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T E N D E R S P E C I F I C A T I O NS

TENDER NO. BHEL/ NR/SCT/ ANPARA D/ BOILER/ UNIT 7/ 706

FOR

Erection, testing, commissioning and trial operation of Boiler , ESP , Boiler Auxiliaries and Power Cycle Piping of UNIT NO. 7 at Anpara - D Thermal Power Plant of 2 x 500 MW units (UNIT 6 &7) of UPRUVNL at Anpara, Sonebhadra, UP

PART I – TECHNICAL BID

Bharat Heavy Electricals Limited
(A Govt. Of India Undertaking)
Power Sector – Northern Region,
Plot No. 25 , Sector - 16A ,
Distt. Gautam Budh Nagar, NOIDA – 201 301 (INDIA)

ISO 9001-2000, ISO 14001 and OHSAS 18001 certified company
SubContract and Purchase Deptt.

Bharat Heavy Electricals Limited
(A Govt. Of India Undertaking)
Power Sector – Northern Region,
Plot No. 25 , Sector - 16A ,
Distt. Gautam Budh Nagar, NOIDA – 201 301(INDIA)
Phone: 0091-0120-2515476 / 2515464 / 2515479
Fax 091-0120-2515464 / 2515467
Email: swapan@bhelpsnr.co.in / msd@bhelpsnr.co.in

TENDER NO. BHEL/ NR/SCT/ ANPARA D/ BOILER/ UNIT 7/ 706

IMPORTANT NOTE

PURCHASER OF THIS TENDER DOCUMENT IS ADVISED TO CHECK AND ENSURE COMPLETION OF ALL PAGES OF TENDER DOCUMENT AND REPORT ANY DISCREPANCY TIMELY FOR CORRECTIVE ACTION, IF ANY, TO THE ISSUING AUTHORITY BEFORE THE BIDS ARE SUBMITTED. ORIGINAL COPY OF TENDER DOCUMENT COMPLETE IN ALL RESPECTS MUST BE SUBMITTED BACK AS PART OF THE BID WITHOUT WHICH THE SAME IS LIABLE TO BE REJECTED BY BHEL.

THIS TENDER SPECIFICATION ISSUED TO:

M/S----------

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ISO 9001-2000, ISO 14001 and OHSAS 18001 certified company
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TENDER NOTICE

Sealed tenders are invited from the contractors fulfilling qualifying requirements for the work of "Erection, testing, commissioning and trial operation of Boiler , ESP , Boiler Auxiliaries and Power Cycle Piping of UNIT NO. 7 at Anpara - D Thermal Power Plant of 2 x 500 MW units (UNIT 6 &7) of UPRUVNL at Anpara, Sonebhadra, UP"

TENDER NO. BHEL/ NR/SCT/ ANPARA D/ BOILER/ UNIT 7/ 706

QUALIFYING REQUIREMENTS (QR):

SL. NO.	CRITERIA
1.0	Tenderers should have an average annual turnover of minimum of Rupees 2344 lacs based on the audited accounts of last three financial years (2006-07, 2007-08 & 2008-09). Bidders shall submit audited annual accounts (balance sheets and profit & loss account) in support of this.
	AND
2.1	Tenderers who wish to participate should have executed, during last seven years, works of similar nature covered in this tender for at least one Boiler, ESP and Power Cycle Piping of capacity of 195 MW unit or above in one single contract or in separate contracts. (Relevant document in support of above shall be submitted.)
	OR
2.2	"Should have executed or executing works of similar nature, as covered in this tender, against direct BHEL's order for a Boiler of 490 MW unit or above rating.
NOTE	i) Executed mentioned above means that Coal Firing has been completed in the Unit. ii) Last 7 years mentioned above will be reckoned as on the Date of Technical Bid Opening iii) If the qualifying work is executed in the 7 year period as specified

	above, even if it has been started earlier, the same will also be considered as meeting the qualifying requirements.
3.0	**Bidders are required to enter into an Integrity Pact (I P) with BHELL against this tender / contract as per Annexure VIII of this NIT by signing and stamping all the pages of I P by authorized representative. Bidder, who do not comply with this requirement shall not be considered against this tender.**

OTHER INSTRUCTIONS :

(i) The Tender Documents comprise of following:

(a) General Conditions of Contract

(b) Special Conditions of Contract, Tender Notice, Project Synopsis etc.

(c) Rate Schedule

(d) Painting Schedule

(ii) Tender Documents with complete details are hosted in this web page. Bidder(s) intending to participate may download the tender document from the web site. Bidder(s) downloading the tender documents from the web site, shall remit **Rs.1000/- (Rupees One thousand only)** in the form of crossed demand draft (non-refundable), in favour of BHEL, NOIDA along with their offer.

(iii) Bidder(s) can also purchase hard copy of tender documents from this office. Tender documents (non transferable) will be issued on all working days between 09.30 Hrs. to 12.30 Hrs within the sale period i.e ***upto*** **02.06.2010** on payment of **Rs.1000/- (Rupees One thousand only)** (non-refundable) either in cash or by crossed demand draft in favour of BHEL, NOIDA. Request for issue of tender document should clearly indicate Tender No. and work.

(iii) Tenders must be submitted to the undersigned in Room No. 104 **latest by 02.06.2010** before opening of technical bids commences. Technical bids shall **be opened at 15.30 Hrs. on 02.06.2010**.

(iv) Earnest Money Deposit (EMD): Refundable, Non-interest bearing **EMD of *Rs 2,00,000/-*** shall be deposited by Account Payee Pay Order 'OR' Demand Draft in favour of " Bharat Heavy Electricals Limited" payable at Delhi/ NOIDA. Those bidders who have already deposited ' One Time **EMD of *Rs 2,00,000/-*** with BHEL, PSNR, NOIDA need not submit EMD with the present tender.

(v) Tenders not accompanied with Full Earnest Money Deposit, as indicated above, will not be considered.

(vi) All corrigenda, addenda, amendments and clarifications to this Tender will be hosted in this web page and not in the newspaper. Bidders shall keep themselves updated with all such amendments.

(vii) Bidders shall enter into an Integrity Pact (IP) with BHEL as per format given at Annexure – XII of this NIT. The bidders are required to return this Integrity Pact (IP) alongwith Techno-Commercial bid (Part-I), duly signed and stamped by the authorized signatory who signs the bid. It may be noted that only those bidders who have entered into such an IP with BHEL would be competent to participate against this NIT i.e. entering into this pact is a preliminary qualification for the bidders. The Independent External Monitor against this NIT shall be Shri Kanwarjit Singh, I. R. S. (Retd), D 6/12, Vasant Vihar, G.F., New Delhi – 110057.

(viii) BHEL reserves the right to accept or reject any or all tenders without assigning any reason whatsoever.

(ix) BHEL takes no responsibility for any delay/ loss of documents or correspondences sent by courier/ post.

(x) Purchase Preference will be given to CPSUs as per Govt. Guidelines.

(xi) Unsolicited rebate/ discount shall not be accepted after bid opening.

(xii) BHEL reserves the right to go for a Reverse Auction instead of Opening the submitted sealed bid, which will be decided after technical evaluation. As such, the bidders should submit their best prices in the 'Sealed Price Bid'. However, bidders are required to confirm their acceptance of "General terms and conditions" governing RA specifically in their technical bid. The "General terms and conditions" governing RA are given in the SCC of the NIT. Bidders are also required to furnish following details in their techno-commercial bid, for this purpose (RA).

Authorization of representative who will participate in the on line Reverse Auction Process;

A) Name and Designation of official
B) Postal Address (Complete)
C) Telephone Nos. (Land line & Mobile both)
D) FAX No.
E) E-mail address
F) Name of Place/ State/ Country, wherefrom he will participate in the RA.

(xiii) BHEL may decide holding **pre-bid conference [PBC]** with any / all intending bidders. On such communication from BHEL, the bidder shall ensure participation for the same at the appointed time, date and place as may be decided by BHEL. In this case pre-bid shall be held as indicated above, For the subject tender, you are requested to participate **PBC at 14-00 Hrs on dated** _____ (date will be intimated to the bidders who have purchased the tender from office) our **BHEL office, NOIDA** As such, bidders should plan their visit accordingly. In case of absence of any bidder(s), the bidder(s) have to accept the outcome of the pre-bid discussion as minuted /recorded without any query and the decision of BHEL shall be final and binding. Final quoted price of bidders will be PRESUMED to be quoted based upon the tender documents (including corrigendum, if any) and minutes of this pre-bid meeting. Bidders are requested to study the tender documents in detail and prepare their queries/clarifications accordingly. All such queries / clarifications shall be clarified.

((xiv) "**THE TENDERER MAY NOTE THAT PARTY WHO WILL BE AWARDED THE SUBJECT TENDER OF BOILER , ESP , BOILER AUXILLARIES AND PCP OF UNIT NO. 6 AT ANPARA OF 2X500 MW UNITS AT ANPARA-D THERMAL POWER PLANT SHALL NOT BE CONSIDERED FOR THE BOILER , ESP , BOILER AUXILLARIES AND PCP FOR UNIT NO. 7."**

DGM/ SCP

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TENDER NOTICE – NEWS PAPER

LAST DATE OF SALE : 02.06. 2010
DATE OF OPENING : 02.06. 2010

NIT NO. / NAME OF WORK
TENDER NO. BHEL/ NR/SCT/ ANPARA D/ BOILER/ UNIT 7/ 706 **Sealed tenders are invited from the contractors fulfilling qualifying requirements for the work of Erection, testing, commissioning and trial operation of Boiler , ESP , Boiler Auxiliaries and Power Cycle Piping of UNIT NO. 7 at Anpara - D TPP of 2 x 500 MW units at Anpara, Sonebhadra, UP.**

NOTES:-

1. Purchase Preference will be given to CPSU as per Govt. Guidelines.
2. Please visit our website at www.bhel.com for complete details of the tender.
3. All corrigenda, addenda, amendments and clarifications to this Tender will be hosted in this web page and not in the newspaper.

Bharat Heavy Electricals Limited
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Power Sector – Northern Region,
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PROCEDURE FOR SUBMISSION OF SEALED TENDERS:

The tenderers must submit their tenders as required in **two parts** in separate sealed covers **prominently superscribed as Part-I Technical bid and Part-II ,Price bid** also indicating on each of the cover tender specification no., date and time as mentioned in tender notice.

TECHNICAL BID (COVER-I)

Except **Price bid Part-II**, complete set of tender document consisting of General conditions of Contract, "Technical specification & Special terms and condition" (Part-I) issued by BHEL shall be enclosed in **Part I Technical Bid only**. All schedules, data sheets and details called for in the specification shall also be submitted along with technical bid. All details / Data / Schedules including offer letter duly signed and stamped are to be **submitted in duplicate**.

PRICE BID (COVER-II)

Tenderers may please note that price bid is **to be submitted only in original copy** of Tender i.e. Price bid (Part-II) issued by BHEL and no duplicate copy of same is required.

These Two separate covers i.e. cover I & II shall together be enclosed in a **third envelope (Cover-III)** and this sealed cover shall be superscribed with tender specification No., due date, time and submitted to officer inviting tender as indicated in tender notice on or before due date as indicated.

PROJECT SYNOPSIS

1. Name of the Owner : UTTAR PRADESH RAJYA VIDYUT UTPADAN NIGAM
2. Address : ANPARA-D THERMAL POWER STATION
   District : SONE BHADRA
   UTTAR PRADESH
3. Installed capacity : New project
4. New Installation : 2 x 500 MW
5. Nearest Railway station :Singrauli – 20 km
   Renukoot - 40 km
   Varanasi - 200 km
6. Nearest City : Varanasi -200 km
7. Nearest Airport : Varanasi – 200 km
8. Maximum Tempreture : 48 Deg C
9. Minimum tempreture : Appx 2 Deg C

SECTION - III `A'

COMMON CONDITIONS OF CONTRACT

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SECTION - III `A'

COMMON CONDITIONS OF CONTRACT

34.0 GENERAL

34.1 The intent of this specification is to provide services for execution of the project according to most modern and proven techniques and codes. The omission of specific reference to any method, equipment or material necessary for the proper and efficient services towards installation of the plant shall not relieve the contractor of the responsibility of providing such services / facilities to complete the work or portion of work awarded to him. The quoted / accepted rates / lumpsum price shall deem to be inclusive of all such contingencies.

Any mismatch/ defect found due to mistake in fabrication/ erection by the contractor shall have to be rectified by the contractor free of cost. Inspection by BHEL/ Customer does not relieve contractor of his responsibility of executing quality erection. The quoted/ accepted rates/ lump sum price shall deem to be inclusive of all such contingencies**.**

Deviations, if any, should be very clearly brought out, otherwise it will be presumed that the bidders' offer is strictly in line with this specification and no deviation will be allowed after the award of contract

34.2 The contractor shall carry out the work in accordance with standard practices / codes / instructions / drawings / documents / specification supplied by BHEL from time to time.

34.3 The work shall conform to dimensions and tolerances given in various drawings and documents that will be provided during erection. If any portion of work is found to be defective in workmanship, not conforming to drawings or other stipulations, the contractor shall dismantle and redo the work duly replacing the defective materials at his cost. Failing which the job will be carried out by BHEL by engaging other agencies/ departmentally and recoveries will be affected from contractor's bills towards expenditure incurred including BHEL's usual overhead charges.

34.4 Following shall be the responsibility of contractor and have to be provided within finally accepted rates / prices:

a Provision, as required, of all types of labour, supervisors, engineers, watch and ward, tools & tackles, calibrated inspection, measuring and testing equipments as specified and otherwise required for the work, consumables for erection, testing and commissioning including material handling.

b Proper out-turn as per BHEL plan and commitment.

c Completion of work as per BHEL Schedule.

d Good quality and accurate workmanship for proper performance of the equipment.

e Repair and rectification.

f Preservation / Re-conservation of all components during storage / erection / commissioning till handing over.

Cutting of pipes to required length segments edge preparation for welding. Pre-assembly, if any

Erection, fit up, alignment and welding or thread jointing - as applicable, of mild steel, alloy steel, carbon steel, stainless steel and GI pipelines

Assembly, fabrication, fit up and installation of auxiliary structures for supporting pipelines.

Installation of all hangers and supports, anchors, guides etc

Supply and application of appropriate paints for painting.
Non-destructive examination as per applicable procedure (LPI/ MPI).
Hydraulic test/ other pressure testing of the pipelines

Cleaning, flushing and steam blowing, if required, of pipelines

Pre-commissioning checks/ tests, commissioning assistance and handing over.
Preparation of inspection and test records, log sheets and joint inspection records as per approved field quality plan and/or in the format as advised by BHEL Engineer

Preparation and submission of marked-up (manual updation of existing erection drawings, preparation of drawings/sketches for site-routed pipelines) drawings for the purpose of making as-built drawings.
Transportation of unused materials and packing materials to BHEL/ client's stores/ storage yard, unload, get them verified by BHEL/ client and stack at required locations as per instruction of BHEL.
House keeping in the erection and pre-assembly area to give the appearance of well-planned and orderly work. The access to site for inspection, approaches by BHEL and customer engineers and loading of the material shall be made available by the contractor at all times

34.5 BHEL-Power Sector(NR) is ISO 9001, ISO 14001, OHSAS 18001, ISO 27001 and SA-8000 certified company. Quality of work, to customer's satisfaction and system requirements is the essence of these certifications. The contractor in all respects will organize his work, systems, environment, process control documentation, tools, plant, inspection, measuring and testing equipments etc. as per instructions of BHEL engineer.

The contractor shall also comply with applicable legislation and regulations with regards to Health, Safety and Environmental aspects for minimizing risk arising from occupational health & safety hazards, controlling pollution and wastage. The Contractor will be responsible for Health, Safety & Environment management (HSE) at site for the construction activities to be carried out by them in accordance with requirements given under section I (a) of GCC and elsewhere in this tender document. The contractor, who is awarded the work, shall have to sign an MOU w.r.t implementation of HSE conditions with BHEL (Safe Work Practices).

34.6 In order to meet the environmental concerns it is expected that the contractor shall plant, protect and maintain at least **250 trees** in the vicinity of the project as per the available space and as per the advise of Engineer . In case no area is earmarked for tree plantation, the contractor may take up any other equivalent environment related project after due approval of the BHEL Engineer. for the entire duration of contract.

35.0 CIVIL WORKS, FOUNDATIONS AND GROUTING.

35.1 BHEL shall provide foundations for all the equipment and columns including other civil work. The contractor for their scope shall check the dimensions of the foundations, locations of pockets, pitch of anchor bolts and other inserts as per drawings. Further, top elevation of foundations shall be checked with respect to benchmark etc. All minor adjustments of foundation level, dressing and chipping of foundation surfaces up to 50 mm, enlarging the pockets in foundations etc., as may be required for the erection of equipment / plants shall be carried out by the contractor.

35.2 Chipping and dressing of foundations up to a 50 mm thickness is in the scope of contract. While on the job, care is essential to avoid too much chipping and resultant lowering of level. In case of excess chipping, contractor has to arrange additional packing plates as per requirements provided BHEL Engineer allows it. When required by manufacturers, the embedded sub-sole plates shall be scraped and checked with

prussian blue to get the required contact with frames.

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

35.4 **Complete grouting of structures equipments, including anchor / foundation bolts, beneath base, base hollows etc. as may be applicable, is included in the scope of contractor. Arranging all labour, building materials including cement as applicable (ordinary Portland as well as Quick setting – free flow – non-shrink grout mix (e.g.shrinkcomp , conbextra etc)), form work, shuttering, and any other requirements is in the contractor's scope.** Contractor shall obtain approval of BHEL for applicable cement (ordinary as well as quick setting – free flow – non-shrink grout mix) prior to procurement and 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.
The contractor shall arrange for sand, stone chips, gravels, anti shrink compound, plasticizer, shuttering, grout mixing machine, labors etc at his cost. The contractor shall prepare the required test pieces/test cubes to ensure the strength of grout and get the same tested in laboratory at his cost. Test cube shall also be taken during grouting for testing in the laboratory and shall be tested at his cost. All necessary arrangement along with watering till complete curing has to be arranged by the vendor

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.

35.5 The contractor shall check and verify the alignment of equipment, alignment of shafts of rotating machinery, the slopes of all bearing pedestals, centering of rotors with respect to their sealing bores, couplings etc. as applicable and the like items to ensure that no displacement had taken place during grouting. The values recorded prior to grouting shall be used during post grouting check up and verifications. Such pre and post grout records of alignment details shall be maintained by the contractor in a manner acceptable to the Engineer.

35.6 Besides grouting as above, any civil works required for safe and efficient operation of tools and tackles like grouting / excavation/ casting of foundation / anchor points for derricks, winches, guy ropes fastening, etc and any other temporary supports shall also be the contractor's responsibility. For these civil works, all materials including cement and required facilities shall have to be arranged by contractor at his own cost.

35.7 Contractor shall ensure at all times that his work areas & 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. No separate payments for dewatering of sub soil or surface water if required at any time during execution of the work including monsoon period shall be considered by BHEL.

36.0 CONSUMABLES

36.1 The contractor shall provide within finally accepted price / rates, all consumables like all welding electrodes (including alloy steel and stainless steel), filler wires (over & above as in cl 36.4). TIG filler wires as supplied by the unit along with the plant materials, will be given free of cost to bidder), all gases (inert, welding, 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 materials hardware items etc required for temporary works such as supports, scaffoldings are to be arranged by him. Sealing compounds, gaskets, gland packing, wooden sleepers for temporary work required for completion of work except those which are specifically supplied by manufacturing unit are also to be arranged by him.

36.2 All the shims, gaskets and packing, which go finally as part of equipment, shall be supplied by BHEL free of cost.

36.3 It shall be the responsibility of the contractor to plan the activities and store sufficient quantity of consumables. Non-availability of any consumable materials or equivalent suggested by BHEL cannot be considered as reason for not attaining the required progress or for additional claim.

36.4 **TIG filler wire and welding electrodes for T 91 alloy steel materials shall be supplied by BHEL Mfg. Units free of cost for erection.** Any other special filler wires and welding electrodes which are supplied by the manufacturing unit as a normal supplies shall also be issued free of charge for erection. Required quantity as arrived at by calculation / standards will only be supplied. It would be the contractors' responsibility to account for the consumption of these filler wires. Weight of free supplied consumables for welding shall not be payable. These have to be erected without extra cost, within the scope of contract. Additional requirement beyond standard / calculated quantity will be at cost recovery basis only unless and otherwise accounted for. Surplus quantity of TIG filler wire, if any, shall be properly stored and returned to BHEL stores. **The contractor has to take care of above in their offer.**

36.5 It shall be the responsibility of the contractor to obtain prior approval of BHEL, regarding suppliers, type of electrodes etc before procurement of welding electrodes. On receipt of electrodes at site these shall be subjected to inspection and approval by BHEL. The contractor shall inform BHEL details regarding type of electrodes, batch number, date of expiry etc and produce test certificate for each lot / batch with correlation of batch / lot number with respective test certificate. No electrode without a valid test certificate will to be used.

36.6 BHEL reserves the right to reject the use of any consumable including electrodes, gases, lubricants / special consumables if it is not found to be of the required standard / make / purity or when shelf life has expired. Contractor shall ensure display of shelf life on consumable wherever required and records maintained.

36.7 Storage of all consumables including welding electrodes shall be done as per requirement / instruction of the Engineer by the contractor at his cost.

36.8 In case of improper arrangement for procurement of any consumable, BHEL reserves the right to procure the same from any source and recover the cost from the Contractor's first subsequent bill at market value plus the departmental charges of BHEL from time to time (30% at present). Postponement of such recovery is normally not permitted. The decision of Engineer in this regard shall be final and binding on the Contractor.

36.9 All lubricants and chemicals required for cleaning, pre-commissioning, commissioning,

testing, preservation and lubricants for trial runs of the equipment shall be supplied by BHEL / BHEL's client. All services including labour and T&P will be provided by the contractor for handling, filling, emptying, refilling etc. and is included in scope of this contract without any extra cost to BHEL. The consumption of lubricants / chemicals shall be properly accounted for. Surplus material if any shall be properly stacked and returned to BHEL/ CUSTOMER stores at no extra cost to BHEL. Recoveries shall be affected for wastage by the contractor.

36.10 Transportation of oil drums, from stores, filling of oil and filling of oil for flushing, first filling of oil and subsequent changeover or topping / making up till the unit is fully commissioned and handed over to customer is included in scope of this contract. The contractor shall have to return all the empty drums to BHEL / BHEL's client store at no extra cost. Any loss / damage to above drums shall be to contractor's account.

36.11 All charges on account of Octroi, terminal or sales tax and other duties on materials obtained for the works from any source shall be borne by the contractor.

37.0 TOOLS AND PLANTS / IMTE's

37.1 T&P **/** IMTE's being provided **by BHEL**, **as per Annexure-II**, to sub-contractor free of hire charges shall be shared by other subcontractors working for BHEL at site and the allotment done by BHEL Engineer shall be final and binding.

37.2 Besides the T&P and IMTEs being made available to contractor free of hire charges by BHEL, all other T&Ps and IMTEs which are required for successful and timely execution of the work covered within the scope of this tender, shall be arranged and provided by the contractor. Indicative lists of T&Ps and IMTEs to be arranged **by the contractor** are given **as per Annexure-III.** He should ensure that these are in good working condition. In the event of the failure of contractor to bring necessary and sufficient T&Ps and IMTEs, BHEL will be at liberty to arrange the same and hire charges as applicable shall be deducted from contractor's bill. Decision of BHEL in this regard shall be final and binding on contractor.

37.3 All distribution boards, connecting cables, wire ropes, hoses, pipes etc, including temporary air / water / electrical connections etc shall have to be arranged by the contractor at his own cost.

37.4 In case of non-availability of the T&Ps to be provided by BHEL due to breakdown, major overhauls, distribution pattern or any other reason, the contractor shall plan / amend / alter his activities to meet erection / commissioning targets in consultation with BHEL.

37.5 The **operation** of all BHEL's cranes being provided free of hire charges, shall be in the scope of the contractor. The contractor shall arrange, at his own cost, trained operators and fuel and other minor consumables (i. e. cotton cloth / cotton waste etc.) for their operation. **The contractor shall deploy only those qualified operators who have been approved by BHEL Engineer.**

All Lubricants for these BHEL cranes such as Mobil oil, gear oil, brake oil, hydraulic oil, torque converter oil and grease will be provided by BHEL free of cost. The contractor will give the requirement for above well in advance.

Scheduled maintenance of BHEL's cranes will be provided by BHEL. However, daily maintenance of the cranes is to be carried out by the contractor for which helpers and miscellaneous consumables for operation of all BHEL cranes shall be provided by contractor within the final accepted rates.

All fuel for operation of all BHEL cranes shall be provided by contractor within the final accepted rates.

37.6 The contractor shall engage trained and experienced operators for the operation of

BHEL's T&Ps. Their skill / performance will be checked by BHEL Engineer before they are allowed to operate the same. However checking of skills by BHEL does not absolve the contractor of his responsibilities for proper and safe handling of equipment, consistent good performance of operators and regular performance evaluation of operators.

37.7 The day to day **operation and routine maintenance** of BHEL's T&Ps **(Other than cranes)** shall be carried out by contractor as per manufacturer's / BHEL's maintenance schedule at his cost. The contractor shall arrange, at his own cost, trained operators, , maintenance gang , fuel and other consumables for their operation. BHEL shall arrange major spares needed for upkeep of DG Set, Welding Sets , Induction Machine , DG Set and Hydraulic Test pumps supplied by BHEL. **The scheduled maintenance of these equipments will be carried out thru the AMC arranged by BHEL** . For upkeep of all other T & P's supplied by BHEL, the Contractor shall arrange spares.

BHEL supplied T&Ps shall be maintained in good working condition during the entire period of use. T&Ps in defective / damaged condition shall be rectified promptly to the full satisfaction of BHEL engineer. Contractor shall maintain records for maintenance of major T&Ps. These shall be made available for Inspection whenever required. In case of any lapses on the part of the contractor, BHEL at its own discretion get the servicing / repair of equipment done at the risk and cost of the contractor with BHEL overheads. Further, if there are breakdowns / damages due to negligence of the contractor, the complete service / repair charges and cost of all the spares damaged with BHEL overheads shall be recovered from contractor's RA bills.

37.8 **Maintenance of BHEL cranes shall be covered under AMC awarded by BHEL to other agency**. However, the contractor against this contract shall arrange all supervision and labour required for routine / day-day maintenance of cranes at his own cost. For attending breakdowns of these cranes, the contractor shall arrange for labour. However specialist's supervision, for attending breakdowns shall be arranged by BHEL as assessed by BHEL Engineer. Repair of self and dynamo shall be the responsibility of the contractor. The cranes shall be fitted with a set of new batteries at the time of initial issue from the stores. However, the charges of the replacement of the other damaged / worn out parts of BHEL cranes will be borne by BHEL, provided the damage is not due to the negligence of the contractor.

All the spares & lubricants (except for diesel) for the cranes (BHEL's Cranes) shall be supplied by BHEL. For all BHEL cranes, if there are breakdowns / damages due to negligence of the contractor, the complete service / repair charges and cost of all the spares damaged with BHEL overheads shall be recovered from contractor's RA bills.

37.09 Increasing / shortening of the crane boom to suit work requirements shall have to be arranged by the indenting contractor at his cost. All necessary manpower tools, support, consumables, illumination etc. will have to be arranged by contractor at his cost. If required, contractor has to return the crane with original boom.

37.10 The area and infrastructure development of the area to be carried out by the customer. However in construction projects of this magnitude it is possible that all the areas / approaches may not be ready. In such cases consolidation of ground and arrangement of sleepers / sand bag filling etc for safe operation / movement of equipment including cranes / trailers etc shall be the responsibility of the contractor at his cost. No compensation on this account shall be payable.

37.11 In the event of contractor not using and maintaining BHEL T&Ps according to BHEL's instructions. BHEL will have the right to withdraw such item without any notice and no claim in this regard shall be entertained and contractor shall be responsible for delay in execution on this account.

37.12 The contractor has to maintain a logbook and shall furnish regular maintenance and

utilization report of the BHEL T & P's under his possession, as per requirement of BHEL.

37.13 Any loss / damage to any part of BHEL T&Ps and IMTEs shall be to the contractor's account and any expenditure on these accounts by BHEL will be recovered from the contractor's bill in case the contractor fails to make good the loss.

37.14 It shall be responsibility of the contractor to take delivery of T&Ps from stores or place of use by other contractor at project site, transport the same to site and return the same to BHEL store / place as intimated by Engineer in project site in good working conditions after use.

37.15 The contractor shall return BHEL T&Ps and IMTEs issued to him in good working condition as and when desired by BHEL (on completion or reduction of workload). If contractor delays return of T&P and IMTE, hire charges as applicable shall be levied by BHEL from time, it was requisitioned till the time of actual return.

T&Ps and IMTEs returned in damaged / unserviceable condition shall be got repaired by BHEL at its own discretion and entire cost of repair with BHEL overheads shall be recovered from the contractor.

37.16 Replacement cost including BHEL overheads in respect of irreparable / completely damaged / non return of T&Ps and IMTEs shall be recovered from the contractor's running / final bills

37.17 Contractor shall ensure deployment of serviced and healthy T&Ps including cranes, lifting tackles, wire ropes, manila ropes, winches and slings etc. History card and maintenance records for major T&Ps will be maintained by the contractor and will be made available to BHEL Engineer for inspection as and when required. Fitness certificate of T&P shall have to be submitted before it is put in use. Identification for such T&Ps will be done as per BHEL Engineer's advice.

The contractor shall arrange adequate nos. of wooden sleepers for compaction of approach for crane movement and material stacking near work site failing which BHEL may get the same done at their risk & cost.

37.18 Contractor shall ensure deployment of reliable and calibrated IMTEs (Inspection measuring and testing equipment). The IMTEs shall have test / calibration certificates from authorized / Government approved / accredited agencies traceable to National / International standards. Each IMTE shall have a label indicating calibration status i.e. date of calibration, calibration agency and due date for calibration. A list of such instruments deployed by contractor at site with its calibration status is to be submitted to BHEL Engineer for control.

37.19 Re-testing / re-calibration shall also be arranged at regular intervals during the period of use as advised by BHEL Engineer within the contract price. The contractor will also have alternate arrangements for such IMTE so that work does not suffer when the particular instrument is sent for calibration. If any IMTEs not found fit for use, BHEL shall have the right to stop the use of such item. It will be necessary for the contractor to deploy proper item. Any readings taken by the defective instrument will be recalled and repeat the readings taken by that instrument with a proper one. In case he fails to do so, BHEL may deploy IMTEs and retake the readings at contractor's cost.

37.20 BHEL shall have lien on all T&P, IMTEs and other equipment of the contractor brought to the site for the purpose of erection, testing and commissioning. BHEL shall continue to hold the lien on all such items throughout the period of contract / extended period. The contractor and / or his sub-contractors, without the prior written approval of the Engineer, shall remove no material brought to the site.

37.21 Contractor shall maintain and operate his tools and plants in such a way that major breakdowns are avoided. In the event of major breakdown, contractor shall make

alternative arrangements expeditiously so that the progress of work is not hampered

The contractor shall be prepared to augment the T & P at short notice to match the planned program and to achieve the milestones.

37.22 **The month wise T&P deployment plan** to be submitted as per format **(at Annexure-D to General Conditions of Contract)** is only to assess the capability as well as understanding of the contractor to execute the work. It shall be the contractor's responsibility to deploy the required T&P, for timely and successful completion of the job, to any extent over and above those indicated in the above deployment plan (including those which are not covered in the plan submitted) without any compensation on this account.

37.23 **One CONSTRUCTION ELEVATOR / PASSENGER LIFT for boiler** will be provided to the contractor. The total erection including dismantling, commissioning, maintenance, statutory clearances shall be in the scope of erection agency against the contract, at no extra cost to BHEL. However, all the spares & lubricants for the **ELEVATOR / PASSENGER LIFT** shall be supplied by BHEL. Necessary supervision of the supplier will be arranged for by BHEL.

All day to day and routine maintenance and checking of the lift is to be carried out by the contractor as per the recommendations of the supplier. He should periodically check the brakes and carry out the all works to ensure the safety for all those using the hoist.

The hoist should never be overloaded as this can lead to serious accidents. Ensuring all safety aspects in operation of lift shall be responsibility of contractor. All the landing platforms are to be erected by him. They are to be provided with proper barricades and hand railings. No separate payment for the temporary jobs will be made. The contractor will have to dismantle such temporary works and return the material to the stores.

The construction and dismantling of the foundations required for the passenger lifts is included in the scope of the contractor.

37.24 EOT crane(s) as available in the TG hall shall be provided to the contractor. The crane may be provided with a trailing cable that has to be handled by the contractor till the charging of the down shop leads. The contractor shall have to deploy his own operator for operating the crane under supervision of BHEL . The running/ capital maintenance of the EOT cranes is excluded from the contractor's scope. Routine maintenance like cleaning and oil topping (oil will be provided by BHEL) will be carried out by the contractor. However, all the spares & lubricants for the EOT crane(s) as available in the TG shall be supplied by BHEL. Necessary supervision of the supplier will be arranged for by BHEL.

38.0 SUPERVISORY STAFF AND WORKMEN

38.1 The contractor shall deploy all the skilled workmen like millwright fitters, welders, crane operators, drivers, gas cutters, riggers, sarangs, masons, carpenters, electricians, helpers and instrument technicians to carry out the works as per specifications. In addition to skilled, semi-skilled and unskilled workmen required for all the works, suitable workmen required for handling and transporting of equipment from site storage to erection site, erection, testing and commissioning as contemplated under this specification shall be deployed. Only fully trained and competent men with previous experience on the job shall be employed. They shall hold valid certificates wherever necessary.

