	3,363	0.00056576
3.1.17	MATERIAL RECONCILIATION	MT	3,363	0.00056576
3.1.18	COMPLETION OF CONTRACTUAL OBLIGATION	MT	3,363	0.00056576
	Total FLUE GAS DESULPHARISER Part >>>>>			0.05657623
4.1 Power Cycle Piping P-91/92 (5A)				
4.1.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	1,436	0.01029033
4.1.2	PLACEMENT IN POSITION	MT	1,436	0.01372045
4.1.3	ALIGNMENT	MT	1,436	0.01029033
4.1.4	WELDING / BOLTING / FIXING	MT	1,436	0.01372045
4.1.5	COMPLETION OF NON DESTRUCTIVE EXAMINATION & STRESS RELIEVING, HEAT TREATMENT (IF NOT APPLICABLE, THEN THIS PORTION TO BE PAID ALONG WITH WELDING/BOLTING/FIXING)	MT	1,436	0.00343011
4.1.6	HANGERS & SUPPORTS ETC WHEREVER NECESSARY AS PER DRG	MT	1,436	0.00343011
4.1.7	HYDRAULIC TEST OR PNEUMATIC TEST	MT	1,436	0.00205807
4.1.8	FLOATING OF LINES, FINAL ADJUSTMENT OF SUPPORTS FOR COLD AND HOT VALUES (if not	MT	1,436	0.00137204

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	applicable, this portion to be clubbed along with hydraulic test/pneumatic test)			
4.1.9	BOILER LIGHT UP	MT	1,436	0.00068602
4.1.10	STEAM BLOWING	MT	1,436	0.00137204
4.1.11	Rolling & synchronization	MT	1,436	0.00068602
4.1.12	FULL LOAD	MT	1,436	0.00068602
4.1.13	TRIAL OPERATION OF UNIT	MT	1,436	0.00068602
4.1.14	Completion of all drains and vents to respective locations and placement of instrument sensors after steam blowing	MT	1,436	0.00068602
4.1.15	Painting	MT	1,436	0.00205807
4.1.16	Area cleaning, temporary structures cutting/removal and return of scrap	MT	1,436	0.00068602
4.1.17	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	1,436	0.00068602
4.1.18	Submission of 'As Built Drawings'	MT	1,436	0.00068602
4.1.19	MATERIAL RECONCILIATION	MT	1,436	0.00068602
4.1.20	COMPLETION OF CONTRACTUAL OBLIGATION	MT	1,436	0.00068602
	Total P-91/92 PIPING Part >>>			0.06860223
4.2 Piping Including P-11,12,22 (HP Piping)				
4.2.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	1,812	0.01018572
4.2.2	PLACEMENT IN POSITION	MT	1,812	0.01358096
4.2.3	ALIGNMENT	MT	1,812	0.01018572
4.2.4	WELDING / BOLTING / FIXING	MT	1,812	0.01358096
4.2.5	COMPLETION OF NON DESTRUCTIVE EXAMINATION & STRESS RELIEVING, HEAT TREATMENT (IF NOT APPLICABLE, THEN THIS	MT	1,812	0.00339524

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	PORTION TO BE PAID ALONG WITH WELDING/BOLTING/FIXING)			
4.2.6	HANGERS & SUPPORTS ETC WHEREVER NECESSARY AS PER DRG	MT	1,812	0.00339524
4.2.7	HYDRAULIC TEST OR PNEUMATIC TEST	MT	1,812	0.00203714
4.2.8	FLOATING OF LINES, FINAL ADJUSTMENT OF SUPPORTS FOR COLD AND HOT VALUES (if not applicable, this portion to be clubbed along with hydraulic test/pneumatic test)	MT	1,812	0.00135810
4.2.9	BOILER LIGHT UP	MT	1,812	0.00067905
4.2.10	STEAM BLOWING	MT	1,812	0.00135810
4.2.11	Rolling & synchronization	MT	1,812	0.00067905
4.2.12	FULL LOAD	MT	1,812	0.00067905
4.2.13	TRIAL OPERATION OF UNIT	MT	1,812	0.00067905
4.2.14	Completion of all drains and vents to respective locations and placement of instrument sensors after steam blowing	MT	1,812	0.00067905
4.2.15	Painting	MT	1,812	0.00203714
4.2.16	Area cleaning, temporary structures cutting/removal and return of scrap	MT	1,812	0.00067905
4.2.17	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	1,812	0.00067905
4.2.18	Submission of 'As Built Drawings'	MT	1,812	0.00067905
4.2.19	MATERIAL RECONCILIATION	MT	1,812	0.00067905
4.2.20	COMPLETION OF CONTRACTUAL OBLIGATION	MT	1,812	0.00067905
	Total P-11,12,22 HP PIPING Part >>>			0.06790480
4.3 LP Piping				
4.3.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	939	0.00457441

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4.3.2	PLACEMENT IN POSITION	MT	939	0.00609922
4.3.3	ALIGNMENT	MT	939	0.00457441
4.3.4	WELDING / BOLTING / FIXING	MT	939	0.00609922
4.3.5	COMPLETION OF NON DESTRUCTIVE EXAMINATION & STRESS RELIEVING, HEAT TREATMENT (IF NOT APPLICABLE, THEN THIS PORTION TO BE PAID ALONG WITH WELDING/BOLTING/FIXING)	MT	939	0.00152480
4.3.6	HANGERS & SUPPORTS ETC WHEREVER NECESSARY AS PER DRG	MT	939	0.00152480
4.3.7	HYDRAULIC TEST OR PNEUMATIC TEST	MT	939	0.00091488
4.3.8	FLOATING OF LINES, FINAL ADJUSTMENT OF SUPPORTS FOR COLD AND HOT VALUES (if not applicable, this portion to be clubbed along with hydraulic test/pneumatic test)	MT	939	0.00060992
4.3.9	BOILER LIGHT UP	MT	939	0.00030496
4.3.10	STEAM BLOWING	MT	939	0.00060992
4.3.11	Rolling & synchronization	MT	939	0.00030496
4.3.12	FULL LOAD	MT	939	0.00030496
4.3.13	TRIAL OPERATION OF UNIT	MT	939	0.00030496
4.3.14	Completion of all drains and vents to respective locations and placement of instrument sensors after steam blowing	MT	939	0.00030496
4.3.15	Painting	MT	939	0.00091488
4.3.16	Area cleaning, temporary structures cutting/removal and return of scrap	MT	939	0.00030496
4.3.17	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	939	0.00030496
4.3.18	Submission of 'As Built Drawings'	MT	939	0.00030496
4.3.19	MATERIAL RECONCILIATION	MT	939	0.00030496
4.3.20	COMPLETION OF CONTRACTUAL OBLIGATION	MT	939	0.00030496

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	Total LP PIPING Part >>>			0.03049610
4.4 HANGERS & SUPPORTS				
4.4.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	1,426	0.00428882
4.4.2	PLACEMENT IN POSITION	MT	1,426	0.00714804
4.4.3	ALIGNMENT	MT	1,426	0.00428882
4.4.4	WELDING / BOLTING / FIXING	MT	1,426	0.00857765
4.4.5	BOILER LIGHT UP	MT	1,438	0.00028829
4.4.6	STEAM BLOWING	MT	1,438	0.00057659
4.4.7	Rolling & synchronization	MT	1,438	0.00028829
4.4.8	FULL LOAD	MT	1,438	0.00028829
4.4.9	TRIAL OPERATION OF UNIT	MT	1,438	0.00057659
4.4.10	Painting	MT	1,438	0.00086488
4.4.11	Area cleaning, temporary structures cutting/removal and return of scrap	MT	1,438	0.00028829
4.4.12	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	1,438	0.00028829
4.4.13	Submission of 'As Built Drawings'	MT	1,438	0.00028829
4.4.14	MATERIAL RECONCILIATION	MT	1,426	0.00028592
4.4.15	COMPLETION OF CONTRACTUAL OBLIGATION	MT	1,438	0.00028829
	Total HANGERS & SUPPORTS Part >>>			0.02862538
4.5 SS Piping				
4.5.1	ON PRE - ASSEMBLY WHEREVER APPLICABLE (IF NOT APPLICABLE, THIS PORTION SHALL BE CLUBBED WITH PLACEMENT IN POSITION)	MT	26	0.00026551
4.5.2	PLACEMENT IN POSITION	MT	26	0.00035401
4.5.3	ALIGNMENT	MT	26	0.00026551
4.5.4	WELDING / BOLTING / FIXING	MT	26	0.00035401

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4.5.5	COMPLETION OF NON DESTRUCTIVE EXAMINATION & STRESS RELIEVING, HEAT TREATMENT (IF NOT APPLICABLE, THEN THIS PORTION TO BE PAID ALONG WITH WELDING/BOLTING/FIXING)	MT	26	0.00008850
4.5.6	HANGERS & SUPPORTS ETC WHEREVER NECESSARY AS PER DRG	MT	26	0.00008850
4.5.7	HYDRAULIC TEST OR PNEUMATIC TEST	MT	26	0.00005310
4.5.8	FLOATING OF LINES, FINAL ADJUSTMENT OF SUPPORTS FOR COLD AND HOT VALUES (if not applicable, this portion to be clubbed along with hydraulic test/pneumatic test)	MT	26	0.00003540
4.5.9	BOILER LIGHT UP	MT	26	0.00001770
4.5.10	STEAM BLOWING	MT	26	0.00003540
4.5.11	Rolling & synchronization	MT	26	0.00001770
4.5.12	FULL LOAD	MT	26	0.00001770
4.5.13	TRIAL OPERATION OF UNIT	MT	26	0.00001770
4.5.14	Completion of all drains and vents to respective locations and placement of instrument sensors after steam blowing	MT	26	0.00001770
4.5.15	Painting	MT	26	0.00005310
4.5.16	Area cleaning, temporary structures cutting/removal and return of scrap	MT	26	0.00001770
4.5.17	PUNCH LIST POINTS/PENDING POINT LIQUIDATION	MT	26	0.00001770
4.5.18	Submission of 'As Built Drawings'	MT	26	0.00001770
4.5.19	MATERIAL RECONCILIATION	MT	26	0.00001770
4.5.20	COMPLETION OF CONTRACTUAL OBLIGATION	MT	26	0.00001770
	Total SS Piping Part >>>			0.00177006
	TOTAL CRITICAL PIPING		0	0.19739857

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	TOTAL OF BOILER WORKS		0	0.94806162
SECTION 2- BUNKER & ALLIED WORKS				
	STRUCTURAL WORKS: Structural steel works including all labour, material (unless otherwise specified in BOQ/contract specification)			
F2301	Erection of Structural steel of mild steel/High strength steel rolled section / built up section / combination of both conforming to IS:2062, pipe sections]			
F2301.1	On pre - assembly wherever applicable (if not applicable, this portion shall be clubbed with placement in position)	MT	2,601	0.00524083
F2301.2	Placement in position	MT	2,776	0.00745840
F2301.3	Alignment	MT	2,776	0.00745840
F2301.4	Welding / bolting / fixing	MT	2,688	0.00541700
F2301.5	Completion of non destructive examination & stress relieving, heat treatment (if not applicable, then this portion to be paid along with welding)	MT	2,688	0.00361133
F2301.6	Hangers & supports etc ,Readiness of floors for concrete pouring as applicable	MT	2,870	0.00192794
F2301.7	Readiness for feeding coal(1% of each mill)& completion of side cladding	MT	2,870	0.00347029
F2301.8	Coal firing	MT	2,870	0.00038559
F2301.9	Trial Operation of Unit	MT	2,870	0.00038559
F2301.10	Painting	MT	2,870	0.00077118
F2301.11	Area cleaning ,temporary structures cutting / removal and return of scrap	MT	2,870	0.00019279
F2301.12	Punch list points /pending points liquidation	MT	2,870	0.00019279
F2301.13	Material reconciliation	MT	2,870	0.00019279
F2301.14	Completion of contractual obligation	MT	2,870	0.00019279

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				0.00000000
A1502	<p>METAL DECK SHEET Type-I, Transportation of MS Deck sheets from BHEL Storage yard to erection site, erection and fixing permanently colour coated galvanised MS troughed metal sheet decking plate of approved colour over roof purlins for cast-in-situ roof slab as per relevant IS code and Grade as per specification. Bare metal thickness(BMT) of deck plate shall be minimum 0.8mm with minimum trough depth of 44mm of grade G250 as per AS1397/grade SS255 as per ASTM A653M/ grade S250GD as per EN 10326 with zinc coating to class Z275 and shall serve as permanent shuttering to the roof slab 40mm thick measured over crest of metal decking & shall have adequate strength to support weight of green concrete and imposed loads of min 100 kg/sqm (for two span condition) during construction between beams as per manufacturer's recommendations/ calculations/ test certificates for approval including fixing of plates to beams, side lapping, end lapping etc. all complete for below mentioned spans. The sheet shall be permanently coated with silicon modified polyester(SMP silicon content 30%-50%) paint or super polyester paint of minimum 20 micron DFT on exposed surface (facing operating floor) over primer coat of minimum 5 micron(nominal) and minimum 10 micron (nominal) SMP or super polyester paint over primer coat of minimum 5 micron (nominal) on other face. SMP and polyester paint system shall be of industrial finish of product type 4 of AS/NZ2728, including fixing of sheet to</p>			0.00000000

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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	top flange of beam with drawn arc welding of headed shear anchor studs @ 260mm c/c in the trough and stitch screws between two adjacent sheets and sealing with epoxy sealant. The shear anchor studs shall conform to type B studs specified in AWS D1.1/D1.1M or equivalent as shear connector of 16 mm dia & 65 mm length manufactured from cold drawn round steel bars conforming to ASTM A 29 of grade designation 1010 through 1020 of standard quality with either semi killed or killed welded by drawn arc stud welding through metal deck sheet. (Deck Sheets shall be provided by BHEL) except sheets, other materials shall be in the agency scope -fasteners and fixing components (like Sealant, screws etc			
a	Span Upto 1800mm	SQM	1,605	0.00040252
b	Span Exceeding 1800mm and upto 2500 mm	SQM	1,605	0.00040252

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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B1502	METAL DECK SHEET Type-II, Transportataion from MS deck sheets from BHEL Storage yard to erection site, erection and fixing of permanently color coated galvanised MS troughed metal sheet decking plate of approved colour over floor beams for cast-in-situ roof slab as per relevant IS code and Grade as per specification. Bare metal thickness(BMT) of deck plate shall be minimum 0.8mm with minimum trough depth of 51 mm of grade G250 as per AS1397/grade SS255 as per ASTM A653M/grade S250GD as per EN 10326 with zinc coating to class Z275 and shall serve as permanent shuttering to the roof/floor slab 150mm thick measured over crest of metal decking & shall have adequate strength to support weight of green concrete and imposed loads of min 100 kg/sqm (for two span condition) during construction between beams as per manufacturer's recommendations/ calculations/ test certificates for approval including fixing of plates to beams, side lapping, end lapping etc. all complete for below mentioned spans. The sheet shall be permanently coated with silicon modified polyster(SMP silicon content 30%-50%) paint or super polyster paint of minimum 20 micron DFT on exposed surface (facing operating floor) and minimum 5 micron on other face over epoxy primer of 5 micron applied over coating (deginated class Z275), including fixing of sheet to top flange of beam with drawn arc welding of headed shear anchor studs @ 260mm c/c in the trough and stich screws between two adjacent sheets and sealing with epoxy sealant.The shear			0.00000000
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TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-XXII: Weightages / Factor

	anchor studs shall confirm to type B studs specified in AWS D1.1/D1.1M or equivalent as shear connector of 19 mm dia & 100 mm length manufactured from cold drawn round steel bars confirming to ASTM A 29 of grade designation 1010 through 1020 of standard quality with either semi killed or killed welded by drawn arc stud welding through metal deck sheet. Measurement of profile sheeting shall be of the plan area of roof/floor covered by MS trough metal decking. The SMP and polyester paint shall confirm to product type 4 as per AS/NZS 2728.(Deck Sheets shall be provided by BHEL)			
a	Span Upto 1800mm	SQM	3,195	0.00080183
b	Span Exceeding 1800mm and upto 2500 mm	SQM	3,195	0.00080183
A1503	Providing and fixing shear connectors of mild steel studs having 16 mm dia and minimum 65 mm projected length above purlin passing through	QUINTAL	1	0.00001817