BHEL reserves the right to decide on the suitability of the workers and other personnel who will be deployed by the contractor. BHEL reserves the right to insist on removal of any employee / workman of the contractor at any time, if they find him unsuitable. The

contractor shall remove him forthwith.

38.2 The supervisory staff including qualified Engineers deployed by the contractor shall ensure proper out-turn of work and discipline on the part of the labour put on the job by the contractor. They should in general see and ensure that the works are carried out in a safe and proper manner and in coordination with other labour and staff deployed directly by BHEL or other contractors of BHEL or BHEL's client / other agency.

Contractor has to arrange for an experienced electrical engineer conversant with electronic circuits for operation and maintenance of Induction heating machines for P/ T-91 welding.

38.3 The work shall be executed under the usual conditions affecting major power plant construction and in conjunction with numerous other operations / activities at site. The contractor and his personnel shall cooperate with other personnel / contractors, coordinating his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.

38.4 The contractor's supervisory staff shall execute the work in the most substantial and workman like manner in the stipulated time. Accuracy of work and aesthetic finish are essential part of this contract. The contractor shall be responsible to ensure that assembly and workmanship conforms to the dimensions and tolerances given in the drawings / documents / instructions given by BHEL Engineer from time to time.

38.5 The contractor shall deploy the necessary number of qualified and approved full time electricians at his cost to maintain his temporary electrical installation till the completion of work.

38.6 It is the responsibility of the contractor to engage his workmen in shifts or on overtime basis for achieving the targets set by BHEL and also during the period of commissioning and testing of unit. The contractor's finally accepted rates / prices shall include all these contingencies.

38.7 During the course of erection,

- If the progress is found unsatisfactory,
- If the target dates fixed from time to time for every mile stones are to be advanced / not being met,
- if it is found that the skilled workmen like fitters, operators, technicians etc deployed are not sufficient,

BHEL after giving reasonable opportunity to the contractor will induct on the work the required workmen in addition to contractor's workmen to improve the progress. The expenses so incurred will be recovered from the contractor's bills with overheads.

38.8 If the contractor or his workmen or employees shall break, deface, injure or destroy any part of a building, road kerb, fence, enclosure, water pipes, cables, drains, electric / telephone poles, wire, trees or any other property or to any part of erected components, the contractor shall make the same good at his own expense. In default, BHEL may cause the same to be made good by other workmen or by other means and deduct the expenses from any money due to the contractor. BHEL's decision will be final and binding.

38.9 Though every endeavor shall be made to ensure that all plant materials are supplied as per schedule. However in a job of this kind it is possible that some materials may be delayed. In order to achieve the ultimate targets, the contractor may have to augment his manpower and resources. No compensation on this account shall be admissible.

38.10 The Contractor has to ensure deployment of qualified Level-2 NDT Engineers and Welding Engineers exclusively for the welding works envisaged under the Package

works

38.11 The **month wise manpower deployment plan** to be submitted as per format **(at Annexure-C to General Conditions of Contract)** is only to assess the capability as well as understanding of the contractor to execute the work. It shall be the contractor's responsibility to deploy the required manpower, for timely and successful completion of the job, to any extent over and above those indicated in the above deployment plan (including those which are not covered in the plan submitted) without any compensation on this account. The contractor shall identify separate persons at site for quality control and safety.

39.0 MATERIAL HANDLING AND STORAGE FOR E/T/C

39.1 All the equipment furnished under this contract shall be received from the project stores, sheds / storage yards and transported to pre assembly area / erection site and stored in the storage spaces in a manner so that they are easily retrievable till the contractor erects them. **While drawing / lifting material from BHEL / customer stores, contractor shall ensure that the balance / other materials are stacked back immediately. No claim is admissible on this account**

39.2 While BHEL will endeavor to store / stack / identify materials properly in their open / close / semi closed / tarpaulins covered storage yard / shed, it shall be contractor's responsibility to assist BHEL in identifying materials well in time for erection. They should take the delivery of the same, following the procedure indicated by BHEL, and transport the material safely to pre-assembly yard / erection site in time, according to program.

39.3 The contractor shall take delivery of components, equipment / consumables from storage area after getting the approval of BHEL Engineer on standard indent forms.

39.4 The contractor shall identify and deploy necessary Engineers / supervisors / workmen for the above work in sufficient number as may be needed by BHEL, for areas covering their scope.

39.5 All the equipment shall be handled very carefully to prevent any damage or loss. No untested wire ropes / slings etc. shall be used for unloading / handling. The equipment shall be properly protected to prevent damage either to the equipment or to the floor where they are stored. The equipment from the stores shall be moved to the actual location at the appropriate time so as to avoid damage of such equipment at site.

39.6 Contractor shall ensure that while lifting slings shall be put over the points indicated on the equipment or as indicated in the manufacturer's drawings. Slings / shackles of proper size shall be used for all lifting and rigging purposes. All care shall be taken to safe guard the equipment against any damage. Dragging of piping / valves should be avoided. In case of any damage the cost shall be covered from the contractor.

39.7 Approach road conditions from the stores / yards to the erection site may not be equipped and ideal for smooth transportation of the equipment. Contractor may have to be adequately prepared to transport the materials under the above circumstances without any extra cost.

39.8 Contractor shall be responsible for examining all the plant and materials issued to him and notify the Engineer immediately of any damage, shortage, discrepancy etc before they are moved out of the stores / storage area. The contractor shall be solely responsible for any shortages or damages in transit, handling, storage and erection of the equipment once received by him. As the erection work will be spread in different areas / locations of the project, contractor has to arrange sufficient number of watch / ward personal to avoid any pilferage of material. As per General Conditions of contract under provisions of clause No 29 BHEL will reserve the right to recover the cost of repair / replacement, if any, to bring back the equipment in original order, in case the

equipment / material is lost / damaged while in the custody of the contractor. BHEL's decision in this regard shall be final and binding on the contractor.

39.9 The contractor shall maintain an accurate and exhaustive record-detailing out the list of all equipment received by him for the purpose of erection and keep such record open for the inspection of the engineer at any time.

39.10 All the material in the custody of contractor and stored in the open or dusty locations must be covered with suitable weather proof / fire retardant covering material wherever applicable and shall be blocked up on raised level above ground. All covering materials including blocks and sleeper shall be arranged by the contractor at his cost.

39.11 If the material belonging to the contractor are stored in area other than those earmarked for his operation the engineer will have the right to get it moved to the area earmarked for the contractor at the contractors risk and cost.

39.12 The contractor shall be responsible for making suitable indoor storage facilities to store all equipment (drawn by the contractor from BHEL / customer stores), which require indoor storage till the time of their installation. The Engineer will direct the contractor in this regard, which item in his opinion will require indoor storage, and the contractor shall comply with Engineer's decision.

39.13 The contractor shall ensure that all surplus / damaged / scrap / unused material, packing wood / containers/ special transporting frames etc are returned to BHEL at a place in project area identified by the Engineer. The contractor will maintain an account for all items received and returned to BHEL. Any shortage in returning such items shall be chargeable to the contractor except for a 5% allowable against wastage for packing wood only.

39.14 The contractor shall hand over all parts / materials remaining extra over the normal requirement with proper identification tags to the stores as directed by the concerned BHEL engineer.

39.15 The contractor shall ensure that all the packing materials and protective devices installed on equipment during transit and storage are removed before installation.

39.16 It shall be the responsibility of the contractor to keep the work / storage areas in neat, tidy and working conditions. All surplus/unusable packing and other materials shall be removed and deposited at location(s) specified by BHEL within the project premises. If required weighing of the same within the project premises will have to be carried out.

39.17 Approach road conditions from stores/ yards to the erection site may not be equipped and ideal for smooth transportation of equipment. Contractor has to be adequately prepared to transport the materials under the above conditions without any extra cost

39.18 Contractor shall ensure at all times that his work areas & 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 regards shall be admitted by BHEL. No separate payments for dewatering of sub soil or surface water if required at any time during execution of the work including monsoon period shall be considered by BHEL .

40.0 PRESERVATION OF COMPONENTS / CLEANING OF EQUIPMENTS

40.1 After taking delivery from BHEL / customer's stores, plant materials storage shall be subjected to the following protection besides other provisions indicated in these specifications elsewhere.

a) Items stored outdoors shall be blocked up at least six inches (6") off the ground

b) Motors, valves, electrical equipment, control equipment and instruments etc shall be

stored indoors in a warehouse provided by contractor. Motor windings shall be kept dry by use of external heat or space heaters.

c) Bearings and other wearing surfaces of plant materials shall be protected against corrosion and kept clean.

d) Insulation materials shall be stored indoors or otherwise protected against getting wet.

40.2 It shall be the responsibility of the contractor to apply preservatives / touch up paints (primer) on equipment handled and erected by him till such time of final painting. It shall be contractor's responsibility to arrange for required paints (primer), thinners, labour, scaffolding materials, cleaning materials like wire brush, emery sheets, etc, cleaning of surface and provide one coat of preservatives / paints (primer) from time to time as decided by BHEL engineer. The accepted rate shall include this work also. It is to be noted that such painting may have to be done as and when required till such time the final painting is carried out.

40.3 The contractor shall effectively protect the finished work from action of weather and from damage or defacement and shall cover the finished parts then and there for their protection.

40.4 Any failure on the part of contractor to carry out works according to above clauses will entail BHEL to carry out the job from any other party and recover the cost from contractor.

40.5 The contractor shall thoroughly clean all the components before installation. Th components whose surfaces are coated with protective coating and sent to site are to b thoroughly cleaned by suitable mechanical/ chemical means as per the approve procedures.

40.6 Contractor shall ensure that components shall be cleaned with kerosene, petrol, approved solvents before assembly and erection of the equipment. For cleaning purposes he shall use only soft cotton cloth. Contractor shall never use cotton waste for cleaning electrical equipments before erection which shall be cleaned with dry air/ vacuum cleaner

40.7 The contractor shall clean inside of all pipes and fittings from dirt, sand and loose scale mechanically and by air blowing before being erected. All pipelines shall be thorough blown and/ or flushed. If necessary certain pipelines may have to be cleaned by ac pickling/chemical cleaning. The procedure for the same shall be provided by BHE However, all chemicals and inhibitors shall be provided by BHEL free of cost. Disposal chemical has to be carried out by the contractor at his own cost as per advice of th engineer

41.0 ERECTION

41.1 All normal erection and assembly techniques necessary for completion of works under this specification and magnitude have to be carried out. It is not possible to specifically list out all of them. Absence of any specific reference will not absolve the contractor of his responsibility for the particular operation. These would include,

- 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, leveling, 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 painting
- All tubes and pipes shall be cleaned by compressed air and shown to engineer before lifting. After cleaning is over end caps will be put on tube/pipe openings till such time they are finally erected.
- Pre-assembly of piping components, if envisaged, shall have to be done at the pre-assembly yard. It is to be noted that BHEL will provide only reasonably leveled open space for pre-assembly yard. The contractor has to arrange desired leveling of the area at their cost. The bidders must inspect the work site before submission of offers.
- 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, 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.
- Contractor should obtain the formal clearance from Chief Inspector of Boilers/ UP to carry out erection & Welding of piping under IBR preview. Arrangement for the visit of Boiler Inspector for field inspection etc. is in the scope of contractor, and necessary drawing/ details only will be given by BHEL.
- Contractor shall arrange the necessary clearance from other statutory authorities as required for installation of the plant and equipment and render all assistance, service required in this regard
- Carrying out piping as per the specification between equipment constituting terminal points, whether the terminal equipments fall with in 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, need correction by suitably resorting to heat correction or other method as instructed by BHEL Engineer, the same need to be done by the contractor within the quoted rate.
- The piping systems which come under the purview of IBR should meet the requirements of IBR. However. BHEL will have the option of changing the code or standard or specifications in this regard depending upon the site conditions. The decision of BHEL Engineer will be final and binding on the contractor. The contractor should be well versed with all the latest amendments of Indian Boiler Regulations.

41.2 Any fixtures, scaffolding materials, approach ladder, concrete block supports, steel structures required for temporary supporting, pre-assembly or checking, welding, lifting and handling during pre-assembly and erection shall be arranged by contractor at his cost.

41.3 No members of any ladder / structure / platform should be cut without specific approval of BHEL. In case it is necessary to cut, the contractor shall rectify / repair in a manner acceptable to BHEL / customer without any additional cost.

41.4 The contractor shall erect scaffolding / temporary platforms for erection. These should be of adequate capacity and shall never be over loaded. These should be replaced when not found suitable during erection work and dismantled on work completion and removed from work site.

41.5 It shall be the responsibility of the contractor to provide ladders on columns for initial work till such time stairways are completed. For this, the ladder should not be welded on the column and should be pre-fabricated clamping type ladders. No temporary welding on any structural member is permitted except under special circumstances with the approval of BHEL. In case it is absolutely necessary then the contractor shall cut the temporary structure and rectify the column as directed by the engineer.

41.6 The contractor is strictly prohibited in using the Boiler / Auxiliary Components for any temporary supporting or scaffolding works etc. In case of such misuse a sum of determined by Engineer will be recovered from contractor's bills.

41.7 Boiler auxiliary columns are plate formed box section and the erection joint is welded type where as the columns are butt type with HSFG bolted flange and partition plates, boiler main column are having flange with splice plates and bolted connections. However, the contractor has to carry out work at site as per drawing.

41.8 The material for platform and other structural sections under PG-36 shall be supplied in running meters. These shall be cut to size / shape / fabricated to required size / shape and to be welded by contractor.

41.9 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.

41.10 Economizer, super-heaters, re-heater coils, burner panels may have to be hydraulically tested individually, if required, before erection as instructed by BHEL Engineer within finally accepted rates.

41.11 Suspensions for ducting will be supplied in running lengths, which shall be cut to size and adjusted as required. Ducts / expansion bellows are dispatched to site in loose walls plates / pieces and these are to be assembled and welded at site along with stiffeners etc., before erection within the finally accepted rates. All joints connecting duct expansion piece and dampers shall be seal welded on inside as well as on outside.

41.12 Assistance in mechanical work associated with the power cylinders, valves, valve actuators etc., coming under various groups shall be provided by contractor within the finally accepted rates.

41.13 Hanger rods are shown in the pressure parts arrangement drawings for boiler. Any cutting / welding of these hangers rods will be done by the contractor. The hangers for pressure parts will be tested for even distribution of load with the help of a torque wrench.

41.14 The headers are provided with hand holes. The contractor, shall as per requirement, carry out removal and re-fixing of hand hole plates within finally accepted rates.

41.15 Burner tilt mechanism will be checked for freeness, serviced and adjusted, if necessary to obtain optimum tilt before installation.

41.16 Skin casing sheet for covering the boiler roof panels, rear arch tube and other areas will be supplied by BHEL. Any cutting, addition and re-fabrication to suit the site conditions

shall be carried out within the finally accepted rates.

41.17 ESP collecting electrodes may require straightening and repair due to minor transport damages before erection and spot heating in position to get correct alignment and same will be carried out by the contractor at no extra cost.

41.18 The contractor shall carry out trial run of all motors including checking the direction of rotation in the uncoupled condition. Checking of alignment and re-coupling of the motor to the driven equipment as per instructions of BHEL engineer and to their satisfaction.

41.19 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.

41.20 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 SCAPH and other equipment as per BHEL engineer's instructions is included in the scope of work.

41.21 Forced lube oil system of motors or rotating equipment form parts of the work under this specification.

41.22 Certain rotating machinery after initial runs and commissioning of the equipment have to be hot aligned as per the instructions of BHEL engineer. Cleaning air pre-heater, fans, boiler 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.

41.23 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.

41.24 After initial trial of rotating equipment, control and power cabling for motors and other equipment / instrumentation shall have to be disconnected for checking alignment and re-setting / re-alignment / hot alignment. Contractor shall have to arrange for disconnecting control and power cabling as per BHEL engineer's instructions and clearance and reconnect the control and power cabling after realignment. Quoted tonnage rate shall be inclusive of the above.

41.25 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.

41.26 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.

41.27 The air-preheater rotor may be disturbed during the initial operation. This may change the original clearances. It requires rechecking and correction of seal clearances.

Contractor shall carry out such checks and resetting of clearances as per the instructions of BHEL engineer. The resetting may have to be repeated till satisfactory results are obtained.

41.28 Checking of air gaps and adjustment of stator / rotor for magnetic center of HT motors shall be carried out as part of erection.

41.29 The fans, mills and other rotating machines shall be checked for clearances and other vital tolerances. The IGV unit shall be serviced. Necessary assistance for balancing of equipment during trial run, if required, shall be provided by the contractor free of cost.

41.30 Complete penetration of water wall (Panel to Panel) welding shall be achieved either by one side or both sides welding.

41.31 Whenever required the contractor shall arrange for pre-qualification of process task performers.

41.32 All attachments welding including those for insulation works coming on pressure parts / non-pressure parts which the contractor has erected shall be done by IBR / BHEL tested welders only.

41.33 All electrical cabling including proper glanding, termination, dressing etc., control and instrumentation works required for completion of Electrostatic Precipitator including its commissioning shall be part of this work. This will include erection of all electrical equipment such as rectifier, transformers, and power supply and control panel, laying of trays and cables and other associated equipment. For cabling job as included in above in the scope, while BHEL shall supply cable lugs (beyond 4 sqmm size free of cost, bidder shall supply necessary copper-tinned cable lugs (upto 4 sqmm), clamp, ferrule, wire markers, pvc binding strap, adhesive tape etc. Bidder's quoted rates shall be inclusive of this. Cable gland shall be of double compression type and of brass material.

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

41.35 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.

41.36 All the motors and equipment shall be suitably doweled after alignment of shafts with taper / parallel machined dowels as per the direction of the Engineer. Dowel pins required are be machined by the contractor at his own cost. However the materials for dowel pins shall be issued by BHEL free of cost.

41.37 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.

41.38 The contractor at no extra cost to BHEL shall carry out servicing and realignment of skid mounted equipment.

41.39 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 be responsible for removal and re-

installation of the instruments. The contractor for this package will maintain the list of all the instruments removed & reinstalled for / after calibration. Instruments prior to removal and after reinstallation shall be considered in custody of the contractor for this package. All instruments such as pressure gauges / temperature gauges, switches etc. forming part of indicated product group (PG) are under the erection scope of this contract and shall be installed and commissioned by the contractor of this package within the quoted rates. However the calibration of these instruments shall be done by C&I agency as above

41.40 All electrical panels, control gears, motors and such other devices shall be properly dried by heating to improve IR valve, before they are energized. Bearings, slip rings commutators and other exposed parts shall be protected against moisture ingress and corrosion during storage and periodically inspected.

41.41 The contractor shall completely erect and test all the piping systems, covered in the specification including sampling lines up to and including sample coolers, hangers & supports, valves and accessories in accordance with the drawings furnished. This includes all necessary bolting, welding, pre-heating, stress relieving, testing, cleaning and painting. System shall be demonstrated in condition to operate continuously in a manner acceptable to the Engineer. Welding shall be used throughout for joining pipes except where flanged, screwed or other type joints are specified or sown on the drawings. All piping shall be erected true to the lines and elevation as indicated in the drawings.

41.42 Pipes sent in standard length shall be cut to suit the site conditions and the layouts. Tubes or pipes wherever deemed to be convenient will be sent in running lengths with sufficient bends. Bends upto 80 -mm nominal bore will have to be fabricated at site. Only cold cutting methods are to be employed for cutting of pipes and tubes irrespective of the size and material. Gas Cutting, if any, will be allowed only in CS LP piping

41.43 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.

41.44 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.

41.45 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.

41.46 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.

41.47 All fittings like `T'-pieces, weld neck flanges, reducers etc., shall be suitably matched with pipes for welding. The valves will have to be checked, cleaned or overhauled in full or in part before erection after chemical cleaning and during commissioning.

41.48 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.

41.49 Suspension for piping, etc., will be supplied in running lengths, which shall be cut to suitable sizes and adjusted as required.

41.50 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.

41.51 No temporary supports should be welded on the pressure parts and piping. In case of absolute necessity prior approval should be taken from BHEL Engineer. In such cases the contractor if required, shall carry out heat treatment.

41.52 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.

41.53 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, flanges, orifices, 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.

41.54 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.

41.55 Layout of small-bore piping in boiler, oil systems etc. as required shall be done as per site requirement. Necessary sketch for routing these lines should be got approved from BHEL by the contractor. There is a possibility of slight change in routing the above pipelines even after completion of erection or from aesthetic point of view. Contractor at no extra cost should carry this out. As built drawing is to be submitted by the contractor after erection completion.

41.56 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.

41.57 **Erection and welding of necessary instrumentation tapping points, thermocouple pads, thermo-wells, valves, battery of first root valves, condensing vessels, flow nozzles/orifices and control valves to be provided on auxiliaries and pipe lines are covered within the scope of this specification.** This will be the responsibility of the contractor and will be done as per the instructions of BHEL Engineer. The welding of all the above items will be contractor's responsibility even if the:

(a) Product groups, under which these items are released, are not covered in the scope of this tender.

(b) Items are supplied by any agency other than BHEL.

41.58 The contractor shall carry out the tightening of the field bolts on the equipment and piping covered under this specification by using either the calibrated torque wrench method or the turn of part method. The methods used the tools and the equipment deployed shall be subject to the approval of Engineer. The competent technicians shall carry out the bolting work.

41.59 The contractor shall assist BHEL in preparation of as built piping drawing.

41.60 Erection of power cylinders, motorised valves, valve actuators etc. coming under various groups is covered under the scope of this specification. However C&I calibration / commissioning for pneumatic valves & power cylinders erected under this contract shall be arranged by BHEL through C&I agency at no cost to the contractor for this package. The contractor will however be responsible for drawing the materials from the stores and handing over to the agency that is to commission these. Any damage / loss in their custody will be the contractors account. The alignment and any mechanical

adjustments including link adjustment, opening & reconnection of links, replacement of valve / actuator or any mechanical part, air filter & regulator cleaning etc. required during calibration and operation, the same shall be carried by the contractor for this package. However, if re-calibration is required till handing over of the equipments the same shall be organised by the contractor for this package as detailed above with in the final accepted rates. The contractor will however be responsible for drawing the materials from the stores and handing over to the agency that is to commission these. Any damage / loss in their custody will be the contractors account.

41.61 The erection of all pneumatic power cylinders for the burner-tilt mechanism is covered within the scope of this specification. BHEL will get these power cylinders for the burner-tilt mechanism calibrated & commissioned. The contractor for this scope of work shall assist and co-ordinate for the same with the agency engaged by BHEL to calibrate such pneumatic actuators.

41.62 The Erection, testing and commissioning of all electrically operated valves, actuators and dampers is covered within the scope of this specification.

Corrections like straightening of ladders, tube support plates adjustment/ removal of ovulates in pipes and opening or closing the fabricated bends of piping to suit the layout shall be considered part of the work and the contractor is required to carry out such work within finally accepted price/ rate as per instructions of Engineer.

The contractor shall fabricate and weld pipes, special bends, as required for installing lube oil systems. The contractor shall also service the lube oil system, carry out the hydraulic test of oil coolers and piping systems as required.

The contractor as part of the scope of work if required or if directed by BHEL shall carry out the servicing and realignment of skid-mounted equipment.

All fittings like ‘T’ pieces, weld neck flanges, reducers etc shall be suitably matched with pipes for welding. The valves have to be checked, cleaned or overhauled in full or in part before erection/after chemical cleaning and during commissioning. Adjustments like removal of ovalities in pipes and opening or closing the fabricated bends of piping to suit layout including specified heat treatment procedures etc. shall be considered part of work.

The contractor shall completely erect and test all the piping systems including their hangers, supports, valves, insulation, and accessories including sampling lines and coolers as per specifications and drawings. The services will include welding, pre-heating, stress relieving, bolting, testing, cleaning insulation and painting. System shall be demonstrated in condition to operate continuously in a manner acceptable to the Engineer. Welding shall be used throughout for joining pipes except where flanged screwed or other type joints are specified or shown on the drawings. All piping shall be erected true to the lines and elevation as indicated in the drawings

Hangers, supports and Aux. Structures for suspension will be supplied in running lengths, which shall be cut to suitable lengths and adjusted as required. Pipes sent in standard length shall be cut to suit the site conditions and the layouts. Tubes or pipes wherever deemed to be convenient will be sent in running lengths with sufficient bends. Bends up to 100 mm nb may have to be fabricated at site wherever required. Contractor may have to cut/ fabricate bends of required radius as per drawings, documents, site requirements for the system completion within the quoted price. Work will include cutting, proper edge preparation by grinding/ machining, heat treatment etc.

Hangers, supports and Aux. Structures for suspension will be supplied in running lengths, which shall be cut to suitable lengths and adjusted as required. Pipes sent in standard length shall be cut to suit the site conditions and the layouts. Tubes or pipes wherever deemed to be convenient will be sent in running lengths with sufficient bends. Bends up to 100 mm nb may have to be fabricated at site wherever required. Contractor may have to cut/ fabricate bends of required radius as per drawings, documents, site requirements for the system completion within the quoted price. Work will include cutting, proper edge preparation by grinding/ machining, heat treatment etc.

Certain adjustments in length may be necessary while erecting high-pressure pipelines. The contractor should remove the extra lengths/ add extra lengths to suit the final layout after preparing edges a fresh by adopting specified heat treatment procedures, at no extra cost.

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.

The contractor shall be responsible for any modifications of shop-fabricated pipes prior to installation to accommodate minor site alteration in pipe routing at no extra cost.

All vents and drains for piping equipment covered in the scope whether shown in the drawings or not, shall be terminated outside the TG hall in atmosphere and at nearest sump-pit as directed by the engineer

Wherever piping erected by the contractor is connected to equipment/ piping erected by the other agencies the joint at the connecting point shall be the responsibility of the contractor of this specification

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. All fittings like `T' pieces, weld neck flanges, reducers etc., shall be suitably matched with pipes/valves for welding.

The valves will have to be checked, cleaned or overhauled (including lapping of seat) in full or in part before erection and/or after chemical cleaning and during commissioning.

The contractor shall be responsible for correct orientation of all valves so that seats, stems & hand wheels are in desired direction. 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

Steel for suspensions for piping will be supplied in running lengths. These are to be cut to suitable sizes and adjusted as per requirement.

No temporary supports should be welded on the piping. In case of absolute necessity prior approval should be taken from BHEL Engineer. In such cases heat treatment, if required, shall be carried out by the contractor.

The hanger assemblies shall not be used for attachment of rigging to hoist the pipes into position. Separate temporary supports shall be used to securely hold the pipe in position till pipe supports are completely assembled and attached to the building structure. Spring suspension/ constant load hangers have to be pre compressed and adjusted for the required loading and erected as per the instruction of BHEL Engineer. Any adjustment, removal of. Temporary arresters/ lockers etc. have to be carried out as and when required

All platforms, hangers, supports and anchors shall be installed as per drawing to obtain safe and reliable and complete pipe installation as per instructions of Engineer. Any

additional installation of above as called for by Engineer shall have to be fabricated and erected by the contractor. The raw materials excepting T&P, consumables, required for fabricating such supports shall be supplied by BHEL free of cost

Spring suspensions/ constant load hangers may have to be pre-assembled for required load and erection carried out as per instructions of BHEL. Any adjustments, removal of temporary arrestors/ lockers etc., have to be carried out as and when required. Adjustment of all hanger supports in cold and hot conditions is included in scope of this specification

Contractor shall install piping in such a way that no excessive or destructive expansion forces exist either in 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

The contractor shall carry out the tightening of the field bolts on the equipment and piping covered under this specification by using either the calibrated torque wrench method or the turn of part method. The procedure to be followed, the tools and the equipment deployed shall be subject to the approval of Engineer. All the torque wrenches shall be calibrated as per requirement and before they are put in use on any job.

During hydraulic testing all piping having variable spring type supports shall be held securely in place by temporary means while constant spring type supports shall be planned or blocked solid during test.

The contractor shall ensure that all supporting elements, anchors & restraint have been installed and adjusted in accordance with the drawings/ sketches & other written instructions of the Engineer. The contractor shall inspect the hangers associated with the piping systems as follows:

- After hydraulic test, with the piping in the cold position, with all travel stops removed, with the pipe completely insulated and complete in all respect ready for start up.
- Piping in the hot position with the unit operating at the maximum load.
- Piping in the cold position during the first complete shut down.

After complete installation and insulation of the piping and filling up of the piping with its normal operating medium. The pipe supports, springs shall be adjusted both in cold and hot conditions for maintaining the slope. If required the spring supports shall be re-adjusted to the hot position after the line has been put in service at its normal maximum operating temperature conditions. Arrangement of Hanger Rod/ Supports shall be as per drawings. Any cutting/ welding of these Supports will be done by the Contractor. The hangers will be tested for even distribution of loads with the help of torque wrench if required

Layout of small bore piping as required shall be done as per site requirement. Necessary sketch for routing these lines should be got approved from BHEL by the contractor. There is a possibility of slight change in routing the above pipelines even after completion of erection or from aesthetic point of view. Contractor at no extra cost

should carry this out.

Erection, testing and commissioning of electrically operated valves and their actuators etc. coming under various groups is covered under the scope of this specification

All valves, including valves, flap valves, dampers and actuators, 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

The contractor shall also or grind the valve seat, if required, to ensure satisfactory performance of valves at no extra cost. All parts such as gaskets, gland packing which form the permanent part of equipment shall be supplied by BHEL free of cost.

Erection and welding of necessary instrumentation tapping points, thermocouple pads, thermo-wells, valves, battery of first root valves, condensing vessels, flow nozzles, blank flanges, trunion, carrier plates, orifices, temperature pads control valves etc to be done covered within the scope of this specification, will also be the responsibility of the contractor as per instructions of BHEL engineer within the finally accepted rates. The welding of all the above items will be contractor's responsibility even if the:

- Product groups, under which these items are released, are not covered in the scope of this tender.
- Items are supplied by any agency other than BHEL.

NOTE: ADDITIONAL THERMOWELLS AS REQUIRED FOR CONDUCTANCE OF THE PERFORMANCE GUARANTEE TEST ARE TO BE INSTALLED BY THE CONTRACTOR.

The contractor is strictly prohibited in using the Boiler/ TG/ Aux. Components for any temporary supporting or scaffolding woks etc. In case of such misuse a sum of determined by Engineer will be recovered from contractor’s bills

Certain skid mounted instruments like pressure gauge, pressure transmitters, temperature gauges, flow switches, flow indicators, etc., are received in assembled condition as integral part of equipment. Contractor shall dismantle such instruments and hand over them to BHEL for calibration. Contractor shall re-erect them in position just before commissioning of the equipment or as and when directed by BHEL

For other agencies, such as TG/Boiler erection, Cabling, instrumentation etc., to commence their work from/ on the equipments coming under this scope, contractor has to clear the front, expeditiously and promptly as instructed by BHEL Engineer. Some time it may be required to re-schedule the activities to enable other agencies to commence/ continue the work so as to keep the over all project schedule.

BHEL drawings for Piping may be suggestive only. The final location and routings shall be decided to suit the site conditions. While routing such lines and fixing the stations, they have to be erected so as to provide easy accessibility and free path for the purpose of easy operation and maintenance. These locations shall be acceptable to the client. Sometimes, the locations of stations and routing of lines may have to be modified as per the site conditions. All such work shall be carried out expeditiously as per the instructions of BHEL engineer. The decision of BHEL engineer is final and binding on the contractor.

Valves and other associated equipments requiring human interface shall be located in the convenient location/ place as required by the customer to facilitate easy operation as per the decision/ instruction of BHEL engineer. Fabrication and installation of access platforms for operation of equipments in the pipelines shall form part of scope. Structural steel for such work will be supplied by BHEL in random size. Tonnage rate applicable for erection of structural components shall be payable for such platforms for fabrication and erection. No separate payment will be made for fabrication. The contractor shall be responsible for correct orientation of all valves so that seats, stem and hand wheel will be in desired locations. Information regarding orientation of valves, not fully located on drawings, may be obtained from the BHEL Engineers before erection.

Contractor shall assist BHEL in preparation of as built piping drawing.

Certain additional items if required to be erected for system completion shall be paid as per item no 2 of rate schedule.

42.0 WELDING, HEAT TREATMENT, RADIOGRAPHY AND NON-DESTRUCTIVE TESTING

42.1 The pressure parts, equipment and piping shall be erected in conformity with the provisions of Indian Boiler Regulation and as may be directed by BHEL as per any standard / specification in practice in BHEL. The method of welding (arc, gas, TIG or other method) may be indicated in the detailed drawings / schedules. BHEL Engineer will have the option of changing the method of welding as per site requirements. **Semi automatic welding (GMAW) process shall be used for non-pressure parts / ducting / structures etc to the maximum possible, considering its cost efficiency, better quality and time saving features.**

42.2 Welding of pressure parts, equipment, piping, high tensile structural steel shall be done by certified high pressure welders who posses valid certificate of CIB of the State in which the equipment is erected as per provision of IBR. The H.P. welder who possesses necessary certificate shall ensure re-validation as per relevant provisions of IBR and keep the certificate valid till the completion of work. The services of such welders, the validity of whose certificates have expired shall not be utilized for high-pressure works.

42.3 All welders including tack welders, structural and high pressure welder shall be tested as per ASME section IX / IBR and approved by BHEL Engineer before they are actually engaged on work even though they may possess a valid IBR 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.

42.4 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 welder's is having passed qualification tests does not absolve the contractor of contractual obligation to continuously check the welder's performance.

42.5 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.

42.6 The contractor shall carry out the root run welding of all HP / LP piping, valves by TIG

welding method only. The contractor shall have to carry out full TIG welding of butt weld joints of tubes / pipes of lesser thickness if required. During the root runs of stainless steel joints, the contractor shall before and during welding have to purge the pipes with inert gas. All weld joints for temporary piping required for alkali flushing, acid cleaning and steam blowing should be got done by HP welders only. The root run should be done by TIG welding. All arrangements required for the above shall be the responsibility of the contractor at no additional cost. Argon Purging is to be done for TIG Run of SS Pipes

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

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

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

42.10 All butt / fillet welds shall be subject to dye penetration test/ other tests as per the instructions of the engineer at no additional cost.

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

42.12 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.

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

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

42.15 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 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.

42.16 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 the contractor**.

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

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

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

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

42.21 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.

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

42.23 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.

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

42.25 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.

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

radiography work.

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

42.28 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.

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

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

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

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

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

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

42.35 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.

42.36 The contractor shall assist BHEL Engineer in preparing complete field welding schedule for all the field welding activities to be carried out in respect of 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.

42.37 For welding of T91 pipe materials, clauses no. 47.0 of this tender will be applicable besides above-mentioned clauses. T 91 materials of boiler tubes shall be welded as per specifications for boiler equipment. The welding electrodes for T91 material shall be supplied by BHEL's Mfg. Unit and shall be issued free for erection to the contractor.

42.38 The pressure parts, equipment and piping shall be erected in conformity with th provisions of Indian Boiler Regulation and as may be directed by BHEL as per ar standard/ specification in practice in BHEL. The method of welding (arc, gas, TIG or othe method) may be indicated in the detailed drawings/ schedules. BHEL Engineer will hav the option of changing the method of welding as per site requirements.

43.0 APPLICATION OF INSULATION AND REFRACTORY

43.1 All attachment welding, including welding of hooks / supports as per pitch both on equipment and piping shall be done as directed by Engineer. Attachment welding shall have to be done by certified welders. If necessary contractor may have to cut the hooks to correct length without any extra cost to BHEL.

43.2 Contractor has to supply and apply heat resistant primer on welded portions before application of insulation.

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

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

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

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

43.7 It is the responsibility of the contractor to ensure that the insulation materials and sheet metal covering issued to him for application are well protected against loss or damage from weather conditions. Closed / semi closed sheds or any other arrangements required for this will be made by him at his cost. If any damage occur 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.

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

43.9 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 contractor's responsibility. Any cutting / bending / welding of fabricated skin casing sheets if required will also be covered within the scope of this contract.

43.10 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.

43.11 Contractor is liable for the exact accounting of the material issued to him and he shall make any unaccountable losses good. Wastage allowance for the material issued are as below:

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

43.12 The entire surplus, unused materials etc., supplied by BHEL shall be returned to BHEL

after the work is over. Materials like gunny bags and packing materials, empty containers may be returned at periodical intervals.

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

43.14 If during erection and commissioning any of the parts are to be 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.

43.15 Removable type of insulation shall be provided for valves, fittings, expansion joints etc as per the drawings or as directed by BHEL Engineer.

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

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

43.18 Special type of Insulation wool used in pent house shall not be cut indiscriminately.

43.19 Contractor shall mix and apply the refractory / insulation as per the instructions of BHEL Engineer. Castable refractory / insulation after application shall be cured as per the instructions of BHEL Engineer. The contractor shall provide the required quantity of wire nails, planks for formwork and other materials for centering and grouting work.

43.20 Application of castable and pourable refractory between tubes, around burners, on ceiling and as directed by Engineer and as per detailed drawings and specifications.

43.21 Dressing of insulation brick to suit site conditions, curing refractory concrete applied/sheet cladding over insulation forms a part of this work.

43.22 Contractor shall observe all precautions for laying / curing of castable refractory. Any defective works found shall be re-laid by contractor at his cost.

43.23 Making structural supporting work for pourable insulation, laying pourable insulation, adhering to all specifications and instructions during application forms a part of this work.

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

44.0 TESTING, PRE-COMMISSIONING, COMMISSIONING AND POST-COMMISSIONING.

44.1 The contractor shall carry out all the required tests and pre-commissioning and commissioning activities required for their successful and reliable operation. These would include hydraulic test of boiler, land flow test, clean air flow test, chemical cleaning of piping and boiler, water washing, oil flushing of oil system 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.

All required tests (Mechanical and electrical) indicated by BHEL and their clients for

successful commissioning are included in the scope of these specifications. These tests / activities may not have been listed in these specifications.

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.

44.2 Commissioning of ESP shall involve required tests such as air leak test, gas distribution test, motor no load test, rapping mechanism trial runs, interlock tests, charging of transformer fields, commissioning of all electrical equipment / panels, heaters and their proper tuning etc. The contractor shall provide all consumables, labour, scaffoldings and items required for satisfactory testing

44.3 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 FD fan through the steam generator up to stack.

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

44.5 The scope of pre-commissioning activities cover installation of all necessary equipment including temporary piping, supports, valves, blanking, pumps, tanks, with access platforms valves, along with accessories required for hydro test, applicable steam blowing or for any other tests. The scope also covers the off site disposal of effluents of the tests under the scope of this contract as per instruction of BHEL Engineer .

44.6 All items / material required for conducting hydraulic test, Chemical Cleaning (alkali boil out, acid cleaning of Boiler – as applicable) , steam blowing of erected Piping etc., will be supplied by BHEL. **However, servicing, dismantling and returning of the same to stores is the responsibility of the contractor who is erecting the equipment / piping**. **The contractor may note that no separate payment shall be released for any temporary works** that are to be carried out for conducting pre-commissioning and commissioning tests. Bidders are advised to include expenses on temporary works along with the rates being quoted by them. Broadly the work on temporary systems will be divided as under:

Boiler: Erection etc. of all temporary piping along with insulation and supports for steam blowing of the installed piping and effluent disposal are to be carried out as part of Boiler work. The Contractor will be responsible for their operation and any servicing required till completion of commissioning activities.

For Chemical Cleaning : Installation and operation of all equipments, temporary piping, tanks and electrical switchgear along with their accessories shall be carried out by another agency of BHEL. While agency appointed by BHEL will be responsible for the Equipments of Chemical Cleaning Operation, the Boiler Contractor shall make ready main boiler equipments required for chemical cleaning process and they will closely associate themselves with the BHEL's agency during the process for carrying out the other operations required on the Boiler for completing the Process. **The Boiler Contractor will carry out the connection / installation and normalizing of terminal connection of the Main Equipment .**

Erection etc. of blowers and blanks and putty required for conducting air tightness test shall be carried out as part of Boiler work (Putty to be procured by the contractor without any extra cost to BHEL).

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

Dismantling of the temporary equipment and piping will be done by the agency that has erected the equipment and piping and they will also responsible to

return these materials to the stores.

44.7 Boiler Drum will be dispatched without fixing internals and internals will be sent separately. The internals have to be fixed as and when required. Dismantling and re-assembly to be done to suit various commissioning requirements.

44.8 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, 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, servicing of valves and any other works incidental to commissioning are to be carried out. During this period though the BHEL's customer's staff will also be associated in the work, the contractor's responsibility will be to arrange for the complete requirement of supervision, men, consumables, T&P and IMTE's till such time the commissioned units are taken over by the BHEL's customer.

44.9 It shall be the responsibility of the contractor to preserve the boiler as per BHEL's requirement. Required chemicals , DM Water and other required items etc required for this purpose will be supplied by BHEL .

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

44.11 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.

44.12 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.

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

44.14 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.

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

44.16 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 realignment are necessary, the contractor at his cost shall do the same as per Engineer's instructions including repair, rectification and replacement work. The parts to be replaced shall be provided by BHEL.

44.17 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 while

constant spring type support hangers shall be pinned or blocked solid during the test.

44.18 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.

44.19 Cleaning and servicing of all the filters / strainers, toppings of oils coming in the system shall be done by the contractor within the accepted price.

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

44.21 The contractor may note that no separate payment shall be released for any temporary works that are to be carried out for conducting pre-commissioning and commissioning tests. Bidders are advised to include expenses on temporary works along with the rates being quoted by them. Broadly the work on temporary systems will be divided as under:

Erection etc. of blowers and blanks and putty 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 will be done by the agency that has erected the equipment. He will also return the equipment to the stores

44.22 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 (Except for Feed, CEP outlet, Drip lines), steam blowing or for any other tests as the case may be and will carry out above activities under this scope of work as per instructions of BHEL. The scope also covers the off site disposal of effluents

44.23 Commissioning of the ESP will involve trial run of all the equipment erected. The boiler has to be lighted up for refractory drying, alkali boil out, acid 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, servicing of valves and any other works incidental to commissioning are to be carried out. During this period though the BHEL's customer's staff will also be associated in the work, the contractor's responsibility will be to arrange for the complete requirement of supervision, men, consumables, T&P and IMTEs till such time the commissioned units are taken over by the BHEL's customer for the entire scope awarded to contractor.

44.24 All arrangement required for steam blowing including removal, reinstallation and welding of CRH NRV and installation of steam blowing arrangements including steam blow off piping is included in the scope of work.

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

44.26 The contractor shall make all necessary arrangements including making of temporary closures on piping/ equipment for carrying out the hydro-static testing on all piping equipment covered in the specification at no additional cost. The contractor shall carryout the required test on the pipelines such as Hydraulic Test (as per IBR requirement/ instruction of BHEL), 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, Metelascope for analysis of weld material of T/P-91 pipings, ultrasonic test kit and engineers required for these tests shall be arranged by the contractor along with Qualified technician within finally accepted rates.

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

44.27 All the above tests should be repeated till all the erected piping satisfy the requirement/ obligation of BHEL and Boiler Inspectorate, if required at various stages. All the repair for site welded joints arising out of the failures during testing shall be done by the contractor as part of the work within finally accepted rates.

44.28 Contractor shall layout all necessary temporary piping, cutting of some of existing valve, placing of rubber wedges in the valves etc., required for hydro test, oil flushing, steam blow off or for any other tests as the case may be and will be carried out above activities under the scope of work as per instructions of BHEL. After the test is over, all the temporary piping, etc., will be removed and returned to BHEL store. All these form part of the scope of work. No separate payment shall be made towards erection and dismantling of these temporary works. Chemical cleaning of feed lines, CEP outlet lines, and Drip lines will be carried out by a separate agency. Cleaning of all other lines is in scope of this contract. However the contractor executing this work has to render all assistance to the separate agency including removal of valves , putting loops and restoring back after cleaning .

44.29 All items required for conducting hydraulic test, oil flushing, steam blowing etc., will be supplied by BHEL. However, servicing, erection and dismantling and returning of the same to BHEL Store is the responsibility of the contractor

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

Suitable welding and stress relieving of temporary blanks or suitably fixing temporary blank flanges with gaskets and fasteners and welding and providing suitable deaeration/ ventilation draining points with valves as per BHEL Engineer's instruction, for performing hydro test of piping and other equipments, is within the scope of this specification. Gaskets, valves, fasteners, blank flanges, blanks or steel for blank flanges will be provided free of cost by BHEL. Contractor shall cut out steel blanks from steel provided. After completion of Hydraulic Test, welded blanks shall be cut and removed and weld burrs ground finished and cavities/ scars of cutting weld filled ~, d ground as per BHEL Engineer's instruction at no extra cost. NDT & SR if required may have to be carried out.
Hydro test of piping has to be repeated several times in consonance with technical/ statutory requirements during stage of erection pre commissioning/ commissioning. Hydro test will have to be done to the satisfaction of Boiler Inspector/ Customer/ BHEL

Engineer after attending repairs, Hydro test shall be repeated before Boiler Inspector/ customer/ BHEL engineer to their satisfaction.
Soon after conducting: the hydro test of the piping, the same shall be preserved against corrosion either by wet preservation or by dry preservation as per the requirement of BHEL Engineer. Contractor shall carry out all the incidental jobs like filling up of water, dozing of chemicals and pressuring the system to the required pressure and keep a constant watch on the preservation work as per the instruction of BHEL Engineer. The preservation shall be resorted to whenever the boiler is not under trial operation till the completion of commissioning activities.
While conducting hydraulic test of steam lines, water lines, either individually or grouping a few lines or in portions, blanks/ spools may have to be put up at terminal points, strainers, valves, flanges etc. After conducting the tests, the blanks shall be removed and the lines restored. Also interconnecting piping between boiler and turbine, the hydraulic test may have to be done section wise and sometimes piping of other agencies may have to be combined. Contractor shall carry out all such incidental work .to satisfactorily conduct the Hyd. Test. Wherever work is involved in the terminal points, contractor shall carryout the same as per instruction of BHEL Engineer. The decision of BHEL Engineer is final and the same is binding on the contractor.

The contractor shall carry out any other tests as desired by BHEL engineers on erected equipment covered in the scope of this contract during testing and commissioning to demonstrate the satisfactory completion of any part or whole of work performed by the contractor.

During Hydraulic Test, the pipes being tested shall be isolated from the equipments to which they are connected.

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.

During this period though the BHEL's/ client's staff will also be associated in the work, the contractor's responsibility will be to arrange for the complete requirement of supervision, consumables, labour, T&P and IMTEs required till such time the commissioned units are taken over by the BHEL's customer.
It is possible that due to any reason the final supporting may not be completed before conducting Hydraulic Test. The contractor may have to strengthen or install any additional supports as per instruction of BHEL. This work is a part of the work and no additional payment shall be made on this account.

45.0 TOUCHUP / FINISH PAINTING

45.1 All exposed metal parts of the equipment, structure, auxiliaries, piping, ducts and other items (covered within the scope of this contract) after installations are to be painted. The surfaces are to be thoroughly cleaned of all dirt, rust, scales, grease, oils and other foreign materials by wire brushing, scrapping, any other method as per requirement of BHEL. The same will be inspected and approved by the engineer before painting.

45.2 Mostly the equipment / items/ components will be supplied with one coat of primer paint and one coat of finish paint. However during storage and handling, the same may get peeled off / deteriorate. All such surfaces are to be thoroughly cleaned.

Typical painting schedule is enclosed for reference

Besides above two coats of approved primer paint is to be applied on all the bare / unpainted surfaces. The gas cut stubs would require being ground and rounded.

45.3 After applying the primer paints, wherever required, all structure / equipment / items, shall be painted with paints as specified by BHEL engineer/ its customer. The number of coats / paint thickness shall be as indicted in the drawing / documents. However at least two coats of finish painting is to be applied. In case proper finish is not obtained in two coats, the contractor shall apply additional coat (s) till proper finish / paint thickness is achieved. Certain equipment / Items are required to be painted with approved quality heat resistant paint / primer. After completion of painting all bright spots shall be cleaned to the satisfaction of Engineer.

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

45.5 **Contractor at no extra cost to BHEL shall supply all paints, primers, tools and other consumables including scaffolding materials required for touchup / finish painting as is mentioned in Cl 45.2 . Paint shall be of BHEL/ its customer's approved make only (i.e. enamel, epoxy, fire resistant or of any other required category specified by BHEL / its customer, drawings, documents and specifications for this package) and painting should be as per colour scheme and quality approved / specified by Engineer. Valid Test Certificate for the paint so supplied shall be made available before use of the same on work.**

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

45.7 **The contractor shall provide legends with direction of flow on equipments and piping in size specified by Engineer. Letter writing shall be done in Hindi /Local language/ English or in all the languages as specified by the engineer.**

45.8 The painters have to undergo test and only qualified painters will be allowed to work.

The contractor shall ensure availability of

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

For CW and ACW piping, the contractor has to do paint application of inside portion also as per drgs./ documents/ applicable specifications, standards and codes

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

46.0 PROGRESS REPORT

46.1 Contractor is required to draw mutually agreed monthly erection programs in consultation with BHEL well in advance. Contractor shall ensure achievement of agreed program and shall also timely arrange additional resources considered necessary at no extra cost to BHEL.

46.2 Weekly progress review meetings will be held at site during which actual progress during the week vis-à-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 non-conformities.

46.3 The contractor shall submit daily, weekly and monthly progress reports, manpower reports, materials reports, consumables (gases / electrodes) report and other reports as per Performa considered necessary by the Engineer.

46.4 The progress report shall indicate the progress achieved against planned, with reasons indicating delays, if any. This should give the remedial actions which the contractor intends to take to make good the slippage or lost time, so that further works again proceed as per the original program and the slippage do not accumulate and effect the overall program.

46.5 The daily manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.

47.0 DRAWINGS AND DOCUMENTS

47.1 The detailed drawings, specifications available with BHEL engineers will form part of this tender specification. These documents will be made available to the contractor during execution of work at site. The contractor will also ensure availability of all drawings / documents at work place.

47.2 Necessary drawings to carry out the erection work will be furnished to the contractor by BHEL on loan, which shall be returned to BHEL Engineer at site after completion of work. Contractor shall ensure safe storage and quick retrieval of these documents.

47.3 The contractor shall maintain a record of all drawings and documents available with him in a register as per format given by BHEL Engineer. Contractor shall ensure use of pertinent drawings / data / documents and removal of obsolete ones from work place and returning to BHEL.

47.4 The data furnished in various annexure enclosed with this tender specification are only approximate and for guidance. However, the change in the design and in the quantity may occur as is usual in any such large scale of work.

47.5 Should any error or ambiguity be discovered in the specification or information the contractor shall forthwith bring the same to the notice of BHEL before commencement of work. BHEL's interpretation in such cases shall be final and binding on the contractor.

47.6 Deviation from design dimensions should not exceed permissible limit. The contractor shall not correct or alter any dimension / details, without specific approval of BHEL.

48.0 INCOME TAX, SERVICE TAX, VAT AND SALES TAX ETC.

48.1 TDS under Income Tax, Sales Tax, VAT and surcharge etc, if any, shall be deducted at prevailing rates on gross invoice value from the running bills unless Exemption Certificate from appropriate Authority / Authorities is furnished.

48.2 Price quoted shall be inclusive of all taxes except service tax. The service tax, as legally leviable & payable by the contractor under the provisions of applicable law/act, shall be paid by BHEL as per contractor’s bill. However, contractor shall have to submit proof of service tax deposited by them immediately after the deposit but not later than the next bill submitted after the due date of deposit. The contractor shall furnish proof of Service Tax registration with Central Excise Division covering the services covered under this contract. Registration should also bear endorsement for the premises from

where the billing shall be done by contractor on BHEL for this project The contractor shall obtain prior approval of BHEL before billing the service tax amount and should submit proper CENVATABLE invoice as per Service Tax Rules.

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

48.3 In VAT applicable States, "Tax Invoice" if required under the relevant State VAT law shall be submitted alongwith other compliances as per concerned VAT Act.

48.4 Contractor shall get his organization registered with concerned sales tax/VAT authorities within 15 days of award of this contract, if applicable. The delay on this account and delay in bringing the material shall be to contractor's account and no extension of time shall be allowed on this account. The sales tax/VAT registration for this contractor shall be forwarded to BHEL within 30 days from the date of LOI. In case the contractor is already registered for sales tax/VAT with Govt. Authorities he must quote his registration no, while submitting their tender.

48.5 Contractor has to make his own arrangement at his cost for completing the formalities, if required, with Sales Tax/VAT Authorities, for bringing their materials, plants, and equipment at site for the execution of the work, including arrangement of Road permits as applicable under this contract.

49.0 EXTRA WORK:

49.1 BHEL may consider for payment of extra works on man hour basis @ Rs.30/- (Rupees thirty only) per man hour only for such of those works which:

A Require major revamping or rework and which are totally unusual to normal erection work.

B Require rectification / modification for improvement in the design during commissioning,

C Requiring fresh fabrication of components in place of rejected / replaced components.

49.2 The rates indicated as above, shall include over time, if any, consumables, supervision, use of tools and tackles and other site expenses and incidentals.

49.3 The extra works, if any, shall be carried out by a separate gang, which will be identified for certification of man-hours. This gang will not be utilized for any other work during the period that they are engaged in the extra-work. Logbook should be maintained and should be signed jointly by the contractor's representative and BHEL Engineer on day-to-day basis. However, signing of the logbook does not necessarily mean acceptance of the extra works, which would be identified by Engineer, whether work is covered in one of the above categories. Only those works and man-hours that are certified by the BHEL Engineer-in-charge will be considered for payment. The decision of BHEL in this regard shall be final and binding on the contractor.

50.0 PRICE VARIATION

50.1 **The finally accepted rates shall remain firm throughout the contract period i. e. up to schedule completion date.** In case due to reasons not attributable to the contractor, the work gets delayed and scheduled completion gets extended, time extension will be granted by BHEL. The applicable rates

during this extension period shall be subjected to price variation provision as per following formula.

$$P1 = \frac{0.75 \times P0 \, (F1 - F0)}{F0}$$

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

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

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

F0 = All India CPI published by Labour bureau, Simla, Govt. of India, for Industrial workers (Base 2001 =100) **applicable on the date of schedule completion.**

50.2 Price variation as per above formula will be calculated and paid on the balance works at the time of such extension (excluding payments towards extra works and over run, if any) on month to month basis during extended period. No Price Variation shall be payable for the work executed during contractual completion schedule.

50.3 With the provision of price variation as per above clauses NO CLAIM / COMPENSATION/OVER RUN on account of any increase whatsoever, (irrespective of whether escalation are steep/ unanticipated or not compensated by the above escalation provisions in full towards minimum wages, consumables, coarse / fine aggregates, steel , wood, electrodes, gases or any other item / reason) will be payable during the entire period of execution including extended period, if any

51.0 RATE SCHEDULE

51.1 Contractor shall fully understand equipment description and scope of work before quoting. The scope of work and responsibility of the contractor as mentioned under these specifications shall be covered within the quoted rates.

51.2 The tenderer shall quote the rates as per the rate schedule only, in part II price bid (Original). Conditional price bids or price bids with any deviation / clarification etc. are liable to be rejected. No cutting / erasing / over writing shall be done.

Contractor's total quoted price as per rate schedule will be taken as tentative only. The contractor undertakes to erect / commission actual quantities as per advice of BHEL Engineer and accordingly the final contract price shall be worked out on the basis of quantities actually erected at site and payments will also be regulated for the same. **The quantities may vary to any extent and no compensation will be payable in variation of quantity. However, in case of over all variation in Contract value (as indicted in LOI), beyond (minus) 30%, the contractor**

will be eligible for compensation as per the following provision:

"The total executed value shall be raised by 10 % subject to the condition that the total value of work executed plus increase as above shall be limited to 70 % of the awarded contract value"

Contractors are requested to take above into account while quoting. The contractor confirms that the rate quoted above takes care of such variation during execution stage.

52.0 INSTRUCTIONS TO TENDERERS

52.1 Offers received without data / information, required under tender clauses-11.1 to 11.11, is liable to be rejected. All these data / information should be duly supported by documentary evidences (Refer note below clause-11)

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

52.3 The tenderers are advised to actually visit the site and fully acquaint themselves with site conditions, location of stores, transportation routes, quantum of work etc. before quoting their rates for this work. BHEL shall not be responsible in any way for non-familiarization of the site conditions. Once the tenderer has quoted for the work, it is implied that he has ascertained various site conditions and NO CLAIM whatsoever will be entertained by BHEL on any such account.

52.4 The contractor in the event of this work being awarded to him shall establish a site office at site and keep posted an authorized responsible officer who should hold a valid power of attorney for the purpose of the contract. Any order or instruction 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.

52.5 LIQUIDATED DAMAGES (LD)

For delay in completion of work attributable to the contractor, the LD shall be applicable at the rate of ½% of the contract value per week of delay or part thereof limited to a ceiling of 10% of the contract value as mentioned under clause no.25.5 of the GCC of the tender.

52.6 SECURITY DEPOSIT

The contractor shall submit Security Deposit within 15 days from the date of issue of LOI as per clause no. 16.2 of the General Conditions of Contract (GCC). In case the contractor opts to furnish Bank Guarantee as a part of Security Deposit, the BG shall be issued as per the Performa enclosed as per Annexure- H of the GCC and also that the BG should be issued preferably through any of the Member Banks as listed in GCC;

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

52.7 INSURANCE

52.7.1 Besides provisions under clause no. 29.0 of GCC regarding insurance, the following shall also be applicable. The contractor shall also take care of the same while submitting their offer.

52.7.2 Insurance for all materials pertaining to the Contractor (T&Ps, Construction Materials etc.) during transit, storage and during construction shall be in his (Contractor's) scope.

52.7.3 The Contractor shall provide insurance cover to all persons employed/engaged by him throughout the period of Contract, including the extended period, if any.

52.7.4 In addition to insurance as per Workmen's Compensation Act, Employer's liability and also Group Personnel Insurance for employees are also to be taken by contractor.

52.8 OTHERS

52.8.1 In case of any contradiction between General Conditions of Contract (GCC) and Special Conditions of Contract (SCC), the latter shall prevail.

52.8.2 **The Price Bids of only those bidders will be opened who will be qualified for the subject job on the basis of pre-qualification evaluation / Techno-commercial bids and acceptance of BHEL's customer for this work i.e M/s UPRUVNL. BHEL reserves the right to reject the bidders with unsatisfactory past performance in the execution of a contract. BHEL's decision in this regard shall be final & binding**

SECTION - IV

SPECIAL CONDITIONS OF CONTRACT FOR MAIN BOILER

SECTION - IV

SPECIAL CONDITIONS OF CONTRACT FOR MAIN BOILER

53.0 SCOPE OF WORK

53.1 The scope of these specifications for Erection, testing & commissioning of Boiler, Rotating Machines, Auxiliaries, Associated Piping, Painting & insulation etc. for of this Project generally covers but not limited to following:

- **Taking delivery of the boiler materials from the project storage yard / stores / sheds/ from vehicles, to erection site, erection, testing and commissioning of boiler and its auxiliaries like static & rotating machines, piping, insulation and flue gas ducting upto BOF etc.**
- **The preservation, safe keeping, watch and ward of all the materials received for ETC.**
- **Receipt, unloading & transportation of boiler drum, burner blocks, mill bases, furnace bottom ring headers to erection site. Receipt of boiler drum, unloading from the trailer and dragging inside boiler structures and positioning on ground before erection. Similarly the burner blocks, mill bases, furnace bottom ring headers are to be also unloaded from trailers by the contractor and shifted to the site of erection before lifting for erection in position.**
- **Checking, dressing, chipping and leveling of foundations.**
- **Pre-assembly, erection, alignment of various equipments, pressure parts, trim and integral piping, non-pressure parts, pulveriser fuel piping, structure, all piping specified in the specifications, machining and grouting etc.**
- **Handling arrangements for rotating machines.**
- **Carrying out of Special processes as per clause 47.0 to 49.0**
- **Welding, heat treatment, radiography, UT and other non-destructive tests wherever required**
- **Hydraulic testing, air leak test, land flow test, clean air flow test and other pre commissioning tests,**
- **Insulation, touchup and finish painting including supply of paints etc.,**
- **Assistance during Chemical cleaning, alkali boil out, acid cleaning and passivation, PG test as per the scope given in the tender.**
- **Steam blowing and safety valve floating including erection and dismantling of all temporary piping, valves, pumps, tanks etc. required for above operations and other commissioning activities including post commissioning operations and stabilisation of the unit,**
- **Unit trial operation, resolving any deficiencies observed and handing over of Unit 6 of 2 x 500 MW Boiler of Anpara D TPS**

53.2 **The PG wise break up of Boiler, Rotary and Static Auxiliaries and piping is tentative as indicated under Annexure-I. Regarding the tonnage indicated the decision of the BHEL Engineer with respect to scope, and keeping the work suitability, quality and time schedule will be final and binding on the contractor. However the work of Boiler shall be broadly as per following**:

Boiler scope mainly includes main boiler / furnace, structures, pressure parts, air heaters and associated ducts (including ducts between air heater and FD/PA fans), burners, Pulverised coal piping, oil system, integral piping, (as specified) elevator structures along with dust proof cladding etc. flue gas ducts to BOF ,, fans (ID/FD/PA/SA), coal mills, feeders, etc. and other equipments not mentioned for completing the system for SG package.

Painting and insulation for the boiler, associated auxiliaries and piping and structures as per drawings, documents and specifications shall be within the scope of work.

53.3 Approx. weight **to be erected for the Boiler & Auxiliaries**, and associated piping shall be **23,760 MT as indicated in Annexure-I-A .** 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 boiler 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 advice of BHEL Engineer and accordingly the final contract price shall be worked out on the basis of quantities actually erected at site and payments will also be regulated for the same.

53.4 The customer M/s. UPRVUNL 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 .

54.0 **Welding in T91 materials is envisaged in the Reheater tubes of the Boiler. The Contractor has to carry out the work for the same for completing the process. The HT, RG and NDT will have to be carried out by the contractor as per welding specifications within the quoted price .**

55.0 **BOILER DRUM UNLOADING AND LIFTING (SPECIAL PROCESS)**

55.1 **Unloading and Transportation of boiler drum from the point of delivery to the boiler cavity at erectable location is in contractor's scope.** Boiler drum (**weighing appx. 214 MT**) may come by Trailer inside the power plant as close as possible to site/ approximately 1 KM near to boiler. All arrangements and resources to unload and drag the boiler drum to the boiler cavity for erection are in contractor's scope.. Contractor shall, if required, fabricate the saddle for dragging of drum to the boiler cavity as incidental to work within the contract. The rails and sleepers for shifting & dragging of the boiler drum, as required, has to be arranged by the contractor within his quoted price. All other necessary arrangement for unloading including supply of required wooden sleepers, required equipment ,slings etc. shall be done by the contractor within his quoted rates.

55.2 The cranes indicated in Annexure-II, may be provided for unloading of boiler drum .

55.3 **The Boiler drum lifting is to be done by Strand Jack Arrangement.** BHEL shall provide this arrangement with required manpower for the equipment assembly, installation and smooth operation of the same to lift the Boiler drum **through other service provider.**

55.4 All preparatory works required for boiler drum lifting are under the scope of this contract.

55.5 The contractor has to provide necessary support by using BHEL' s and his own available **cranes** including operation and maintenance with **consumables and T & P** with all necessary **manpower** for the handling, positioning, assembly, erection & dismantling and loading of the strand jack equipments and its accessories arranged by BHEL through other sources for the boiler drum lifting work.

55.6 Arrangement of required platforms, scaffoldings and jacking supports, temporary lighting at site and electric power point of 220/ 415 V supply for the entire operation of boiler drum lifting with the strand jack mechanism shall be in the scope of this contract. The contractor has to make all infrastructures for the utilization of construction power for the strand jack mechanism. **To assist by providing required T & P like welding machine, grinding m/c, gas-cutting torches etc free of charge to the other agency deployed by BHEL with strand jack arrangement, during the entire activity,** if required.

55.7 **Boiler drum is to be shifted, dragged, positioned & aligned below the strand jack lifting arrangement prior to lifting process as well as the alignment of boiler drum during erection is under the scope of this contract.**

55.8 The contractor at site will fabricate and install the required drum-lifting structures for the strand jack mechanism. Fabrication, lifting, positioning, & welding of cathead structure is under the scope of this contract. The contractor at his cost shall arrange necessary steel which is not provided by BHEL and other consumable. The contractor, at his own cost, shall carry out fabrication, erection and complete installation of drum lifting structure. After completion of drum erection and alignment, the contractor shall dismantle the drum lifting arrangements. Required T&P given to contractor for drum lifting shall be returned to BHEL stores in good condition and to the satisfaction of the Engineer. No payment shall be made for erection and dismantling of temporary bracing.

55.9 Drum lifting shall be allowed after completion of main structural work and all the bracing including the bracing for all the columns and horizontal boiler level platforms. **Contractor shall carry out the lifting and positioning, fixing and tightening of 'U'- rod supports for boiler drum.**

55.10 HSFG Bolts are to be tightened by calibrated torque wrench as per the instructions of the Engineer. These should be check tightened / re-tightened by torque wrenches before guirder lifting / as instructed by the Engineer.

56.0 CHEMICAL CLEANING

56.1 **Chemical Cleaning** will be carried by a separate agency deployed by BHEL. While the work of installation of tanks, Pumps, Piping and operation of the system is in the scope of that agency, the Contractor has to extend all assistance (including providing of welding power point) and complete interface requirements for the completion of the work.

SECTION - V

SPECIAL CONDITIONS OF CONTRACT FOR ESP WORKS

CLAUSE NUMBER	DESCRIPTION
57	SCOPE OF WORK
58	ERECTION OF ELECTROSTATIC PRECIPITATOR
59	PRE–COMMISSIONING TESTS AND COMMISSIONING
60	BROAD SCOPE OF ELECTRICAL AND C&I WORKS
61	N A
62	BRIEF DESCRIPTION OF ELECTRICAL AND C&I WORKS

SECTION - V

SPECIAL CONDITIONS OF CONTRACT FOR ESP WORKS

57.0 SCOPE OF WORK

57.1 The scope of work under this tender generally consists of:

Handling /transportation of equipments / materials from storage yard for installation, pre-asembly, erection, testing, commissioning and handing over of Electrostatic Precipitators including ducting, structures, insulation, painting etc. From boiler outlet flange to chimney for 2x500 MW Anpara D TPS , Anpara , U P.

Approx. tonnage involved is 11,578 MT ,as per ANNEXURE – I-B

The scope of these specifications not limited to but covers mainly following:

- Taking delivery of the materials from the project storage yard / stores / sheds to erection site.
- Their preservation, safe keeping, watch and ward.
- Checking, dressing, chipping and leveling of foundations.
- Pre-assembly, erection, alignment of various equipments, machining and grouting.
- Welding, heat treatment, radiography, UT and other non-destructive tests wherever required
- Hydraulic testing, air leak test, clean air flow test and other pre-commissioning tests and commissioning.
- Installation ,testing, other pre commissioning tests and commissioning of all items in scope of this specifications.
- Insulation and finish painting including supply of paints etc.,
- Unit trial operation, resolving any deficiencies observed and handing over .