TECHNICAL CONDITIONS OF CONTRACT (TCC)
Chapter-XXII: Weightages / Factor

	metal decking as per relevant IS codes and specification.			
B1503	Providing and fixing shear connectors of mild steel studs having 19 mm dia and minimum 100 mm projected length above purlin passing through metal decking as per relevant IS codes and specification.	QUINTAL	5	0.00010823
C1503	Providing and fixing special coated fastener conforming to corrosion resistant Class 3 AS3566 and tested 1000 hrs salt spary test to be used for fixing pre-fabricated insulated Metal sandwich Panels with the structural members below.	QUINTAL	5	0.00009319
A1504	Transporatation of cladding sheets from BHEL storage yard to erection site and fixing of External sheet of Permanent colour coated metal cladding with troughed M.S. sheets of minimum 0.6mm bare metal thickness of grade G250 as per AS1397/grade SS255 as per ASTM A653M/ grade S250GD as per EN 10326 with zinc coating to class Z275/ aluminium zinc alloy coating to class AZ150 on both sides including fixing to supports / rails by concealed fixing system, corrosion resistant self tapping / self drilling type fasteners with suitable cap, flashing etc. all complete. The exposed face of the sheet shall be permanently coated with silicon modified polyster(SMP silicon content 30%-50%) paint of 40 micron minimum DFT or super polyster paint of minimum 20 micron DFT on exposed surface over primer coat of minimum 5 micron(nominal) and minum 10 micron (nominal) SMP or super polyester paint over primer coat of minum 5 micron (nominal) on other face. SMP and	SQM	3,825	0.00089908

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	polyster paint system shall be of industrial finish of product type 4 of AS/NZS2728. (Sheets shall be provided by BHEL)			
B1505	Transportation from BHEL Store and erection of prefabricated permanent colour coated sandwiched insulated metal cladding of approved color comprising of top sheet as troughed permanently colour coated sheet and bottom sheet as plain permanently colour coated with 50 mm thick insulation sandwiched between the two sheets.(payment shall be made on surface area of the cladding including flashings) fixing screw shall be agency scope. (Sheets shall be provided by BHEL)	SQM	1,645	0.00033975

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Chapter-XXII: Weightages / Factor

A 1508	transportation of sheets from BHEL Storage yard to erection site, erection and fixing of Inner sheet of Permanent colour coated metal cladding with troughed M.S. sheets of minimum 0.6mm bare metal thickness of grade G250 as per AS1397/grade SS255 as per ASTM A653M/ grade S250GD as per EN 10326 with zinc coating to class Z275/ aluminium zinc alloy coating to class AZ150 on both sides including fixing to supports / rails by concealed fixing system (Z purlin), corrosion resistant self tapping / self drilling type fasteners with suitable cap, flashing etc. all complete. The exposed face The sheet shall be permanently coated with silicon modified polyester (SMP silicon content 30%-50%) paint of 40 micron minimum DFT or super polyester paint of minimum 20 micron DFT on exposed surface over primer coat of minimum 5 micron (nominal) and minimum 10 micron (nominal) SMP or super polyester paint over primer coat of minimum 5 micron (nominal) on other face. SMP and polyester paint system shall be of industrial finish of product type 4 of AS/NZS 2728. 'Z' spacers of at least 2mm thick galvanized steel sheet of grade 350 as per IS 277 would be fixed the inner sheeting on face side at runner locations all complete as per specification.	SQM	100	0.00002351
2311	Providing and fixing in position of permanent mild steel bolts (class 4.6 as per IS : 1367 and grade 'C' as per IS: 1363) and nuts, washers etc. up to and inclusive of 39 mm diameter and upto 300mm long for structural steel work etc all complete.	KG	11,160	0.00096683

TECHNICAL CONDITIONS OF CONTRACT (TCC)
Chapter-XXII: Weightages / Factor

2312	Providing and fixing in positing of high strength structural bolts (of property class 8.8 and product grade `C' as per IS: 1367) and conforming to IS: 3757 and high strength structural hardened and tempered nuts (of property class `8' as per IS:1367) conforming to IS:6623 with hardened and tempered washers as per IS:6649 etc. up to and inclusive of 39 mm diameter and upto 300 mm long for structural steel work etc all complete.	KG	44,640	0.00563427
2313	Dismantling of steel structure, lowering of material and carriage of the dismantled material up to field fabrication shop / projects storage including temporary dismantling, cutting, re-welding, supporting, and restoring to correct position all temporarily dismantled members, re-alignment of all adjacent connected members to their correct positions (weight of such adjacent members and temporarily dismantled members not payable), scaffolding, staging, tools & tackles, gas cutting, welding, consumables etc all complete.	MT	85	0.00054285
2314	Addition to, alterations in and/or modification of "Erection Marks" including cutting of parts, gauging of welds, cutting, grinding, fabrication, welding, drilling holes, straightening, removal of bends, raising to the required level, painting, transportation, return of unutilised steel pieces to the project store, temporarily dismantling, cutting, re-welding, supporting and restoring to correct position of all the temporarily dismantled members, realignment of adjacent connected members (weight of such temporarily dismantled			0.00000000

TECHNICAL CONDITIONS OF CONTRACT (TCC)
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	and adjacent members not payable) etc all complete for the following:			
a	In erected position	MT	43	0.00072204
b	In fabrication yard	MT	43	0.00057520
2315	Re-erection of dismantled fabricated structural steel members including carriage of modified "Erection Marks" from the field fabrication shop to erection site, lifting to required position, aligning in position, tack welding, final welding and touch up painting including temporary dismantling and re-erection of temporarily dismantled members, cutting, rewelding, supporting and restoring to the correct position of all temporarily dismantled members, re-alignment of adjacent connected members(weight of such temporarily dismantled members and adjacent members not payable), scaffolding, staging, tools & tackles, gas cutting, welding, consumables etc all complete.	MT	85	0.00083237
2323	Conducting radiography test on welds wherever specified including equipments, measuring devices, gauges, test report etc. all complete.	RM	288	0.00127634
2324	Conducting ultrasonic test on welds wherever specified including equipments, measuring devices, gauges, test report etc. all complete.	RM	288	0.00023337
2325	Conducting ultrasonic test on steel plates as per ASTM-A435 or equivalent wherever specified	SQM	288	0.00010841

TECHNICAL CONDITIONS OF CONTRACT (TCC)
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	including equipments, measuring devices, gauges, test report etc. all complete.			
2326	Conducting magnetic particle test on welds wherever specified including equipments, measuring devices, gauges, test report etc. all complete.	RM	145	0.00008436
2327	Conducting dye penetration test on welds wherever specified by the engineer including provision of necessary equipments, measuring devices, gauges etc. all complete (over and above the work already specified in the specifications.)	RM	288	0.00017401
	TOTAL OF BUNKER WORKS			0.05193838
	Grand Total			1.00000000

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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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Instructions to the bidders

1. **Bidders shall quote Total Lump-sum Price for the entire scope of work in Rupees 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. This Total Lump-sum Price is bifurcated in Section 1 (E&C of Boiler & Auxiliaries) and Section 2 (Bunker & allied works) based on the BHEL fixed percentage weightages w.r.t the Total Lump-sum Price quoted by the bidder for the subject tender.
3. BHEL has pre-fixed the Weightage/Factor as detailed above in this chapter for deriving the Unit Rates. By multiplying BHEL pre-fixed the Weightages / Factor and the total amount as mentioned in sl no. 1 above; Total Amount of individual items shall be derived.
4. Unit Rate/Item Rate shall be derived by dividing the total Amount of the individual items derived above and the total quantity of the individual items. Unit Rate/Item Rate thus arrived shall be rounded off to two decimal places.
5. Based on the quantities of individual item and the item rates arrived in Sl No 4 above, the total amount for individual items shall be derived. Total amount thus derived shall be rounded off to two decimal places.
6. **Grand Total amount for the work shall be derived by BHEL by summing up respective total amounts. *The Grand total amount thus derived shall be considered for award of the work.***
7. **Bidders to note that this is an item rate contract. Payment shall be made for the actual quantities of work executed at the unit rate arrived at as per Sl No.4 above.**

ANNEXURE -A

**APPLICABLE PGMA LIST OF BALANCE WORK BOILER PACKAGE UNIT#3 (Boiler Cust no 1830) :: 3X800 MW
PVUNL PATRATU PROJECT**

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
STRUCTURE	08	001	FURN UPR BKSTYS-F&R	8.351
STRUCTURE	08	003	FURN UPR BKSTYS-SIDE	16.973
STRUCTURE	08	006	FURN INT BKSTYS	212.946
STRUCTURE	08	007	FURN LWR BKSTYS	79.768
STRUCTURE	08	111	FURN REAR ARCH BKSTYS	32.000
STRUCTURE	08	380	FURN BOT SUPRTS	477.316
STRUCTURE	08	400	FURN GUIDES	10.000
STRUCTURE	08	501	FURN B P BKSTYS-F&R	10.098
STRUCTURE	08	503	FURN B P BKSTYS-SIDE	35.823
STRUCTURE	08	901	FURN KEY BKSTYS-UPR	9.326
STRUCTURE	08	910	EX.MOVT MEAS COMP	1.241
STRUCTURE	08	911	BULK BPS ITEMS-UPPER	0.069
STRUCTURE	08	912	BULK BPS ITEMS-INTER	1.923
STRUCTURE	08	913	BULK BPS ITEMS-LOWER	0.402
STRUCTURE	34	101	BUNKER COLUMNS 1ST TIER	0.000
STRUCTURE	34	102	BUNKER COLUMNS 2ND TIER	0.000
STRUCTURE	34	103	BUNKER COLUMNS 3RD TIER	0.000
STRUCTURE	34	104	BUNKER COLUMNS 4TH TIER	0.000
STRUCTURE	34	105	COLM-Q ROW LOWE TIER	125.333
STRUCTURE	34	200	BUNKER SUPPORT BEAMS	20.030
STRUCTURE	34	300	BUNKER BAY HORIZONTAL BRACINGS&	30.735
STRUCTURE	34	390	MISC.STRUCTURES	51.076
STRUCTURE	34	441	BUNKER HORIZONTAL BEAMS TIER 1	1.921
STRUCTURE	34	442	BUNKER HORIZONTAL BEAMS TIER 2	0.000
STRUCTURE	34	443	BUNKER HORIZONTAL BEAMS TIER 3	0.000
STRUCTURE	34	444	BUNKER HORIZONTAL BEAMS TIER 4	78.057
STRUCTURE	34	445	BUNKER HORIZONTAL BEAMS TIER 5	137.187
STRUCTURE	34	511	BUNKER VERTICAL BRACINGS TIER 1	21.178
STRUCTURE	34	512	BUNKER VERTICAL BRACINGS TIER 2	0.000
STRUCTURE	34	513	BUNKER VERTICAL BRACINGS TIER 3	1.900
STRUCTURE	34	514	BUNKER VERTICAL BRACINGS TIER 4	25.389
STRUCTURE	34	515	BUNKER VERTICAL BRACINGS TIER 5	54.775
STRUCTURE	34	721	HSFG FASTENERS FOR 34PG - TIER 1	0.777
STRUCTURE	34	722	HSFG FASTENERS FOR 34PG - TIER 2	2.479
STRUCTURE	34	723	HSFG FASTENERS FOR 34PG - TIER 3	1.960
STRUCTURE	34	724	HSFG FASTENERS FOR 34PG - TIER 4	8.154
STRUCTURE	34	725	HSFG FASTENERS FOR 34PG - TIER 5	4.858
STRUCTURE	34	730	HSFG FASTENERS - BUNKER SUPPORT BEAMS	14.613
STRUCTURE	34	731	FASTENERS	9.001
STRUCTURE	34	732	FASTENERS	3.883
STRUCTURE	34	733	FASTENERS	1.000
STRUCTURE	34	810	FLOOR GRILLS	3.000
STRUCTURE	34	820	STAIRS	5.000
STRUCTURE	34	850	HAND RAILS	5.000
STRUCTURE	35	010	FOUNDATION MATERIALS	101.185
STRUCTURE	35	131	MIDDLE COLUMNS RHS 1ST TIER	73.219
STRUCTURE	35	132	MIDDLE COLUMNS RHS 2ND TIER	71.057
STRUCTURE	35	133	MIDDLE COLUMNS RHS 3RD TIER	26.461
STRUCTURE	35	134	MIDDLE COLUMNS RHS 4TH TIER	14.436
STRUCTURE	35	135	MIDDLE COLUMNS RHS 5TH TIER	27.476
STRUCTURE	35	136	MIDDLE COLUMNS RHS 6TH TIER	11.332
STRUCTURE	35	137	MIDDLE COLUMNS RHS 7TH TIER	0.000
STRUCTURE	35	138	MIDDLE COLUMNS 8TH TIER	0.000
STRUCTURE	35	139	MIDDLE COLUMNS 9TH TIER	0.000

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
STRUCTURE	35	141	AUXILIARY COLUMNS LHS 1ST TIER	0.000
STRUCTURE	35	142	AUXILIARY COLUMNS LHS 2ND TIER	0.000
STRUCTURE	35	143	AUXILIARY COLUMNS LHS 3RD TIER	0.000
STRUCTURE	35	144	AUXILIARY COLUMNS LHS 4TH TIER	0.000
STRUCTURE	35	145	AUXILIARY COLUMNS LHS 5TH TIER	0.000
STRUCTURE	35	146	AUXILIARY COLUMNS LHS 6TH TIER	0.000
STRUCTURE	35	147	AUXILIARY COLUMNS LHS 7TH TIER	0.000
STRUCTURE	35	148	AUXILIARY COLUMNS LHS 8TH TIER	0.000
STRUCTURE	35	149	AUXILIARY COLUMNS LHS 9TH TIER	0.000
STRUCTURE	35	151	AUXCOL LHSLWR 1&2PAS	0.000
STRUCTURE	35	152	AUXCOL RHSMID 1&2PAS	0.000
STRUCTURE	35	153	AUXCOL RHSUPR 1&2PAS	0.000
STRUCTURE	35	154	AUXILIARY COLUMNS RHS 4TH TIER	0.000
STRUCTURE	35	155	AUXILIARY COLUMNS LHS 7TH TIER	0.000
STRUCTURE	35	156	AUXILIARY COLUMNS RHS 6TH TIER	0.000
STRUCTURE	35	157	AUXILIARY COLUMNS RHS 7TH TIER	0.000
STRUCTURE	35	158	AUXILIARY COLUMNS RHS 8TH TIER	0.000
STRUCTURE	35	159	AUXILIARY COLUMNS RHS 9TH TIER	0.000
STRUCTURE	35	181	MAIN COLUMNS 1ST TIER	0.000
STRUCTURE	35	182	MAIN COLUMNS 2ND TIER	0.000
STRUCTURE	35	183	MAIN COLUMNS 3RD TIER	0.000
STRUCTURE	35	184	MAIN COLUMNS 4TH TIER	0.000
STRUCTURE	35	185	MAIN COLUMNS 5TH TIER	0.000
STRUCTURE	35	186	MAIN COLUMNS 6TH TIER	0.000
STRUCTURE	35	187	MAIN COLUMNS 7TH TIER	0.000
STRUCTURE	35	188	MAIN COLUMNS 8TH TIER	0.000
STRUCTURE	35	189	MAIN COLUMNS 9TH TIER	0.000
STRUCTURE	35	190	GIRDER PIN CONNECTIO	0.000
STRUCTURE	35	211	CEILING STRUCTUREMAI	30.579
STRUCTURE	35	212	CEILING STRUCTUREMAI	24.463
STRUCTURE	35	213	CEIL STRUCT -CROSS W	0.000
STRUCTURE	35	214	CEIL STRUCT -CROSS W	0.000
STRUCTURE	35	221	CEILING STRUCTURE RO	2.823
STRUCTURE	35	222	CEILING STRUCTURE RO	0.786
STRUCTURE	35	231	CEILING STRUCTURE HO	1.551
STRUCTURE	35	232	CEILING STRUCTURE HO	0.181
STRUCTURE	35	311	HORIZONTAL BRACING I	9.975
STRUCTURE	35	312	HORIZ BRACING II PAS	10.585
STRUCTURE	35	321	HORIZ BRACING I PASS	14.682
STRUCTURE	35	322	HORIZ BRACING II PAS	24.432
STRUCTURE	35	331	HORIZ BRACING I PASS	4.021
STRUCTURE	35	332	HORIZ BRACING II PAS	1.717
STRUCTURE	35	341	HORIZ BRACING I PASS	7.622
STRUCTURE	35	342	HORIZ BRACING II PAS	0.757
STRUCTURE	35	351	HORIZ BRACING I PASS	2.871
STRUCTURE	35	352	HORIZ BRACING II PAS	5.465
STRUCTURE	35	361	HORIZ BRACING I PASS	1.491
STRUCTURE	35	362	HORIZ BRACING II PAS	2.232
STRUCTURE	35	371	HORIZONTAL BRACING@79100 (MBL-7)1ST PASS	1.398
STRUCTURE	35	372	HORIZONTAL BRACING @79100(MBL-7)2ND PASS	2.336
STRUCTURE	35	374	HORIZONTAL BRACING@87500(MBL-8) 1ST PASS	1.345
STRUCTURE	35	375	HORIZONTAL BRACING@87500(MBL-8) 2ND PASS	0.309
STRUCTURE	35	381	LANDING & CONNECTING PLATFORMS TIER-1	9.142
STRUCTURE	35	382	LANDING & CONNECTING PLATFORMS TIER-2	8.768
STRUCTURE	35	383	LANDING & CONNECTING PLATFORMS TIER-3	13.794
STRUCTURE	35	384	LANDING & CONNECTING PLATFORMS TIER-4	2.701
STRUCTURE	35	385	LANDING & CONNECTING PLATFORMS TIER-5	14.863
STRUCTURE	35	386	LANDING & CONNECTING PLATFORMS TIER-6	10.189
STRUCTURE	35	387	LANDING & CONNECTING PLATFORMS TIER-7	5.388

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
STRUCTURE	35	388	LANDING & CONNECTING PLATFORMS TIER-8	9.754
STRUCTURE	35	389	LANDING & CONNECTING PLATFORMS TIER-9	2.073
STRUCTURE	35	390	MISC STRUCTURES	6.660
STRUCTURE	35	441	HORIL BEAMS FIRST PASS-TIER-1	14.506
STRUCTURE	35	442	HORIL BEAMS FIRST PASS-TIER-2	4.536
STRUCTURE	35	443	HORIL BEAMS FIRST PASS-TIER-3	23.197
STRUCTURE	35	444	HORIL BEAMS FIRST PASS-TIER-4	18.784
STRUCTURE	35	445	HORIL BEAMS FIRST PASS-TIER-5	17.967
STRUCTURE	35	446	HORIL BEAMS FIRST PASS-TIER-6	0.227
STRUCTURE	35	447	HORIL BEAMS FIRST PASS-TIER-7	0.909
STRUCTURE	35	448	HORIL BEAMS FIRST PASS-TIER-8	0.576
STRUCTURE	35	449	HORIZONTAL BEAMS - FIRST PASS - TIER-9	0.000
STRUCTURE	35	451	HOR BEAM-SECOND PASS- TIER-1	19.622
STRUCTURE	35	452	HOR BEAM-SECOND PASS- TIER-2	46.207
STRUCTURE	35	453	HOR BEAM-SECOND PASS- TIER-3	0.000
STRUCTURE	35	454	HOR BEAM-SECOND PASS- TIER-4	0.000
STRUCTURE	35	455	HOR BEAM-SECOND PASS- TIER-5	0.000
STRUCTURE	35	456	HOR BEAM-SECOND PASS- TIER-6	0.000
STRUCTURE	35	457	HOR BEAM-SECOND PASS- TIER-7	0.000
STRUCTURE	35	458	HOR BEAM-SECOND PASS- TIER-8	0.000
STRUCTURE	35	459	HORIZONTAL BEAMS - SECOND PASS- TIER-9	0.000
STRUCTURE	35	511	FRONT BRACING-TIER-1	0.495
STRUCTURE	35	512	FRONT BRACING-TIER-2	0.248
STRUCTURE	35	513	FRONT BRACING-TIER-3	0.000
STRUCTURE	35	514	FRONT BRACING-TIER-4	0.255
STRUCTURE	35	515	FRONT BRACING-TIER-5	0.358
STRUCTURE	35	516	FRONT BRACING-TIER-6	0.279
STRUCTURE	35	517	FRONT BRACING-TIER-7	0.000
STRUCTURE	35	518	FRONT BRACING-TIER-8	0.000
STRUCTURE	35	519	Front Bracing - Tier - 9	0.000
STRUCTURE	35	521	SIDE BRACING-TIER-1	20.012
STRUCTURE	35	522	SIDE BRACING-TIER-2	0.000
STRUCTURE	35	523	SIDE BRACING-TIER-3	0.000
STRUCTURE	35	524	SIDE BRACING-TIER-4	0.048
STRUCTURE	35	525	SIDE BRACING-TIER-5	0.000
STRUCTURE	35	526	SIDE BRACING-TIER-6	0.000
STRUCTURE	35	527	SIDE BRACING-TIER-7	1.834
STRUCTURE	35	528	SIDE BRACING-TIER-8	0.000
STRUCTURE	35	529	Side Bracing - Tier - 9	0.000
STRUCTURE	35	531	REAR BRACING-TIER-1	43.921
STRUCTURE	35	532	REAR BRACING-TIER-2	34.731
STRUCTURE	35	533	REAR BRACING-TIER-3	11.034
STRUCTURE	35	534	REAR BRACING-TIER-4	2.106
STRUCTURE	35	535	REAR BRACING-TIER-5	17.726
STRUCTURE	35	536	REAR BRACING-TIER-6	0.000
STRUCTURE	35	537	REAR BRACING-TIER-7	0.000
STRUCTURE	35	538	REAR BRACING-TIER-8	0.000
STRUCTURE	35	539	Rear Bracing - Tier - 9	0.000
STRUCTURE	35	701	HSFG FASTENERS	1.308
STRUCTURE	35	721	HSFG FASTENERS FOR 35PG - TIER 1	5.308
STRUCTURE	35	722	HSFG FASTENERS FOR 35PG - TIER 2	3.488
STRUCTURE	35	723	HSFG FASTENERS FOR 35PG - TIER 3	12.684
STRUCTURE	35	724	HSFG FASTENERS FOR 35PG - TIER 4	9.896
STRUCTURE	35	725	HSFG FASTENERS FOR 35PG - TIER 5	9.701
STRUCTURE	35	726	HSFG FASTENERS FOR 35PG - TIER 6	11.516
STRUCTURE	35	727	HSFG FASTENERS FOR 35PG - TIER 7	13.271
STRUCTURE	35	728	HSFG FASTENERS FOR 35PG - TIER 8	4.852
STRUCTURE	35	729	HSFG FASTENERS FOR 35PG - TIER 9	7.880
STRUCTURE	35	730	HSFG FASTENERS - CEILING	26.112

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
STRUCTURE	35	811	FLOOR GRILLS AND GUARD PLATE	6.495
STRUCTURE	35	812	EDGE STRIP AND GUARD PLATE	16.994
STRUCTURE	35	821	STAIRS - LOWER	1.060
STRUCTURE	35	822	STAIRS - MIDDLE	0.706
STRUCTURE	35	823	STAIRS - UPPER	0.706
STRUCTURE	35	851	HAND RAILS AND POSTS	21.917
STRUCTURE	35	993	CONSUMABLES AND RECTI	41.665
STRUCTURE	35	995	CHUTE PIPE AND LADDE	35.373
STRUCTURE	36	111	COLUMNS NEAR APH TIER 1	188.965
STRUCTURE	36	112	COLUMNS NEAR APH TIER 2	116.113
STRUCTURE	36	113	COLUMNS NEAR APH TIER 3	155.891
STRUCTURE	36	114	COLUMNS NEAR APH/SCR Tier4	66.968
STRUCTURE	36	115	COLUMNS NEAR APH/SCR Tier5	97.485
STRUCTURE	36	151	BEAMS AND BRACINGS NEAR APH TIER 1	188.694
STRUCTURE	36	152	BEAMS AND BRACINGS NEAR APH TIER 2	124.080
STRUCTURE	36	153	BEAMS AND BRACINGS NEAR APH TIER 3	194.285
STRUCTURE	36	154	BEAMS&BRACINGS NEAR APH/SCR Tier 4	240.200
STRUCTURE	36	155	BEAMS&BRACINGS NEAR APH/SCR Tier 5	148.534
STRUCTURE	36	311	MAIN FLOOR I MBL 1ST	8.381
STRUCTURE	36	312	MAIN FLOOR I MBL 2ND	8.835
STRUCTURE	36	313	NON-MBL FLOOR BETWEE	31.289
STRUCTURE	36	314	NON-MBL FLOOR BETWEE	24.346
STRUCTURE	36	315	NON-MBL FLOOR BETWEE	236.612
STRUCTURE	36	316	NON-MBL FLOOR BETWEE	59.573
STRUCTURE	36	321	MAIN FLOOR II MBL 1ST	12.633
STRUCTURE	36	322	MAIN FLOOR II MBL 2ND	25.513
STRUCTURE	36	323	NON-MBL FLOOR BETWEE	39.855
STRUCTURE	36	324	NON-MBL FLOOR BETWEE	85.091
STRUCTURE	36	325	NON-MBL FLOOR BETWEE	178.351
STRUCTURE	36	326	NON-MBL FLOOR BETWEE	120.512
STRUCTURE	36	331	MAIN FLOOR III MBL 1	15.856
STRUCTURE	36	332	MAIN FLOOR III MBL 2	32.650
STRUCTURE	36	333	NON-MBL FLOOR BETWEE	22.140
STRUCTURE	36	334	NON-MBL FLOOR BETWEE	31.533
STRUCTURE	36	335	NON-MBL FLOOR BETWEE	221.298
STRUCTURE	36	336	NON-MBL FLOOR BETWEE	263.719
STRUCTURE	36	341	MAIN FLOOR IV MBL 1ST	26.650
STRUCTURE	36	342	MAIN FLOOR IV MBL 2ND	7.242
STRUCTURE	36	343	NON-MBL FLOOR BETWEE	22.289
STRUCTURE	36	351	MAIN FLOOR V MBL 1ST	15.610
STRUCTURE	36	352	MAIN FLOOR V MBL II ND	13.237
STRUCTURE	36	353	NON-MBL FLOOR BETWEE	21.905
STRUCTURE	36	354	NON-MBL FLOOR BETWEE	38.681
STRUCTURE	36	355	NON-MBL FLOOR BETWEE	22.818
STRUCTURE	36	361	MAIN FLOOR VI MBL 1ST	3.598
STRUCTURE	36	362	MAIN FLOOR VI MBL 2ND	2.941
STRUCTURE	36	363	NON_MBL FLOOR ABOVE	57.137
STRUCTURE	36	364	NON MBL FLOOR ABOVE MBL VI	32.933
STRUCTURE	36	365	NON MBL FLOOR ABOVE MBL VI	5.000
STRUCTURE	36	366	NON MBL FLOOR ABOVE MBL VI	5.000
STRUCTURE	36	371	FLOOR BEAMS @ 79100 (MBL-7) 1ST PASS	7.867
STRUCTURE	36	372	FLOOR BEAMS @ 79100 (MBL-7) 2ND PASS	2.557
STRUCTURE	36	373	FLOOR BEAMS @ 83400 (TIER-8)	15.554
STRUCTURE	36	374	FLOOR BEAMS @ 87500 (MBL-8) 1ST PASS	2.820
STRUCTURE	36	375	FLOOR BEAMS @ 87500 (MBL-8) 2ND PASS	1.440
STRUCTURE	36	376	FLOOR BEAMS @ 90500 (TIER-8)2ND PASS	7.283
STRUCTURE	36	381	LAND & CONN PLAT LOW	5.723
STRUCTURE	36	382	LAND & CONN PLAT MID	28.590
STRUCTURE	36	383	LANDING & CONNECTING PLATFORMS - UPPER	15.860