The work to be carried out under the scope of this specification covers the complete work of handling/ transportation at site, temporary storage prior to erection, if required, cleaning , preservative painting, erection, alignment, welding, leveling, adjustment, chipping & leveling of foundation, welding of hooks, plates, insulation of all mechanical equipment, works of all electricals, cabling and C&I, final painting, etc., Gas distribution test, Gas tightness test, all pre-commissioning tests, start-up and initial run of individual equipment, final commissioning, initial run of tESPs and other items covered in the Weight Schedule etc at **Unit 6 of 2X500 MW**. Anpara D TPS Unit-up to handing over of the units to BHEL/their customer including PG test of the unit. The work shall conform to dimensions and tolerances given in

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various drawings and documents that will be provided during erection. If any portion of works is found to be defective in workmanship not conforming to drawings/documents or other stipulations, the contractor shall dismantle and re-do the work duly replacing the defective materials at their own cost, failing which recoveries, as determined by BHEL, shall be effected from contractor's bills.

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.
NO DEVIATION IN SCOPE OF WORK, WHATSOEVER, SHALL BE ALLOWED BY BHEL.
The work to be carried out under this scope covers the complete work of Electrostatic Precipitators (ESPs), Ducts etc of Unit-6 at 2 x 500 MW Anpara D including outside shell ,structural steel support and frame work, access ladders, platforms, safety rails, stairways, walk ways, access doors and weather proof pent house, Transformer handling system at roof etc.

57.2 Foundation and other necessary civil works for supporting structures, equipment etc, will be provided by BHEL. The dimensions of the foundation and anchor bolt pits shall be checked by contractor for their correctness with respect to the above access as per the erection drawings. Further, top elevation column foundations shall be checked with respect to bench-mark etc. All minor adjustment of foundation levels dressing and chipping of foundation surfaces etc. upto 50 mm as may be required for the erection of equipment/plants will be carried out by the contractor at no extra cost. Grouting of all columns, equipment base plates, anchor bolt holes etc are included in the scope. The foundation pockets shall be cleaned by using compressed air. The grouting mixture shall be either composed of port land cement or ready mix grout of approved quality. **However, in both the cases the vendor has to arrange Portland cement and ready mix grout component respectively within the awarded contractual value and no payment shall be released by BHEL to the contractor on this account.** Before arranging the type of cements/grouting materials, the contractor must take approval from BHEL/Customer for the brand to be used. Application of the two options will depend on drawing/specification/ instruction of BHEL Engineer. The contractor shall arrange for sand, stone chips, gravels, anti shrink compound, plasticizer, shuttering, grout mixing machine, labors etc at his cost. The contractor shall prepare the required test pieces/test cubes to ensure the strength of grout and get the same tested in laboratory at his cost. Test cube shall also be taken during grouting for testing in the laboratory and shall be tested at his cost. A necessary arrangement along with watering till complete curing has to be arranged by the vendor.

57.3 All the necessary lifting tackles, tools and plants including tractors, trailers, Lorries, trucks, Pulley blocks, jacks, winches, wire rope etc. of suitable capacities etc. and other equipment incidental to carry out this work shall have to be arranged by the contractor himself at his cost. However cranes as per Annex will be provided by BHEL free of cost on time-sharing basis.

57.3 BHEL Engineer reserves the right to inspect lifting tackles and equipment before allowing their use. Such approval however, shall not relieve the contractor of his responsibility to ensure safe handling of equipment taking due precautions to avoid any accident and damage to other equipment and personnel.

57.4 All hardware such as rails, sleepers, maxpuller etc., required for dragging or for any other connected works shall be arranged by the contractor at his own cost.

57.5 The contractor shall execute the work in the most substantial and workman like manner. The same shall be, handled with care and diligence. Any loss to BHEL due to contractor's lapses shall have to be made good by the contractor. All surplus, damaged, unused materials, package materials/containers, gunny bags etc. shall be returned to BHEL.

57.6 If the contractor or his workmen break, deface, injures or destroy any part of building, road, kerbs, fence enclosures, water pipes, drains, electric/telephone poles or wires, trees or any other property or damage any part of erected stores, stored components etc. the contractor shall make the same good at his own expenses (of Which BHEL site Engineer's decision shall be final) failing which the site Engineer shall get the same rectified by other agencies at the risk and cost of the contractor and the same shall be deducted from the sums that may be due then or at any time thereafter become due to the contractor or even from his security deposit.

57.7 All the Riggers, Sarangs, etc engaged for the work should have adequate experience, which should be supported by documentary evidence, if called for.

57.8 Pre-assembly of equipment to be done at the pre-assembly yard for inspection and checking. It is to be noted that BHEL will provide only reasonably leveled open space for pre-assembly yard. The contractor has to arrange desired leveling of the area at their cost. Entire Pre-assembly area to be leveled ash compacted and this is to be done by the contractor within his quoted rate. The fixtures, steel structures required for temporary supporting for pre-assembly, checking, and welding for lifting and handling during pre-assembly and erection shall be arranged by the contractor at his own cost. Steel for such work if required shall be arranged by the contractor.

57.9 All the works such as cleaning, touch up painting, checking, aligning, assembling, temporary erection for alignment, dismantling of certain equipment for checking and cleaning, surface preparation, grinding, straightening, chamfering filing, chipping, drilling, reaming, rapping, shaping, filling up etc and other works, as may be applicable in such erection works which are treated as incidental to the erection works and are necessary to complete the work satisfactorily, shall be carried out by the contractor as part of the work. All consumables including **Paints for touch up painting, as required, shall have to be supplied by the contractor at his cost.**
The painting schedule for Main Boiler will be applicable for the respective items of ESP

57.10 The contractor shall fabricate and install as part of the work , all platforms ladders , and approaches wherever required for facility of operation of equipment/instrument wherever required but not specifically shown in the drawings/bill of materials. However raw materials for the same shall be provided by BHEL.

57.11 Attachment welding of necessary seal boxes inspection windows, instrument tapping points, etc., both for regular measurement and performance testing to be provided on ESP, covered within the scope of this tender, will also be the responsibility of the contractor and the same will be done as per the instructions of BHEL Engineer. The erection and welding of all above items will be the contractor's responsibility, within their quoted rate even if:

- Product groups (PG) under which these items are released are not

covered in the scope of this tender.

- Items are supplied by an agency other than BHEL.

57.12 Fabrication of supports wherever required, shall also be carried out by the contractor without any extra cost. Any additional support if required for effective completion of work, as advised by BHEL engineer, shall be fabricated and erected by the contractor at no extra cost. However, the raw material required for such additional supports shall be supplied by BHEL.

57.13 **Approach platforms** for valves/gates/other areas for carrying out regular commissioning / O&M activities are to done by the contractor within the quoted price. In case, certain platforms are to be erected for above purpose & for which regular materials have not come from BHEL/Manufacturing Units, even then the contractor has to do it within the included scope treating it as normal scope of work without any extra payment. Any additional steel required to make such fabricated items shall be arranged by BHEL at free of cost. The contractor has to make necessary finish with painting for giving aesthetic look also. No extra payment shall be released by BHEL on this account to the vendor.

57.14 All rotating machinaries and equipment under the scope shall be cleaned, lubricated, checked for their smooth rotation if necessary by dismantling and refitting before erection. If, in the opinion of the BHEL Engineer, the equipment is to be checked for clearances, tolerances at any stage of the work or during commissioning period, facilities for dismantling, cleaning, lubricating and refitting shall be provided by the contractor. All consumables required shall be supplied by the contractor at no extra cost.

57.15 All attachment, welding, fixing hooks, supports, anchors, studs, plates, angles and other steel components to support inner roof insulation only shall have to be carried out by the contractors as specified in the drawings and as per instructions of the Engineer. welding of supports shall be done by Qualified HT welders only.

57.16 In case of any class of work for which there is no such specification as laid down in the contract, such as welding of stainless steel parts such work shall be carried out including supply of consumables in accordance with the instructions and requirements of the Engineer at no extra cost.

57.17 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 other equipment and personnel. Test certificates and periodical calibration of lifting appliances from a recognised body are to be submitted to BHEL site office, as per requirement of BHEL/ISO system. Expenditure on such works forms a part of the scope of work.

57.18 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.

57.19 The contractor shall carry out the trial run of motors including checking of the direction of rotation in the uncoupled condition, checking alignment and re-coupling

the motor to their respective driven equipment. Before starting the motor IR Value of the motor shall be recorded and if found necessary dry out operation shall be carried out by the contractor to make up the IR Value to normal, as per the advice of BHEL Engineer within the quoted rate.

57.20 Proper account of the packing wood and steel supports forming part of packing will be kept by the contractor and returned to BHEL stores from time to time.

57.21 Temporary blanking /restoration of ESP inlet / outlet and hopper flanges for commissioning , if required , has to be done by contractor free of cost. Further to above, any contingency arrangements required to carry out commissioning work is included as normal scope of work. This type of jobs include removal of temporary arrangements and restoration with the normal items on a later date is treated as normal scope of work. No additional payment shall be given by BHEL to the contractor on this account.

57.22 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.

57.23 Instrument tapping coming on the ESP to be welded/fitted by the contractor within the quoted price.

57.24 ESP collecting electrode may require straightening and repair due to minor transportation damage before erection and spot heating in position to get correct alignment. Contractor shall carry out this within his quoted rate.

57.25 Layer of insulation mattress on roof top of ESP (inner roof) shall be applied before outer roof is placed.

57.26 Fixing of deflection plates in the inlet screen sheet of ESP as per flow model report drawing. However, adjustment / re-positioning of the plates may be required to be done by the contractor during gas distribution test within the quoted rate.

57.27 All the collecting and emitting electrode suspension frames are to be checked in dimension and pitches before erection. All the readings are to be logged. Straightening of frames distorted during transportation shall be carried out by the contractor within quoted price.

57.28 Erection of electrical equipment like high voltage rectifier transformer, heating elements, rapping gear motor, cabling, glanding of control panels, C&I, etc. are included in the scope of the contractor. Filtration of the Transformer oil also need to be done by the vendor within his quoted rate and for carrying out the same, **vendor must deploy TWO 500 LPM oil filtration unit as per site requirement**

57.29 Removal of all temporary supports, foreign materials, scraps, debris etc. from inside of the ESP and other erected components and thorough cleaning to achieve clearance / IR values between collecting and emitting system shall be done by the contractor.

57.30 For all plate welding , seal welding from inside and stitch welding from other side is to be followed as per drawing.

57.31 Roof top sheeting & side cladding over ESP pent house to be done by the vendor within his quoted price. Required corrugated sheets and fixing hardwares will be supplied by BHEL under regular supply. Minor consumables like bitumen washers, putty etc. need to be arranged by the vendor within his quoted price.

57.32 Minor straightening of plates of inner / outer roof, funnels, GD screen sheets, hopper panels damaged during transportation shall be carried out by the vendor within his quoted rate.

57.33 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.

57.34 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.

57.35 All necessary certificates and licenses, permits & clearances required to carry out this work from the respective statutory / local authorities are to be arranged by the contractor at his cost in time to ensure smooth progress of work.

57.36 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.

57.37 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 the contractor** unless otherwise specified in the relevant clauses. The contractor's quoted rates should be inclusive of all such contingencies.

57.38 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. 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.

57.39 The contractor shall make all fixtures, temporary supports, steel structures required for jigs & fixtures, anchors for load and guide pulleys required for the work. However, necessary steel will be provided by BHEL free of charge from the scrap / surplus materials available at site.

57.40 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. No claim for extra payment for such work will be entertained.

57.41 **The details of equipments to be erected under this contract** is generally as per the schedule given in **Annexures – I**. 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 erection documents which will be furnished in the course of erection and the weight and quantity as per the relevant engineering documents will only be admissible for the billing purpose.

57.42 Instrumentation like pressure switches, air sets, filters, regulators, pressure gauges, dial thermometers, flow meters, valve actuators, flow indicators, centrifugal / speed switches of motors etc. which are received in assembled condition as integral part of

equipments ,shall be dismounted, calibrated and re-erected by Contractor as per requirement.

57.43 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.

57.44 Suspensions of ESP are to be tightened by Calibrated torque wrench.

57.45 During the course of erection, testing and commissioning certain rework/ modification/ rectification/ repair/ fabrication etc., will be necessary on account of feed back from various power station units already commissioned and/ or units under erection and commissioning and also on account of design discrepancies or manufacturing defects and site operation/ maintenance requirements. This will also include modifications/ re-works suggested by FES/ other inspection group etc. 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.

57.46 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 has to be completed within such planned shutdowns. This may call for working with enhanced resources and working on extended hours. Contractor's offer shall cover all such contingencies.

57.47 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.

57.48 The contractor will make his own arrangement for his communication needs at his site office or residential area/labour colony.

57.49 All T&Ps, lifting tackles and pulling devices to be deployed by the contractor must bear valid/latest test certificates for their suitability and the documents shall be preserved at site. The contractor shall ensure deployment of reliable and calibrated instrument, measuring and test equipments (IMTE). The IMTE, as required for the job, shall have valid test /calibration certificate from authorised /Govt. approved agencies. The contractor shall also keep provision of alternate arrangement for such IMTE so that the work does not suffer when a particular IMTE is sent for calibration. Re-testing / re-calibration shall also to be arranged by the contractor at their own cost at regular interval during the period of use as advised by BHEL.

57.50 The contractor shall submit a list of various tools, plants, material handling equipment etc. being provided by them, to the Construction Manager, BHEL Barh site before taking up the work in hand. The above items shall be deployed by the contractor after taking prior approval of the Construction Manager with respect to their suitability and quality. These equipments shall not be removed from site without the written permission of the Construction Manager, BHEL - Barh Site.

57.51 In event of any failure on the part of the contractor in providing necessary T&P etc BHEL may at its discretion also terminate the contract on this ground and take out any or whole amount of the contract from the scope of the contractor or impose penalty as per panal rates of BHEL. Decision of BHEL in this regard will be final and binding on the contractor.

57.52 The contractor at his own cost shall provide all consumables required for the work excepting those, specified in other clauses shall be provided by BHEL. The consumables supplied by the contractor shall be subject to prior approval of BHEL.

57.53 During the period of contract the contractor shall be responsible for keeping the entire

area allotted to him clean and free from rubbish debris etc. to entire satisfaction of BHEL. The contractor shall provide proper sanitary arrangement in the work area & office.

57.54 The contractor shall have total responsibility for all materials in his custody, and shall ensure protection of all materials from theft, fire, pilferage and any other damage and loss. The contractor shall make suitable security arrangement to ensure the above.

57.55 The contractor shall be responsible to ensure that none of the personnel move beyond the areas marked out for his operation. In case of a need for the contractor's personnel to move beyond the area marked for him, the same shall be done with a written permission of the construction manager.

57.56 Contractor shall be responsible for examining all the shipment and notify the BHEL engineer immediately of any damage, shortage, discrepancies etc. for the purpose of engineer's information only. The contractor shall submit to the engineer a report detailing all the receipts after actual receipts of consignments. However, the contractor shall be solely responsible for any shortage or damage after giving a clear receipt to railway/transport companies, and for shortages/damages during transit from material receipt /unloading point to stores/storage yard/work site.

57.57 The contractor shall maintain an accurate and exhaustive record detailing out the list of all materials/equipment received by him and keep such records both in hard copies and also in soft copies ready for the inspection of the engineer at any time.

57.58 The materials/equipment which are stored in the open or dusty location and required to be covered must be covered with suitable weatherproof and flameproof covering materials wherever applicable at any number of times at no additional cost. Such weatherproof/flameproof covering which gets worn out from uses should be replaced periodically as per instruction of BHEL Engineer at no additional cost. In no occasion, this work can be linked with preservation. All materials /Equipment shall be handled very carefully to prevent any damage/loss. No bare wire ropes/slings etc shall be used without the specific approval of BHEL.

57.59 If the materials/equipments belonging to the contractor are stored in areas other then those earmarked for him, the engineer will have the right to get it shifted to the area earmarked for the contractor at the contractor's cost.

57.60 For completion of work, the contractor may have to work in one or more shifts. He will not be eligible for any extra charges on account of this.

57.61 All the contractor's employees shall carry identification cards/gate passes while working at site.

57.57 The contractor, during execution of the work under scope, shall take utmost care in preserving the identification marks/tags as available on the materials.

57.63 Although all tools and plants of suitable capacities required for timely and safe completion of work under the specification shall be provided by the contractor at his own cost, based on contractor’s demand (depending upon load to be lifted or approach availability at site), BHEL will provide free of cost as per Annex-III (including operator as available) suitable crane on shared basis for erection & material handling. However, such requirement shall be intimated in writing by vendor suitably to the construction manager. Daily routine maintenance, monthly servicing of crane etc. of BHEL, will be under the scope of BHEL. Provision of T&Ps by BHEL shall be subject to following-

a) Actual use of T&P including marching as per entry in log-book duly certified by BHEL Engineer shall be considered for calculation of overtime charges.

b) The contractor shall be responsible for the safe and proper use of T&P issued to him. Any loss/damage to any part of the above T&P, for reason attributable to the

contractor shall be to his account. In case contractor fails to make good the loss, and expenditures on these account will be recovered from contractor's bills. BHEL's decision in this regard shall be final and binding on the contractor.

c) The contractor shall have to return the above T&Ps at the earliest in good working condition, subject to normal wear & tear.

d) T&P issued shall be used only for the designated scope of work under specification.

e) If at any time, it is noticed that contractor is not using any of the T&Ps properly according to the instruction of BHEL, BHEL will have the right to withdraw any and all such T&P and any cost due to this shall be to contractor's account.

The contractor shall also submit to BHEL for approval a list of T&P, tackle etc., prior to commencement of site activities. These tools & tackles shall not be removed from site without written permission of BHEL.

57.64 The PG wise break up is tentative as indicated under ANNEXURE-I. PGs have been indicated to have faster systems readiness. In case of dispute regarding the tonnage indicated, the decision of the BHEL Engineer with respect to scope, and keeping the work suitability, quality and time schedule will be final and binding on the contractor.

The terminal points are indicated in enclosed annexure.

Painting and insulation shall be covered in the scope of this contract.

Approx. weight to be erected for each ESP, DUCTING, STRUCTUTRES ETC. shall be 11,578MT as indicated in Annexure-I-B. 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 boiler 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 advice of BHEL Engineer and accordingly the final contract price shall be worked out on the basis of quantities actually erected at site and payments will also be regulated for the same

57.65 SUBMISSION OF PERIODICAL REPORTS

Contractor shall submit periodical reports in respect of following aspects of operation:

1) Consumption of consumables like welding electrodes, gases and paints.
2) Consumption of construction power
3) Availability and utilization of BHEL 's tools & plants
4) Availability and utilization of contractor's tools & plants
5) Daily manpower reports
6) Daily progress reports of activities & incidents
7) Test / Calibration reports
8) Records of wages , EPF payment.
9) BHEL/client may specify any other report/record as required.
10) Record of Protocol/Logsheet

57.72 STATUTORY INSPECTION OF WORK

The work to be executed under these specifications has to be offered for inspection, at appropriate stages of work to statutory authorities to comply with applicable regulations.

The work related statutory inspections, though not limited to, are as under:

Factory inspector, labour commissioner, electrical inspector PF commissioner and other authoritiy connected to this project work.

The scope includes getting the approvals from the statutory authorities, which includes arranging for inspection visits of statutory authority periodically as per BHEL engineer's instructions, submitting co-related inspection reports, documents etc. and following up the matter with them. Contractor shall also make all arrangements for offering the products / systems for inspection at location, as applicable, to the concerned authority.

It shall be contractor's responsibility to obtain approval of statutory authorities, whenever applicable, for the conducting of any work which comes under the purview of these authorities. Any cost arising from this shall be contractor's account.

58.00 ERECTION OF ESP

58.1 The details of equipments to be erected under this work are generally as per the weight schedule given in Annexure I-B**.** 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 erection documents, which will be furnished in the course of erection.

58.2 Wherever called for, pre-assembly of supporting structures, casing walls have to be done on ground.

58.3 All site welds for casing, inlet & outlet duct connections have to be kerosene tested for establishing leak proof-ness.

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

58.5 Straightness of all collecting electrodes has to be checked on ground prior to loading in to the field. Straightening of the collecting electrodes, if necessary, shall be done by the contractor within the quoted price as per instruction of BHEL engineer.

58.6 Bundle of collecting electrodes should be handled only with special fixture supplied for the purpose as regular DU.

58.7 BHEL will provide huck-bolting m/c with necessary auxiliaries free of charges. However, the contractor shall arrange electrical connections, operation etc. Vendor shall also arrange for minor maintenance of the Huck-bolting machine, including changing of some frequent worn-out spares. Required Jaws, spares and Hydraulic oil of the Machine only will be supplied by BHEL free of any charges.

58.8 Clearances as prescribed between collecting electrodes and with casing wall / emitting electrodes have to be maintained. Spot heating of collecting electrodes wherever called for, shall be done as part of work.

58.9 Erection, alignment/ fixing in final position, of high voltage rectifiers of ESP is in the scope of work.

58.10 Installation of interlocks is in the scope of work.

58.11 Complete erection, alignment, testing, pre-commissioning and commissioning etc for drive motors of collecting electrodes and emitting electrode rapping mechanism is in the scope of work.

58.12 Contractor has to fabricate and erect canopies for motors, actuators etc. as per

instruction of BHEL if the same is not indicated in the drawings. However, the contractor will be paid for this work on accepted extra work rate for ESP. BHEL will supply the material required for platforms/canopies in random lengths & sizes.

58.13 It shall be the responsibility of the contractor to provide temporary ladders on columns for initial works, if required, till permanent ladder/ stairways are completed.. Material and fabrication of temporary ladders is in the scope of contractor. All temporary ladders are to be of bolting type and no welding on to permanent members will be permitted.

58.14 Following installation jobs are also to carried out by the contractor within his quoted price.

A) Matching flanges along with all bolts, nuts, gaskets, and all the expansion joints etc. as required to be connected to the ESPs to the duct wall.

B) Flue gas inlet distribution system complete with perforated plates, turning vanes, deflector plates, flow splitters, guide vanes and all necessary gas flow control devices in the inlet and outlet cones and duct warranted by the results of flow model test, complete duct stiffening devices, interior bracings, slide plates, access doors, brackets, supporting structures, hangers, sampling connections, etc.

C) Rapping system complete with structural supporting frame, drives, and automatic rapping control, etc.

D) Ash hoppers complete with panel type heaters, level monitors and indicators, outlet flanges, jointing material, poke holes, access doors and walkways beneath the hoppers.

E) Opacity monitors complete with all accessories at the outlet of each gas stream of each ESP but upstream of the ID Fan i.e four (4) nos. per set of ESP serving one steam generator.

F) Safety devices, safety barriers, etc.

G) Monorails with electrically operated hoists on the roof for handling transformer rectifiers. Water washing system for the precipitator and hoppers along with all piping, valves and nozzles etc.

58.15 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.

58.16 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.

58.17 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.

58.18 Proper account of the packing wood and steel supports forming part of packing will be kept by the contractor and returned to BHEL / Customer designated stores /areas from time to time.

58.19 Temporary blanking of ESP inlet / outlet for commissioning , if required , has to be done by contractor free of cost.

58.20 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.

58.21 Instrument tapping coming on the ESP to be welded/fitted by the contractor within the quoted price.

58.22 Fixing of deflection plates in the inlet screen sheet of ESP as per flow model report, drawing ,to be provided by BHEL. However, adjustment / re-positioning of the plates may be required to be done by the contractor during gas distribution test within the quoted rate.

58.23 All the collecting and emitting frames are to be checked in dimension and pitches before erection. All the readings are to be logged.

58.24 Erection, testing & commissioning, trial operation and handing over of electrical equipment like high voltage rectifier transformer sets alongwith cable trays & cabling JBs(filled with non-inflammable silicon fluid having flash point higher than 300 deg centigrade),control panels complete with bus-sections, electronic controllers, grounding switches , controls ,leveling wheels etc., drive motors and actuators ,couplings and coupling guards for all rotating auxiliaries etc., heating elements, ,rapping gear motor are included in the scope of the contractor. Erection of Insulators along with heating and ventilation system for insulator compartments ,complete with fans ,heaters and necessary controls are also in the scope of the contractor.

58.25 Welding of high tensile structural steel shall be done by using certified welders, who posses requisite certificate and who are approved by BHEL Engineer/customer.

58.26 All welders shall be tested and approved by BHEL Engineer/ customer before they are actually engaged on the work even though they may posses the requisite certificates. BHEL reserves the right to reject any welder without assigning any reasons. The contractor will be responsible for the periodic renewal, re-testing of the welders as demanded by BHEL/statutory requirements.

58.27 BHEL Engineer/ customer may stop any contractor's welders from his work if his work is unsatisfactory for any technical reason or in the opinion of BHEL Engineer, will adversely affect the quality of welding. Even though the welder has earlier passed the tests it does not relieve the contractor from his contractual obligations, to check the performance of the welders.

58.28 All charges for testing of welders including destructive and non destructive tests, if conducted by BHEL or by the inspecting authority shall have to be borne by the contractor. All testing facility shall be made available by contractor.

58.29 Approved list of welding electrodes are given with the specification. It is mandatory on part of the vendor to use welding electrodes strictly in conformance of the list. For use of any alternative brand in case of necessity,, necessary written permission from BHEL / Customer need to be obtained.

58.30 Baking and holding of welding consumables shall be as per BHEL Welding Manual. Electrodes shall be baked and dried in Thermostat controlled oven before they are used in erection work, and all welders shall have a portable electrode drying oven

at the work spot.

58.31 The contractor shall also be equipped for carrying out NDT, like liquid penetrant inspection, magnetic particle inspection, etc as & when required for work within the quoted rates.

59 PRE–COMMISSIONING TESTS AND COMMISSIONING

59.1 Gas tightness test of ESP and ducts by kerosene test / soap solution test with own consumables, labour , scaffolding and other items , if any.

59.2 Gas distribution test / flow test with own consumables, labour , scaffolding and other items , if any.

59.3 Trial run of collecting rapping , emitting rapping and GD rapping mechanism as per instruction of BHEL engineer.

59.4 Checking IR value of the ESP fields.

59.5 Air load test of ESP along with all fields.

59.6 Charging of ESP with flue gas during light-up / synchronization / coal firing.

59.7 All the rapping motors, if necessary, shall be stripped open , thoroughly serviced with proper care and re-assembled before erection. During servicing if any deficiency in noticed, the same should be brought to the notice of BHEL without any delay.

59.8 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.

59.9 In case any defect is detected during tests / trial runs, 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 re-adjustment and re-alignment are necessary, the same shall be done as per BHEL Engineer's instruction. This exercise may have to be repeated as per the site requirement and shall be treated as normal scope of work within the quoted rate and no additional/extra payment shall be released by BHEL to the vendor in this account.

59.10 Contractor has to provide all categories of labourers including necessary tools, measuring instruments, consumables , supervision and other inputs as required during the entire period of commissioning of ESP till handing over.

59.11 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 any over time payment may be involved. The contractor's quoted rate shall be inclusive of all these factors also. Exclusive Commissioning engineer(s)/supervisor(s) have to be engaged by the contractor for carrying out commissioning activities round the clock during normal working days/holidays and two exclusive electricians are also required to be maintained as per the instructions of BHEL engineers .This is treated as normal scope with no extra cost.

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

59.13 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.

59.14 In case, any rework is required because of contractor's faulty erection which is noticed during commissioning, the same has to be rectified by the contractor at his cost. If during commissioning any improvement or rectification due to design requirements is involved, the same shall be paid as extra. For this purpose, daily labour report indicating therein, nature of work carried out, consumables used etc, shall be maintained by the contractor and got signed by BHEL Engineers every day.

59.15 **NA**.

59.16 Gas tightness test/ flow test of ESP and ducts by kerosene test / soap solution test with own consumables , labour , scaffoldings and other items if any.

59.17 Trial run of collecting rapping , emitting rapping and GD rapping mechanism as per instruction of BHEL Engineer.

59.18 Checking I. R . value of ESP fields.

59.19 Air load test of ESP along with all fields .

59.20 Charging of ESP with flue gas during light up / synchronization / coal gas firing.

59.21 All the rapping motors if necessary shall be stripped open thoroughly serviced with proper care and reassembled properly before erection by the contractor. During servicing if any deficiency is noticed the same should be taken up with BHEL Engineer at site without any delay.

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

59.23 All the shaft 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 vibrations 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 the recommendations of BHEL Engineer before starting.

59.24 All the bearings , gear boxes etc of the equipment and electrical motors to be erected are provided with protective grease only. Contractor shall arrange for cleaning the bearings , gears etc. with kerosene or some agent , as and when required by BHEL Engineer, by dismantling some of the parts of the equipment during erection and shall arrange for re - greasing / lubricating them with recommended lubricants ,which will be supplied by BHEL free of cost.

59.25 Lubricating oil units of the rotating machines are to be cleaned thoroughly before pouring of final lubricating oil.

59.26 The various categories of workman required for assistance in pre - commissioning, commissioning and post commissioning activities not limited but may be as follows:
Electrician .
Mill Wright fitter.
Fitters for ESP internal work .
Welders.
Riggers.
Helpers.
Supervisors.

The above group of workers may be required to work round the clock during testing & Commissioning of ESP including the rotating machines covered under this package.

59.27 In case of any defect is detected during tests/trial runs such as looseness , undue noise or vibration , strain on connected equipment etc., the contractor shall immediately attend to these defects and take necessary corrective measures. If any re-adjustment and re- alignment are necessary , the same shall be done as per BHEL Engineers instruction at no extra cost.

59.28 In case any rework is required because of contractor's faulty erection which is noticed during any stage of erection/commissioning , the same has to be rectified by the contractor at his cost . If during commissioning, any improvement or rectification due to design requirements is involved , the same shall be paid at extra rate. For this purpose , daily report indicating therein nature of work carried out , workmen deployed, consumables used etc. shall be maintained by the contractor and got signed by BHEL Engineers every day.

59.29 Roof top sheeting & side cladding over ESP pent house to be done by the vendor within his quoted price. Required corrugated sheets and fixing hardware will be supplied by BHEL under regular supply. Minor consumables / hardware like bitumen washers, putty etc. need to be arranged by the vendor within his quoted price.

60 BROAD SCOPE OF ELECTRICAL AND C&I WORKS

60.1 Scope of work involving Erection, Testing, Commissioning, Calibration and Stabilization of the Electrical package is elaborated in detail hereunder.

60.1.1 The work covered under this specification is of highly sophisticated nature, requiring the best quality of workmanship, engineering and construction management. The contractor should ensure timely completion of work. The contractor must have adequate quantity of tools, measuring instruments, calibrating equipment etc. in his possession. He must also have on his rolls adequate trained, qualified and experienced engineers, supervisory staff and skilled personnel. The manpower deployment identified by contractor should match requirement of sophistication.

60.1.2 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 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.

60.1.3 All the work shall be carried out as per the 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.

60.1.4 The services, tests and support to be provided by the agency for the work mentioned in the various sections of this tender are indicative and not exhaustive, but not limited to these for the completion of the work in all respects.

60.1.5 Contractor shall calibrate, erect, commission all the equipments, cabinets/panels, instruments and cabling etc. as per sequence prescribed by BHEL at site. The sequence of erection / commissioning methodology will be decided by the BHEL engineers depending upon the availability of materials/work fronts etc. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the methods of erection / commissioning adopted in erection / commissioning of similar jobs or for any reasons whatsoever.

60.1.6 The work to be carried out under the scope of this specification covers the complete work of arranging issue of materials, loading, handling, transporting, unloading,

preassembly, erection, calibration, testing, air flushing, pre-commissioning tests, commissioning of systems, trial run of various auxiliaries & Unit as a whole, instrumentation work during performance Guarantee test (PG test) achieving various activities till handing over of the unit to BHEL's customer, providing maintenance team to cater to guarantee responsibilities. The work shall conform to dimensions and tolerances specified in various drawings, QP that will be provided during the erection. 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 done by engaging other agencies or departmentally by BHEL and recoveries will be effected from contractor's bills towards expenditure incurred including 30% departmental charges.

60.1.7 The terminal points as decided by BHEL shall be final and binding on the contractor.

60.1.8 The technical description of the various packages is available in ANNEXURE to give general idea to tenderer about the type of equipment to be erected, calibrated, tested and commissioned.

60.1.9 During the course of erection, testing and commissioning of the electrical work of ESP Unit, certain rework/ modification/ rectification/ repairs/ fabrication etc. will be necessary on account of feed back from various thermal power stations or units already commissioned and/or units under erection and commissioning and also on account of design discrepancies and manufacturing defects and site operation/ maintenance requirements. Contractor shall carryout such rework / modification / rectification / fabrication repairs etc. promptly and expeditiously. These works shall be in the scope of this contract within the awarded price.

60.1.10 The contractor's scope of work is further described in the clauses hereafter.

60.1.11 All tools, tackles, fixtures, equipments, materials, manpower, supervisors/ engineers, consumables, Copper washers, Teflon tube, electrodes including oxygen, acetylene argon etc gases, paints etc. 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 him unless otherwise specified in the relevant clause. The contractor’s quoted rates should be inclusive of all such contingencies. Electrodes shall be baked / dried in the electrode drying oven (range 375 – 425 deg C) to the temperature and period specified by BHEL Engineer before their use. Necessary drying oven / portable oven shall be provided by the contractor at his cost.

60.1.12 The scope of work under this tender specification covers transportation, calibration, erection, testing, commissioning, Trial operation, PG test, substantial completion and stabilization. Protocols/Log sheets/As built drgs (at least 6 copies) - to be prepared by the subcontractor, all necessary stationary shall be supplied by the contractor.

60.1.13 Equipments /instruments required to be erected for this work, though not limited to but are generally as per weight schedule. For any items or class of work not specified herein but required for total completion of work, the same shall be carried out as per BHEL requirement. However the payment of these items/class of work shall be regulated on the basis of mutually agreed rate arrived at by either of the following methods, which should be done prior to undertaking the work.