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
STRUCTURE	36	391	MISCELLANEOUS PLATFO	64.758
STRUCTURE	36	392	MISCELLANEOUS PLATFO	69.000
STRUCTURE	36	393	APH, SCAPH, HANDLING	70.000
STRUCTURE	36	394	MISCELLANEOUS PLATFO	20.000
STRUCTURE	36	395	0	26.000
STRUCTURE	36	396	SLIDE BEARING PLATES	0.635
STRUCTURE	36	610	BOILER ROOF STRUCTUR	2.686
STRUCTURE	36	611	BOILER ROOF SHEETING	1.445
STRUCTURE	36	613	RAIN WATER PIPES AND	13.680
STRUCTURE	36	620	BOILER SIDE CLADDING	313.163
STRUCTURE	36	621	BOILER SIDE CLADDING	42.490
STRUCTURE	36	700	HSFG BOLTS	0.740
STRUCTURE	36	701	FASTERNERS	1.000
STRUCTURE	36	721	HSFG FASTENERS FOR 36PG - TIER 1	22.148
STRUCTURE	36	722	HSFG FASTENERS FOR 36PG - TIER 2	10.470
STRUCTURE	36	723	HSFG FASTENERS FOR 36PG - TIER 3	17.793
STRUCTURE	36	724	HSFG FASTENERS FOR 36PG - TIER 4	18.356
STRUCTURE	36	725	HSFG FASTENERS FOR 36PG - TIER 5	6.741
STRUCTURE	36	726	HSFG FASTENERS FOR 36PG - TIER 6	3.906
STRUCTURE	36	727	HSFG FASTENERS FOR 36PG - TIER 7	3.466
STRUCTURE	36	728	HSFG FASTENERS FOR 36PG - TIER 8	5.247
STRUCTURE	36	729	HSFG FASTENERS FOR 36PG - TIER 9	0.740
STRUCTURE	36	730	HSFG FASTENERS - CEILING	0.531
STRUCTURE	36	731	FASTENERS	8.133
STRUCTURE	36	732	FASTENERS	0.150
STRUCTURE	36	733	FASTENERS	0.150
STRUCTURE	36	740	POSTS AND HANGERS	44.765
STRUCTURE	36	811	FLOORGRILLSANDGUARDP	27.987
STRUCTURE	36	812	FLOORGRILLSANDGUARDP	103.842
STRUCTURE	36	813	FLOORGRILLSANDGUARDP	115.141
STRUCTURE	36	814	FLOORGRILLSANDGUARDP	309.458
STRUCTURE	36	821	STAIRS AND LADDERS	61.446
STRUCTURE	36	822	STAIRS AND LADDERS	8.850
STRUCTURE	36	823	STAIRS AND LADDERS	13.000
STRUCTURE	36	851	HANDRAILS AND POSTS	109.530
STRUCTURE	36	852	HANDRAILS AND POSTS	14.075
STRUCTURE	36	853	HANDRAILS AND POSTS	63.359
STRUCTURE	36	993	CONSUMABLESANDERECIT	10.000
STRUCTURE	36	999	RAIN CUTTER PIPPING	29.689
STRUCTURE	38	210	INTER CONN PLATFORMS	11.000
STRUCTURE	38	299	MILL HANDLING MONORA	85.869
STRUCTURE	38	310	CONN PLATFORMS TO MI	87.000
STRUCTURE	38	410	MILL MAINTANANCE PLA	20.526
STRUCTURE	38	510	LIFT BEAMS AND BRACI	83.918
STRUCTURE	38	610	ELEVATOR CLADDING ST	32.142
STRUCTURE	38	611	ELEVATOR CLADDING SH	29.640
STRUCTURE	38	710	LIFT MACHINE ROOM DE	74.000
STRUCTURE	38	810	FLOORGRILLS AND GUAR	91.009
STRUCTURE	38	820	STAIRS AND LADDERS	11.000
STRUCTURE	38	850	HAND RAILS AND HAND	29.734
STRUCTURE	38	993	CONSUMABLES AND EREC	39.822
STRUCTURE	38	381	ECO handling strcture	110.000
STRUCTURE	39	012	FOUNDATION MATERIALS	111.201
STRUCTURE	39	101	COLUMNS FRAMES BEFOR esp	423.920
STRUCTURE	39	102	COLUMNS FRAMES BEFOR esp	410.776
STRUCTURE	39	160	COL.BRACING FOR FD S	389.108
STRUCTURE	39	299	PLATFORMS - BEFORE ESP	193.346
STRUCTURE	39	301	STRUC AND PLATFORM F	7.572
STRUCTURE	39	302	STRUC FOR MOTOR HOOD	20.188

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
STRUCTURE	39	304	FAN HANDLING STRUCTU	22.866
STRUCTURE	39	305	FAN HANDLING STRUCTU	16.493
STRUCTURE	39	700	HSFG FASTENERS FOR P	63.295
STRUCTURE	39	810	FLOOR GRILL	213.058
STRUCTURE	39	820	STAIRS	52.139
STRUCTURE	39	850	HAND RAIL AND HAND R	119.521
STRUCTURE	39	993	CONSUMABLES AND EREC	25.408
STRUCTURE	39	142	COLS FRAMES NEAR ID	582.816
STRUCTURE	39	141	COLS FRAMES NEAR ID	102.001
STRUCTURE	39	150	COL FRAMES BETN I.D.	105.546
STRUCTURE	39	300	PLATFORMS - AFTER ESP	143.153
STRUCTURE	39	600	Fan handling strcture	111.202
STRUCTURE	SS	111	SCR Supporting Post	235.980
STRUCTURE	SS	112	SCR Supporting Post	45.953
STRUCTURE	SS	113	SCR Supporting Post	63.035
STRUCTURE	SS	191	SCR Supporting Post	12.708
STRUCTURE	SS	215	Scr Supporting Girder	184.329
STRUCTURE	SS	311	Plan Hori.Bracing Floor 1	106.091
STRUCTURE	SS	321	Plan Hori.Bracing Floor 2	101.675
STRUCTURE	SS	331	Plan Hori.Bracing Floor 3	112.219
STRUCTURE	SS	341	Plan Hori.Bracing Floor 4	162.324
STRUCTURE	SS	361	Scr Floor 1	47.324
STRUCTURE	SS	362	Scr Floor 2	32.517
STRUCTURE	SS	363	Scr Floor 3	12.601
STRUCTURE	SS	364	Scr Floor 4	76.470
STRUCTURE	SS	391	Miscellaneous Platforms-Part I	29.967
STRUCTURE	SS	392	Miscellaneous Platforms-Part Ii	13.602
STRUCTURE	SS	393	Miscellaneous Platforms-Part Iii	10.000
STRUCTURE	SS	394	Handling Structure - Part 1	81.126
STRUCTURE	SS	395	Handling Structure - Part 2	92.192
STRUCTURE	SS	396	Handling Structure - Part 3	45.463
STRUCTURE	SS	441	SCR Post Connecting Beams	267.360
STRUCTURE	SS	442	SCR Post Connecting Beams	72.600
STRUCTURE	SS	443	SCR Post Connecting Beams	104.949
STRUCTURE	SS	551	Scr Vertical Bracings	89.157
STRUCTURE	SS	552	Scr Vertical Bracings	26.092
STRUCTURE	SS	553	Scr Vertical Bracings	43.170
STRUCTURE	SS	700	Hsfg Fasteners	23.659
STRUCTURE	SS	701	Fasteners	5.422
STRUCTURE	SS	730	HSFG FASTENERS - SCR SUPPORT BEAMS	4.929
STRUCTURE	SS	810	Floor Grill	246.175
STRUCTURE	SS	811	Floor Grills&Guard Plate	32.000
STRUCTURE	SS	820	Stairs & Ladders	16.255
STRUCTURE	SS	850	Handrail	41.612
PP	04	147	SUPPRTS FOR COLLECTR & SEPARATOR VESSEL	4.992
PP	04	321	VERTICAL SEPARATOR	0.000
PP	04	323	STORAGE TANK	0.000
PP	04	347	SEPERATOR/COLLECTING VESSEL SUPP DD	0.082
PP	04	547	SEPERATOR/COLLECTING VESSEL SUPP SHOP	0.000
PP	05	137	EVAPORATOR INLET HDR - FRNT	15.721
PP	05	147	FUR LWR REAR INLET HDR	15.710
PP	05	155	FUR LWR SIDE INLET HDRS	14.847
PP	05	227	FUR UPPER REAR OUTLET HDR	0.000
PP	05	231	FUR UPPER FRNT OUTLET HDR	0.000
PP	05	251	FUR UPPER SIDE OUTLET HDRS	0.000
PP	05	327	FUR INTERMEDIATE REAR HDR	11.850
PP	05	330	FUR INTERMEDIATE FRNT HDR	0.000
PP	05	350	FUR INTERMEDIATE SIDE HDRS	0.000
PP	06	400	FUR BURNER PANELS	50.000

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
PP	06	401	BURNER PANEL- OS	0.200
PP	06	431	FRONT UPPER WW PANEL ATTACHMENT	0.050
PP	06	434	FRONT INTERMEDIATE WW PANEL -OS	11.889
PP	06	437	FRONT WW LOWER PANEL-OS	42.000
PP	06	441	REAR UPPER WW PANEL -OS	3.545
PP	06	444	REAR INTERMEDIATE WW PANEL -OS	60.000
PP	06	447	REAR LOWER WW PANEL -OS	42.000
PP	06	451	SIDE UPPER WW PANEL ATTACHMENT	0.200
PP	06	453	SIDE INTERMEDIATE WW PANEL -OS	90.000
PP	06	455	SIDE LOWER WW PANEL -OS	20.000
PP	06	500	FUR SOFA PANELS	2.737
PP	06	501	SOFA PANELS -OS	0.056
PP	06	515	CORNER SOFA PANELS	25.000
PP	06	731	FUR VERTICAL WALL PANELS - FRNT	0.000
PP	06	732	FRONT WW PNL + ATT	0.033
PP	06	734	FUR UPPER FRNT SPIRAL PANEL	0.000
PP	06	735	FUR FRNT SPIRAL TO VERTICAL TRANS. PANEL	0.000
PP	06	737	FUR LWR FRNT SPRL PNL WITH I/T TERM TUBE	66.522
PP	06	741	FUR REAR ARCH PANELS	42.859
PP	06	744	FUR UPPER REAR SPIRAL PANEL	85.000
PP	06	745	FUR REAR SPIRAL TO VERT TRANSITION PANEL	13.561
PP	06	747	FUR LWR RR SPRL PNL WITH I/T TERM TUBES	83.468
PP	06	751	FUR VERTICAL WALL PANELS - SIDE	0.502
PP	06	752	FUR LWR VERTICAL WALL PANELS - SIDE	0.681
PP	06	753	FUR UPPER SIDE SPIRAL PANELS	0.000
PP	06	755	FUR LWR SIDE SPIRAL PANELS	62.000
PP	06	759	FUR SIDE SPIRAL TO VERT TRANSITION PANEL	0.735
PP	07	102	LINKS FROM SEPARATOR TO STORAGE TANK	0.000
PP	07	110	DOWNCOMER TO CONNECTING SPHERE	0.000
PP	07	125	CONNECTING SPHERE	0.000
PP	07	217	SCREEN RELIFE TUBES	0.812
PP	07	223	FUR SCREEN AND HANGER ASSEMBLY	0.000
PP	07	231	FUR SPIRAL WALL OUTLET TERM TUBES	1.160
PP	07	232	FUR VERTICAL WALL INLET TERM TUBES	4.771
PP	07	309	FURNACE WALL SUPPORTS FRONT-DD	0.194
PP	07	315	FUR SIDE RISERS	0.823
PP	07	316	FUR REAR RISERS	1.018
PP	07	318	FUR FRNT RISERS	0.000
PP	07	331	RISER TUBE SUPPORT DD ITEM	0.022
PP	07	360	FURNACE SPIRAL WALL SUPPORT DD ITEM	0.100
PP	07	361	FURNACE WALL¿ SUPPORT REAR DD ITEM	0.714
PP	07	362	FURNACE WALL¿ SUPPORT SIDE L&R DD ITEM	0.619
PP	07	393	CONSUMABLES & ERECTION MATERIALS-DD	0.078
PP	07	402	WW FRT HDR SUSPN	12.686
PP	07	403	WW SIDE HDR SUSPN	1.219
PP	07	405	WW SCR.HDR SUSPN.	20.404
PP	07	409	FURNACE WALL SUPPORTS FRONT	1.553
PP	07	423	FURNACE SCREEN TUBES ATTACHMENT	1.039
PP	07	431	RISER TUBE SUPPORT	7.863
PP	07	460	FURNACE SPIRAL WALL SUPPORTS MISC ITEMS	24.000
PP	07	461	FURNACE WALL SUPPORTS REAR	6.977
PP	07	462	FURNACE WALL SUPPORTS SIDES L & R	4.930
PP	07	502	WW FRONT HEADER SUSPN SHOP ITEM	0.000
PP	07	503	WW SIDE HEADER SUSPENSION SHOP ITEM	1.638
PP	07	505	WW SCREEN HEADER SUSPN SHOP ITEM	1.200
PP	07	509	MISC PR.PART COMPNTS	0.700
PP	07	531	RISER TUBE SUPPORT SHOP ITEM	4.435
PP	07	560	FURNACE SPIRAL WALL SUPPORT SHOP ITEM	1.000
PP	07	883	FILLER PLATES¿-FURNACE WALLS	2.000

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
PP	07	991	WELDING ELECTRODES-PART-1	0.231
PP	07	992	WELDING ELECTRODES	0.282
PP	07	993	EREC MATLS, CONSUMES	1.632
PP	09	003	MATL FOR INST TAPPG	1.000
PP	09	004	SEAL BOX FURN OPENG	13.402
PP	09	005	SEAL BOX INST OPENG	3.818
PP	09	304	SEAL BOXES FOR FURNACE OPENINGS-DD	0.500
PP	10	135	FUR ARCH SUPPPORT INLET HDR	0.000
PP	10	174	FINISH SH INLET HDR	0.000
PP	10	176	SH PLATEN FRONT INLET HEADER(S-26)	0.000
PP	10	178	SH PLATEN INLET HDR	0.000
PP	10	182	BP LWR REAR HDR	16.596
PP	10	183	BP UPPER SIDE INLET HDR	0.000
PP	10	184	BP EXTENDED SIDE INLET HDR	0.000
PP	10	185	BP LWR FRNT HDR	15.300
PP	10	191	SH FUR ROOF INLET HDR	0.000
PP	10	235	FUR ARCH SUPPPORT OUTLET HDR	0.000
PP	10	274	FINISH SH OUTLET HDR	0.000
PP	10	276	SH PLATEN FRONT OUTLET HEADER(S-28)	0.000
PP	10	278	SH PLATEN OUTLET HDR	0.000
PP	10	283	BP LWR SIDE HDRS	28.087
PP	10	284	BP EXT FLOOR OUTLET HDR WITH TERM TUBES	13.500
PP	10	285	BP FRNT OUTLET HDR	2.757
PP	10	291	SH FUR ROOF OUTLET HDR	0.000
PP	11	074	FINISH SH FRNT ASSY WITH I/T TERM & COT	28.474
PP	11	078	SH PLATEN ASSY WITH TERM TUBES - LEFT	9.135
PP	11	374	FINISH SH REAR ASSY WITH O/T TERM & COT	0.000
PP	11	378	SH PLATEN ASSY WITH TERM TUBES - RIGHT	15.186
PP	11	406	SH FRNT UPPER PNL ATTACHMENT	0.300
PP	11	467	SH SC SIDE PNL UPPER LEFT ATTACHMENT	0.100
PP	11	469	SH SW PANELS LOWER FRONT (L&R)-OS	0.100
PP	11	474	SH VERTICAL SPACED COIL ATTACHMENT	0.300
PP	11	487	BP LTRH HANGER TUBE ATTCHMENT	2.500
PP	11	491	SH RADIANT ROOF TUBES (LEFT)-OS	0.100
PP	11	494	SH EXTENDED BOTTOM PANELS-OS	0.100
PP	11	606	BP FRNT WALL PANELS	0.000
PP	11	608	BP FRNT WALL PANEL - LWR	0.000
PP	11	684	BP EXTENDED SIDE FIN WELDED PANEL	0.000
PP	11	694	BP EXTENDED SIDE FLOOR FIN WELDED PANEL	23.500
PP	11	716	BP UPPER REAR PANEL	0.112
PP	11	717	SH REAR WALL PANEL INTER(LEFT)	0.089
PP	11	718	BP LWR REAR PANEL	0.003
PP	11	767	BP UPPER SIDE PANEL-LEFT	0.000
PP	11	768	SH SIDE WALL PANELS INTER (FRONT)	32.643
PP	11	769	BP LWR SIDE PANEL - LEFT	0.000
PP	11	787	BP REAR ROOF PANELS	0.000
PP	11	791	SH FUR ROOF FIN WELDED PANEL	0.323
PP	11	967	BP UPPER SIDE PANEL-RIGHT	35.513
PP	11	968	SH SIDE WALL PANELS INTER (REAR)	32.646
PP	11	969	BP LWR SIDE PANEL - RIGHT	35.832
PP	11	991	SH FUR ROOF TUBES	64.217
PP	12	178	LINK TO SH DESUPERHEATER	0.000
PP	12	179	LINK TO FINISH SH INLET HDR	15.668
PP	12	181	FUR ARCH SUPPORT LINKS	0.000
PP	12	184	BP EXTENDED SIDE CONNECTION LINK	38.135
PP	12	187	SH BYPASS PIPES	6.411
PP	12	306	SH SPPRT FOR LINES AND LINKS DD ITEM	0.034
PP	12	314	SUSPN OF SH R.ROOF HEADERS DD ITEM	0.017
PP	12	317	SUSPN OF R.ROOF HEADERS DD ITEM	0.068

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
PP	12	324	SUSPENSION OF SH REAR WALL DD ITEMS	0.011
PP	12	327	SUSPENSION OF SH REAR WALL DD ITEMS	0.096
PP	12	328	SUSPENSION OF SH REAR WALL DD ITEMS	2.064
PP	12	344	SUSPN OF VERT. SPACED ASSY DD ITEM	0.011
PP	12	348	SUSPN OF VERT. SPACED ASSY DD ITEM	0.356
PP	12	354	SUSPN OF VERT. SPACED ASSY DD ITEM	0.073
PP	12	368	RH VERT PLATEN FRNT COIL LEFT DD ITEM	0.893
PP	12	393	SH MISC COMPONENTS DD ITEM	0.200
PP	12	405	SH HANGER TUBE ATTACHMENT	4.690
PP	12	506	SH SPPRT FOR LINES AND LINKS SHOP ITEM	1.771
PP	12	514	SUSPN OF SH R.ROOF HDRS SHOP ITEM	0.267
PP	12	517	SUSPN OF R.ROOF HEADERS SHOP ITEM	1.566
PP	12	524	SUSPENSION OF SH REAR WALL SHOP ITEM	1.309
PP	12	528	SUSPENSION OF SH REAR WALL SHOP ITEM	2.820
PP	12	544	SUSPN OF VERT. SPACED ASSY SHOP ITEM	2.843
PP	12	548	SUSPN.OFSHFL.SHSPD.CL.ASY&SHTT.SPD-SHOP	1.933
PP	12	554	SUSPN OF VERT. SPACED ASSY SHOP ITEM	3.825
PP	12	568	SUSPN OF SH PLATEN COIL ASSY-SHOP	1.301
PP	12	800	SH DESUP-STAGE II	0.000
PP	12	803	SH STEAM COOLED SPACER TUBES	1.500
PP	12	805	BP FRNT WALL SCREEN TUBES	0.000
PP	12	850	SH CONNECTING PIPE	1.634
PP	12	852	LINKS TO SH PLATEN INLET HDR	1.338
PP	12	883	FILLER PLATE¿-BACK PASS PANEL	0.500
PP	12	900	SH DESUPERHEATER	0.000
PP	12	903	SH MISCL COMPONENTS	7.000
PP	12	906	SH LINK SUPPORTS	1.979
PP	12	907	RAD&RR ROOF SUPPORTS	9.112
PP	12	914	EXPN-SH RAD ROOF HDR	1.596
PP	12	916	Sh Desh Supports S-01 -Ad	0.000
PP	12	917	SUSPN OF RADINT ROOF	3.404
PP	12	924	SUSPN-SH BAKPASS HDR	2.337
PP	12	927	SUSPN OF REAR ROOF	2.097
PP	12	928	SUSPN - SH REAR WALL	12.990
PP	12	944	SUSPN-SH PLATEN HDRS	1.999
PP	12	948	SUSP-VERT SPACD ASSY	19.705
PP	12	954	SUSP-VERT SPACD HDRS	4.633
PP	12	968	SUSPN OF PLATEN ASSY	3.817
PP	12	991	WELDING ELECTRODES-PART-1	0.000
PP	12	992	WELDING ELECTRODES	0.000
PP	12	993	EREC MATLS, CONSUMES	7.916
PP	12	994	PORT IN FOR THK MSMT	0.050
PP	15	136	LTRH INLET HDR	0.896
PP	15	178	FINISH RH INLET HDR	0.000
PP	15	236	LTRH OUTLET HDR	0.000
PP	15	278	FINISH RH OUTLET HDR	0.000
PP	16	201	LTRH UPPER ASSEMBLY	0.000
PP	16	202	LTRH INTERMEDIATE ASSEMBLY	0.000
PP	16	203	LTRH LWR ASSEMBLY WITH INLET TERM TUBES	21.229
PP	16	270	LTRH PENDANT ASSY WITH O/T TERM TUBES	16.534
PP	16	278	FINISH RH ASSEMBLY WITH TERMINAL TUBES	0.000
PP	16	379	RH VERPLN FR COIL RT	10.000
PP	17	174	LINK TO RH DESUPERHEATER	0.000
PP	17	304	RH SPPRTS FOR LINES AND LINKS DD ITEM	0.017
PP	17	306	RH SUPRT FOR LINES AND LINKS DD ITEM	0.009
PP	17	319	RH FRNT SUSPENSION DD ITEM	0.132
PP	17	407	RH SC SPACER TUBE ATTCHMENT	0.100
PP	17	476	RH V.S. CENTRE CROSS OVER TUBE ATTCHMT	6.000
PP	17	504	RH SUPRTS FOR LINES AND LINKS SHOP ITEM	3.782

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
PP	17	506	RH SUPRT FOR LINES AND LINKS SHOP ITEM	0.200
PP	17	807	RH STM COOL SPACERS	0.100
PP	17	900	RH DESUPERHEATER	0.000
PP	17	903	RH MISCL COMPONENTS	83.056
PP	17	904	RH HDR SUPRT AB ROOF	2.843
PP	17	906	RH SUPRT LINES & LIN	1.164
PP	17	919	RH FRONT SUSPENSION	4.051
PP	17	991	WELDING ELECTRODES-PART-1	0.000
PP	17	992	WELDING ELECTRODES	0.000
PP	18	001	FUR ROOF SKIN CASING	19.400
PP	18	002	1 PASS ROOF SKINCASG	0.150
PP	18	010	PR PARTS ATTACH-CASG	0.350
PP	18	701	FURNACE ROOF SKIN CASING BOI ITEM	0.100
PP	19	092	ECO OUTLET TERM TUBES	11.774
PP	19	306	ECO SUPPORTS FOR LINE & LINKS DD ITEM	0.167
PP	19	307	ECO FEED PIPE SUSPN DD ITEM	0.125
PP	19	402	ECO HANGER TUBE ATTACHMENT	0.354
PP	19	506	ECO SUPPORTS FOR LINE & LINKS SHOP ITEM	34.879
PP	19	507	ECO FEED PIPE SUSPN SHOP ITEM	24.267
PP	19	701	ECO INLET HDR	25.020
PP	19	702	ECO OUTLET HDR	0.000
PP	19	704	ECO II INLET HEADER	9.377
PP	19	753	ECO JUNCTION HDR	0.000
PP	19	763	ECO JUNCTION HDR	0.000
PP	19	783	ECO JUNCTION HDR	0.000
PP	19	793	ECO JUNCTION HDR	0.000
PP	19	802	ECO LWR HANGER TUBES	8.682
PP	19	804	ECO UPPER HANGER TERMINAL TUBES	32.778
PP	19	814	ECO UPPER ASSY - LEFT	172.321
PP	19	824	ECO LWR ASSY -LEFT	367.611
PP	19	850	ECO INLET LINKS	78.675
PP	19	851	LINKS FROM ECO OUT. HDR TO ECO MIX LINE	31.394
PP	19	852	ECO MIXING LINE	21.124
PP	19	853	LINKS FROM ECO MIX LINE TO FURN I/T HDRS	63.270
PP	19	884	ECO INTER ASSY - LEFT	368.249
PP	19	903	ECO.MISCL COMP	128.592
PP	19	904	ECO HDR SUPT AB ROOF	18.667
PP	19	905	ECO HDR SUPT BL ROOF	0.972
PP	19	906	ECO LINE&LINK SUPORT	16.147
PP	19	907	ECO,FEEDPIPE SUPPORT	13.639
PP	19	914	ECO UPPER ASSY - RIGHT	169.574
PP	19	924	ECO LWR ASSY-RIGHT	361.641
PP	19	984	ECO INTER ASSY - RIGHT	362.273
PP	19	991	WELDING ELECTRODES-PART-1	0.000
PP	19	992	WELDING ELECTRODES	0.000
PP	20	051	LONG RETRACT SB M11E	94.350
PP	20	054	WALL BOX NPR LRSB MI	1.576
PP	20	201	WALL DESLAGGER RW5E	30.690
PP	20	204	WALL BOX NPR-RW5E	4.374
PP	20	511	DA HEAD VALVE ASSY	0.227
PP	20	794	WALL BOX NPR FOR TP	0.063
PP	20	962	TR PROBE DUP PT&AC	2.026
PP	20	998	SPL TOOLS FOR SB	0.000
PP	21	600	S.B. PPG & FITTINGS	39.164
PP	21	601	S.B PIPING SUPPORTS	1.927
PP	21	602	SB PIPING - DD ITEMS	3.614
PP	21	603	SB PIPING - BOI ITEMS	0.024
PP	21	604	SB PIPING SUPPORTS - OS ITEMS	11.958
PP	21	605	SB PIPING SUPPORTS - DD ITEMS	0.010

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
PP	21	606	SB PIPING SUPPORTS - BOI ITEMS	0.000
PP	21	700	BULKED BPS COMP	0.597
PP	21	800	SB VALVES (BHEL)	6.386
PP	21	825	SB VALVES (SUBDELY)	1.300
PP	21	850	SB SAFETY VALVE BHEL	0.052
PP	21	992	WELDING ELECTRODES	0.000
PP	24	350	BLR FILLING PIPING	3.553
PP	24	351	H&S BLR FILLING PPG	0.052
PP	24	352	BOILER FILL PIPING - DD ITEMS	0.254
PP	24	353	H&S FOR BOILER FILL PIPING - OS ITEMS	1.000
PP	24	354	BOI ITEMS FOR BLR TRIM PIPING	0.001
PP	24	700	BULKED BPS COMP	0.472
PP	24	800	BOILER TRIM PIPING	74.681
PP	24	803	BOILER TRIM PIPING - DD ITEMS	0.558
PP	24	804	SUPPORTS - BLR TRIM PIPING - OS ITEMS	43.117
PP	24	805	LINK TO BOILER RECIRCU SYSTEM	0.027
PP	24	806	MIXING VESSEL	0.002
PP	24	807	RECIRCU PUMP SUCTION LINE	0.116
PP	24	808	RECIRCU PUMP DISCHARGE LINE	14.313
PP	24	809	BOILR RECIR LINK FROM BF LINE	7.673
PP	24	810	H AND S FOR STARTUP SYSTEM	28.758
PP	24	811	FUR LINK TO FLASH TANK HWL1&2	0.152
PP	24	815	SPRAY WATER SYSTEM	62.609
PP	24	817	H&S FOR START-UP SYSTEM - OS ITEMS	14.743
PP	24	818	H&S FOR START-UP SYSTEM - DD ITEMS	0.197
PP	24	820	EXHAUS PIPE SAFETY VLV	73.454
PP	24	822	DE-SUPERHEATER PIPES - OS ITEMS	1.083
PP	24	823	DE-SUPERHEATER PIPES - DD ITEMS	0.336
PP	24	824	EXHAUST PIPE FOR SV - OS ITEMS	21.321
PP	24	825	SILENCER SUPPORTS	0.110
PP	24	826	SILENCER SUPP - OS ITEMS	29.657
PP	24	827	EXHAUST PIPE FOR SV - DD ITEMS	1.898
PP	24	828	EXHAUST PIPE FOR SV - BOI ITEMS	0.038
PP	24	835	STARTUP VENT DIFFUSER SILEN SUP	2.291
PP	24	836	START-UP VENT, DIFFUSER, SIL SUPP-OS	10.988
PP	24	837	START-UP VENT, DIFFUSER, SIL SUPP-DD	0.028
PP	24	840	SAMPLE COOLER AND SUPPORTS	0.960
PP	24	841	Sample Cooler & Supports - OS Items	0.179
PP	24	842	Sample Cooler and Suprts-DD items	0.014
PP	24	855	RECIRCULATING PUMB COMP	19.722
PP	24	860	VALVES (BHEL)	60.246
PP	24	865	CTL VALVES FOR SPRAY PIPING SD	11.220
PP	24	867	CTL VAL FOR STARTUP RECIRCU SYS	12.380
PP	24	880	SAFETY VALVES	4.893
PP	24	881	SAFETY VALVES AND ERV(BHEL) SD	1.920
PP	24	883	SAFETY VALVES (BHEL) - NON HT	5.485
PP	24	885	SILENCERS(BHEL)	0.000
PP	24	950	SPECIAL TOOLS	0.000
PP	24	955	LAP TOOL SV&ERV	0.000
PP	24	960	LAP TOOL-CON VAL(BHEL)	0.000
PP	24	992	WELDING ELECTRODES-TRIM PPG	0.000
PP	24	993	CONSUME & EREC MATLS	0.150
PP	24	994	NAME PLATES	0.270
PP	42	001	PNEUMATIC FITTINGS	0.088
PP	42	005	INSTRUMENT FITTINGS	0.400
PP	42	046	DO PUMP-MOTOR ASSY	0.300
PP	42	065	DRAIN OIL TANK	2.767
PP	42	070	BURNER STN SKID ASLY	6.850
PP	42	128	PIPING,PUMP HOUSE STEAM - IBR	0.700

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
PP	42	150	PIPING, OPERATING FLOOR HFO & TRACER	4.600
PP	42	152	PIPING,OP.FLR LFO	0.800
PP	42	154	PIPING,OP.FLR DO	0.500
PP	42	157	PIPING,OP.FLR AIR	0.020
PP	42	158	PIPING,OPR'G FLOOR STEAM-IBR	4.510
PP	42	200	SUB.DEL FO SYSTEM	3.500
PP	42	300	BHEL VALVE F.O. SYS	2.700
PP	42	358	BHEL VALVE,OPR'G FLOOR STM-IBR	0.650
PP	42	700	BULKED BPS COMPONENT	1.000
PP	42	710	FUEL OIL SYSTEM - DD ITEMS	4.000
PP	42	858	FUEL OIL SYSTEM - SHOP ITEMS	21.000
PP	42	992	IMPORTED ELECTRODES	0.000
PP	45	200	WINDBOX - SUB DELIVERY	4.000
PP	45	710	WIND BOX & SOFA ASSEMBLY - DD ITEMS	0.009
PP	45	801	WINDBOX AND SOFA TUBE ATTACH	34.011
PP	45	802	WINDBOX ASSEMBLY - 32" WIDTH	108.908
PP	45	804	WINDBOX - SOFA ASSEMBLY	7.254
PP	45	805	WINDBOX SUPPT AIR CYL MOUNTG	39.494
PP	45	806	WINDBOX ASSEMBLY - CORNER SOFA	24.924
PP	45	858	WIND BOX & SOFA ASSY - SHOP ITEMS	48.746
PP	97	297	MTM CLAMPS & PADS	0.300
PP	97	282	FLOWMETERS	2.600
PP	97	599	PNEU.ACTUR A&FG SYS	3.500
PP	Deaerator		Deaerator	0.000
PP	81	036	CW STORAGE TANK 16-25 CUM	7.673
PP	81	060	Special tanks and vessels	0.000
PP	80	370	HP DRAIN FLASH TANK VENT TO ATMOSPHERE	106.277
NPP	28	220	DOORS	14.685
NPP	28	700	BPS FASTENERS	1.650
NPP	29	200	SCR SYSTEM	400.000
NPP	30	105	FUR BOTTOM ENCL FRAM	59.310
NPP	30	211	FUR REAR ARCH ENCL	5.935
NPP	30	215	MAIN BOILER ENCL	46.310
NPP	30	219	VERT ROOF ENCL	134.872
NPP	30	223	GAS DIST BAFFLES	0.438
NPP	30	224	ANTIVIBRATION BAFFLES	46.240
NPP	30	233	1ST PASS DECK SPRT	55.636
NPP	30	234	2ND PASS DECK SPRT	53.830
NPP	30	235	ENCL SUPPORT STEEL	81.717
NPP	41	350	ACOIL GUN ASSY	1.125
NPP	41	390	OIL GUN VICE&RACK	1.031
NPP	41	500	HEA IGNITOR	0.728
NPP	41	710	OIL GUN ASSEMBLY - DD ITEMS	0.002
NPP	43	004	ASSY SCNR&GUN AIR SY	4.209
NPP	43	005	ASSY MILL AIR SYSTEM	23.443
NPP	43	104	M/C SCNR&GUN AIR SYS	13.001
NPP	43	105	M/C MILL AIR SYSTEM	85.426
NPP	43	200	SUBDEL,IGNR,SCNR AIR	14.000
NPP	43	710	SEAL AIR & SCANNER AIR SYSTEM - DD ITEMS	0.300
NPP	47	200	FUEL PIPING - SUB-DELIVERY	38.000
NPP	47	281	FUEL PIPE SUPPORTS	50.000
NPP	47	283	FUEL PIPE MISC ITEMS	50.000
NPP	47	289	ST PIPE SHOP BEND REST OF MILL	1160.000
NPP	47	710	PULVERISED FUEL PIPING - DD ITEMS	5.000
NPP	47	858	FUEL PIPING - SHOP ITEMS	35.000
NPP	48	012	DUCT - -FDFAN TO A.H	75.260
NPP	48	014	EXP.JT - -FDFAN TO A.H	6.193
NPP	48	015	SUPPORT-FDFAN TO A.H	23.734
NPP	48	018	MISC. DUCT&SPRT MATL	27.864