60.1.13.1 Based on rate of identical/similar items in the rate schedule.

60.1.13.2 Based on the rate arrived from nearby items in the rate schedule.

60.1.13.3 Wherever any item rate for similar type of work or nearby item rate is not existing in

the rate schedule, rate will be worked out on the basis of work element or from fundamentals of estimation or existing rates in other job.

60.1.14 Contractor shall provide necessary resources for completion of such work within the stipulated time schedule. Value of such work shall be included while computing the total value of work finally executed for all contractual purposes, particularly for contract variation purpose.

61 N A

62 BRIEF DESCRIPTION OF ELECTRICAL AND C&I WORKS

62.1 **INSTALLATION OF PANELS**

62.1.1 Electrical control panels, electronic control panels, etc., are normally supplied in suit of either one/two/three or loose shipping sections with integral base frame or loose supplied. These panels may have to be installed as stand alone or in group consisting of number of panels in each row, depending upon the plant layout and foundation arrangement.

62.1.2 Installation of panel shall include fixing of base frame, fabrication of base frame if required, leveling, alignment, fixing of anti-vibration pads, removal of side covers, fixing of cubicle interconnection hardware, bus bar jointing, wiring interconnection, welding and grouting of panels and base frames, mounting of panel canopy wherever supplied as part of panel, drilling of gland plates and sealing of cable entries. In certain case where canopies are not supplied but have to be fabricated out of MS/Aluminium sheets provided by BHEL, payment will be done on weight basis, the subcontractor to indicate the rate.

62.1.3 Panels have to be shifted to their locations through floor openings, temporary openings like floor grills, door etc. which shall be part of work and no claim whatsoever will be entertained with regard to non-availability of opening as per shortest route etc. Panel have to be erected in the ESP control room etc.

62.1.4 Panel and instruments once erected in position should be properly protected using necessary care to prevent ingress of dust/moisture. This will have to be periodically cleaned and surroundings have to be kept tidy.

62.1.5 Wherever the panels to be mounted on cable trenches, channel supports have to be provided across the cable trench over which the base frame of panel shall be mounted. For such work, structural steel fabrication, installation rates shall be applicable.

62.1.6 Normally the panels shall be supplied with instrument, relay, meters, electronic modules etc. mounted and pre-wired. However, if these are supplied loose / separately for safety in transit, contractor shall mount/wire such devices and made additional openings in the panels if required as part of the panel installation work and no separate rates shall be applicable unless otherwise specially listed in the rate schedule.

62.1.7 No separate payment shall be made for replacement of any devices like electronic modules, relays, conductors, terminal block, push buttons etc. which are found defective during pre-commissioning/ post-commissioning of the panels.

62.1.8 For troubleshooting and tuning/fine tuning C&I items to match machine commissioning/ operation process, several removal, recalibration, replacements will be required. This shall be considered as normal work & no separate payments shall

be made for such rework.

62.1.9 Minor civil works like drilling, chipping, punching holes and opening in concrete floors, slabs and brick walls, grouting, related to Rack, support installation, minor civil works required for installation of control panels, Junction boxes etc., shall be included in the erection cost of such items. Also all miscellaneous civil works like chipping away and making good as necessary in floor slab/wall for cabling / earthing etc., as required are included in the scope for which no separate payment is applicable. The scope also includes supply of grouting/fixing material, if any.

62.2 **FABRICATION AND INSTALLATION OF STRUCTURAL STEEL**

62.2.1 Structural steel material like MS angles, channels, beams, flats, plates etc. shall be supplied in running meter and same shall be used for fabrication of panel base frame, cable tray supports, canopies, instrument and junction box frames, impulse pipe/instrument air pipe supports and instruments etc.

62.2.2 This shall include cutting into size, conduiting of end connections, if required, welding, grinding of excess weld deposits, drilling of holes for mounting of device/instrument, installation at location, leveling, alignment, providing bracings and painting etc. No gas cut holes will be permitted.

62.2.3 All the fabricated supports/frames shall be applied with one coat of primer red oxide paint before installation and two coat of synthetic approved quality of prescribed shade of final paint,. If required, BHEL shall prescribe time gap between first and second coat of final paint.

62.2.4 Frame installation/cable tray accessories' installation at site may involve mounting either on concrete floor by grouting/using anchor fasteners or on steel structure by welding etc. All consumables including anchor fasteners shall be arranged by the contractor.

62.2.5 In certain packages, galvanized members of junction box frames and instrument racks shall be supplied in cut to sizes and frame assemblies are required to be done as per drawing by bolting/welding. The installation rate as quoted shall include the assembling of the frames.

62.2.6 Gas cutting of tray/impulse pipe support and gas cut holes in frame shall be avoided. Only drilled hole shall be permitted in frame etc.

62.3 **LAYING OF PIPES AND TUBES (IMPULSE PIPES & INSTRUMENT AIR PIPES)**

62.3.1 Root valves are generally provided on process pipe line by other agencies. Prior to starting impulse pipe, contractor to identify the process point with respect to PIDs.

62.3.2 Installation of impulse pipe of CS/AS/SS material shall include cleaning, air flushing, cutting to length from the running meter, edge preparation, cold bending, welding of sockets /reducers/tee/cross/isolating valves/union nut and nipples/tail pieces etc., mounting of SS/CS valve manifolds and compression fittings, providing supports, clamping, conducting leak test/hydraulic pressure test and painting and other accessories as per instrument hook-up diagram. Piping works shall involve either arc or TIG welding.

62.3.3 Liquid penetration and/or Magnetic particle testing of welded joints in impulse piping will have to be done by the contractor. However, for impulse pipes in high-pressure lines (viz., Main Steam, BFP Discharge, Feedwater system, S/H and R/H Spray lines, CRH, HRH, HP/LP bypass, etc.) 10% of the weld joints are to be tested. For the low-pressure lines, 2% of the joints are to be thus tested. The contractor must arrange for necessary equipments/consumables at his own cost. All impulse line to be

hydrotested to 1.5 times the working pressure.

62.3.4 IBR certified welders shall be deployed for welding of impulse pipes, welding of thermowell and contractor shall take approval for welder and welding consumables from BHEL site engineer.

62.3.5 Laying of GI pipe for instrument air line shall include air blowing, cutting from the running meter length, threading, installation of elbows/tee/reducer /moisture traps/auto drain pot/check valves/isolating valves, supporting clamping, conducting leak test and seal welding of threaded joints.

62.3.6 Threaded joints of air line shall be made leak proof by using Teflon tapes, Copper washers or other sealing compound. All consumables shall be in the scope of contractor.

62.3.7 All fittings and accessories for impulse pipe and air line shall be provided by BHEL. Quoted rate for piping shall include cost of installation of such fittings and no separate rates are envisaged.

62.3.8 Contractor shall provide GI “U” clamps for impulse pipe and GI pipes within the quoted rates for installation of the same.

62.3.9 Impulse pipes shall be applied with one coat of primer red oxide paint and two coats of synthetic approved quality of prescribed shade of final paint. BHEL may prescribe a time gap between first coat and second coat of final paint.

62.4 CABLE TRAYS/ CABLE DUCTS

62.4.1 Various types of sheet metal, galvanised cable tray, i.e. Perforated, ladder type, seal metal duct, solid bottom tray, shall be provided in a standard length along with accessories like hardware, bends, reducers, coupler plate, tray covers and tray clamps etc.

62.4.2 Installation of cable tray/cable duct shall include cutting, laying, jointing, supporting, drilling holes in the support, providing tees/reducers/bends/clamps as per tray route layout. Fabrication of bends/tees/reducers from straight length, fixing of tray covers, welding of tray on support, cleaning and application of cold galvanising paint on weld joints including supply of paint is in the scope of contractor. Installation of tray/duct covers, wherever provided, will be done as a part of tray erection and no extra rates will be payable.

62.4.3 In case cable trays are required to be fabricated from structural steel and installed, unit rate applicable for fabrication and installation of structural steel shall be applicable in such instance.

62.4.4 Cable trays/ducts have to be routed underground in cable trench, over head on structure, valves, floors etc. for various application such as cable laying, copper tubes, conduits, thermocouple, temperature gauge capillary etc. Cables trays wherever erected shall be preferably in vertical conditions.

62.5 CABLE LAYING (POWER/ CONTROL/ INSTRUMENTATION SHIELDED/ UNSHIELDED CABLES/ PLUG-IN CABLES/ COAXIAL/ UTP/ STP/ DATA HIGHWAY, ARMOURED/ UN-ARMOURED, SINGLE/ MULTI-CORE, PVC/ HR PVC/ FRLS/ TEFLON/ XLP INSULATION)

62.5.1 Cable laying include cutting to the required length, laying in overhead/underground cable trench/through pipes/flexible conduits, dressing/clamping in tray, drilling of holes in gland plates in panels and junction box, glanding, splicing, dressing of

spliced wire inside the panel and JBs, providing PVC numerical/alphabetical / printed ferrules, termination by using crimp type copper tinned/aluminium lugs, insulated/un-insulated, termination (crimp, soldering, etc.), plug-in connections with insert type crimping, providing identification cable tags, PVC/aluminium at both the ends and at appropriate interval throughout the route length, continuity checking, insulation resistance checking, high voltage test on HT cables.

62.5.2 Entry to the panels and JBs may be at top, sides or bottom. All cables are required to be properly supported and clamped near to the JB/panel.

62.5.3 Wherever cable glanding is not possible, either due to the gland plate size limitations or more number of cable entries, prefab plug-in cables, etc., for such cases cables may have to be lifted inside the panel by either making cut-out in gland plate and providing rubber profile for sharp edge protection or alternatively, providing 4" or 6" PVC pipe coupling gland and these pipe coupling gland shall be supplied by contractor within the quoted rates.

62.5.4 **Supply of, PVC cable ties, PVC ferrules, PVC button and tapes, cable identification tag of PVC/metallic, clamping and dressing material with hardware, PVC sleeves etc. shall be supplied by the contractor within the quoted rates for cable laying. The quality of material shall be got approved from BHEL engineer prior to their use on job. Required lugs will be supplied by BHEL**

62.5.5 All care should be taken to avoid abrasion, tension, twisting, kinking, stretching of cables during installation.

62.5.6 Cable shielding – all signal cables are supplied with bare shielded copper wire/with braided wire shield. Generally shield wire is kept isolated at instrument/field device end and continuity is maintained through JBs and grounded at panel end only. While terminating the shield wire either in panel or JBs, PVC sleeves are to be used to avoid two-point earthing.

62.5.7 Wherever cables run through ducts, conduits, valves, etc., they shall be sealed using fire/weather proof compound. In addition to this, cable entry in panels, MCCs, instruments, electrical actuators etc., are also required to be sealed. The required material for doing so shall be deemed to have been included by contractor in the cable laying.

62.5.8 Many of the cable trays and cables have to be laid in cable trenches. For this purpose, the cover of the trenches have to be opened for working in site and whenever the cables are to be laid in existing cable tray, all safety precautions have to be observed. After completing the work, the trenches have to be cleaned and covers put back into position. Contractor shall also carry out de-watering from the trenches if required and arrange pumps etc., at his cost.

62.5.9 Looping wire at terminal block of panels and electrical motors/actuator as shown in the inter-connection diagrams or as required is to be done by contractor at no extra cost.

62.5.10 Contractor shall carefully plan the cutting schedule of each cable drum in consultation with site engineer such that wastage are minimised.

62.5.11 The erection contractor shall make every effort to minimize wastage during erection work. In any case, the wastage shall not exceed the following limits:

	% Wastage on issued Qty	
62.5.11.1	HT Cables	1%

62.5.11.2	LT cables above 70 mm square	1%
62.5.11.3	LT cables upto 70 mm square	2%
62.5.11.4	Control & special cables	3%
62.5.11.5	Fire survival cables	1%
62.5.11.6	Steel materials	1% by weight (for cable trays/tray support installation)

62.5.12 If the actual wastage be more than the specified figure, then equivalent price of the excess portion will be deducted from the contractor's bill.

62.6 **PUSH BUTTONS, STARTER, FUSE BOARD ETC.**

62.6.1 The above items shall require to be mounted on wall / column / floor.

62.6.2 For mounting of above items the required structural steel, like ISMC, ISA and Flat shall be supplied by BHEL free of cost. In case BHEL could not supply the same, it will be supplied by the Contractor and payment shall be made as per applicable item of Rate schedule. However, Rowl plug and necessary fixing hard-wares is to be supplied by the contractor at his cost and will be deemed to be included in the rate of erection of the item.

62.6.3 Checking of components, removal & reinstallation of internal component and re-wining, testing and commissioning shall be under the scope of the contractor.

62.6.4 Terminal Connections:

62.6.5 The types of cable terminations are as detailed below:

62.6.5.1 All field cables are crimp type of different sizes.

62.6.5.2 All JBs are both side screw type.

62.7 **FIELD INSTRUMENTATION**

62.7.1 Various type of primary/secondary indicating/recording instrument for pressure, temperature, flow, level and analytical measurement shall be supplied either loose or mounted along with the equipment.

62.7.2 Scope of work under erection/calibration/testing/commissioning shall include calibration, setting, adjustment, writing instrument tag number with paint, report making, installation, servicing, minor repairs/servicing, putting instrument into service, signal checking from field upto the functional group panels and remote indicating instrument, functional checks, interlock and protection/alarm/loop checks by simulating the field devices, providing assistance for trouble shooting during pre-commissioning/post-commissioning till system is handed over to the customer.

62.7.3 It is the responsibility of contractor to make erection, calibration/testing protocols for various measuring equipments/devices and they should get duly certified by customer/BHEL engineer and should be submitted to BHEL engineer regularly. However, sample formats will be given by BHEL and have to be printed by contractor in adequate numbers.

62.7.4 Contractor shall establish calibration laboratory with adequate facilities and they should arrange standard test instruments duly calibrated from recognized agencies and calibration report of the same to be submitted prior to start of calibration of the field instruments/devices.

62.7.5 Installation of instrument shall also include drilling of holes and tapping for mounting of instrument and local instrument frames/panels and supply of hardware for

mounting of the instrument.

62.7.6 Some devices may need removal, calibration/testing, re-fixing, adjustment, etc., and commissioning. Separate payment shall not be made for this. The rates quoted for the commissioning of these equipments should take care of the above. Also, the contractor shall remove such devices prior to erection either at site or at store to avoid damages/pilferages and keeping in safe custody and the same shall be installed prior to commissioning of such equipment.

62.7.7 It shall be the responsibility of the contractor to ensure that the calibrated instruments show correct reading while installed in the system. However, recalibration may become necessary due to reasons not attributable to the contractor, e.g. Lapse of Time after first calibration, Need for change in range/parameter, etc. If re-calibration is required due to no fault of the contractor, the rates payable for re-calibration shall be decided and certified by concerned BHEL site engineers.

62.7.8 The contractor shall keep record of such instrument with the reason for re-calibration and certified by the BHEL Engineer.

62.7.9 For the very few cases where required, the contractor shall carry out re-orientation of bottom/top entry arrangement for process connection if needed due to site condition in existing instrument rack/enclosure/JB and re-location of existing instrument including removing of the existing tubing and re-installation of the same at appropriate location due to any change in grouping of the instrument and no extra payment shall be applicable.

62.7.10 In certain cases instruments / devices are supplied on equipment or drawn by other agencies as part of mechanical package. The same are to be received or to be collected from other agencies for keeping in safe custody to avoid damages. The same are to be erected back after calibration for which unit rate shall be applicable for erection and calibration. Contractor shall maintain record of such instrument duly certified by BHEL engineer. However for removal of such instrument, no separate rate/payment shall be applicable.

62.7.11 The entire work of erection, testing, commissioning of the connected devices/equipments as listed in rate schedule is to be carried out including laying of peripherals cables (either plug-in or plugs to be fabricated at site).

62.8 FINAL PAINTING

62.8.1 **All the fabricated frames, instrument racks, Junction box frame, trays, supports, panel base frame, impulse pipes, etc., wherever applicable shall be first painted with one coat of primer paint (metal red oxide) and then two coats of approved quality paint of approved shade by BHEL Engineer after thoroughly cleaning the surface of dust, rust, scale, grease, oil, etc., by wire brushing, scrapping or any other suitable method. The quoted rates should be inclusive of all these including supply of paints and consumables.**

62.8.2 Other equipments like JBs, Panels etc., shall be painted with two coats of synthetic approved quality paint. The quoted rates should be inclusive of application of two final coats of synthetic approved quality paint. All the consumables such as wire brush, other cleaning materials, painting implements, etc., is to be arranged by the contractor at his own cost. All equipment painting will be done by spray painting.

62.8.3 All the weld joints of GI cable trays and GI structural members shall be applied with a coat of cold galvanizing zinc paint and paint shall be arranged by contractor at his

cost.

62.9 **MISC OTHER INSTRUMENT/ EQUIPMENT ERECTION, CALIBRATION AND COMMISSIONING**

62.9.1 Dimension and weight as mentioned against control panels, MCCs, etc. in the BOQ cum rate schedule are only approximate and there may be changes in dimension and weight in actual supply of the equipment and no rate variation shall be applicable on this account.

62.9.2 Wherever brief description of the system is given under various sub-heads, it is only for the understanding system requirements. It does not indicate the total specification of work. For such system, other clauses are also applicable wherein work details are specified.

62.9.3 Normally, cable glands on junction boxes side are received in mounted condition. While terminating the cables as per drawings, the cable glands are to be removed and fixed. Wherever cable glands are not received along with junction boxes, the cable glands as per the requirement will be provided by BHEL and the contractor has to make necessary holes/adjust the available holes in the JB for fixing these. No separate payment will be made for drilling of holes and fixing the cable glands to the junction boxes. Nameplates for JBs will be supplied separately. These are to be suitably written and fixed onto the JBs. Separate payment will not be made for this.

62.9.4 The push buttons and indicators in the systems are provided as loose with different type of connectors. The fixing of connectors and their wiring from push buttons to indicators shall be the responsibility of contractor. No separate payment will be made for fixing of connectors. The cable laying and termination charges will be paid as per applicable rate schedule.

62.10 **PRE-COMMISSIONING/ COMMISSIONING AND POST COMMISSIONING ACTIVITIES**

62.10.1 The work is also inclusive of assistance/coordination during various commissioning activities of the boiler and turbine package along with its auxiliaries and station package. The various activities, tests, trial runs may have to be repeated till satisfactory results are obtained and also to satisfy the requirements of customer/consultant/ statutory authorities like boiler inspector, electrical inspector etc.

62.10.2 In case any malfunctioning and/or defects are found during tests, trial runs such as loose components, undue noise or vibration, strain on connected equipments etc., the contractor shall immediately attend to these defects/ malfunctions and take necessary corrective measures. If any readjustment and realignment is necessary, the same shall be done as per BHEL engineer's instructions without any cost implication to BHEL.

62.10.3 During each stage of commissioning, if any part of the instrument needs repair/rectification/rework/replacement, the same shall be done expeditiously and promptly by the contractor. Contractor's claim, if any, for such repair/rectification/ rework/replacement etc. for reasons not attributable to contractor will be governed by clause on extra works of the special conditions of contract. The parts to be replaced shall however be provided by BHEL free of cost..

62.10.4 The pre-commissioning activities will start prior to light up of boiler and various trials, commissioning operations shall continue till the 660 MW ESP units are handed over

to customer. Simultaneous commissioning activities will be in progress in various areas, checking of equipments erected, making ready for trial runs, alkali flushing, chemical cleaning, mass flushing etc. All these works need specialised gangs including electricians/instrument mechanics in each area to render assistance to BHEL commissioning staff. Contractor shall earmark separate manpower for various commissioning activities. This manpower shall not be disturbed or diverted.

62.10.5 The mobilisation of these commissioning gangs shall be such that planned activities are taken up in time and also completed as per schedule and the work undertaken round the clock if required. It is the responsibility of contractor to discuss on day to day / weekly / monthly basis the requirement of manpower, consumables, tools and tackles with BHEL engineer and arrange for the same. If at any time the requisite manpower, consumables, T&P are not arranged then BHEL shall make alternate arrangements and necessary recoveries with overhead cost will be made from the bills of the contractor.

62.10.6 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 without any extra payment.

62.10.7 In case any rework / repair / rectification / modification / fabrication etc. is required because of contractor's faulty erection which is noticed during commissioning or at any stage, the same has to be rectified by the contractor at his cost. If 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. Claims if any, for such works from the contractor shall be governed by relevant section of Special Conditions of Contract.

62.10.8 It is the responsibility of contractor to provide for necessary labour, tools and tackles and consumables till the completion of work under these specifications even in case erection, testing and commissioning of this work is delayed due to reasons not attributable to the contractor.

62.10.9 During commissioning activities and carrying out various tests, minor items like gauges, manometers, etc., have to be temporarily erected and put in service to suit the commissioning activities. BHEL will provide the necessary gauges and equipment. Contractor has to carry out the erection, calibration, dismantling of the same. After completion of activities the temporary systems have to be removed and returned to stores. No extra charges will be payable towards these.

62.10.10 Commissioning Assistance

62.10.11 During pre-commissioning, commissioning, post commissioning and trial operation stages of various systems, certain category of manpower assistance with T&P and consumables will have to be provided to BHEL commissioning engineers exclusively at their disposal. It shall be the responsibility of the contractor to provide following category of minimum manpower assistance including necessary consumables, hand tools, calibration equipment etc. The quoted rates shall include this.

62.10.11.1 Engineer (electrical, instrumentation).

62.10.11.2 Electrician (ITI).

62.10.11.3 Instrument technician (ITI).

62.10.11.4 Helper/fitter/welder.

62.10.12 The above manpower assistance including necessary consumables are indicative only. Contractor has to augment the manpower as and when required as per work

demand and necessity at site.

62.10.13 It shall be specifically noted that above employees of the contractor may have to work round the clock and hence considerable overtime payment may be involved. No additional compensation by for the same shall be payable, irrespective of number of hours per day.

62.10.14 For electrical works, 415 volts and above, the contractor has to bring qualified electricians.

62.10.15 Calibration, Testing & Commissioning

62.10.16 Calibration, testing & commissioning activity as specified in this technical specification and rate schedule against various equipments, devices, systems etc. are broadly classified below. However, there may be some overlapping between the activities (erection, calibration and testing, commissioning.) The classification of activity is only a guideline for understanding the total volume of work in each activity. The contractor shall have no claim for performing or providing manpower assistance for such overlapping work, which is also within the scope of the work.

62.11 **Calibration**

62.11.1 Verification after drawing of material of various types, range of the field devices with respect to instrument schedule, data sheet or system document.

62.11.1.1 - Codification of instruments as per system tag numbers

62.11.1.2 - Calibration / adjustment of instrument as per system requirement / set values.

62.11.1.3 - Providing head correction in case of pressure measurement as per calculated values or actual measured value for the instrument, which are used for interlock protections / monitoring.

62.11.1.4 - Verification of installation of instruments for range, type, tag number as per physical location of process point as per process, instrumentation diagram.

62.11.1.5 - Checking and ensuring the proper function of instrument.

62.11.1.6 - All the recorders shall be made functional with proper chart movement and ink marking.

62.11.2 Site testing shall be required for all electrical equipment installed by contractor to ensure proper installations, setting, connection and functioning in accordance with drawings, specification, manufacturer's recommendations and approved quality plan for installation, testing & commissioning.

62.11.3 The contractor shall take full responsibility for satisfactory testing, pre-commissioning, commissioning and trial run of the connected equipment under overall guidance of BHEL and shall locate any cause of malfunction and shall make the necessary minor wiring changes or cable connections to obtain the intended operation. Testing shall also include any additional tests which the engineer deems necessary because of site conditions to determine that equipment, material and system meets requirement of the specification. The following are some of the major site tests. Checking shall be done on all circuits & modules and not as a typical checking in sample basis.

62.11.4 For commissioning of Relays of various panels, as required, services of OEM (Original Equipment Manufacturer) is to be arranged by the contractor at his own cost.

62.11.5 For commissioning of any other system, if required, services of OEM (Original Equipment Manufacturer) shall be arranged by BHEL free of cost.

62.11.6 The contractor shall deploy special commissioning manpower for commissioning of the Equipments / Systems under the scope of this contract. The contractor will be responsible for mobilizing all T&P etc. as required for successful commissioning of the Equipments / Systems under the scope of this contract and shall carry out all necessary pre-commissioning and commissioning checks / tests. Contractor shall obtain prior approval on such agency from BHEL site before deployment. No separate amount will be paid for such deployment. The quoted rate shall be deemed to be inclusive of this cost.

62.11.7 The contractor has to provide manpower for commissioning viz. Engineer/ Supervisor having experience in commissioning of the Electrical Equipments / Systems under the scope of this contract.

62.12 **Erection**

62.12.1 Issue and drawal of material from store, verification, inspection as per shipping list, drawings and documents.

62.12.2 Preservation, up keeping, safe custody of the erected equipments till handing over to the customer.

62.12.3 Verification of installation as per drawing and document for the correctness of cabling, JBs, impulse pipe, various field device, panels, instruments etc.

62.12.4 Continuity check and IR value check of cables.

62.12.5 Verification of correction of cable termination with respect to instrument, electrical hook-up diagram, panel interconnection diagram, JB schedule.

62.12.6 Checking earthing of the equipments and cable shield wire continuity.

62.12.7 Energizing the functional group control panels and field devices.

62.12.8 All cable glands/piping/tubing to be fixed as per installation requirement before commissioning.

62.13 **Checks after erection : checks shall be carried out not limited to following details.**

62.13.1 **PANELS**

62.13.1.1 Arrangement of various shipping sections as per GA drawings.

62.13.1.2 Front, rear side and top clearances

62.13.1.3 Proper positioning of ends of main bus bars in adjoining sections.

62.13.1.4 Tightness of bus bars joints between adjoining sections and its shrouding.

62.13.1.5 Alignment of panels

62.13.1.6 Welding of base channels to embedded plates / bolting with foundation bolts.

62.13.1.7 Adequacy of supporting channels 3rd its arrangement.

62.13.1.8 Free closing and opening of door, tight closing of door.

62.13.1.9 Free movement of drawout modules and proper alignment of fixed and moving contacts, including terminals.

62.13.2 **PUSH BUTTON STATION / LOCAL STARTERS**

62.13.2.1 General arrangement of fixing

62.13.2.2 Tightness of nuts & bolts

62.13.2.3 Tightness of door closing

62.13.2.4	Mechanical operation of push button switches
62.13.3	**General Checks on switchboards, transfer panels & push button stations.**
62.13.3.1	Check of control wiring
62.13.3.2	General check for cleanliness inside the switch board.
62.13.3.3	Operation of mechanical parts of relays, switches, push buttons etc.
62.13.3.4	IR check of power & control circuits.
62.13.3.5	Verification of switch development.
62.13.3.6	Alignment of contracts with vertical busbars and contact pressure
62.13.3.7	Verification of components like fuse, links and their ratings etc.
62.13.3.8	Connection to earthing points
62.13.4	**Special checks for motor starter panels**
62.13.4.1	Primary / secondary injection test for bimetal / other relays.
62.13.4.2	Verification of operation of control circuit in selected starter modules of different categories.
62.13.4.3	Operation of panel space heaters / thermostats.
62.13.5	**Special check for busduct**
62.13.5.1	Cleanliness of busbar, supports etc.
62.13.5.2	Earth & insulation resistance
62.13.5.3	Measurement of contact resistance
62.13.5.4	HV test.
62.13.6	**Testing, Commissioning & Trial Operation**
62.13.6.1	Power cable connection for tightness & phase sequence test
62.13.6.2	Energisation by closing I/C breaker
62.13.6.3	Control circuit operation of each starter module
62.13.6.4	Verification of timer settings
62.13.6.5	Verification of bus transfer & auto re-closing.
62.13.6.6	Energisation of power circuit of each module & operating motors on no load Checking operation from local push button station, and remote (CR), with and without all interlocks.
62.13.6.7	Motor IR value measurement, bearing/winding RTD checking, drying out of motor, providing assistance for trial run of motor which includes monitoring temperature rise winding/bearing during trial run.
62.13.6.8	Contractor shall prepare calibration/testing report/protocols.
62.13.6.9	During trial run of various systems, if the performance of any instrument is found erratic, un-satisfactory and requires re-adjustment, re-calibration etc., the defect shall be attended by contractor.
62.13.6.10	Observing and checking the performance of the various devices on load/process variation. Any deficiencies/defect noticed during the variable load conditions, the same should be attended properly.
62.13.6.11	Observe the proper functioning of sub-group/sub-loop control.
62.13.6.12	Check the operation of various control in manual/auto mode for smooth functioning.
62.13.6.13	Clearing of all bad / invalid signals noticed during commissioning.

62.13.6.14 Providing necessary assistance for Trial Operation of the unit is in scope of this specification. Trial Operation shall be considered successful on completion of operation of the respective units for a continuous period of 720 hours at maximum available load. Out of this period, 72 hours shall be at full rated load of the unit. Smooth operation and availability of all instrument/controls of the systems installed under the scope herein, shall be ensured by the contractor. Contractor shall provide adequate number of skilled manpower and T&P for this purpose. Interruption in Trial Operation for reasons attributable to the Contractor shall result in re-start of the Trial Operation all over again, consequential extension in Time Schedule / Contract Period shall be to the contractor's account.

62.13.6.15 If any small wiring correction or minor modification in control panel wiring is noticed during the commissioning, it shall be carried out as a part of commissioning activity.

62.13.7 **Post-commissioning.**

62.13.7.1 Contractor shall rectify the defect observed/informed by customer during the trial run.

62.13.7.2 Contractor shall submit the as- built drawing as per guidelines and instruction of BHEL engineer.

62.13.7.3 After trial run/handing over of the equipment, if due to unforeseen reasons, certain works crop up, the contractor shall provide all the assistance.

62.13.8 PG Test Assistance

62.13.8.1 For PG test assistance, laying of impulse pipes, cables, etc. and installation of instrument tapping points shall be done by the contractor. These activities may be carried out at any point of time before or after Completion of Facilities. Payments will be made as per item rates of comparable similar or identical items in the rate schedule. Such temporary installations shall have to be dismantled after the completion of PG Test for which no separate payment is admissible.

62.13.8.2 The list of above tests to be carried out by the contractor is not exhaustive and they may have to carry out separate tests which may be necessary for satisfactory completion of the job, at no extra cost.

62.14 **GUIDELINES FOR ERECTION**

62.14.1 Electrical cabling /wiring: All the cables will be properly laid in cable trays, dressed and clamped with aluminium flats. The cable will be terminated at both ends with suitable lugs and printed ferrules and will be glanded properly. Suitable equipment and consumables for ferrule printing has to be arranged by the contractor at his own cost. For cable identification, the contractor shall provide at his cost aluminium tags at regular intervals through one run of the cable.

62.14.2 All electrical connections shall be tested for polarity and proper connections.

62.14.3 Insulation test of the various circuits shall be done.

62.14.4 The checking of operation of individual equipment and instruments to which the cabling/wiring connected shall also be done by the contractor.

62.14.5 Wherever supplied, GI cable trays shall be of bolted construction only with fixing screws and coupler plates.

62.14.6 To the extent possible, all the trays shall be fixed in vertical orientation

62.14.7 Sharp bends of cable trays shall be avoided in all type of cable trays.

62.14.8 Installation of cable racks and supports structure shall be carried out in all the

required areas. Steel embedments shall be provided in the cable trenches, ceiling slabs and concrete blocks for installing the cable racks and support structures.

62.14.8.1 Ladder perforated type able trays shall be used in cable trenches and vertical risers.

62.14.8.2 Perforated cable trays shall be used in higher elevations in boiler and TG area.

62.14.9 Cable racks in the trenches and control room are to be shared with other contractors installing cables in different areas wherever required. Contractor shall cooperate with the other contractors in sharing the cable trays and proper dressing and clamping the cables.

62.14.10 Where power and control cables are to be laid in the same route, suitable barriers to segregate them physically shall be employed.

62.14.11 Space equal to the diameter of cable shall be provided between power cables of six over 50 mm in diameter.

62.14.12 When cables pass through floors, walls etc., it shall be passed through a pipe for mechanical protection and the pipe ends sealed suitably.

62.14.13 Care shall be taken to avoid short bending and kinking of conductor damaging insulation and stressing the cable beyond pulling force recommended by the manufacturer. Cable shall be protected at all times from mechanical damage.

62.14.14 The minimum radius of formed bend of an insulated cable shall be 12d for un-armoured cables and 15d for armoured cables where ‘d’ is the overall diameter of the cables.

62.14.15 No cable shall be laid in ducts or trenches where other services such as oil pipes, steam or water pipes are laid.

62.14.16 Where cabling passes through brickwork or concrete work, the contractor shall provide suitable local protection against mechanical damage wherever necessary.

62.14.17 The lay out of all cables shall be arranged to give adequate clearance from other services and cables shall be routed to avoid hot zones.

62.14.18 Jointing of cables shall be avoided as far as practicable. However, jointing if at all necessary shall be done by crimping type cable joints after getting approval of BHEL engineer.

62.14.19 The cable schedules indicating cable sizes, tentative cables routing information will be furnished by BHEL at site to the contractor during execution.

62.14.20 Earthing installations: All instruments/panels, cable trays, JBs etc. are to be earthed as per standard Earthing procedures/practices.

62.14.21 All equipments shall be earthed by two separate and distinct connections. Earthing terminals will be available in all equipment supplied by BHEL.

62.14.22 The earthing conductors shall be of mild steel/GI strip/ wires. All connections from equipment to main earthing conductors shall be made as illustrated in earthing drawing. A copy of earthing drawing shall be provided to the contractor at site during execution.

62.14.23 A continuous earthing conductor shall be installed in all cable trays and securely clamped to each tray section by suitable connectors to form a continuous earthing system. When two or more trays supporting power cables run in parallel, a continuous earthing conductor shall be provided on trays only with tap offs to the control cable trays. All rapping motors will be earthed to this conductor.