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
NPP	48	019	AIRDUCT SUP FDN MATL	4.588
NPP	48	112	DUCT - -PAFAN-PRI-AH	95.293
NPP	48	114	EXP.JT - -PAFAN-PRI-AH	4.605
NPP	48	115	SUPPORT-PAFAN-PRI-AH	17.916
NPP	48	141	SEAL AIR HAG&ID GATE	7.562
NPP	48	142	DUCT - -COLDAIRBUS	169.499
NPP	48	144	EXP.JT - -COLDAIRBUS	7.425
NPP	48	145	SUPPORT-COLDAIRBUS	25.317
NPP	48	200	INS TAPPINGS ON DUCT	5.525
NPP	48	202	DUCT - AH-WIND BOX	27.219
NPP	48	204	EXPJT - AH-WIND BOX	27.881
NPP	48	205	SUPORT AH-WIND BOX	42.454
NPP	48	206	CLH/VLH -HOT AIR	15.151
NPP	48	207	FLOWMTR-SEC AIRFLOW	0.009
NPP	48	208	DUCT-SEC.AIR TO WB	91.814
NPP	48	212	DUCT - WIND BOX CONN	12.153
NPP	48	214	EXPJT - WIND BOX CONN	0.000
NPP	48	222	SQ DUCT AH-HOT AIR BUS	89.339
NPP	48	224	EXPN PCS AH-HOT AIR BUS	15.756
NPP	48	225	SUPPORT AH-HOT AIR BUS	15.405
NPP	48	232	DUCT - HOT AIR BUS	120.158
NPP	48	234	EXPJT - HOT AIR BUS	2.628
NPP	48	235	SUPORT HOT AIR BUS	11.989
NPP	48	262	RECT DUCT AIHTR TOPRINOZZLE AND SECA	127.851
NPP	48	264	EXPN PIECE AIHTR TOPRINOZZLE AND SECA	34.483
NPP	48	265	SUPPORTS AIHTR TOPRINOZZLE AND SECA	22.510
NPP	48	267	FLOW METER- SOFA	4.550
NPP	48	372	DUCT - ECO HOPPER TO AH	31.111
NPP	48	382	DUCT - ECO-HOPPER	172.563
NPP	48	384	EXPNJT - ECO-HOPPER	60.900
NPP	48	385	SUPPORT - ECO-HOPPER	94.500
NPP	48	386	DUCT - ECO TO ECO HOPPER	90.000
NPP	48	395	CLH/VLH-FLUE GAS	15.750
NPP	48	432	DUCT - AH-BLROUTFL	581.300
NPP	48	434	EXPJT - AH-BLROUTFL	37.377
NPP	48	435	SUPORT AH-BLROUTFL	89.561
NPP	48	462	DUCT - BLROUTFL-EP	363.886
NPP	48	464	EXPJT - BLROUTFL-EP	31.629
NPP	48	465	SUPORT BLR OUTFL-EP	45.883
NPP	48	482	DUCT - ESP TO ID FAN	401.971
NPP	48	484	EXPNJT - ESP TO ID FAN	27.018
NPP	48	485	SUPPORT - ESP TO ID FAN	87.791
NPP	48	492	DUCT - IDFAN-CHIMNY	310.106
NPP	48	494	EXPNJT - IDFAN-CHIMNY	20.836
NPP	48	495	SUPORT IDFAN-CHIMNEY	95.794
NPP	48	496	SQ DUCT,ID FAN-CHIMNEY,RIGHT	92.150
NPP	48	498	DUCT - ,ID FAN-CHIM,	392.829
NPP	48	662	CIRCULAR DUCT HOT BUS MILLS	121.124
NPP	48	664	EXPN PCS HOT BUS MILLS	12.661
NPP	48	665	SUPPORTS HOT BUS MILLS	34.547
NPP	48	667	FLOW METER	21.426
NPP	48	700	BULKED BPS COMPONENT	5.695
NPP	48	911	SLIDE BRG PL & PAC BELLOW-BLR	2.330
NPP	48	912	SLIDE BRG PL-ID SYS	1.906
NPP	48	915	MAN HOLE DOORS (450X450)	13.852
NPP	48	993	ERECTON-MATERIALS	95.820
NPP	57	010	GATE-FD FAN OUTLET	19.848
NPP	57	033	DAMPER-SA SCAPH INLET	18.800
NPP	57	063	DAMPER-SA SCAPH OUTLET	21.000

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
NPP	57	083	DAMPER-SA SCAPH BYPASS	21.000
NPP	57	110	GATE-PA FAN OUTLET	15.432
NPP	57	113	DAMPER-PA FAN OUTLET	15.100
NPP	57	141	SEAL AIR HAG AND ID FAN OUTGAT	30.000
NPP	57	143	DAMPER-COLD AIR TO MILL	8.850
NPP	57	160	GATE-COLD AIR TO MILLS	20.900
NPP	57	173	DAMPER-PA APH INLET	13.250
NPP	57	203	DAMPER-SA APH OUTLET	40.750
NPP	57	209	MTG BKT FOR CL DAMPER AIR CYL	5.200
NPP	57	223	DAMPER-PA APH OUTLET	19.100
NPP	57	270	GATE-HOT AIR TO MILLS	32.800
NPP	57	273	DAMPER-HOT AIR TO MILL	15.250
NPP	57	430	FLUE GAS AH OUT GATE	89.800
NPP	57	460	GATE-ESP INLET	113.400
NPP	57	466	PLATFORMS AND LADDERS	77.580
NPP	57	577	ELECT ACTUATOR FOR GATE,DAMPER	86.000
NPP	57	578	ELECTRICAL ITEMS FOR GATE,DAMP	0.070
NPP	57	620	GATE-SCR BYPASS	117.000
NPP	57	988	DUCTS COMMISSIONING SPARES	0.050
NPP	57	470	GATE-ESP OUTLET	87.700
NPP	57	480	GATE-ID FAN INLET	78.600
NPP	57	490	GATE-ID FAN OUTLET	71.200
NPP	57	491	BLOWER WITH MOTOR	14.000
NPP	57	497	KNIFE GATE VALVE	12.000
NPP	57	577	PLATFORMS AND LADDERS(only installed ,dampers platform	86.000
NPP	95	489	COAL FLOW MONITER	0.250
NPP	96	588	ELECT.ACTUATOR-A&FG	0.500
NPP	99	099	MISC CHAIN PULLY BLO	0.150
NPP	99	501	Quick Erection Scaffold	0.000
NPP	SD	307	SCR Duct Flow Devices	30.500
NPP	SD	342	SCR INLET DUCTING	115.000
NPP	SD	344	EXPJNT-SCR INLET DUCTING	48.449
NPP	SD	345	SUPPORTS-SCR INLET DUCTING	21.000
NPP	SD	352	SCR OUTLET DUCTING	173.994
NPP	SD	354	EXPJNT-SCR OUTLET DUCTING	24.008
NPP	SD	355	SUPPORTS-SCR OUTLET DUCTING	14.529
NPP	SD	362	SQ DUCT-OVERFIREAIR	58.627
NPP	SD	364	EXPNPCS OVERFIREAIR	15.054
NPP	SD	365	SUPPORT OVERFIREAIR	10.636
NPP	SD	386	SCR BYPASS DUCT	502.460
NPP	SD	407	LPA Screen	11.000
NPP	SD	911	SCR DUCT BEARING PLATE	2.000
NPP	SD	915	SCR DUCT MANHOLE DOORS	4.000
NPP	SD	993	SCR DUCT ERECTION MATERIAL	10.000
NPP	SR	200	AMMONIA SYSTEM SCR AREA - SUB DELIVERY	5.000
NPP	SR	203	AMMONIA SYSTEM SCR AREA - BHEL VALVES	0.500
NPP	SR	206	AMMONIA SYSTEM SCR AREA - BOI VALVES	1.000
NPP	SR	207	AMMONIA SYSTEM-FASTENERS	0.500
NPP	SR	251	AMMONIA SYSTEM SCR AREA-PIPING SUPT,MISC	0.500
NPP	SR	252	AMMONIA SYSTEM SCR AREA - DD ITEMS	0.200
NPP	SR	258	AMMONIA SYSTEM SCR AREA - SHOP ITEMS	1.500
NPP	SR	270	AMMONIA INJECTION SKID	1.000
NPP	SR	281	AMMONIA SCR UTILITY PIPING SUPTS, MISC	0.500
NPP	SR	282	AMMONIA SCR AREA UTILITY - DD ITEMS	0.500
NPP	SR	288	AMMONIA SCR AREA UTILITY - SHOP ITEMS	1.000
NPP	SR	300	DILUTION AIR SUPPLY SYSTEM - SD	2.500
NPP	SR	301	DIL AIR SUPPLY SYST - PIPING SUPT, MISC	10.000
NPP	SR	303	DILUTION AIR SUPPLY SYSTEM - BHEL VALVES	1.000
NPP	SR	306	DILUTION AIR SUPPLY SYSTEM - BOI VALVES	3.000

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
NPP	SR	307	DILUTION AIR SUPPLY SYSTEM - FASTENERS	1.000
NPP	SR	308	DILUTION AIR SUPPLY SYSTEM - SHOP ITEMS	40.000
NPP	SR	330	DILUTION AIR HEATER -ELECTRIC	5.000
NPP	SR	400	SCR - RECTIFIER	48.000
NPP	SR	490	SCR-REACTOR SEALING SYSTEM	3.000
NPP	SR	500	CATALYST DE- DUSTING SYSTEM	20.000
NPP	SR	900	SCR - CATALYST TROLLEY	1.000
NPP	SR	988	AMMONIA SYSTEM-COMMISSIONING SPARES	0.000
NPP	SR	990	SCR-CATALYST HANDLING SYSTEM	5.000
NPP	SR	992	AMMONIA SYSTEM-WELDING ELECTRODES	0.000
NPP	SS	901	SCR Supporting Posts and Restraints	59.462
NPP	SS	906	SCR Rectifier Truss Arrangement	54.654
NPP	SS	907	SCR Cap Truss Arrangement	104.753
NPP	SS	908	SCR Bottom Hopper Truss Arrangement	27.956
NPP	SS	911	SCR Catalyst Front Casing Wall Layer 1	8.056
NPP	SS	912	SCR Catalyst Front Casing Wall Layer 2	8.089
NPP	SS	913	SCR Catalyst Front Casing Wall Layer 3	8.083
NPP	SS	914	SCR Catalyst Front Casing Wall Layer 4	8.094
NPP	SS	916	SCR Rectifier Front Casing Wall	10.516
NPP	SS	917	SCR Cap Front Casing Wall	24.304
NPP	SS	918	SCR BOTTOM HOPPER FRONT CASING WALL	26.858
NPP	SS	921	SCR Catalyst Rear Casing Wall Layer 1	12.340
NPP	SS	922	SCR Catalyst Rear Casing Wall Layer 2	12.340
NPP	SS	923	SCR Catalyst Rear Casing Wall Layer 3	12.340
NPP	SS	924	SCR Catalyst Rear Casing Wall Layer 4	12.338
NPP	SS	926	SCR Rectifier Rear Casing Wall	10.938
NPP	SS	927	SCR Cap Top Casing Wall	54.956
NPP	SS	928	SCR BOTTOM HOPPER REAR CASING WALL	32.235
NPP	SS	931	SCR Catalyst Left Casing Wall Layer 1	15.731
NPP	SS	932	SCR Catalyst Left Casing Wall Layer 2	15.731
NPP	SS	933	SCR Catalyst Left Casing Wall Layer 3	15.731
NPP	SS	934	SCR Catalyst Left Casing Wall Layer 4	15.725
NPP	SS	936	SCR Rectifier Left Casing Wall	12.365
NPP	SS	937	SCR Cap Left Casing Wall	28.162
NPP	SS	938	SCR BOTTOM HOPPER LEFT CASING WALL	21.646
NPP	SS	941	SCR Catalyst Right Casing Wall Layer 1	15.731
NPP	SS	942	SCR Catalyst Right Casing Wall Layer 2	15.731
NPP	SS	943	SCR Catalyst Right Casing Wall Layer 3	15.731
NPP	SS	944	SCR Catalyst Right Casing Wall Layer 4	15.724
NPP	SS	946	SCR Rectifier Right Casing Wall	12.365
NPP	SS	947	SCR Cap Right Casing Wall	28.162
NPP	SS	948	SCR BOTTOM HOPPER RIGHT CASING WALL	21.645
NPP	SS	951	SCR Catalyst Support Arrangement Layer1	45.032
NPP	SS	952	SCR Catalyst Support Arrangement Layer2	45.032
NPP	SS	953	SCR Catalyst Support Arrangement Layer3	45.032
NPP	SS	954	SCR Catalyst Support Arrangement Layer4	44.932
NPP	SS	961	SCR Catalyst Supp Hanger Strap Layer1	12.554
NPP	SS	962	SCR Catalyst Supp Hanger Strap Layer2	12.679
NPP	SS	963	SCR Catalyst Supp Hanger Strap Layer3	12.679
NPP	SS	964	SCR Catalyst Supp Hanger Strap Layer4	12.301
NPP	SS	971	SCR Catalyst Loading Door Layer 1	7.472
NPP	SS	972	SCR Catalyst Loading Door Layer 2	7.472
NPP	SS	973	SCR Catalyst Loading Door Layer 3	7.472
NPP	SS	974	SCR Catalyst Loading Door Layer 4	7.472
NPP	SS	982	SCR Floor Grills	120.000
NPP	SS	983	SCR Fasteners	6.000
NPP	SS	996	SCR Miscellaneous 1	20.000
NPP	SS	997	SCR Miscellaneous 2	20.000
NPP	SS	998	SCR Miscellaneous 3	20.000