62.14.24 All joints in the earthing system shall be welded type. Earthing connections to all equipments including motors shall be bolted type.

62.14.25 Earthing connections shall be free from tinning scale paint, approved quality, grease, rust or dirt at the time of making joint.

62.14.26 Metallic sheaths, screens/shields and armour of all multicore cables shall be bonded and earthed.

62.14.27 Earthing conductors along their run on columns, beams, walls etc. shall be supported by suitable cleats at intervals of 750 mm.

62.14.28 Welded joints on GI earthing conductors shall be coated with one coat of bituminous paint in case of buried earth grid or earth flats to be laid in cable trench. For site welded GI strips/wires which are exposed these are required to be painted with one coat of cold galvanizing zinc paint. Contractor to arrange the required paint and other items at his cost.

62.15 GUIDELINES FOR HANDLING AND STORAGE OF ELECTRONIC CUBICLES/ SUBASSEMBLIES/ LOOSE ITEMS

62.15.1 Immediately after unloading at site, the electronic equipment should be kept in a covered area. Handling and lifting of package should be done without jerks or impacts. Packing case should not be dropped or slided along the floor under any circumstances. Suitable forklift should be used to move the case to its final position. All above points are to be strictly followed as electronic equipments may get damaged due to vibration and shock.

62.15.2 After unloading at site, the package of the equipment shall be inspected for external damage. In case the package is damaged, package number and details of damage should be noted. The details of damage should be reported to concerned site engineer.

62.15.3 Cases should be opened/unpacked using correct nail pullers. While opening the planks, care should be taken to see that equipment inside is not damaged. Cases should not be unpacked in areas where they are exposed to rain, water/liquid splashing, dust or other harmful materials like chlorine gas, sulphur dioxide etc.

62.15.4 After opening the case, all supports provided for transport are to be removed with due care.

62.15.5 Hinged frames should not be opened when equipment is not secured to floor as this is likely to cause it to topple over. The hinged frame can be opened only if the equipment is still fixed on to bottom wooden pallet.

62.16 STORAGE

62.16.1 The equipment should be preferably in its original package and should not be unpacked until it is absolutely necessary for its installation or advised by BHEL engineer. The equipment should be best protected in its cases. It should be arranged away from walls.

62.16.2 The wooden pallet provided for packing itself can be retained for raised platform to protect equipment from ground damps, sinking into around and All the equipments, materials and goods kept in the store room should be identified and registered in a book. Inspection report should be recorded. Any discrepancy observed should be communicated to site engineer.

62.16.3 The packing material shall be retained if the cubicle is to be repacked after inspection.

62.17 SUB-ASSEMBLIES

62.17.1 All subassemblies should be kept in a separate place where it is easily accessible.

62.17.2 Subassemblies should have a protective cover in case it is stored without wooden packing/case to prevent accumulation of dust. Silica gel packets should also be kept along with it.

62.17.3 Subassemblies should not be stacked one above the other.

62.18 LOOSE ITEMS

62.18.1 The loose items supplied for the main equipment falls into various categories like tools, cables, prefabricated cables, console inserts, recorders, VDU/CRT, other display units, printers, sensors and transducers, cable glands, cable ducts, frames, racks, etc. These are to be categorized and stored separately.

62.18.2 Guidelines for handling of electronic modules

62.18.3 All the modules shall be handled by qualified persons only.

62.18.4 Electronic modules should only be touched when it is absolutely essential to do so.

62.18.5 Before touching any electronic module, the operator should discharge the static electricity by earthing himself or better still, ensure constant discharge by wearing an earthed wrist strap.

62.18.6 The operator should not wear clothing made entirely from synthetic fibres, but a mixture containing at least 65% cotton.

62.18.7 The PCB should always be held by front panel or by module frame and electronic components / connectors should never be touched.

62.18.8 The electronic modules should not be placed close to television sets or CRT units.

62.18.9 Soldering irons and any other tools used must be grounded.

62.18.10 All modules using CMOS components are packed in antistatic bags when transported loose to avoid ESD failures. The antistatic bags must always be used to transport modules at site from one place to the other.

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SPECIAL CONDITIONS OF CONTRACT FOR PIPING

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SECTION - VI

SPECIAL CONDITIONS OF CONTRACT FOR PIPING

69.0 SCOPE OF WORK

69.1 The scope of work under this tender for **Unit 7 of** 500MW sets ETC of Boiler, Power Cycle and LP piping package broadly -but not limited to -consists of:

01. Collection of Materials from BHEL Store/yards/other designated places and transportation to erection site/ Floor, their preservation, safe keeping, watch and ward.

02. Checking, dressing, chipping and leveling of foundations, De-watering, Pre-assembly, erection, anchoring, alignment of various equipment, machining and grouting, wrapping, coating wherever applicable.

03. Welding, heat treatment, radiography (including supply of radioactive sources) and other non-destructive tests, heat treatment, hydraulic testing, during chemical cleaning/ flushing, steam blowing dismantling, re-erection etc wherever required

04. Pre- commissioning checks/ tests and commissioning and handing over of all items/ equipment in scope.

05. Erection and dismantling of all temporary piping, valves, etc during above operations, other commissioning activities including post commissioning, handing over and all assistance during PG test.

06. Grouting, painting, along with supply of required materials, machineries and other resources as required to carry out the job.

07. Insulation of all equipments as per requirement.

08. Arranging statutory co-ordination for IBR related activities.

09. Chemical cleaning (as applicable), oil flushing, steam blowing and associated testing plus related activities of different system and normalization.

10 Arrangement of fixing of steam blowing and hydro-test blanks and restoration.

11 Handing Over of the System to Client

12. Preparation of MIRs, drawings, following of safety and quality norms and documentation, preparation of material status and up-gradation of activities, networks at regular intervals.

69.3 Major equipment to be installed, tested and commissioned under this specification is given in Annexure I-C. However, changes in design may occur as is usual in any such large scale work for which no compensation will be payable and contractor shall complete the entire work as detailed in tender specifications within finally accepted rates/ prices.

NOTES:-

a) All the above systems of piping include the erection of pipes, bends, elbows, valves, fittings, impulse piping up to and including first root valve(s), sampling lines, drains, hangers and supports and other accessories so as to make the system complete in all respects.

b) Above systems of piping can be regrouped/ renamed or any addition or deletion in the system can be made in order to make system complete as per requirement. No extra claim shall be entertained on this account.

c) The equipment and piping systems indicated above are only major items and does not cover all the equipment/ piping system to be erected/ commissioned. Contractors are however, required to erect/ commission within the price quoted by them, all connected equipment/ system shown in manufacturer's drawings/ other documents which may be necessary for erection completion and overall commissioning of set under scope of this tender.

d) 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.

e) Carrying out piping as per the specification between equipment constituting terminal points, whether the terminal equipments fall with in the scope of work/ specification or not, 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 need correction by suitably resorting to heat correction or other method as instructed by BHEL Engineer, the same need to be done by the contractor within the quoted rate.

f) 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 and equipments erected by the contractor is completely covered in the scope of work.

69.3.1 ADDITIONAL PLATFORM/ STRUCTURES

Additional platforms, structures and approaches wherever required by the engineer to facilitate operation are to be fabricated and installed.

69.3.2 INSULATION

All 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 aluminum cladding.

69.4 Approx. weight of major components has been indicated in Annexure I

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

All insulation and Piping supporting systems / structure of PCP will be paid as per Sl No 5 and 4 respectively of the Rate Schedule.

69.5 (SPECIAL PROCESS)

For Piping Systems, P91 materials is envisaged for PGMA 80-300, 80-301, 80-303, 80-304, 310, 311 and 312. Special care is essential for carrying out the installation of this system and strict quality norms and welding procedure will have to be followed at site. The Contractor and their staff are advised to get familiarized/ trained with th1s work process/ procedure. In addition to the general clauses for Welding, HT and NDT given under clause 42 of this tender, the following clauses will be applicable. This welding is to be carried out strictly under the supervision of BHEL Engineer and all repairs etc will be carried out as per the laid out procedure.

The details mentioned hereunder comprise of the major requirements for the process. The Contractor has to provide all services and consumables required for completion of the work.

Erection, welding, heat treatment and NDE works or as specified by the BHEL during execution of PIPING OF P91 MATERIAL and for the combination of materials like P-22 with P-91, or other combinations of alloy steels shall be the part of contract. Some of the salient details in regards to P91 material are being indicated in the clauses mentioned below however the erection, welding and NDT process are to be done as per the procedure/ specifications to be furnished by BHEL/ as per the instructions by site engineer.

69.5.1 Prior to erection, supplied pipes shall be inspected thoroughly and if any defect like crack, lamination, and deposit noticed, the same shall be confirmed by Liquid Penetrant Inspection (LPI). If confirmed, it shall be referred to BHEL.

69.5.2 Cutting of P-91 material shall be done by bandsaw/ hacksaw/ machining/ grinding only.

69.5.3 Edge preparation shall be done only by machining/ by chamfering machine. In extreme cases, edge can be prepared by grinding with prior approval of BHEL.

69.5.4 During edge preparation care should be taken to avoid excessive pressure to prevent heating up of the pipe edges.

69.5.5 All edge preparation done at site shall be checked by Liquid Penetration Test. Weld built-up on edge preparation is prohibited.

69.5.6 The pipe fit-up for welds shall be carried out properly, as per drawing specifications, by using temporary pipe clamps arranged by the contractor to ensure proper alignment and root gap. Use of site manufactured clamps for fit-up is acceptable. Neither tack welds nor bridge piece shall be used to secure alignment. Partial root weld of minimum 20mm length by GTAW may be allowed with the prior permission of BHEL engineers.

69.5.7 Suitable reference punch marks shall be made on both the pipes (at about 200 mm from the EP) at least on four axis to facilitate U. T on weld joint.

69.5.8 Provide Enclosure for Welding area suitable for guarding against cold draught, water and dust at all welding locations.

69.5.9 No pre-heating is required for **fixing Thermocouples** (of Ni-Cr/ Ni – Al of 0.5 mm gauge size) **with resistance spot welding**.

69.5.10 Argon gas to be used both for purging as well as shielding shall be of 99.99 purity levels conforming to IS 5760-1998. Dry Argon gas with requisite quality shall be used for purging the root side of weld. The gas flow rate to be maintained during purging is 10 to 25 liters/ minute and for shielding during GTAW is 8 to 14 liters/ minute

69.5.11 The purging dam (blank) shall be fixed on either side of the weld bevel prior to Pre-heating. The dam shall be fixed inside the pipe and it shall be located away from the heating zone. Purging is to be done for root welding (GTAW) followed by two filler passes of SMAW in case of butt welds.

69.5.12 Wherever possible, solid purging gas chambers are to be used which can be removed after welding. If not possible, only water-soluble paper is to be used.

69.5.13 NA

69.5.14 Purging is not required in case of nozzle and attachment welds, when they are not full penetration joints.

69.5.15 Start purging from inside of pipe when root temperature reaches 220 deg. Centigrade. Provide continuous and adequate Argon gas to ensure complete purging in the root area. The minimum preflushing time for purging before start of welding shall be 5 minutes, irrespective of the pipe size.

69.5.16 Preheating: Prior to start of pre-heating ensure that surfaces are clean and free from grease, oil and dirt. Pre-heating temperature shall be maintained at 220 deg. Centigrade by using induction heating. The temperature shall be ensured by using a calibrated autographic recorder and two calibrated thermocouples fixed at 0 and 180 degree positions on both pipes 50 mm away from the edge. The thermocouples shall

be welded with spot welding machine. The pre-heating arrangement shall be inspected and approved by BHEL engineer. Alternate arrangements shall be made during power failure. Two numbers additional square thermocouple are to be fixed for emergency use. Gas burners shall be employed to maintain the temperature until the power resumes.

69.5.17 Welding: Root welding shall be done using GTAW process (as per WPS) five minutes after the start of Argon purging. Filler wires shall be clean and free from rust or oil. Argon purging shall be continued minimum two filler passes of SMAW.

69.5.18 Post Weld Heat Treatment: Heating shall be done by Induction heating only as per the procedure/ specifications provided by the BHEL engineers. Generally the PWHT temperatures for P-91 with P- 91 material shall be 760 + 10 Deg. C and the soaking time shall be 2.5 minutes per mm of weld thickness, subject to a minimum of two hours. The rate of Heating/ Cooling is to be strictly maintained.

69.5.19 The PWHT temperature shall not deviate from the values specified in the chart range since any deviations to the specified holding temperature range, will adversely affect the mechanical properties of the weldment and may lead to rejection of the weldment. The weld joints should be kept dry. Under no circumstances any water/ liquid is allowed to come in contact with weld as well as preheated portion of the pipe

69.5.20 The recording of time and temperature shall be continuously monitored with a calibrated recorder right from pre-heating. This shall be ensured at every one hour by site-authorized personnel.

69.5.21 The width of the thermal insulation beyond the heating band shall be at least two times the heating bandwidth on either side of the weldment.

69.5.22 All equipment like recorder, thermocouple, oven, thermostat etc. should have valid calibration carried at BHEL approved labs. The calibrated reports should be reviewed and accepted by calibration In-charge at site prior to use.

69.5.23 Same procedures of welding and heat treatments shall be followed for the weld joints repairs. The NDE shall be conducted for the entire weld joint.

69.5.24 All the NDE i.e. LPI, MPI, UT and hardness shall be performed on the weld joints as per the standards/ specifications/ direction of BHEL. The maximum allowable hardness at weld and parent metal shall be 300 HV10. Joints having hardness above 300 HV shall be re-heat treated and hardness shall be checked again.

69.5.25 Welders qualified as per ASME Section – IX and IBR on P-91 material shall only be engaged for the welding of P91 materials. Welders shall have to undergo all the training for above. The welders shall have to be tested and qualified by BHEL site. Contractor shall arrange for the same and entire expenditure towards this shall be borne by the Contractor.

69.5.26 **Contractor shall deploy exclusive Engineers and Supervisors who will be responsible for the completion of all activities from weld fit-up to final clearance of weld joints after satisfactory NDE and acceptance by BHEL/**

Customer/ IBR.

69.5.27 No interruption is allowed during preheating, welding and PWHT. Hence all equipment for the purpose of power supply, welding, heating etc. hence all alternative arrangements, (gas burner arrangement for maintaining temperature etc.) shall be arranged by the contractor within the normal scope of this contract. All the preventions/ procedures to be ensured to avoid abruption to on going heating/ cooling process. Before start of erection, welding and heat treatment process for P 91 materials all the associated persons shall acquire complete knowledge on the subject from BHEL site engineers to avoid metallurgical failures.

69.5.28 The Induction heating equipment shall be drawn from BHEL stores, transported, installed and commissioned wherever required at site. For routine and breakdown maintenance, Contractor shall have to deploy sufficient Manpower, Tools & Plants within his quoted rate. The contractor shall provide electrical cables and switches required. All the equipment shall be protected by providing covers or sheds at site by the contractor within the quoted rate. Any loss/ damage of equipment/ tools by the contractor shall be recovered from the contractor.

69.5.29 All the consumables to carry out the work for the P91 materials required for welding and heating process like gas burner arrangement, all gases, purging dams, blanks, welding electrodes, filler wires, etc. except those consumables supplied by BHEL units, if any, shall be in the scope of contractor. Thermocouples, compensating cables, insulating materials, glass fibre cord, ceramic filter blanket, ceramic filter rope for P91 material welding, filler wire for root welding and electrodes for site joints for P91 material welding shall be supplied by BHEL.

69.5.30 DG set for backup power supply, provided by BHEL is to be operated by the contractor bi-weekly/ as specified by the supplier to ensure its healthiness during excegencies of power failure for heating processes of P91 materials on account of power failures. Cables and switches, required fuels, operator and other consumables & its operations and maintenance shall be in the scope of contractor within the awarded value. Please also see clause 69.5.27.

69.5.31 The contractor shall arrange welding Machine for Demagnetizing material along with cable and Residual Field Indicator.

69.6 For carrying out the installation , the following items are being provided by BHEL free of cost:

a) Induction Heating Machine with Outgoing Cables

b) Suitable Power BackUp (DG Set)

c) Spot welding Machine for Fixing of Thermocouples

d) Calibrated Thermocouples

e) Calibrated temperature Recorder

f) Contact Type calibrated temperature Gauge.

The following will have to be provided by the Contractor:

a) Qualified operator for Induction Machine and DG Set

b) All cables for connecting Induction Machine and DG Set to Main Supply along with Changeover System.

c) UT Testing and Hardness testing Equipment

d) Welder Qualified as per ASME IX and IBR for P91 Materials . Site Welder Qualification tests will be conducted also .

e) Exclusive Trained Welding Engineer for Supervising P91 Welding and Heat Treatment

f) Qualified NDE Engineer (Level -II) and welding Supervisor (Level-I)

g) Required GTAW and SMAW machines

h) Welding Machine for Demagnetizing along with cable and Residual Field Indicator

i) Providing Enclosure for Welding area suitable for guarding against cold draught, water and dust at all welding locations .

j) Providing of all electrodes and fillers for the welding

k) Providing of Argon purging for the welding operation (incuding supply of consumables eg Water Soluble Paper / Aluminiun Dam arrangement.)

l) Providing of Heating by Gas Burner as Standby Arrangement.

m) Providing of Baking ovens and portable ovens

n) Providing Band Saw/ hacksaw/ Grinder for Cutting with tools.

o) Providing machining for Edge preparation

p) Providing of LPI and MPI Facility as specified in the Welding process, including supply of all consumables.

q) Providing and applying insulation band as specified in the welding procedure.

The above comprise of the major requirements for the process . The Contractor has to provide all services and consumables for completion of the work.

SECTION - VI

SPECIAL CONDITIONS OF CONTRACT - COMMON

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70 HEALTH, SAFETY & ENVIRONMENT MANAGEMENT AND SOCIAL ACCOUNTABILITY.

70.1 The contractor will be responsible for **Health, Safety & Environment management at site** for the construction activities to be carried out by them in accordance with requirements given under section I (a) of GCC.

Some of the common safety rules to be followed during working are as follows**: -**

- No outsider is allowed to enter construction area without permission.
- No body is allowed to enter at construction site without Safety Shoe.
- Never enter work area without Safety helmet & chin strap in place.
- No climbing/working allowed without proper safety belt above 2 m. height.
- Do not exceed the speed limit 25 Kmph within premises.
- No debris obstacles allowed on the roads & passages.
- All accidents/incidents to be reported to site Incharge.
- Do not walk on pipelines or false ceiling.
- Maintain good Housekeeping at work site.
- No photography/ Videography allowed without permission
- Risk factor in construction is approximately 3 times the manufacturing sector.
- 48% of the workforce is drawn from rural background. They lack technical perspective & relevant industrial common sense. Safety awareness to be developed among these workers employed by Sub-contractors.
- Infrastructure to be developed for carrying out jobs properly in a safe manner.
- All Site supervisors & engineers (including subcontractor's) must be imparted structured training on construction safety before start of the job & record to be maintained.
- Availability of qualified & trained Site Engineer at site during all working hours.
- Site Safety training to be imparted to all workers & plan to be made to cover every worker.
- Tools box talk (5-15 minutes) by supervisor prior to commencement of any job.
- All accident / incidents (Near Miss) to be reported & investigated.(formats & procedure should be finalized)
- Daily Safety Checking by Each Site Engineer along with Safety engineer.
- Weekly co-ordination meeting of all Safety engineers with BHEL safety officer.
- Monthly safety meeting with Site In-charges.
- Reports: Weekly/monthly/annual SHE report format should be finalized.
- All Safety equipment must be ISI marked & checked by Safety officer before use.
- Tag system for erection & use of scaffoldings.
- Bamboo/wooden Scaffolding material not allowed.
- LPG cylinders not allowed for gas cutting.
- Good House keeping. Separate waste bins to be used for flammable &

non-flammable material.

- Safety awareness programs for workers by display of boards, posters, competitions, talks etc.
- Deployment of Safety Supervisors for every 250 workers and part there of at work site.
- Display of List of First Aid trained persons.
- Testing certificates for lifting tools & tackle.
- Provision & maintenance of fire extinguishers at construction site & material stores.
- Display of emergency telephone numbers at various locations.
- For work in confined space use 24 V lamp fitting & use tools with air motors or electric tools with max. 24 V.
- For confined space entry Gas test must be done before & at regular intervals.
- Checking & tag of equipment like grinding machine, welding machine, gas cutting set etc. by supervisors before use.

Further, the contractor is required to provide proper Safety Net System wherever the hazard of fall from height is present as per instructions of BHEL Engineer at site. The safety net shall be fire resistant, duly tested and shall be of ISI mark and the nets shall be located as per site requirement to arrest or to reduce the consequences of a possible fall of persons working at different heights.

70.2 Contractor shall make necessary arrangements to ensure that the atmosphere in working area (under the scope of work in this tender) and on roads is free from particulate matter like dust, sand etc. by keeping the top surface wet for ease in breathing. Provision of required tanker with spraying arrangement has to be ensured by contractor within the quoted rates, at no extra cost to BHEL

Contractor shall ensure following:

1. Contractor has to maintain contact with local hospital having scanning & other ultra modern medical facilities required during emergency including Ambulance.
2. Contractor has to ensure pre employment medical check for all staff & workers.
3. Contractor has to ensure that adequate First Aid facilities with trained nurse & ambulance are available at work site for emergency purpose. This emergency set-up should include, but not limited to, following

- Male nurse (in shifts)
- Oxygen set up
- Breathing apparatus
- Eye wash facility
- Stretcher
- Trauma blanket
- Medicines.

The contractor against this contract is required to arrange and maintain ambulance at site for entire contract period. The above emergency facility set up including ambulance, male nurse etc. will be shared by BHEL and its other contractors working at this project at no extra cost to BHEL and its sub-

contractors. In case, under unavoidable circumstances, if the ambulance is not available / being used elsewhere , the contractor will have to arrange for the same as under clause 70.2.1

70.3 The contractor shall comply with following towards Social Accountability;

(a) The contractor shall not employ any employee less than 15 years of age in pursuant to ILO convention. If any child labour were found to have been engaged , the Contractor shall be levied with expenses of bearing his education expenditure which will include stipend to substantiate appropriate education or employ any other member of family enabling to bear the child education expenditure.

(b) The contractor shall not engage Forced/Bonded Labour and shall abide by abolition of Bonded Labour System(Abolition) Act, 1976.

(c) The contractor shall maintain Health & safety requirement as stipulated in the Contract and Contract Labour(Regulation & Abolition) Act,1970.

(d) The Contractor shall abide by UN convention w.r.t Human Rights and shall be liable for Discrimation/Corporal punishment for failure in meeting with relevant requirements.

(e) The Contractor shall abide the requirement of Contract Labour(Regulation & Abolition) Act,1970 for working hours.

(f) The Contractor shall abide by the Statutory requirement of Minimum Wages Act 1708, payment of Wages Act 1936.

(g) The Contractor shall arrange potable drinking water to its employees & workers.

70.4 Contractor shall make necessary arrangements to ensure following:

1. **Contractor shall ensure deployment of qualified level-2 Engineers for NDT services at site.**
2. **Contractor shall ensure deployment of Qualified & Experienced Safety Engineers / Officers at site.**
3. Contractor shall ensure that all the **T & Ps deployed** by them, including cranes, (Indicative lists of **T&Ps and IMTEs** to be arranged by the contractor are given as per Annexure-III) **are regularly certified by approved testing agency** & the relevant certificates to this effect are to be given to BHEL for records.

It may be noted that **non-compliance to the above three conditions** will result in **penal action** as may be decided by the competent authority of BHEL**.**

70.5 The Contractor shall be fully responsible for accidents caused due to him or his agents or workmen's negligence or carelessness in regard to the observance of the safety requirements and shall be liable to pay compensation for injuries. It may be noted that non-compliance to HSE requirements will result in penal action. **In case of violations of safety requirements, the Contractor shall be liable for a penalty of Rs. 200/- for the first violation and Rs. 500/- for the subsequent violations. For serious lapses, as decided by BHEL Engineer, fines upto Rs. 5000/- at a time can be**

imposed.

The amount towards penalties as above will be deducted from running bills of the Contractor. The amount so collected above will be utilized for supporting the safety activities at site. The decision of BHEL on above will be final and binding on the Contractor.

71.0 FACILITIES TO BE PROVIDED BY BHEL/ CONTRACTOR

71.1 BHEL shall provide limited open space for office and store/ workshop at site free of rental charge. It is the responsibility of the contractor to construct sheds, provide / distribute all utilities like electricity, drinking water etc., as a part of his scope of work within the accepted rates. Electricity for office and workshop will be provided on free of cost basis at one point as decided by BHEL. Further distribution will have to be made by the contractor at their own cost. . Meter for electricity will have to be provided by the Contractor at his own cost. **The Contractor will have to arrange for construction at his cost .**

71.2 BHEL shall provide limited open space for labour colony near the plant free of rental charge. Contractor shall be responsible for providing all necessary facilities like residential accommodation, transport, electricity, water, medical facilities etc. as required under various labour laws and statutory rules and regulations framed there under to the personnel employed by him.

Electricity will be provided at one point on chargeable basis Meter for electricity will have to be provided by the Contractor at his own cost. . **Water for labour colony will be provided free of cost at one point and has to be distributed by the Contractor at his own cost**

71.3 On completion of work or as and when required by BHEL, all the temporary buildings, structures etc. shall be dismantled and leveled 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, it will be got done at his risk and cost, and expanses incurred shall be re-covered from the contractor along with prevailing overhead. The decision of BHEL Engineer in this regard shall be final.

71.4 Electricity source (415/ 440 V) for utilizing **construction power** will be provided free of charge at a single point (approximately 750 Mtr near to the construction site of boiler) from where contractor shall make arrangement for drawl of power including power cable, suitable power distribution boards and further distribution conforming to the standards and requirements including maintenance of the distribution lines at his own cost to use construction power. The contractor shall submit to the Engineer his electrical power requirements.

Any other voltage if required shall be arranged by the contractor from power supply as above. All wiring must comply with local regulations and will be subject to Engineer's inspection and approval before connecting supply. Contractor will have to provide necessary calibrated meters (tamper proof, suitably housed in a weather proof box with lock & key arrangement) at each point of power supply along with calibration certificate from authorised / accredited agency for working out the power consumption at his own cost. In case of re-calibration required for any reason the necessary charges including replacement by calibrated meters is to be borne by the contractor. Supply of electricity shall be governed by Indian Electricity Act and Installation Rules and other Rules and Regulation as applicable.

NOTE:

- They will however ensure that there is no wastage. Periodical audits will be held to ensure that these resources are being optimally used. For this the contractor has to provide an energy meter at his end.
- In case any wastage is observed BHEL reserves the right to recover any charges / penalty as deemed fit.
- Contractor will have to provide proper insulated cables for power distribution and joints, if any, will be done with proper jointing kits.

71.5 Required energy meter, all cables, fuses, power distribution boards, switches, switchboards, bus bars, earthing arrangements, protection devices e.g. ELCB, if any, and any other installation as specified by statutory authority, client in this regard, for drawl of construction power shall be arranged by the contractor. Obtaining approvals, payment of necessary fees, duties etc towards the clearance of such installations, prior to these being put to use or as may be specified, shall be the responsibility of the contractor.

Electricity for construction power and light will be provided by near boiler, ESP and A/B row. Contractor shall arrange further distribution of power for construction purposes.

71.6 BHEL shall provide and maintain all general station illumination at site. Till such time such arrangements are made, the contractor at his cost should arrange for temporary lighting in and around his work area. However adequate lighting facilities such as flood lamps, hand lamps and area lighting shall be arranged by the contractor at the site of construction, contractor's material storage area etc. within finally accepted rates.

71.7 BHEL will not be responsible for any loss or damage to the contractor’s equipment as a result of variation in voltage or frequency or interruptions in power supply. The contractor should ensure that the work in critical areas are not held up in the event of power break-down and for the same he should have suitable standby arrangement at his cost. In the event of breakdown in the electric supply, if the progress of work is hampered, it will be the responsibility of the Contractor to step up the progress of work after restoration of electric supply so that overall progress of work is not affected.

71.8 Provision of distribution lines of both electrical power and water from the central points to the required place with proper distribution boards observing the safety rules laid down by the electrical authorities of the state shall be done by the contractor, supplying all the materials like cables, distribution board, switch boards, TPN, CBS, ELCBS/ MCCBS/ Copper / Brass clamps, copper conductor, change over switches pipes and calibrated energy meter etc. If any failure is caused in supply of the power and water, it is the responsibility of the contractor to make alternate arrangements at his own cost. Contractor shall be adequately equipped to arrange standby diesel welding generators in the event of construction power failure. Essential welding jobs shall not be stopped on account of main construction power failure. The contractor shall adjust his working shifts / hours accordingly and deploy additional manpower if necessary so as to achieve the targets.

71.9 The contractor while drawing construction power supply from Distribution Board should strictly adhere to following points.

a) All electrical installations should be as per Indian Electricity rules.

b) All distribution Boards installed by the contractor should be constructed with fireproof

materials viz. Steel frames, Bakelite sheets etc.

c) Connection for single phase should be taken from phase and neutral. Nowhere the connection should be taken with earth as neutral.

d) Contractors have to make their own arrangement for their equipment/ DB earthing

e) All electrical connections should be made through connectors, nuts and bolts, switches, plug and sockets. Loose connections or hooking up of wires shall not be permitted.

f) All electrical equipment / tools and plants should be properly earthed. DBs to be earthed diagonally opposite at two points.

g) Contractor should use "MCCB" and "ELCB" either on incoming or outgoing connections to the DBs.

h) Contractor should ensure that all the CBs / TPNs/ Fuses/ MCCB / ELCB cables etc. should be of adequate rating/ capacity.

For permission of supply connections contractor has to submit a test report of their installations with a single line diagram of connected/ proposed loads.

71.10 ELCB will be tested once in a week or as directed by BHEL by actually simulating the earth leakage for all installations and the same shall be recorded in the logbook to be maintained by the contractor.

71.11 In case of power cuts / load shedding no compensation for idle labour or extension of time for completion of work will be given to contractor. BHEL shall not be responsible for any inconvenience or delay caused due to any interruption of power supply and no compensation for delay in work can be claimed by the contractor due to such non-supply on the grounds of idle labour, machinery or any other grounds.

71.12 Deleted

71.13 On completion of work or as and when required by BHEL, all the temporary buildings, structures, pipe lines, cables etc shall be dismantled and leveled 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 Engineer will get it done and expanses incurred shall be recovered from the contractor along with prevailing overheads. The decision of BHEL Engineer in this regard shall be final.

71.14 In case of non-availability of customer supplied power and / or water, it is the responsibility of the contractor to make alternative arrangements. Contractor shall be adequately equipped to arrange standby diesel welding generators in the event of construction power failure to complete Essential welding jobs .

71.15 BHEL shall provide required 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.

71.16 Compressed air required for construction purposes shall be arranged by Contractor. However, compressed air required for the instrumentation, start-up and plant operation purposes shall be provided by the owner as per the requirement and specifications indicated by the contractor

71.17 **The contractor under this contract shall also provide free of cost services of skilled persons for a total period of 240 Man-months exclusively for use by BHEL. This**

manpower will be required for following services

- **Qualified computer operators for office work. (48 man months)**
- **Clerks / Skilled workers for working in store, office and colony. (72 man-months)**
- **Unskilled workers for working in store, office and colony. (120 man-months)**

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

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

71.18 The scope of work will also include providing free of cost services of qualified Supervisors for direct supervision of various works covered under this tender specification or other than the scope covered under this tender as decided by BHEL. These qualified supervisors shall be provided for 60 (SIXTY) man-months as per site conditions. The supervisors shall possess a minimum qualification of a mechanical / electrical engineering degree/ diploma. They shall be deployed in all areas covered under various specifications as well as other related areas as may be deemed essential based upon work requirements, though not specified. They shall be guided by BHEL Engineers to ensure smooth work progress as and when /where required /deployed. No separate payment shall be paid for providing the services as per this clause. The contractor shall provide these free of cost services within the quoted rates as per Rate Schedule.

In case contractor fails to provide above-mentioned man-power as desired by BHEL, the latter shall have right to hire such services from other agencies at the risk and cost of the contractor. However, if BHEL does not utilize the man-months as per above provision, fully or partly, recovery at the rate of Rs. 20,000/- against each engineer's man-months will be made from the final bill of the contractor.

71.19 Contractor should install a PC ALONG WITH MODEM to connect with our server (LAN) AT SITE

72.0 TIME SCHEDULE

72.1 The contractor is required **to commence the work within 15 days from the date of issue of letter of intent** unless BHEL decides to fix any other later date.

72.2 Entire scope of work of erection, testing, commissioning etc. as detailed in tender specification **shall be completed within 24 months** from the scheduled date of start of work as per the programs / milestones indicated by BHEL from time to time. Contractor has to mobilise adequate resources to meet BHEL's commitments to their customer as indicated from time to time. **In case due to reasons not attributable to the contractor, the work**

gets delayed and additional manpower / resources have to be mobilized so as to expedite the work to meet various milestones, same shall be done within the quoted rates as per Rate Schedule, at no extra cost to BHEL.

72.3 The various mile stone dates to be achieved, for BOILER # 7 as per the current status of contract are as below:

MILE STONES	MONTH
Start of Erection	As Mentioned in 72.1
Drum lifting	5th Month
Boiler Hydro Test (drainable)	14th Month
Boiler Hydro Test (non-drainable)	16th Month
Boiler Light up	17th Month
EDTA cleaning completion & restoration	18th Month
Steam Blowing completion	19th Month
Safety Valve Floating	19th Month
Synchronisation & Coal Firing	19th Month
Trial operation	21th Month
Handing over	23th Month

72.4 The work under the scope of this contract is deemed to be completed in all respects, only when the contractor has discharged all the responsibilities laid down in the contract. The decision of BHEL on completion date shall be final and binding on the contractor.

73.0 OVER RUN

73.1 In case due to reasons not attributable to the contractor, the work gets delayed and the scheduled completion gets extended, the contractor shall not be entitled for any over run compensation for a period of first **3 (Three) months** after the contractual completion date. In case the scheduled completion time gets **extended beyond 3 (Three) months** as stated above, the contractor shall be considered for payment of fixed over run charges, @ **Rs.2,00,000/- per month (Rupees Two Lacs only)** for entire scope of work on receipt of advance notice intending to claim over run and on fulfillment of following conditions:-

(a) The reasons for delay in completion of work are not attributable to contractor but however subject to the provisions of clause – 31.

(b) Contractor achieves the targets fixed during the over run period.

However, the over run charges shall be limited to 10% of the contract value.

73.2 Once the claim of over run charges is admitted no other compensation whatsoever (like for delays in receipt of materials, availability of fronts etc.) will be entertained.

73.3 The contractor shall maintain sufficient workforce (both skilled and unskilled) and other resources required for completion of the job expeditiously for the entire contractual period including total extended period.

74.0 TERMS OF PAYMENT

74.1 The 'Engineer' will certify regarding the actual work executed in the measurement books and bills, which shall be accepted by the contractor in measurement book.

74.2 Contractor shall submit bills for the work completed under the specification, once in a month

detailing work done during the month. The format for billing shall be approved by BHEL before raising invoices.

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

ADVANCE PAYMENT

1. **5%** of the contract value shall be paid as interest bearing advance against submission of a Bank Guarantee as per BHEL format given at Annexure – **IX** of this NIT for an amount equal to 1.25 times of advance valid for **12 months** initially and thereafter extension for a period upto which the advance is fully adjusted. The interest chargeable shall be Prime Lending Rate of State Bank of India plus 2%.

2. The advance paid along with interest shall be recovered from the contractor's progressive bills to an extent of **10%** of each progressive bill amount along with interest charges till it is fully recovered. The BG amount shall be allowed to be reduced every six months by an amount equal to the amount adjusted against running bills.

3. The BG shall be returned after full adjustment of the entire amount of advance along with interest.

I.A PROGRESSIVE PAYMENT ON PRO-RATA BASIS FOR MAIN BOILER

I-AA **2 X 0.25 % of the contract value** on start of pre assembly work by deploying at least one numbers of 75 T crane, one number of 18/20 T crane, one number of 14/20 MT Hydra and one no. of 20/30 T trailor in working condition at site for Boiler and ESP area respectively .

I-AB **2 X 0.25 % of the contract value** on erection of first column of BOILER and on start of erection work of ESP column respectively after checking its trueness on certification by BHEL Engineer.

I.AC **An amount limited to 1.00 % of the contract value shall be payable in one or more installments,** solely at the discretion of Construction Manager/ BHEL at different stages of the contract execution to facilitate resource augmentation or to meet any exigency of work. In case of its non utilization 'OR' its part utilization, the entire/balance payment against this category shall be released along with commissioning of respective boiler (coal firing).

I.AD PROGRESSIVE PAYMENT ON PRO-RATA BASIS (80% of unit rates)

(**Applicable for installation of all items of Boiler , ESP except Insulation work for Sl. No. 1 , 2 ,4 of Rate Schedule**)

1 15% of the applicable contract unit rate on pro-rata basis on completion of pre assembly wherever required and 15 % of the applicable contract unit rate on pro-rata basis on placement in position and rough alignment.

OR

30% of the applicable contract unit rate on pro-rata basis on placement in position and rough alignment for the items where pre-assembly is not involved.

2 50% of the applicable contract unit rate on pro-rata basis on completion of final alignment / fastening / welding / grouting along with proper supports including radiography / NDT / stress relieving wherever involved.

I.AE PROGRESSIVE PAYMENT ON PRO-RATA BASIS (80 % of unit rates)

(Applicable for INSULATION AND REFRACTORY work of BOILER AND PCP for sl. No. 1 , 2 , 5 of Rate Schedule)

1 65% of the applicable contract unit rate on fabrication/fixing of retainers, lagging & stitching of mattresses and welding of retainers, fixing of casing supports, fabrication, beading, sealing, bitumen painting, installation and screw fixing of cladding & completion of all jobs as per specifications. The above work includes transportation of required material on location and its proper protection

2 15% of the applicable contract unit rate payable on system completion and area cleaning.

I.AF PROGRESSIVE PAYMENT on pro-rata basis

(80 % of unit rates)

Applicable for Piping work of Main Boiler for Sl. No. 1 , 3 of Rate Schedule

1 30 % of the item rate will be paid on transportation, pre-assembly, placement as per layout and rough alignment.

2 40 % of the item rate will be paid on completion of alignment, fastening, welding & proper supporting of piping.

3 8 % of the item rate will be paid on completion of NDT, Stress Relieving & other quality checks.

4 02 % of the item rate will be paid Setting of Hangers .

NOTE: BHEL site in charge, at his discretion can split / re-group above payment schedule, to facilitate site operations in exceptional cases.

I AG MILESTONE PAYMENTS - Main Boiler (5 % of CV)

1 2 x 0.35 % of CV on successful completion of drainable and nondrainable hydro test of the boiler respectively .

2 0.5 % of CV on successful completion of air and gas tightness test of furnace / APH and ducts required for Boiler Light Up.

3 0.5 % of CV on successful completion of boiler light up.

4 0.3 % of CV on successful completion of trial run of ID, FD & PA fans

5 0.3 % of CV on successful completion and commissioning of hoists and handling equipment for FD/ID/PA/MILLS

6 0.7 % of CV on successful completion of trial run of milling system

7 0.5 % of CV value on successful completion of steam blowing and SVF.

8 1.5 % of CV on coal firing operation.

II AH MILESTONE PAYMENTS FOR ESP (3.6 % of CV)

1 4 x 0.15 % of CV on successful completion of mechanical work of each pass of ESP

2 4 x 0.15 % of CV on successful completion of electrical work of each pass of ESP

3 4 x 0.15 % of CV on successful completion of Gas tightness test of each pass ESP.

4 4 x 0.15 % of CV on successful completion of Gas distribution test of each pass ESP

5 4 x 0.15 % of CV on successful completion of Commissioning of rapping system.

6 4 x 0.15 % of CV value on successful completion of Charging of all fields of each ESP & Completion of Commissioning.

II AI MILESTONE PAYMENTS FOR POWER CYCLE PIPING (1.4 % of CV)

1 0.7 % of CV on successful completion of Alkali Flushing / Chemical Cleaning and Normalisation

2 0.7 % of CV on successful completion of Steam Blowing and Normalisation

I AJ Providing and applying PAINTING-Payment on Prorata basis

2.0 % of CV for boiler, auxiliaries including APPLICABLE piping systems.

1.5 % of CV for ESP And Associated Ducting

0.5 % of CV for PC Piping systems.

I AK 1.5 % of Main Boiler Amount will be payable on handing over of the boiler to BHEL's Customer or 3 months after contractor has discharged his responsibilities as stipulated in this contract, whichever is earlier, if delay in handing over is not attributable to contractor. The boiler shall be considered as handed over on completion of trial operation.

I AL The balance 2.5% CV shall be payable on completion of all pending work, rework wherever required, area cleaning, reconciliation of materials, fulfillment of contractual obligations, and on submission and passing of Final Bill.

NOTE:

Payments at I AK & I AL shall be released after adjustment of the CV based on actual work carried out

ANNEXURE - I

WEIGHT SCHEDULE

AA: SUMMARY OF WEIGHTS

Approximate weight to be erected for each boiler:

a) Boiler Unit – 1 Package : 23760 MT
b) ESP PACKAGE : 11578MT
c) PIPING PACKAGE : 2138 MT

ANNEXURE – I-A

BB: Product Group (PG) Wise Weight Schedule For BOILER

SL NO.	PG	Description	Wt (MT)
1	**4**	BOILER DRUM WITH INTERNALS	**244**
2	**5**	WATER WALL HEADERS	**192**
3	**6**	WATER WALL PANELS	**593**
4	**7**	CIRCULATION SYSTEM e.g. DOWNCOMER & RISER TUBES AND HANGERS & SUSPENSION	**325**
5	**8**	BUCKSTAYS & FURNACE GUIDES	**654**
6	**9**	SEAL BOXES FOR FURNACE OPENING & INSTRUMENT INSERTS	**12**
7	**10**	SUPER HEATER HEADERS	**183**
8	**11**	SUPER HEATER COILS	**885**
9	**12**	SH SPACER TUBES, SAT. LINKS, DESH & DESH LINKS, SH HANGERS & SUPPORTS	**432**
10	**15**	REHEATER HEADERS	**53**
11	**16**	REHEATER COILS	**311**
12	**17**	REHEATER LINKS & SUSPENSIONS	**96**
13	**18**	FURNACE ROOF SKIN CASING	**21**
14	**19**	ECONOMISER COILS, HEADERS & PIPES	**889**
15	**20**	SOOT BLOWERS	**78**
16	**21**	SOOT BLOWING STEAM PIPING	**29**
17	**24**	BOILER TRIM PIPING, SAFETY VALVES, SILENCERS, NAME PLATES ETC.	**333**
18	**28**	FURNACE DOORS & FASTENERS	**13**
19	**30**	MAIN BOILER ENCL.	**189**
20	**31**	SKIN CASING & COMPONENTS	**16**
21	**32**	FIXING COMPONENTS FOR INSULATION	**185**
22	**33**	INSULATION	**1080**
23	**35**	MAIN BOILER STRUCTURES	**4806**
24	**36**	BOILER MAIN FLOORS, STAIRS & LADDERS ETC.	**3441**
25	**37**	BOILER OUTER CASING COMPONENTS	**73**

SL NO.	PG	Description	Wt (MT)
26	**38**	INTERCONNECTING STRUCTURES & PLATFORMS	**696**
27	**39**	COLUMNS & FRAMES FOR DUCTING, FAN HANDLING STRUCTURES ETC. **(UPTO BOF INCLD HANDLING STR)**	**502**
28	**41**	OIL & GAS BURNERS, IGNITORS ETC.	**4**
29	**42**	OIL SYSTEM PIPINGS	**92**
30	**43**	IGNITOR, SCANNER & SEAL AIR SYSTEM	**84**
31	**45**	COAL BURNERS	**154**
32	**47**	PULVERISED FUEL PIPING & SUPPORTS	**500**
33	**48**	AIR DUCTS, FLUE GAS DUCTS, DAMPERS, EXPN. JOINTS, DUCT SUPPORTS ETC. **(UPTO BOF)**	**1623**
34	**50, 52**	SCAPH, ROTARY REGEN. AIR HEATER	**2168**
35	**55, 56**	PA, FD, ID, SEAL AIR AND PENT HOUSE FANS	**421**
36		MOTORS (PA, FD, ID, MILLS, SA, SC ETC.)	**182**
37	**57**	GATES AND DAMPERS	**510**
38	**61**	COAL MILLS & SUB-DELIVERIES INCLUDING ACCESSORIES ETC	**1200**
39	**65**	COAL FEEDERS	**54**
40	**67**	MILL PLANT AUXILIARIES	**84**
41	**80**	PIPING AND INSULN	**100**
44	**81**	TANKS, VESSELS, EXPANDERS, INSLN, GAUGES ETC.	**132**
45	**99**	MISC. HANDLING EQUIPMENT	**121**
		TOTAL	**23760**

ANNEXURE – I-B

PGMA	DESCRIPTION OF PG FOR ESP AND ASSOCIATED DUCTING	DESIGN WEIGHT (MT)
79	**ESP AS PER ANNEXURE BELOW**	9196
89	GALLERIES & RAILS **PER ANNEXURE BELOW**	140
39	COLUMNS & STRUCTURES **(BEYOND BOF INCLD HANDLING STR)**	923
48	DUCTS & DAMPERS **(BEYOND BOF)**	1319
	TOTAL	11578

Sl No	PGMA	DESCRIPTION	TOTAL WT in Kgs. (Tentative)
1	79701	ROLL/SLIDE SUPPORTS	40000
2	79705	ESP-SUB-DELIVERY COM	1000
3	79706	INSULATOR HOUSING AS	58000
4	79708	GAS DIST. ASSY	85000
5	79709	GD-RAPPING MECHANISM	12154.2
6	79710	GD_DRIVE ARRANGEMENT	852.408
7	79711	GAS SCREEN-EP	67000
8	79713	EMIT SYST SUSPENSION	21786.96
9	79714	SUPPORT INSULATORS	9600
10	79715	EMITTING ELECTRODES	38746.4
11	79716	EMIT ELECT RAPP MECH	50000
12	79717	DRIVE ARGT. FOR EMIT	41000
13	79719	COL ELEC SUSPENSION	173000
14	79720	COLLECTING ELECTRODE	880356.376
15	79721	EMIT SYS FRAME-TOP	144500
16	79722	EMIT SYS FRAME BOTOM	217000
17	79723	INSPECTION DOORS	23769.944
18	79724	SHOCK BARS	153719.101

19	79725	COLL ELECT RAPP MECH	124000
20	79726	COLL ELEC RAPP DRIVE	8524.08
21	79728	ESP ROOF PANELS	200000
22	79730	ELECTRICAL SD COMPTS	18425.6
23	79731	GEARED MOTORS FOR RA	23922
24	79732	EMIT SYS FRAME-MIDLE	316000
25	79737	JUNCTION BOX & PUSH	2268
26	79742	OUTER ROOF-EP	282000
27	79743	HOPPER RIDGES	94000
28	79744	HOPPER UPPER PART	422000
29	79745	HOP MLD&LOWER PART	403000
30	79746	INSULATOR SUPP PANEL	111000
31	79747	ROOF PANEL ASSY	176000
32	79748	CASING STRUCTURE	426000
33	79749	CASING SHELL/PANEL	720000
Sl No	**PGMA**	**DESCRIPTION**	**TOTAL WT in Kgs. (Tentative)**
34	79750	INLET-OUTLET FUNNEL	165000
35	79755	PENT HOUSE FOR E P	275000
36	79757	SPLITTER&GUIDE VANES	28000
37	79759	CONTROL ROOM-INSERTS	150000
38	79760	CABLE-CABLE RACKS	281000
39	79761	EP PERF TEST EQUIPT	985.376
40	79762	EARTHING,CABLE TRAYS	105000
41	79763	ASH LEVEL INDICATOR	2424.64
42	79765	APP PLATFORM-HOPPER	250000
43	79766	WATER WASHING SYSTEM	4500
44	79767	MIN WOOL FOR ESP INS	390000
45	79768	FIXING COMP. FOR ESP	325000
46	79772	INTERLOCKS-EP	2396
47	79773	ELECTRICALLY OPERTD	6000
48	79774	OPACITY MONITOR & AC	1000
49	79777	LT SWITCH BOARD/ESP	35000
50	79778	BAPCON & ACCESSORIES	1000
51	79780	FOUNDATION MATLS FOR	25000
52	79781	SUPPOTING STRUCTURES	845000
53	79790	HEATING ELEMENTS	4884

54	79791	PANEL TYPE HOPPER HE	34000
55	79792	AUXILIARY CONTROL PA	40000
56	79793	RAPPER CONTROL PANEL	2400
57	79794	STATCON PANEL	1200
58	79795	IOS PANEL	300
59	79820	COLLECTING ELECTRODE	875398.8
60	79988	COMMISSIONING SPARES	500
61	79996	TOOLS & TACKLES	200
62	89610	EP GALLERIES&STAIRS	126000
63	89611	ESP ROOF HANDRAILS	14000

ANNEXURE – I -C

WEIGHT SCHEDULE FOR POWER CYCLE PIPING SYSTEM

Sl No	PGMA	Description	WEIGHT (KGS)	TYPE
1	80-301	MS FROM BOILER STOP VALVE TO ESV	114,000	P 91
2	80-303	MS HEADER TO AUX PRDS	15,000	
3	80-304	MS HEADER TO HPBP VALVE	24,000	P 91
4	80-307	HP AND LP BYPASS WARM UP	1,700	P 91
5	80-310	HRH FROM REHEATER TO INTERCEPTOR VALVE	300,000	P 91
6	80-311	HRH FROM INTERCEPTOR VALVE TO TURBINE	20,000	
7	80-312	LPBP VALVE UPSTREAM AND DOWNSTREAM	109,000	
8	80-320	CRH FROM TURBINE TO REHEATER	129,000	
9	80-321	HPBP VALVE TO CRH PIPING	12,000	
10	80-322	CRH PIPING TO DEAERATING HEATER	11,000	
11	80-340	AUX STEAM HEADER	5,600	
13	80-345	AUX STEAM TO DEAERATING HEATER	6,800	
14	80-362	EXHAUST STEAM FROM PRIME MOVERS-SG SCOPE	20,000	
15	80-373	AUX STEAM HEADER SV EXHAUST	6,400	
16	80-424	BFD BETWEEN HTRS AND GROUP PROTECTION	47,000	
17	80-425	BFD FROM FINAL HPH TO SG TP	119,000	
18	80-430	SPRAY WATER TO HPBP	5,200	
19	80-432	SPRAY WATER TO BOILER DESH UPTO SG TP	19,000	
20	80-433	SPRAY WATER FROM BFP INTERSTAGE	4,200	
21	80-452	HP PIPING DRAINS - SG SCOPE	24,000	
22	80-453	LP PIPING DRAINS - SG SCOPE	8,400	
23	80-811	H AND S FOR BOILER FEED DISCHARGE PPG LU	20,000	
Sl No	**PGMA**	**Description**	**WEIGHT (KGS)**	**TYPE**

24	80-812	H AND S FOR AUXILIARY STEAM PIPING FOR L	28,000	
25	80-830	H AND S FOR CRITICAL PIPING - STEAM LINE	130,000	
26	80-840	AUX STR FOR MAIN STEAM PIPING FOR SB	311,000	
27	80-871	H AND S OF MISCELLANEOUS PIPING FOR SYN	35,000	
28	80-300	Main stm Ppng from SH outlet to Stop Val	32,000	
29	80-342	Aux Steam To Scaph	13,448	
30	80-343	Aux Steam To Sootblowers	2,076	
31	80-344	Aux.Steam To F.O.Pump House/Tank Heati	4,000	
32	80-351	Aux Steam To Unlisted Users-Sg Scope	15,402	
33	80-352	Aux Steam To Unlisted Users-Tg Scope	1,926	
34	80-355	Steam Tracing Line Of Hfo	3,000	
35	80-364	Cbd Tank Vent To System	2,720	
36	80-365	Cbd Tank Vent/Sv Exhaust To Atmosphere	836	
37	80-366	Ibd Tank Vent To Atmosphere	11,383	
38	80-368	Scaph Drain Tank Vent/Sv Exhaust To At	2,206	
39	80-395	Aux Steam To Fo Atomising	1,108	
40	80-399	Steam blowing piping - temporary	61,000	
41	80-418	Ecection Materials For Instruments	231	
42	80-450	Cbd And Emergency Drum Drain	1,912	
43	80-451	Boiler Integral Piping Drains	13,886	
44	80-453	Lp Piping Drains-Sg Scope	4,816	
45	80-454	Scaph Drains	6,217	
46	80-455	Drain From Ulisted Eqpt/Vessel-Sg Scop	3,423	
47	80-460	Sg Aux Cooling Water Unit System	45,124	
48	80-471	Boiler Wash Water To & From Unit	11,249	
49	80-477	Service Water	3,042	
Sl No	**PGMA**	**Description**	**WEIGHT (KGS)**	**TYPE**

50	80-480	Fire Water-Other Areas	10,973	
51	80-600	Hp Dozing	1,103	
52	80-604	Acid cleaning Piping - Temporary	50,000	
53	80-612	Service Air For Unit	12,029	
54	80-616	Inst Air For Unit	10,494	
55	80-650	Heavy Fuel Oil Main Lines	10,000	
56	80-800	Hangers and supports of Main steam pipin	8,200	
57	80-812	Hangers & Supports - Aux.Steam Ppg,Lu	22,440	
58	80-816	H&S of Acid Cleaning Piping	8,000	
59	80-820	Aux.Structure-Drains & Vents,Lu	32,667	
60	80-901	Sd Valves&Specialities-Boiler Lightup	8,485	
61	80-917	BHEL val-Acid Cleaning Alkali flus -Temp	5,500	
62	80-918	BHEL val-Temporary piping for SB	5,200	
63	80-927	H&S for Temp piping - Steam blowing	9,000	
64	80-992	Imported Electrodes	164	
65	81-325	Mineral Wool Mattress-External Piping	47,186	
66	81-341	Sealing Compound-External Piping	510	
67	81-350	Aluminium Sheet-External Piping	24,999	
			2,138,574	
68		Insulation of Piping (PEM Supply)	250,000	
70		Valves etc of Piping (PEM Supply)	50,000	

NOTE:

a) Above details are only to give a general idea to the contractor to quote the rates in the Rate schedule. Besides PGs indicated above, there is likelihood of addition/ deletion of PGs for release of some items integral to Boiler. Contractor is required to carryout such PGs also within their applicable tonnage rate. The decision of BHEL regarding deletion of existing PG or inclusion of new / additional PG in boiler will be final & binding on the contractor. Certain items like insulation material, cladding, valves etc. may supplied by other suppliers / BHEL units like PEM etc. as per PGMA applicable for Boiler system by other units e.g PEM etc.. Such items are also to be erected as per tonnage rates & as directed by BHEL. No extra claim shall be entertained on t6his account.

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

c) All insulation and Piping supporting systems / structure of PCP will be paid as per Sl No 5 and 4 respectively of the Rate Schedule

d) Above system of piping can be regrouped / renamed or any addition / deletion in the system can be made in order to make system complete as per requirement. No extra cost shall be entertained on this account.

e) The piping systems mentioned above are only indicative and does not cover all the piping systems to be erected / commissioned. Contractors are however required to erect commission all piping systems shown in drawings & other documents which may be necessary for erection, completion & overall commissioning of the plant at the accepted unit rates.

f) The weights indicated are tentative only and may vary during execution of work. The contractor is required to erect / commission all piping systems shown in drawings and documents, which may be necessary for overall commissioning of BOILER. Payment shall be released on the basis of actual work executed as per final accepted rates.

g) Tentative weights of power cycle piping of Stainless Steel, Alloy Steel and carbon steel piping may very as per final engg and supplies.

h) Bidders may note above while quoting / accepting tonnage rates for subject work.

Annexure-II

LIST OF T&Ps & IMTEs BEING PROVIDED BY BHEL FOR USE OF CONTRACTOR FREE OF HIRE CHARGES ON SHARING BASIS.

SL NO	EQUIPMENT	QUANTITY	REMARKS
1	Crawler Crane 600 MT	01 no.	On Sharing Basis
2	Crawler Crane 200 / 250 MT	01 no	On Sharing Basis
3	Crawler Crane 100 / 135 MT	01 no	On Sharing Basis
4	EOT Crane in TG hall 125 / 30 MT	01 no.	As per requirement .
5	Strand Jack Lifting Arrangement (only for Boiler drum lifting operation)	01 set	By BHEL agency
6	Motorized Hydraulic Test Pump 0-600kg/cm2	01 no.	
7	Construction Elevator	01 no.	
8	Induction heating machine with DG Set	APR	
9	Chemical Cleaning Setup For Boiler and Piping	01 set	By BHEL agency
10	Aneometer 0-15 M / Sec	01 no.	
11	Pitot Tube	01 no.	

NOTES:

1. These cranes will be provided on sharing basis on specific instruction of the Engineer as per the work requirement.
2. Any other special T&P if supplied by the manufacturer will also be provided to the contractor free of hire charges as and when made available for work. Special tools and tackles are to be used only for the purpose for which these are meant and to be returned in good working condition.
3. The operation and routine maintenance of all BHEL Cranes shall be carried out by the contractor AND required fuel for operation of crane shall be provided by the contractor at his cost. 600 T capacity cranes are for erection of 4^{th} and above tiers of boiler columns and ceiling girders. However, BHEL entirely at its discretion can allow use of this crane in other areas / works also on the same terms and conditions.
4. Any other special IMTE's if supplied by the manufacturer will also be provided to the contractor free of hire charges as and when made available. Special IMTE's are to be used only for the purpose for which these are meant and to be returned in good condition.

5. The T & P listed above shall be provided by BHEL and remaining required T & P shall be under the scope of contractor to execute the awarded scope of work.
6. Contractor has to facilitate the boiler drum lifting as per SCC Cl no.55. The Boiler drum unloading and shifting to the boiler shall be done by the contractor as per specification.
7. Other terms and conditions regarding above items shall be as per Clause No.37 (T&P/IMTE's).

ANNEXURE-III

INDICATIVE LIST OF MAJOR T&P AND IMTE'S TO BE PROVIDED BY CONTRACTOR FOR EXECUTION OF TENDERED WORKS FOR MOST DURATION OF THE CONTRACT UNLESS OTHERWISE SPECIFIED.

SL NO	EQUIPMENT	DEPLOYMENT QUANTITY		
		MAIN BOILER	ESP	PIPING
1	Crawler Crane 75 MT	1 no.	1 no.	APR- 1 no
2	Mobile Crane 40 MT	1 no.	1 no.	APR
3	Mobile Crane 18 / 20 MT	1 no.	1 no.	APR
4	Hydra Crane 14 T / 20 T	3 no	2 no.	Min 1 no
5	Trailer with pulling unit 20 / 30 MT	2 no	1 no	1 no
6	Trailer with pulling unit 15 MT	1 no	2 no.	APR-Min 1 no
7	Low Bed Trailer 50 MT	As per requirement		
8	Air Compressor 210 CFM	1 no		
9	Electric Winch 2 / 3 / 5 /10 / 15 MT or higher capacity	20 nos / As per requirement		
10	Hydraulic Jack	As per requirement		
11	MIG / CO2 Welding machines	Min. 10 nos or as per requirement		
12	Heat treatment and Stress relieving sets	As per requirement		
13	Welding sets with accessories and ovens for welding electrodes backing and holding	Min. 50 / As per requirement	Min. 25 / As per requirement	Min. 20 / As per requirement
14	Hydraulic Pipe Bending Machine (Manual and Motorised) of various sizes.	Min 1 number each.		
15	Radiography arrangement including source	As per requirement		MIN 2 NOS
16	Oil Filtering Machine 500 LPM	2 no.		
17	Stress Relieving Sets, including oil cooled transformers, heating coils, panels Recorders Etc.	Adequate numbers.		
18	Vacuum Cleaner (Industrial)	1 number.		

SL NO	EQUIPMENT	MIN DEPLOYMENT QUANTITY		
19	Pipe chamfering machine	APR		
20	Dehumidifier unit	APR		
21	Pipe cutting & beveling machines	Adequate numbers		
22	Air Compressor	APR		
23	Hydraulic jacks, chain pulley blocks of various & suitable capacities	APR		
24	Three phase distribution board with complete setup for drawl & distribution of construction power	APR		
25	Electric cables for drawl & distribution of construction power, heating machines	APR		
26	Sleepers of suitable sizes	APR		
27	Various sizes of clamps/ fixtures for assembling pipes.	APR		
28	Dewatering pumps	APR		
29	Portable hardness tester	APR		
30	Recordable UT test Equipment suitable to meet the requirements (KRAUTKRAMMER MODEL USN 50 or EQUIVLENT)			MIN 2 NOS
31	Radiography arrangement/equipment including source			MIN 2 NOS
32	Hardness testing equipment (Equotip or Microdur make)			MIN 2 NOS
33	Stress relieving equipment with temperature recorder.	APR		APR
34	Magnetic particle testing equipment-DRY & WET type			APR
35	Temperature recorder for 0-1000C 6/12 points with thermo couples / rods and compensating cable			APR
36	Spectrometer for metal testing			APR
37	Alco meter for paint thickness checking	MIN 2 NOS		
38	Hand Operated Megger 500 / 1000 V	As per requirement		
39	Tong Tester 10, 20 Or 50 Amp + / - 3 % Accuracy	As per requirement		
40	Digital and Analogue Millimetres	As per requirement		

SL NO	EQUIPMENT	MIN DEPLOYMENT QUANTITY
41	U Tube Manometer 0-2000 mm Water Column	As per requirement
42	Inclined Manometer 0-50 mm Water Column	As per requirement
43	Calibrated Pneumatic Torque wrench	As per requirement
44	Bolt Tension Calibrator	As per requirement
45	Equo-tip hardness tester or Equivalent	As per requirement
46	Special Slings for Unloading Boiler Drum , Erection of Ceiling Girders	As per requirement

NOTES:

1. The above list specifies only major T&P & IMTE's (may not be complete) to be deployed by the contractor as per the work requirement. All additional IMTE's / other tools and plants including suitable capacity D shackles, slings, rails sleepers hydraulic / mechanical jacks, pipe clamps for erection etc which are required for satisfactory & timely completion of work shall also be deployed by the contractor within finally accepted rate / price.
2. In case contractor fails to provide above-mentioned minimum Tools and plant / equipments as mentioned above under the scope of contractor, the latter shall have right to hire such services from other agencies at the risk and cost of the contractor as per the works requirement, on the sole discretion of construction manager.
3. Sleepers, rails, jacks, winches etc required for unloading of heavy consignment such as Boiler drum, etc are also to be arranged by contractor at his own cost. However in such cases BHEL may extend limited assistance by way of issuing such T & P that may be available in their stores, free of hire charges. These will have to be returned after use. Any damages / losses / to these will have to be born by the contractor and cost / repair charges plus applicable overheads recoverable from him. No claim whatsoever will be entertained on non-availability of these items.
4. Other terms and conditions regarding above items shall be as per clause no 37 (Tools & Plants/IMTE).

Annexure IV

EXCLUSIONS

1. All civil works other than dressing/ chipping of foundation surfaces, fixing of supports and hangers in trenches, walls and grouting of all equipment covered under scope of this specification.

2. All cabling work other than those supplied by BHEL with the equipment.

3. Complete control and instrumentation work other than those specifically included in this specification.

4. All AC & DC motor starters, switchgears and associated controls center unless otherwise specifically mentioned in the specification.

5. Supply of chemicals required for chemical cleaning.

6. Supply of all shims and gaskets, which go finally as part of equipment.

ANNEXURE-V

CERTIFICATE OF DECLARATION FOR CONFIRMING THE KNOWLEDGE OF SITE CONDITIONS

We,…… Hereby declare and confirm that we have visited the project site under the subject namely, ……and acquired full knowledge and information about the site conditions, wage structure, Industrial climate and total work involved. We further confirm that the above information is true and correct and we will not raise any claim of any nature due to lack of knowledge of site condition.

Tenderer's Name and Address.

Place: (Signature of the Tenderer's With stamp)

Date:

ANNEXURE-VI

NON DISCLOSURE AGREEMENT

Memorandum of Understanding

BHEL PSNR is committed to Information Security Management System as per Information Security Policy.

M/s…… providing……service to BHEL PSNR, Noida hereby undertake to comply with the following in line with Information Security Policy of BHEL PSNR;

- **To maintain confidentiality of documents & information which shall be used during the execution of the Contract.**
- **The documents & information shall not be revealed to or shared with third party which shall not be in the business interest of BHEL PSNR.**

( ) ( )

M/s. BHEL, PSNR M/s……..

ANNEXURE-VII

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

(To be given in Company letterhead)

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

ANNEXURE - VIII

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

REF: **Dt.**

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

Sub.: Tender for Erection, testing, commissioning and trial operation of Boiler , ESP , Boiler Auxiliaries and Power Cycle Piping of UNIT NO. 7 at Anpara - D Thermal Power Plant of 2 x 500 MW units (UNIT 7 &7) of UPRUVNL at Anpara, Sonebhadra, UP.

Dear Sirs,

With reference to above, this is to confirm that as per tender conditions, we have visited Anpara site before submission of our offer and noted the job content & site conditions etc.

We also confirm that we have not changed / modified the tender documents as appeared in the website and in case of observance at any stage, it shall be treated as null and void. We hereby confirm that we have not taken any deviation from tender clauses together with other references as enumerated in the above referred NIT and we hereby convey our unqualified acceptance to all terms and conditions as stipulated in the tender and NIT. In the event of observance of any deviation in any part of our offer at a later date whether implicit or explicit, the deviations shall stand null & void.

We confirm to have submitted offer strictly in accordance with tender instructions.

Thanking you,

Yours faithfully,

(Signature, date & seal of authorized representative of the bidder)

ANNEXURE - IX

BANK GUARANTEE FOR PAYMENT OF ADVANCE

B.G. No. Date

This deed of Guarantee made this _____day of_____two thousand_____by_____(Bank) hereinafter called the "The Guarantor" (which expression shall unless repugnant to the context or meaning thereof be deemed to include its successors and assigns) in favour of M/S Bharat Heavy Electricals Limited a Company incorporated under the Companies Act, 1956, having its registered office at BHEL House, Siri Fort, New Delhi - 110049 through its unit at Power Sector-Northern Region, Noida, Distt. Gautam Budh Nagar, (U.P.) India, hereinafter called "The Company" (which expression shall unless repugnant to the context or meaning thereof be deemed to include its successors and assigns).

WHEREAS M/s. _____(hereinafter referred to as the Contractor) have entered into a Contract arising out of Letter of Intent no._____dtd_____(hereinafter referred to as "the Contract") for the --< Name of_work >-- with the Company.

AND WHEREAS the Contract inter-alia provides that the Company will pay to the Contractor interest bearing advance of Rs._____ (Rupees_____ only) on certain terms and conditions specified in the Contract subject to the Contractor furnishing a Bank Guarantee for Rs._____ (Rupees_____ only) in favour of the Company.

AND WHEREAS the Company has agreed to accept a Bank Guarantee from a Bank to cover the said advance.

AND WHEREAS the Contractor has approached the Guarantor and in consideration of the arrangement arrived at between the Contractor and the Guarantor, the Guarantor has agreed to give the Guarantee as hereinafter mentioned in favour of the Company.