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
NPP	SS	999	SCR Temporary Intern. Supp for Erection	36.000
NPP	SC	104	DENOX SYS. - FIELD INTERCONNECTING EQPTS	50.000
NPP	SC	112	DENOX-PNEUMATIC ACTUATOR IN A&FG SYSTEM	0.400
NPP	SC	116	DENOX -PNEUMATIC TUBINGS FIT. & AIR SET	0.200
NPP	SC	300	DENOX SYSTEM - FIELD GAUGES	0.100
NPP	SC	304	DENOX SYSTEM - FIELD SWITCHES	0.050
NPP	SC	308	DENOX-FIELD TRANSMITTERS & TEMP. ELEMENT	0.200
NPP	SC	312	DENOX SYSTEM - FLOW MEASURING DEVICES	0.150
NPP	SC	316	DENOX SYSTEM -ANALYSERS	0.500
NPP	SC	324	DENOX SYSTEM - ERECTION MATERIALS	3.000
NPP			Valves (Solenoid valves,pneumatic valve, manual valve gate)	25.000
NPP			Collector conveyor Apron type	160.000
NPP			Support Structure for Apron Conveyor	5.000
NPP			Loading and discharge chute with fastners	0.220
NPP			Bucket Elevator	20.000
NPP			Chute Connected to the Mill	1.650
NPP			Chute Connected to the Pbox	1.760
NPP			Pyrite Hopper with support	20.000
NPP			Chute Connected between Bucket Elevator & Silo	0.330
NPP			Expansion Joint (200 NB)	54.000
NPP			Ruptchre Disc	1.000
NPP			Level Switch (RF type)	1.000
NPP			Spray Pipe (40NB)	10.000
NPP			Spray Pipe (15NB)	4.000
NPP			Soleniod Valve	27.000
NPP			Pressure Switch	0.500
NPP			Spray Nozzle	0.100
NPP			Vent Filter	0.500
NPP			Level Transmitter (type)	0.500
NPP			Manual Hoist	1.000
NPP			Water Pipe 100 NB	10.000
NPP			Pump (10 CuMtrr @ 15 MWC)-3 sets	15.000
NPP			Motor-3 sets	6.000
NPP			Valve at Outlet 3-sets	3.000
NPP			GI Pipe 50 NB	10.000
NPP			GI Pipe 25 NB	8.000
NPP			GI Pipe 15 NB	5.000
NPP			Gate/Ball Valves (25 NB)	2.000
NPP			Gate/Ball Valves (15 NB)	1.000
NPP			Solenoid Valve/Quick exhaust valve	0.200
NPP			Hose	0.500
NPP	80	399	STEAM BLOWING PIPING-TEMPORARY	109.000
NPP	80	604	ACID CLEANING PIPING-TEMPORARY	130.000
Insulations- Wool Mattress	33	021	BLR PP MINRL WOOL	905.000
Insulations- Wool Mattress	33	221	DUCT MINERAL WOOL	1212.500
Insulations- Wool Mattress	55	919	Axial FD fan mineral wool	20.400
Insulations- Wool Mattress	55	939	Axial PA fan Insulation wool	14.000
Insulations- Wool Mattress	SL	021	Mineral Wool for SCR System	325.000
Insulations- Wool Mattress	79	867	MIN WOOL FOR ESP INSULATIO	490.000
Insulations- Wool Mattress	FW	265	LINING OF DUCT BETWEEN SCR (FGD Insulation)	18.000
Insulations- Wool Mattress	81	325	MINERAL WOOL MATTRESS	71.000
Insulations- Pourable & castable	33	210	MAIN BLR CAST REF GR	180.000
Insulations- Pourable & castable	33	230	MAIN BLR POUR INSUL	90.000
Insulations- Iron Parts	31	010	COMPS WELDED TO PR	0.974
Insulations- Iron Parts	31	104	FUR REAR ARCH SKIN	2.620
Insulations- Iron Parts	32	010	FICOM BLR PP INSUL	7.544
Insulations- Iron Parts	32	210	FIX COMP-DUCT INSULN	69.505
Insulations- Iron Parts	32	700	BULKED DD COMPONENT	215.000
Insulations- Iron Parts	32	810	EQUIPMENT OUTER CASING	423.556

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
Insulations- Iron Parts	33	924	MISC EQPTS PCK MATLS	0.400
Insulations- Iron Parts	33	970	MISC EQPTS EXP METAL	18.000
Insulations- Iron Parts	33	975	MISC EQPTS SEAL COMP	0.500
Insulations- Iron Parts	37	010	BLR OUTER CSG COMPS	51.795
Insulations- Iron Parts	37	810	BLR OUTER CASING	64.720
Insulations- Iron Parts	SL	210	Fixing Components for SCR System	11.000
Insulations- Iron Parts	SL	700	Bulked DD components for SCR System	19.000
Insulations- Iron Parts	SL	701	BPS Fasteners for SCR System	1.000
Insulations- Iron Parts	SL	810	Outer Casing for SCR System	83.000
Insulations- Iron Parts	79	868	FIXING COMP. FOR ESP INSUL (ESP Insulation)	131.000
Insulations- Iron Parts	FW	267	INSULATION MATERIALS FOR D	40.000
Insulations- Iron Parts	81	318	FIX COM FOR MISCELLANEOUS PPG INSULATION	8.000
Insulations- Al cladding sheets	32	700	BULKED DD COMPONENT	215.000
Insulations- Al cladding sheets	32	810	EQUIPMENT OUTER CASING	423.556
Insulations- Al cladding sheets	PE	M	PEM Supply	42.500
Insulations- Al cladding sheets	89	615	INSULATION CLADDING SH FOR	115.000
Insulations- Al cladding sheets	FW	268	INSULATION MATERIALS FOR D	40.000
Insulations- Al cladding sheets	81	341	SEALING COMPOUND FOR INSL	0.400
Insulations- Al cladding sheets	81	350	ALUMINIUM CLADDING FOR INSULATION	22.000
Insulations- Al cladding sheets	PE	M	Ancillary material	31.000
RM	55	000	AXL FAN TOOL & FIXTU	0.000
RM	55	011	FD FAN FOUNDATION MATL	1.800
RM	55	017	FD FAN C&I ITEMS	0.040
RM	55	021	AXL IDFAN FDN MATL	0.830
RM	55	024	ID SEALING/COOLING FANS	3.000
RM	55	027	ID FAN C&I ITEMS	0.060
RM	55	031	PA FAN FOUNDATION MATL	1.400
RM	55	037	PA FAN C&I ITEMS	0.100
RM	55	091	FISRT FILL LUBRICANTS	4.000
RM	55	216	AXIAL FD FAN ROTOR	4.185
RM	55	328	AXIAL 2 REACTION ID FAN ROTOR	6.808
RM	55	335	AXIAL 2 REACTION PA FAN ROTOR	7.600
RM	55	516	AXIAL FD FAN STATOR	26.117
RM	55	628	AXIALID FAN COUPLING	21.022
RM	55	635	AXIALPA FAN STATOR	17.784
RM	55	810	AXL FD FAN COUPLING	1.200
RM	55	820	AXIAL ID FAN COUPLING	5.945
RM	55	830	AXIAL PA FAN COUPLING	1.400
RM	55	910	AXIAL fd FAN LUBE OIL SYSTEM	3.000
RM	55	911	AXIAL FD FAN SILENCER	67.500
RM	55	920	AXIAL ID FAN LUBE OIL SYSTEM	7.000
RM	55	930	AXIAL PA FAN LUBE OIL SYSTEM	4.000
RM	55	931	PA FAN SILENCE	56.000
RM	56	077	SEAL AIR FAN C & I ITEMS	0.020
RM	56	161	RADIAL PENT HOUSE VENTILATION FAN	1.200
RM	56	173	RADIAL SEAL AIR FAN ROTOR	1.650
RM	56	373	RADIAL SEAL AIR FAN BEARINGS	0.310
RM	56	473	RADIAL SEAL AIR FAN STATOR	7.600
RM	56	670	RADIAL SEAL AIR FAN MOTOR	2.300
RM	56	870	SEAL AIR FAN COUPLING(RADIAL)	0.090
RM	FD	MOTOR	FD FAN MOTOR	16.500
RM	PA	MOTOR	PA FAN MOTOR	32.000
RM	ID	MOTOR	ID FAN MOTOR	0.000
RM	65	200	COAL FEEDER- SUB-DELIVEY	0.905
RM	65	710	COAL FEEDER - DD ITEMS	0.228
RM	65	736	36GRAVIMETRIC FEEDER	64.938
RM	65	997	FEEDER MAN.SPARE	0.000
RM	67	200	COAL FEEDING SYSTEM- SUB DELY.	0.729
RM	67	204	RAW COAL GATES	4.086

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
RM	67	272	BUNKER OUTLET GATE -36" MOTOR	9.331
RM	67	276	FEEDER INLET GATE- 36" CHAIN	8.560
RM	67	283	FEEDER OUTLET ISOLATION GATE	11.116
RM	67	710	COAL FEEDING SYSTEM - DD ITEMS	0.443
RM	67	801	DOWN SPOUT	9.248
RM	67	802	BUNKER EMPTYINGCHUTE	28.431
RM	67	803	FEED PIPE TO MILL	27.674
RM	67	997	Fdr Isolation gate mand spares	0.000
RM	95	088	FSSS FLAME SCANNER	0.000
RM	95	488	FEEDER MOUNTED C&IEQ	2.500
RM	95	988	FF CONT COMMG SPARE	0.000
RM	95	487	GRA.FDR.ELEC.PACKAGE	0.050
RM	95	485	GRAVI.FDR.REMOTE.CAB	3.000
RM	99	100	FAN HANDLING EQUIPT	14.500
RM	99	400	SCAPH,RAPH HANDLG EQ	5.000
RM	99	300	PUMP HANDLING EQUIPT	3.700
RM	99	600	FO SYSTEM HANDLG EQU	1.000
RM	MILL	HAND. EQ.	MILL HANDLING EQUIPMENTS	50.000
RM	61	001	JOURNAL SHAFT ASSY	55.872
RM	61	002	JOURNAL HEAD ASSY	21.600
RM	61	003	JURNAL SKIRT ASSLY	1.979
RM	61	004	JOURNAL HEAD LINER ASSLY	8.600
RM	61	101	PGB ASSEMBLY-HP1103-DC	0.000
RM	61	102	SPECIAL FASTENERS FOR HP-1103 MILL	7.778
RM	61	103	BOWL HUB & VANE WHEEL ASSEMBLY	0.000
RM	61	110	PLANETARY GEAR BOX	1.215
RM	61	201	MILL SIDE ASSEMBLY	0.000
RM	61	301	SEPARATOR BODY AND JOC ASSEMBLY	0.000
RM	61	302	SEPARATOR TOP ASSEMBLY	0.000
RM	61	308	JOURNAL OPENING COVER ASSY WITH SPRING ASSY	35.216
RM	61	310	JOURNAL OPENING COVER	1.223
RM	61	311	ROTOR AND ROTOR DUPPORT ASSY	0.000
RM	61	312	MULTI PORT OUTLET PLATE ASSEMBLY	0.000
RM	61	314	DRIVE ASSY	0.000
RM	61	410	MDV ASSEMBLY (KNIFE GATVE VALVES)	18.000
RM	61	803	STUD TENSIONING EQUIPMENT-100T	0.130
RM	61	911	Base plates and foundation bolts	0.000
RM	MILL	MOTOR	Motors	14.150
RM	FW	212	SLURRY RECIRCULATION PUMP	80.000
RM	FW	230	AIR OXIDATION SYSTEM	14.000
RM	RC	MOTOR	RC Pump Motors	208.000
RM	OXIDATION	MOTOR	Oxidation Blowers motors	34.000
APH	50	510		20.000
APH	52	000		0.000
APH	52	010	LARG AH-ROTOR ASSY	941.838
APH	52	011	LARG AH-ROTOR POST	35.611
APH	52	012	LARG AH-ROTORPINRACK	6.052
APH	52	013	LARG AH-ROTORSEALS	20.000
APH	52	030	LARG AH-ROTORHOUSING	43.596
APH	52	041	HOT END CONN PLATE	76.863
APH	52	042	COLD END CONN PLATE	163.753
APH	52	054	LARG AH-AXIAL SEAL	1.460
APH	52	055	LARG AH-BY PASS SEAL	2.100
APH	52	100	LARGE AH ROTOR DRIVE	15.500
APH	52	101	LARG AH-AUX ROTDRIVE	10.460
APH	52	211	LARG AH-AIRSEAL PIPE	1.000
APH	52	220	LARG AH-GENS DETAILS	3.500
APH	52	261	LARG AH-GUIDE BEARNG	5.136
APH	52	262	LARG AH-SUPRT BEARNG	12.901

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
APH	52	271	OIL PIPING GUIDE BRG	0.700
APH	52	272	OIL PIPING SUPRT BRG	0.700
APH	52	274	LUB OIL CIRCULATION UNIT	1.400
APH	52	275	LARGE AIR HEATER-LUBRICANTS	2.000
APH	52	301	WASH MANIFLD GAS INL	2.700
APH	52	302	WASH MANIFLD GAS OUT	2.900
APH	52	338		3.500
APH	52	339	LARGE AH-RETRACT CLNG DEV (HE)	2.500
APH	52	988	LARG AH COMMISSIONING SPARE	0.000
ESP	79	801	ROLL/SLIDE SUPPORTS	0.000
ESP	79	805	ESP-SUB-DELIVERY COMPONENT	1.000
ESP	79	806	INSULATOR HOUSING AS	103.400
ESP	79	808	GAS DIST. ASSY	31.568
ESP	79	809	GD-RAPPING MECHANISM	11.396
ESP	79	810	GD_DRIVE ARRANGEMENT	1.300
ESP	79	811	GAS SCREEN-EP	25.000
ESP	79	813	EMIT SYST SUSPENSION	22.974
ESP	79	814	SUPPORT INSULATORS	21.480
ESP	79	815	EMITTING ELECTRODES	54.000
ESP	79	816	EMIT ELECT RAPP MECH	74.200
ESP	79	817	DRIVE ARGT. FOR EMIT. SYS	61.007
ESP	79	819	COL ELEC SUSPENSION	0.000
ESP	79	820	COLLECTING ELECTRODE	40.625
ESP	79	821	EMIT SYS FRAME-TOP	22.956
ESP	79	822	EMIT SYS FRAME BOTOM	0.000
ESP	79	823	INSPECTION DOORS	31.724
ESP	79	824	SHOCK BARS	38.515
ESP	79	825	COLL ELECT RAPP MECH	71.158
ESP	79	826	COLL ELEC RAPP DRIVE	13.800
ESP	79	828	ESP ROOF BEAM	5.585
ESP	79	830	ELECTRICAL SD COMPTS	36.700
ESP	79	831	GEARED MOTORS FOR RAPPING	33.450
ESP	79	832	EMIT SYS FRAME-MIDLE	214.281
ESP	79	837	JUNCTION BOX & PUSH BUTTON	2.400
ESP	79	841	ELECTRICAL MISCELLANEOUS I	30.000
ESP	79	842	OUTER ROOF-EP	361.584
ESP	79	843	HOPPER RIDGES	35.386
ESP	79	844	HOPPER UPPER PART	652.276
ESP	79	845	HOP MLD&LOWER PART	614.355
ESP	79	846	INSULATOR SUPP PANEL	36.053
ESP	79	847	ROOF PANEL ASSY	43.566
ESP	79	848	CASING STRUCTURE	0.000
ESP	79	849	CASING SHELL/PANEL	66.551
ESP	79	850	INLET-OUTLET FUNNEL	176.944
ESP	79	855	PENT HOUSE FOR E P	165.304
ESP	79	857	SPLITTER&GUIDE VANES	46.300
ESP	79	859	SUPPORTS FOR ELECTRICAL IT	30.700
ESP	79	860	CABLE-CABLE RACKS	280.500
ESP	79	861	EP PERF TEST EQUIPT	23.950
ESP	79	862	CABLE TRAY AND FLEXIBLE SU	208.000
ESP	79	863	ASH LEVEL INDICATOR	4.300
ESP	79	864	MISCELLANEOUS ITEMS	15.000
ESP	79	865	APP PLATFORM-HOPPER	262.907
ESP	79	866	WATER WASHING SYSTEM	6.100
ESP	79	872	INTERLOCKS-EP	3.300
ESP	79	873	ELECTRICALLY OPERTD HOIST&	5.800
ESP	79	874	OPACITY MONITOR & ACCESSOR	1.000
ESP	79	877	LT SWITCH BOARD/ESP SWTICH	60.000
ESP	79	878	BAPCON & ACCESSORIES	0.700

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
ESP	79	880	FOUNDATION MATLS FOR ESP	10.000
ESP	79	881	SUPPOTING STRUCTURES FOR E	86.228
ESP	79	889	GUIDE PLATE/VANE EP INLET	15.000
ESP	79	890	HEATING ELEMENTS	1.700
ESP	79	891	PANEL TYPE HOPPER HEATERS	50.000
ESP	79	895	IOS PANEL	0.200
ESP	79	988	COMMISSIONING SPARES	0.000
ESP	79	996	TOOLS & TACKLES	0.000
ESP	89	610	EP GALLERIES&STAIRS	65.807
ESP	89	611	ESP ROOF HANDRAILS	13.500
ESP	89	612	FLOOR GRILL AND STEP TREAD	23.294
ESP	89	613	FLOOR GRILL AND MOBILE LAD	154.380
ESP	89	614	PENT HOUSE ROOFING SHEETS	63.500
ESP	89	618	HSFG BOLTS FOR ESP STRUT	9.981
FGD	FW	213	ABSORBER SYSTEM INTERNALS	22.000
FGD	FW	215	MIST ELIMINATOR & ACCESSOR	28.000
FGD	FW	219	ABSORBER SYSTEM-BASE	61.000
FGD	FW	220	ABSORBER SYSTEM-STRUCTURES	816.000
FGD	FW	221	ABSORBER SYSTEM-CASING BOT	130.000
FGD	FW	222	ABSORBER SYSTEM-CASING TOP	607.000
FGD	FW	223	ABSORBER SYSTEM ACCESSORIE	39.000
FGD	FW	224	ABSORBER SYSTEM-LINING-C27	89.000
FGD	FW	227	EMERGENCY QUENCH SYSTEM	9.000
FGD	FW	228	ABSORBER-W/D INTERFACE	14.000
FGD	FW	229	W/D WASH SYSTEM	9.000
FGD	FW	231		0.000
FGD	FW	232		0.000
FGD	FW	234		0.000
FGD	FW	251	EXPANSION JOINT BETWEEN BY	15.000
FGD	FW	253	EXPANSION JOINT BETWEEN SC	16.000
FGD	FW	255	DUCT BETWEEN BYPASS DUCT I	146.000
FGD	FW	257	DUCT BETWEEN SCRUBBER AND	146.000
FGD	FW	260	DUCT STRUCTURE BETWEEN DUC	86.000
FGD	FW	262	DUCT STRUCTURE BETWEEN SCR	86.000
FGD	FW	280	FOUNDATION MATL FOR DUCT S	10.000
FGD	FW	281	FOUNDATION MATL FOR SCRUBB	50.000
FGD	FW	282	FOUNDATION MATL FOR ELEVAT	10.000
FGD	FW	292	STRUCTURES FOR ELEVATOR	4.000
FGD	FW	293	ELEVATOR AND ACCESSORIES	4.000
FGD	FW	300		239.774
FGD	FW	301		393.642
FGD	FW	302		28.591
FGD	FW	303		16.435
FGD	FW	305		29.645
FGD	FW	314	MISCELLANEOUS- FGD SYSTEM	20.000
FGD	FW	610	GALLARIES&RAILINGS FOR SCR	218.000
FGD	FW	244	OXIDATION AIR DISTRIBUTION(FGD piping)	20.000
P92	80	300	MS FROM SUPERHEATER TO BOILER STOP VALVE	247.000
P92	80	301	MS FROM BOILER STOP VALVE TO ESV	550.000
P92/AS/CS	80	303	MS HEADER TO AUX PRDS	6.000
P92	80	304	MS HEADER TO HPBP VALVE	20.000
P92	80	307	HP AND LP BYPASS WARM UP	2.000
P92	80	310	HRH FROM REHEATER TO INTERCEPTOR VALVE	441.000
P92	80	312	LPBP VALVE UPSTREAM AND DOWNSTREAM	110.000
P91/P22/CS	80	451	BOILER INTEGRAL PIPING DRAINS	18.000
P92/P22/CS	80	452	HP PIPING DRAINS - SG SCOPE	42.000
P22	80	319	PERMANENT STEAM BLOWING PIPING	1.600
P22/CS	80	320	CRH FROM TURBINE TO REHEATER	311.000
P22	80	321	HPBP VALVE TO CRH PIPING	22.000

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
P22/CS	80	336	EXTRACTION STEAM TO HP HEATER NO.1	7.500
P22	80	338	EXTRACTION STEAM TO HP HEATER-3	6.000
CS-HP Piping	80	322	CRH PIPING TO DEAERATING HEATER	18.600
CS-HP Piping	80	323	STEAM TO BFP DRIVE TURBINE	6.800
CS-HP Piping	80	324	CRH HEADER TO AUX.PRDS	1.900
CS-HP Piping	80	329	EXTRACTION STEAM TO BFP DRIVE TURBINE	12.000
CS-HP Piping	80	331	EXTRACTION STEAM TO LP HEATER-2	8.000
CS-HP Piping	80	332	EXTRACTION STEAM TO LP HEATER-3	7.000
CS-HP Piping	80	333	EXTRACTION STEAM TO LP HEATER-4	10.000
CS-HP Piping	80	334	EXTRACTION STEAM TO LP HEATER-5	7.500
CS-HP Piping	80	335	EXTRACTION STEAM TO DEAERATING HEATER	16.000
CS-HP Piping	80	337	EXTRACTION STEAM TO HP HEATER-2	6.200
CS-HP Piping	80	339	AUX STEAM TO BFD TURBINE	3.000
CS-HP Piping	80	340	AUX STEAM HEADER	7.500
CS-HP Piping	80	342	AUX STEAM TO SCAPH	12.000
CS-HP Piping	80	343	AUX STEAM TO AH SOOT BLOWERS	5.000
CS-HP Piping	80	345	AUX STEAM TO DEAERATING HEATER	7.250
CS-HP Piping	80	349	AUX STEAM TO GLAND SEALS - TG SCOPE	1.000
CS-HP Piping	80	351	AUX STEAM TO UNLISTED USERS - SG SCOPE	23.000
	80	355		3.000
CS-HP Piping	80	421	BOILER FEED PUMP RECIRCULATION	13.000
CS-HP Piping	80	423	BOILER FEED PUMP TO HPH INCLUDING BYPASS	173.000
CS-HP Piping	80	424	BFD BETWEEN HTRS AND GROUP PROTECTION	127.000
CS-HP Piping	80	425	BFD FROM FINAL HPH TO SG TP	66.000
CS-HP Piping	80	430	SPRAY WATER TO HPBP	5.100
CS-HP Piping	80	433	SPRAY WATER FROM BFP INTERSTAGE	14.000
CS-HP Piping	80	434	UNLISTED SPRAY WATER - SG SCOPE	4.900
CS-HP Piping	80	457	MANIFOLDS FOR HP FLASH BOX AND CONDENS	1.500
HP piping	80	901	SUB DELIVERY VALVES FOR LIGHT UP	10.000
HP piping	Hyd		BFp circulation valve, restriction orifices Heat reducers BFp s	15.000
HP piping	Trichy		Trichy supplied valves & QC NR VS	292.800
HP piping	Trichy		Control valves & flow elements Pem supply	292.800
HP piping	Trichy		HPBP valves, sparya vales breakdown orifices	292.800
LP PIPING	80	344	AUX STEAM TO FO SYSTEM TP	30.000
LP PIPING	80	355	Steam tracing piping	3.000
LP PIPING	80	363	EXHAUST STEAM FROM PRIME MOVERS-TG SCOPE	35.000
LP PIPING	80	370	HP DRAIN FLASH TANK VENT TO ATMOSPHERE	186.000
LP PIPING	80	371	DRAIN FLASH TANK VENT TO CONDENSER	4.200
LP PIPING	80	373	AUX STEAM HEADER SV EXHAUST	2.200
LP PIPING	80	375	UNLISTED SV EXHAUSTS - TG SCOPE	0.500
LP PIPING	80	379	HPH SV EXHAUST TO FLASH TANK	6.200
LP PIPING	80	381	HP HEATER VENTS - TG SCOPE	0.500
LP PIPING	80	382	LP HEATER VENTS	1.800
LP PIPING	80	385	VENT FROM UNLISTED PPG/EQPT TO COND	6.900
LP PIPING	80	395	AUX STEAM TO FUEL OIL ATOMISING	0.200
LP PIPING	80	400	CONDENSATE SUCTION	8.000
LP PIPING	80	401	CD FROM PUMP TO LPH1/DC INLET TEE AND RE	56.000
LP PIPING	80	402	CD FROM LPH1/DC INLET TEE TO TG TP	25.000
LP PIPING	80	403	CD FROM TG TP TO DEAERATING HEATER	14.000
LP PIPING	80	407	CONDENSATE FOR SEALING OF VACUUM	4.000
LP PIPING	80	408	CONDENSATE DUMP FROM HEADER	5.000
LP PIPING	80	418	ERECTION MATERIALS FOR INSTRUMENTS	0.700
LP PIPING	80	419	DEAERATOR SAFETY VALVE EXHAUST TO ATM	4.700
LP PIPING	80	420	BOILER FEED PUMP SUCTION	21.000
LP PIPING	80	435	UNLISTED SPRAY WATER - TG SCOPE	2.000
LP PIPING	80	442	GLAND STEAM COOLER DRAINS	0.350
LP PIPING	80	443	LP HEATER-1 TO CONDENSER	7.000
LP PIPING	80	444	LP HEATER-2/3/4/5 DRAINS AND DRIP PUMP I	14.000
LP PIPING	80	446	DEAERATING HEATER OVER FLOW AND DRAIN	6.800

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
LP PIPING	80	447	HP HEATER DRAINS	33.000
LP PIPING	80	449	TG CYCLE PIPING DRAINS AND VENTS	11.000
LP PIPING	80	453	LP PIPING DRAINS - SG SCOPE	1.900
LP PIPING	80	454	SCAPH DRAINS	2.000
LP PIPING	80	455	DRAIN FROM UNLISTED EQPT/VESSEL-SG SCOPE	34.000
LP PIPING	80	459	HP FLASH TANK DRAIN TO CONDENSER	0.850
LP PIPING	80	460	SG AUX COOLING WATER UNIT SYSTEM	65.000
LP PIPING	80	463	TG AUX COOLING WATER	98.000
LP PIPING	80	471	BOILER WATER WASH TO AND FROM UNIT	30.000
LP PIPING	80	477	SERVICE WATER PIPING	65.000
LP PIPING	80	478	DRINKING WATER PIPING	6.000
LP PIPING	80	480	FIRE WATER-OTHER AREAS	30.000
LP PIPING	80	493	HP FLASH TANK VENT TO CONDENSER	2.275
LP PIPING	80	494	LP FLASH TANK VENT TO CONDENSER	3.100
LP PIPING	80	495	LP FLASH TANK DRAIN TO COND	2.750
LP PIPING	80	545	LP CONDENSATE PIPING WITHIN TG HALL FOR	8.300
LP PIPING	80	610	SERVICE AIR-COMP SUCT AND DIS TO RECEI	11.000
LP PIPING	80	612	SERVICE AIR FOR INDIVIDUAL UNITS	15.000
LP PIPING	80	614	INST AIR COMP SUC AND DIS TO RECEIVER	10.000
LP PIPING	80	616	INSTRUMENT AIR FOR INDIVIDUAL UNIT	23.000
LP PIPING	80	673	LUBE OIL PIPING SYSTEM	21.000
LP PIPING	80	993	MISC ERECTION MATLS	0.500
LP PIPING	80	992	WELDING ELECTRODES-1	20.000
SS	80	412	CONDENSATE TRANSFER	6.000
SS	80	473	DEMINERALISED WATER SYSTEM	18.000
SS	80	601	LOW PRESSURE DOSING PIPING	1.000
SS	81	415	TEST THERMOWELLS	0.750
HANGER	80	830	H AND S FOR CRITICAL PIPING - STEAM LINE	322.000
HANGER	80	920	H AND S FOR HYDRO TEST	33.000
HANGER	80	921	H AND S FOR LIGHT UP STEAM LINE	106.456
HANGER	80	926	H AND S FOR TEMPORARY PIPING ACID AND AL	20.000
HANGER	80	927	H AND S FOR TEMPORARY PIPING - STEAM BLO	20.000
HANGER	80	928	H AND S FOR BOILER LIGHT UP - TG	41.713
HANGER	80	930	H AND S FOR SYNCHRONISATION - TG	77.000
HANGER	80	933	H AND S FOR LP PIPING	21.000
HANGER	80	935	VLH AND CLH for MS PPG UPTO MSV -HERP	13.000
HANGER	80	936	VLH AND CLH for SG PPG -HERP	7.000
HANGER	80	937	VLH AND CLH Critical PPG -HERP	83.000
HANGER	80	940	AUX STRUCTURE FOR CRITICAL PPG AND CD B	188.000
HANGER	80	941	VLH AND CLH for BFD PPG -HERP	11.000
HANGER	80	942	VLH AND CLH for TG PPG -HERP	16.000
HANGER	PE	PEM	ME Bellows	128.000
HANGER	81	411	DIRECT GAUGES FOR STEAM LINES	0.750
HANGER	81	412	DIRECT GAUGES FOR NON-STEAM LINES	0.850
HANGER	81	414	LOCAL CONTROL EQPT FOR NON-STEAM LINES	0.050
HANGER	81	416	PERFORMANCE GUARANTEE TEST MATERIALS	1.650
HANGER	81	417	INSTRUMENTATION FOR STARTUP SYSTEM	0.300
HANGER	PE	M	LP chemical dosing system PEM supply	42.500
HANGER	LUBE OIL	PUMP	Lube oil transfer pump	1.500
HANGER	PORT.	W TANK	Potable water tank	60.000
HANGER	81	036	CW STORAGE TANK 16-25 CUM	15.100
HANGER	81	060	SPECIAL TANKS AND VESSELS	60.000
HANGER	81	100	CONDENSATE PUMP	5.500
HANGER	81	110	COOLING WATER PUMP	0.380
HANGER	PE	PEM	PHE,MISc pumps,dosing systems.hoists,EOT crane,conical s	128.000
HANGER	FW	226	EMERGENCY QUENCH WATER TAN (FGD pkg)	22.000
Sub-Total Boiler :				51260.5
Bunker			Bunker structure	2775.000
Sub-Total Bunker:				

CATEGORY	PG	MA	DESCRIPTIONS	BALANCE Quantity (in MT)
	Grand Total			54035.5