NOW THIS DEED WITNESSES AS FOLLOWS:-

(1) In consideration of the Company having agreed to advance a sum of Rs._____ (Rupees_____ only) to the Contractor , the Guarantor do hereby guarantee the due recovery by the Company of the said advance with interest thereon as provided according to the terms and conditions of the Contract. If the said Contractor fails to utilise the said advance for the purpose of the Contract and /or the said advance together with interest as aforesaid is not fully recovered by the Company the Guarantor do hereby unconditionally and irrevocably undertake to pay to the Company without demur and merely on a demand, to the extent of the said sum of Rs._____ (Rupees_____ only) any claim made by the Company on them for the loss or damage caused to or suffered by the Company by reasons of the Company not being able to recover in full the advance with interest as aforesaid.

(2) The decision of the Company whether the Contractor has failed to utilise the said advance or any part thereof for the purpose of the Contract and / or as to the extent of loss or damage caused to or suffered by the Company by reason of the Company not being able to recover in full the said sum of Rs._____ with interest if any shall be final and binding on the Guarantor, irrespective of the fact whether the Contractor admits or denies the default or questions the correctness of any demand made by the Company in any Court Tribunal or Arbitration proceedings or before any other Authority.

(3) The Company shall have the fullest liberty without affecting in any way the liability of the Guarantor under this Guarantee, from time to time to vary any of the terms and conditions of the Contract or extend time of performance by the Contractor or to postpone for any time and from time to time any of

the powers exercisable by it against the Contractor and either enforce or forebear from enforcing any of the terms and conditions governing the Contract or securities available to the Company and the Guarantor shall not be released from its liability under these presents by any exercise by the Company of the liberty with reference to the matters aforesaid or by reasons of time being given to the Contractor or any other forbearance, act or commission on the part of the Company or any indulgence by the Company to the Contractor or of any other matter or thing whatsoever which under the law relating to sureties would, but for this provision have the effect of so releasing the Guarantor from its liability under this guarantee.

(4) The Guarantor further agrees that the Guarantee herein contained shall remain in full force and effect during the period till the Company discharges this Guarantee, subject to however, that the Company shall have no claim under this Guarantee after_____ i.e. (the present date of validity of Bank Guarantee unless the date of validity of this Bank Guarantee is further extended from time to time, as the case may be) unless a notice of the claim under this Guarantee has been served on the Guarantor before the expiry of the said period in which case the same shall be enforceable against the Guarantor not withstanding the fact that the same is enforced after the expiry of the said period.

(5) The Guarantor undertakes not to revoke this Guarantee during the period it is in force except with the previous consent of the Company in writing and agrees that any liquidation or winding up or insolvency or dissolution or any change in the constitution of the Contractor or the Guarantor shall not discharge the Guarantor's liability hereunder.

(6) It shall not be necessary for the Company to proceed against the Contractor before proceeding against the Guarantor and the Guarantee herein contained shall be enforceable against them notwithstanding any security which the Company may have obtained or obtain from the Contractor shall at the time when proceedings are taken against the Guarantor hereunder be outstanding or unrealised.

(7) Notwithstanding anything contained herein before, our liability under the Guarantee is restricted to Rs._____(Rupees_____). Our guarantee shall remain inforce until _____, i.e. the present date of validity of Bank Guarantee unless the date of validity of this Bank Guarantee is further extended from time to time. Unless a claim or demand under this guarantee is made against us on or before---------, we shall be discharged from our liabilities under this Guarantee thereafter.

(8) Any claim or dispute arising under the terms of this documents shall only be enforced or settled in the courts at New Delhi/ Delhi only.

(9) The Guarantor hereby declares that it has power to execute this Guarantee under its Memorandum and Articles of Association and the executant has full powers to do so on its behalf under the Power of Attorney dated_____ (To be incorporated by the Bank) granted to him by the proper authorities of the Guarantor.

IN WITNESS whereof the _____(Bank) has hereunto set and subscribed its hand the day, month and year first, above written.

Signed for and on behalf of the Bank

WITNESSES

1. Name & Address

2. Name & Address

Notes:

1. The above BG shall be executed on the non-judicial stamp papers of adequate value procured in the name of the Bank in the state where the Bank is located.

2. The above BG is required to be sent by the executing bank directly to BHEL at the address where tender is submitted /accepted under sealed cover.

ANNEXURE – X

GENERAL TERMS AND CONDITIONS OF REVERSE AUCTION (RA)

Against this enquiry for the subject item / system with detailed scope of supply as per our tender specification, BHEL-PSNR, NOIDA may resort to "REVERSE AUCTION PROCEDURE" i.e. **ONLINE BIDDING on INTERNET.**

1. For the proposed reverse auction, technically and commercially acceptable bidders only shall be eligible to participate.
2. BHEL will engage the services of a service provider who will provide all necessary training and assistance before commencement of on line bidding on Internet.
3. In case BHEL decides to conduct reverse auction, BHEL's service provider shall contact the vendor directly and impart them the training.
4. Business rules like event date, time, start price, bid decrement, extensions, etc. also will be communicated through service provider for compliance.
5. Vendors have to fax the compliance form in the prescribed (provided by service provider) before start of Reverse auction. Without this the vendor will not be eligible to participate in the event.
6. **Total Price quoted shall be inclusive of all taxes except service tax in line with the NIT conditions for the subject work in Indian Rupees (INR), which is to be worked out as per the BOQ (Rate Schedule) given in tender enquiry and subsequent changes made, if any. EXCEL Sheet shall be provided, if applicable.**
7. Reverse auction will be conducted on schedule date & time.
8. At the end of reverse auction event, the lowest bidder value will be known on the network.
9. The lowest bidder has to fax the duly signed filled-in prescribed format as provided on case-to-case basis to BHEL through service provider after completion of event on the same day preferably.
10. Any variation between the on-line bid value and signed document will be considered as sabotaging the tender process and will invite disqualification of vender to conduct business with BHEL as per prevailing procedure.
11. In case BHEL decides not to go for Reverse auction procedure for this tender enquiry, the price bids and price impacts, if any already submitted and available with BHEL shall be opened as per BHEL standard practice.

ANNEXURE - XI

Authorization of representative who will participate in the on line Reverse Auction Process;

1	NAME & DESIGNATION OF OFFICIAL	
2	POSTAL ADDRESS (COMPLETE)	
3	TELEPHONE NOS. (LAND LINE & MOBILE BOTH)	
4	FAX NO.	
5	E-MAIL ADDRESS	
6	NAME OF PLACE/ STATE/ COUNTRY, WHEREFROM S/HE WILL PARTICIPATE IN THE REVERSE AUCTION	

Annexure - XII

INTEGRITY PACT

Between

Bharat Heavy Electricals Ltd. (BHEL), a company registered under the Companies Act 1956 and having its registered office at "BHEL House", Siri Fort, New Delhi – 110049 (India) hereinafter referred to as "The Principal", which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the ONE PART

and

_____, (description of the party along with address), hereinafter referred to as "The Bidder/ Contractor" which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the OTHER PART

Preamble

The Principal intends to award, under laid-down organizational procedures, contract/s for _____

_____

_____. The Principal values full compliance with all relevant laws of the land, rules and regulations, and the principles of economic use of resources, and of fairness and transparency in its relations with its Bidder(s)/ Contractor(s).

In order to achieve these goals, the Principal will appoint Independent External Monitor(s), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

Section 1 – Commitments of the Principal

1.1 The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles:-

1.1.1 No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

1.1.2 The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential / additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.

1.1.3 The Principal will exclude from the process all known prejudiced persons.

1.2 If the Principal obtains information on the conduct of any of its employees which is a penal offence under the Indian Penal Code 1860 and Prevention of Corruption Act 1988 or any other statutory penal enactment, or if there be a substantive suspicion in this regard, the Principal will inform its Vigilance Office and in addition can initiate disciplinary actions.

Section 2 – Commitments of the Bidder(s)/ Contractor(s)

2.1 The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.

2.1.1 The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to the Principal or to any of the Principal's employees involved

in the tender process or the execution of the contract or to any third person any material, immaterial or any other benefit which he / she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

2.1.2 The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any illegal or undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

2.1.3 The Bidder(s)/ Contractor(s) will not commit any penal offence under the relevant IPC/ PC Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

2.1.4 The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

2.2 The Bidder(s)/ Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

Section 3 – Disqualification from tender process and exclusion from future contracts

If the Bidder(s)/ Contractor(s), before award or during execution has committed a transgression through a violation of Section 2 above, or acts in any other manner such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s)/ Contractor(s) from the tender process or take action as per the separate "Guidelines on Banning of Business dealings with Suppliers/ Contractors", framed by the Principal.

Section 4 – Compensation for Damages

4.1 If the Principal has disqualified the Bidder from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent Earnest Money Deposit/Bid Security.

4.2 If the Principal has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to section 3, the Principal shall be entitled to demand and recover from the Contractor liquidated damages equivalent to 5% of the contract value or the amount equivalent to Security Deposit/Performance Bank Guarantee, whichever is higher.

Section 5 – Previous Transgression

5.1 The Bidder declares that no previous transgressions occurred in the last 3 years with any other company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.

5.2 If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

Section 6 – Equal treatment of all Bidders/ Contractors/ Sub-contractors

6.1 The Bidder(s)/ Contractor(s) undertake(s) to obtain from all subcontractors a commitment consistent with this Integrity Pact and report Compliance to the Principal. This commitment shall be taken only from those sub-contractors whose contract value is more than 20 % of Bidder's/ Contractor's contract value with the Principal. The Bidder(s)/ Contractor(s) shall continue to remain responsible for any default by his Sub-contractor(s).

6.2 The Principal will enter into agreements with identical conditions as this one with all Bidders and Contractors.

6.3 The Principal will disqualify from the tender process all bidders who do not sign this pact or violate its provisions.

Section 7 – Criminal Charges against violating Bidders/ Contractors /Sub-contractors

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the Vigilance Office.

Section 8 –Independent External Monitor(s)

8.1 The Principal appoints competent and credible Independent External Monitor for this Pact. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.

8.2 The Monitor is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the CMD, BHEL.

8.3 The Bidder(s)/ Contractor(s) accepts that the Monitor has the right to access without restriction to all contract documentation of the Principal including that provided by the Bidder(s)/ Contractor(s). The Bidder(s)/ Contractor(s) will grant the monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his contract documentation. The same is applicable to Sub-contractor(s). The Monitor is under contractual obligation to treat the information and documents of the Bidder(s)/ Contractor(s) / Sub-contractor(s) with confidentiality.

8.4 The Principal will provide to the Monitor sufficient information about all meetings among the parties related to the contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitor the option to participate in such meetings.

8.5 As soon as the Monitor notices, or believes to notice, a violation of this agreement, he will so inform the Management of the Principal and request the Management to discontinue or take corrective action, or heal the situation, or to take other relevant action. The Monitor can in this regard submit non-binding recommendations. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.

8.6 The Monitor will submit a written report to the CMD, BHEL within 8 to 10 weeks from the date of reference or intimation to him by the Principal and, should the occasion arise, submit proposals for correcting problematic situations.

8.7 The CMD, BHEL shall decide the compensation to be paid to the Monitor and its terms and conditions.

8.8 If the Monitor has reported to the CMD, BHEL, a substantiated suspicion of an offence under relevant IPC / PC Act, and the CMD, BHEL has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Office, the

Monitor may also transmit this information directly to the Central Vigilance Commissioner, Government of India.

8.9 The number of Independent External Monitor(s) shall be decided by the CMD, BHEL.

8.10 The word 'Monitor' would include both singular and plural.

Section 9 – Pact Duration

9.1 This Pact begins and shall be binding on and from the submission of bid(s) by bidder(s). It expires for the Contractor 12 months after the last payment under the respective contract and for all other Bidders 6 months after the contract has been awarded.

9.2 If any claim is made / lodged during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified as above, unless it is discharged/ determined by the CMD, BHEL.

Section 10 – Other Provisions

10.1 This agreement is subject to Indian Laws and jurisdiction shall be registered office of the Principal, i.e. New Delhi.

10.2 Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.

10.3 If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.

10.4 Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

10.5 Only those bidders/ contractors who have entered into this agreement with the Principal would be competent to participate in the bidding. In other words, entering into this agreement would be a preliminary qualification.

For & On behalf of the Principal

(Office Seal)

For & On behalf of the Bidder/ Contractor

(Office Seal)

Place----------

Date----------

Witness: _____

(Name & Address) _____

_____

Witness: _____

(Name & Address) _____

_____

BHARAT HEAVY ELECTRICALS LIMITED Tiruchirappalli - 620 014	

ANPARA-D-THERMAL POWER PROJECT
2X500MW
CUSTOMER NO: 0659 & 0660
PAINTING SCHEDULE

PE-Civil reviewed items at sl. no. 3,8& 12 only.
Remaining items to be reviewed by Pe-Mech.

Prepared by	**L.Gragori Dy.Mgr / P.Lab**		**Document No: Q: PL: C3 - PS / 0659**
Reviewed by	**R. Sundararaman DM / PE / FB**		**Revision No: 00 Dated: 17.05.2008**
Approved by	**Dr.G.Ravichandran DGM /P.Lab**		**Sheet No. : 1 of 11**

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RECORD OF REVISIONS

Rev. No	Date	Details of revision	Remarks

00	**17.05.2008**	**New**	**Prepared in line with agreed resolutions of declared deviations for Anpara-D-Thermal Power Project-2 X 500MW -BTG Pkg & Civil Works Dt. 01 – 04/05/07 Sl. No. 149 to Sl. No. 155**

Sl.No.	PGMA / Description	Surface Prepa-ration &	Primer coat	Intermediate coat	Finish coat	Total DFT

		Surface Profile	Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	µm (min)
1 PS 1AC1	Drum (Except Internals), Drum suspension 04 – 126,146,196	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30µm per coat	2	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20µm per coat	3	Inter-national-Orange Shade No: 592 of IS 5	100
2 PS5	Drum internals 04 - 136	SSPC-SP1/ or SSPC – SP3 Solvent / Power Tool Cleaning	Rust Preventive Fluid to PR: CHEM: 09 – 04 DFT=25µm per coat	1	--	--	--	--	--	25
3 PS19A	Buck stays 08 – 001, 003,006,007,111,380,382,400 08 – 501,503,901,907,910 Boiler supporting structures 21-601 35 – 111, 112,121,122,130,140,150,190 35 – 211,212,213,214,221,222,231,232 35 – 311,312,321,322,331,332,341,342 35 – 351, 352,361,362,381,382,383,390 35 – 441,442,443,451,452,453,511,512	Blast cleaning to SA2 ½ (Near white metal) with surface profile 35-50 µm	Inorganic Ethyl Zinc Silicate Primer DFT=75µm per coat	1	Epoxy Based MIO /TiO2 Pigmented Intermediate Coat DFT=75µm per coat	1	#Epoxy Finish Coat, DFT=35µm per coat + #Ali.Acrylic PU Paint DFT=30µm per coat	2 1	Grey Shade To RAL 9002	250

 # Out of 2 coats of Epoxy based finish paint, one coat of Epoxy finish paint shall be given at shop / subcontracting works and second coat of Epoxy finish and one coat of aliphatic Polyurethane paint shall be applied at site.

.No.	PGMA / Description	Surface Prepn &- Surface	Primer coat	Intermediate coat	Finish coat	Total DFT

		Profile	Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	µm (min)
3 PS19A	35 – 513,521,522,523,531,532,533,821 Galleries & Stair-ways 36 – 110,130,150,311,312,313,314 36 – 315,316,321,322,323,324,325 36 – 326,327,331,332,333,334,335 36 – 341,342,343,344,345,346,347 36 – 348,351,352,353,354,355,361 36 – 362,363,391,392,393,394,395 36 – 610,620,621,740 Interconnecting walkways 38 – 210,299,310,381,410, 510,610,611,710, 39-302 ID system structures 39 – 101,102,141,142,150,300,301 39 –304,305,306,47-261,	Blast cleaning to SA2 ½ (Near white metal) with surface profile 35-50 µm	Inorganic Ethyl Zinc Silicate Primer DFT=75µm per coat	1	Epoxy Based MIO/TiO2 Pigmented Intermediate Coat DFT=75µm per coat	1	#Epoxy Finish Coat, DFT=35µm per coat + #Ali.Acrylic PU Paint DFT=30µm per coat	2 1	Grey Shade To RAL 9002	250

Out of 2 coats of Epoxy based finish paint, one coat of Epoxy finish paint shall be given at shop / subcontracting works and second coat of Epoxy finish and one coat of aliphatic Polyurethane paint shall be applied at site.

Sl.No.	PGMA / Description	Surface Prepn &- Surface	Primer coat	Intermediate coat	Finish coat	Total DFT

		Profile	Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	μm (min)
4 PS9/10	Components >95° C Insulated/Uninsulated other than components in Column 5 &7 Ring Headers,Down Comers,Hot air Headers outside the gas path etc. 09-001,002,003. 17-776,18-002,003,010,020 21-600,800,850 24-300,301,315, 320,325,335,340, 24-360,373,374,375,380,385, 28-220 30-103,105,211,212,215,219,220, 31-010,102,104,105,41-350,390 42-002,005,020,030,120,128,150,154 42-158,300,358, 47-263, 43-004,005,104,105 48-, 014,114,204,205,207,212,214,222, 48-224,225,232,234,235,,385, 386,432, 48-435, 462,465,468,482, 48-485,492,494,495,662,664,667	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 DFT 20 μm per coat	2	--	--	--	--	--	40

Sl.No.	PGMA / Description	Surface Prepn &- Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT µm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
5 PS2	Loose tubes, SH, RH & Eco.coils 07-215 to 218,223,225,226,231,232 11- 036,038,077,078,095,336,338,377,378, 791, 991.; 12- 178,395,495,515,619,803,805,850,852, 900,903,906,914,917,924,927,928,944, 948,954,968, 16-077,079,377,379 17-807,904,919,929 19-814,824,851,884,914,924,984	SSPC – SP2 or SSPC – SP3 Hand tool / Power tool cleaning	Red Oxide Zinc Phosphate Dip coat primer to PR: CHEM: 09 – 03 DFT=35µm per coat	1	--	--	--	--	--	35
6 PS1E	Components < 95° C / & Insulated 24-350,351, 35-995,36-611,613, 37-010, 42-010,065,070,152, 157 45-321,325,326, 48- 012,015,112,115,141,142,144,145,200, 202,665 65-736 67-204,272,276,283,801,802,803,	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30µm per coat	2	--	--	Syn. Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20µm per coat	3	Smoke Grey Shade No: 692 of IS5	100

Sl.No.	PGMA / Description	Surface Prepn &- Surface	Primer coat	Intermediate coat	Finish coat	Total DFT

		Profile	Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	μm (min)
7 PS3	Components >95° C coming in the gas path, 05-137,139,147,158,159,227,229, 231,251, 06-400,631,633,634,637,641,643, 644,647,651,653,655,670, 07 –102,104,106,107, 402,403,404,405,420,431,500,601,993, 10-135,178,182,183,185, 191,195,218,235,278,283, 10-291,295,315,687, 11 – 395, 606,608,716, 717,718,767,768,769,787,916,917,918, 967,968,969,987,12-993, 15-177,279 19-701,702,850,903, 905,907 24-993,30-235,31-993, 32-010,110,120,310,410,510,710 35-993 36-993, 48-993,97-585	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744 DFT= 30μm per coat	2	--	--	--	--	--	60
8 PS6	Hand rails and posts, ladders / rungs 35 – @ 822,@823,851 36 – @820,851,852,853 38 – @820,850 39 – @820,850 Floor Grills, Step threads 35 – 811,36-811,812,813,814 38 – 810, 39 – 810	a) Hot dip Galvanizing to a coating weight of 610 gm per sq.m (minimum) and to a coating thickness of 87.0 microns (minimum). Refer Notes given below **								

Notes **: The Guard plates, channels for step treads and Stringer channels shall be painted as per painting scheme prescribed in Sl..No: 03.

PAINTING SCHEME FOR VALVES

Sl.No.	PGMA / Description	Surface Prepa-ration & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT µm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
09	Cast carbon steel valves (Conventional) Cast alloy steel valves (Conventional) All API valves, QCNRV, SV & SRV Silencers	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr.I	2	--	--	--	--	--	40
	Forged valves	Phosphating	To a coating weight of 1500 mg per sq.ft.	--	--	--	--	--	--	--
	Soot Blower components	SSPC-SP6/ Comml. Blast Cleaning 35-50µm	Red-oxide Zinc Phosphate primer IS 12744	2	--	--	Syn. Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20µm per coat	3	Verdigris Green Shade No. 280 of IS5	100
	HP / LP system	SSPC-SP6/ Comml. Blast Cleaning 35-50µm	Heat Resistant Aluminium Paint to IS 13183 Gr.I	2	--	--	--	--	--	40

Sl.No.	PGMA / Description	Surface Prepa-ration & Surface Profile	Primer coat		Intermediate coat		Finish coat			Total DFT µm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
10	For CLH & VLH PGs 07,08,12,17,19,21,24,47,48 &80	Abrasive blast cleaning to Sa 2 ½ 35- 50 microns	Epoxy zinc rich primer To IS 14589 Gr.II %VS=35, (min) DFT=40 microns per coat	1	--	--	Aliphatic acrylic Poly-urethane paint %VS=40.0 (min) DFT=30.0 microns per coat	1	Phirozi Blue Shade No. 176 of IS5	70
11 PS8A	Components > 95 C, un-insulated Fuel pipes 47-266.267,268,269	SSPC-SP3/ Power Tool Cleaning	General purpose Aluminium paint to IS 2339	2	--	--	--	--	Alumunum	40
12 1BE	All Columns below '0' level (embedded in concrete) PGs 35,36,38 39	SSPC-SP3/ Power Tool Cleani	HB Chlorinated Rubber Based Zinc Phosphate primer %VS=40, (min) DFT=50 µm per coat	1	--	--	--	--	Grey	50

NOTES:

1. Rust Preventive Coating should be given on HSFG Bolt and nut threads.

2. Machined surfaces are to be applied with a coating of Temporary Rust Preventive oil.

3. All threaded and other surfaces of foundation bolts and its materials, insulation pins, Anchor channels, Sleeves Retainers shall be coated with Temporary Rust Preventive Fluid and during execution of civil works; the dried film of coating shall be removed using organic solvents.

4. Ground shade/colour of Finish paints & identification tag/Band for equipments, pipings pipe service, boiler supporting structures and other boiler components shall be followed as per contract requirements.

5. PGMAs under Sub-Vendor items are not indicated. For all bought-out and sub-vendors items including PGMAs mentioned above falling under the scope of BHEL the same scheme as for main equipment as covered in this document shall be followed.

6. These Painting Schemes are valid for only Customer No: 0659 & 0660 of NTPC –Anpara-D

07. No painting is required for Stainless Steel, Nonferrous & galvanized components.

08. Wherever inside surfaces of components under PGMA 48 – XXX, need protection till erection, two coats of Red-oxide zinc phosphate primer paint to IS12744 to a DFT of 60 microns shall be applied, after power tool cleaning.

09. The Temporary Rust Preventive coating that already been applied on any components, tubes, pipes etc., shall be removed by suitable solvents / heating to 350 –400 °C for an hour before primer paint application –but, in this case, it should be ensured that the minimum surface cleanliness required for primer paint application shall be SSPC – SP2 (equivalent – Hand Tool cleaning).

10. In components, wherever plates / sheets of thickness less than or equal to 5 mm and rods/tubes/drain water pipes are used, power tool / hand tool cleaning to SSPC – SP3 / SP2 shall be followed and the painting shall be done as described in Scheme No: 06.

11. For all commissioning components-erection materials (xx-993) two coats of Red oxide Zinc Phosphate Primer shall be applied to meet the temporary protection till erection, after power tool cleaning.

12.Touch-up painting of damaged areas shall be carried out as per agreed clause.

13.All components covered under different PGMA's are to be painted In case any component is left out, the same shall be deemed to be included under the relevant section based on paint logic approved.

14. For very small components like clamps etc. scheme no.6 shall be followed.

15. For very small components with weldable primer at edges, the entire component shall be applied with weldable primer.

Painting Scheme – Details for procurement & application purposes

Sl.No.	Generic nature of paint	Theoretical Covering Capacity Sq.m per Litre.	No. of pack	Volume solids, % (min)**	DFT in microns (min) per coat	Shade	Shade No. to IS5	Mode of appln.	Over coating interval, Hrs.
1	Inorganic ethyl zinc silicate to IS 14946 –Main Coat	8	2	60	100	Grey	--	Spray only	16
2	Poly amide cured Epoxy based MIO pigmented intermediate coat	8	2	60	75	Brown	--	## Spray	24
3	Epoxy based polyamide cured finish paint to IS 14209	10	2	40	40	Smoke Grey	692	Spray	24
4	Aliphatic acrylic polyurethane paint to IS 13213	10	2	40	30	**Grey** Phirozi – Blue.	RAL 9002 176	Spray Spray	24 24
5	Heat resistant aluminimum paint to IS 13183 Grade I	10	1	-	-	--	--	Brush / Spray	24
6	Red oxide zinc phosphate primer paint to IS 12744	10	1	--	--	-	--	Brush / Spray	12
7	Red oxide Zinc Phosphate Dip coat primer paint to PR: CHEM: 09-03	10	1	--	--	--	---	Dip	12
8	Long oil alkyd synthetic enamel finish paint to IS2932	10	1	--	--	Reqd. shade	Corrpdg. Shade no.	Brush / Spray	12
9	Temporary Rust preventive fluid to PR: CHE: 09 – 04	10	1	--	--	--	--	--	12
10	Epoxy Zinc rich primer to IS14589 Gr.II	8	2	35	40	Grey	--	Spray	24
11	General purpose Aluminium paint to IS 2339	10	2	--	20	Aluminum	--	Brush	12
12	HB Chlorinated Rubber Based Zinc Phosphate Primer-Colour Grey	8	1	40	50	Grey	--	Brush / Spray	12

Brush painting is accepted, if recommended by the Paint suppliers. The covering capacity of paints specified is only approximate.
The paints and Rust Preventive fluid shall be procured from BHEL's approved suppliers. ** Values are indicative.

Painting of Damaged Areas

(Areas where the paint has deteriorated badly by erosion and areas where the paint film has lost its adhesion and where the steel has rusted appreciably, should be repainted as follows)

Sl.No.	Components	Surface Prepa-ration	Primer coat		Intermediate coat		Finish coat			Total DFT µm (min)
			Paint	No. of coats	Paint	No. of coats	Paint	No. of coats	Shade	
1	Paint damaged components fall under Sl.no: 3	Power tool cleaning to bare metal	Epoxy zinc rich primer to IS 14589 Grade II to a DFT of 50 mic/coat T.DFT 100mic	2	As given in scheme	1	As given in scheme	3	As given in scheme	250
2	Paint damaged components fall under Sl.no: 10	Power tool cleaning to bare metal	One coat of Epoxy zinc rich primer to IS 14589 Grade II to a DFT of 40 microns	1	--	--	As given in scheme	1	As given in scheme	70
3	Paint damaged components fall under Sl.no: 1,2,4,5,6,7,9.	Power tool cleaning to bare metal	As given in scheme	As given in scheme	--	--	As given in scheme	As given in scheme	As given in scheme	As given in scheme

BHARAT HEAVY ELECTRICALS LIMITED
PIPING CENTRE, CHENNAI– 17
QUALITY ASSURANCE & CONTROL DEPT.

PAINTING SCHEME FOR PIPING

PROJECT NAME : - ANPARA - 'D' TPP EXTN 6 & 7 (2 X 500MW)
BHEL CUSTOMER Nos :- 0659, 0660, 6960, 6961.

QPNo: 6960:QPC:11
REV.NO: 01
Date : 11.09.2009

Sl. NO	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat			Finish coat			Total DFT Microns (Min.)	REMARKS
			Primer	No of coats	Paint	No of coats	Shade	Paint	No of coats	Shade		
1	2	3	4	5	6	7		9	10	11	12	13
1	Insulated Piping, components (MS, HRH, CRH, Aux Steam lines, Safety valve exhaust, Heater vents, Tanks & Vessels...)	SSPC-SP3/ Power Tool Cleaning	Red oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744	2 (min.DFT = 25 microns per coat.)	—	—	—	Synthetic enamel paint (long Oil alkyd) to IS 2932	1 (min.DFT = 25 microns per coat.)	Smoke Grey Shade No 692 of IS 5	75	Refer Note 1
2	Uninsulated Piping, components (Spray Water Condensate lines ...,Tanks & Vessels)	SSPC-SP3 / Power Tool Cleaning	Red Oxide - Zinc Phosphate (Alkyd base to IS: 12744)	2 (25 Microns per coat)	—	—	—	Synthetic enamel Long oil Alkyd to IS: 2932	3 ** (35 microns per coat) (2 at shop + 1 at site)	Smoke Grey (Shade No. 692 of IS: 5)	120 at shop + 35 at site	** 1 coat of DFT-35 microns finish coat at site
3	Structures	Blast cleaning to Sa2½ with surface profile 35-50 microns	Inorganic Ethyl Zinc Silicate Primer.	1 (min.DFT = 75 microns per coat.)	Epoxy Based MIO/TiO2 Pigmented Intermediate Coat	1 (DFT = 75 microns Min per coat.)	—	$ Epoxy Finish Coat $ Aliphatic Acrylic PU Paint	2 $ (35 Microns per coats) + 1 $ (30 Microns per coats)	Smoke Grey Shade No 692 of IS 5 $$	185 Shop + 65 Site	
4	Hangers & Supports-(CLH,VLH)	Blast cleaning to Sa2½ with surface profile 35-50 microns	Epoxy Zinc rich primer to IS 14589 Gr.II,% VS = 35 Min	1 (min.DFT = 40 microns per coat)	—	—	—	Aliphatic Acrylic Polyurethane paint ,%VS = 40 min	1 (30 microns per coat)	Phirozi Blue Shade No.176 of IS 5	70	
5	Valves (Bought out)	SSPC-SP3/ Power Tool Cleaning	Heat resistant Aluminum Paints to IS 13183 Gr.I					—	—	Aluminum	40	
6	Pipe Clamps.	SSPC-SP3/ Power Tool Cleaning	Red oxide Zinc Phosphate Primer (Alkyd Base) to IS 12744	(30 microns per coat.)	—	—	—	Synthetic enamel paint long oil alkyd to IS 2932	2 (20 Microns per Coat)	Note 2	70	
7	Stainless steel / Galvanized items	No paint										

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$:- Out of 2 coats of Epoxy based finish paint, one coat of Epoxy finish paint shall be given at shop / subcontracting works and second coat of Epoxy finish and one coat of Aliphatic Acrylic Polyurethane paint shall be applied at site after erection by brush and / or spray. as recommended by the Paint manufacturer.

$$:- The final colour shade to be applied at site after erection shall be as per NTPC colour coding scheme (Note for NTPC use)

Note: 1) Piping above 60 Deg C are insulated. If not insulated,the same shall be painted with 2 coats of 20 microns each of Heat resistant Al.paint to IS 13183 Gr.II (total DFT 40 mic.)

2) Smoke grey shade for Carbon Steel ; White shade for Alloy Steel Clamps.

PREPARED BY :	APPROVED BY:	For NTPC use	Page 1/1
R.LOGANATHAN, SAE / QA	G.PANNEERSELVAM, DGM / QA		

एनटीपीसी लिमिटेड
(भारत सरकार का उद्यम)
NTPC Limited
(A Govt. of India Enterprise)
(Formerly National Thermal Power Corporation Ltd.)
केन्द्रीय कार्यालय नोएडा
Corporate Centre NOIDA

Reference: AnparaD:1089:1630

Date:17-09-09

From:	Mr. Srikrisna DGM (CW-Engg)	To:	R Kannan R Kannan, Sr.Mgr, No-80 (Old No-93), GOPATHY NARAYAN SWAMY ROAD, T.NAGAR, CHENNAI-600017
		CC:	ceppmm@gmail.com secanparad@gmail.com null

SUBJECT : ANPRAD, BHEL-PIPING CENTRE

Please find enclosed following drawings/documents for necessary action at your end as indicated in purpose code.

VENDOR DRG NO:	null
NTPC DRG NO:	9464-108-01PC-PVM-H-012
REVISION NO:	01
DRG TITLE:	Painting Schedule-HP Piping
APP CATEGORY:	I
RELEASE DATE:	17-09-09
COMMENTS:	NO COMMENTS

BHARAT HEAVY ELECTRICALS LIMITED
PIPING CENTRE, CHENNAI– 17
QUALITY ASSURANCE & CONTROL DEPT.

PAINTING SCHEME FOR LP PIPING

(CW / ACW / ECW / Plant water, Air Piping, etc...,)

PROJECT NAME : - ANPARA - 'D' TPP EXTN 6 & 7 (2 X 500MW)
BHEL CUSTOMER Nos :- 0659, 0660, 6960, 6961.

QPNo : 6960:QPC:12
Rev No : 01
Date : 11.09.2009

Sl. NO	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate coat			Finish coat				REMARKS
			Primer	No of coats	Paint	No of coats	Shade	Paint	No of coats	Shade	Total DFT Microns (Min.)	
1	2	3	4	5	6	7	8	9	10	11	12	13
1	(a) Internal Surface - CW Pipe (for pipe dia - 1000 mm and above)	Blast Cleaning SSPC SP-10 SA 2½ *(Refer Note 1)*	Epoxy based Zinc rich Primer *(Refer Note 2)*	1 (50 Microns Min. per coat)	-----	-----	-----	Coal tar epoxy *(Refer Note 2)*	2 (75 Microns Min. per coat)	-----	200 Microns *(Refer Note 3)*	
	(b) Holiday test (Refer Note 3)	Holiday testing by low voltage (75 Volts Min.) wet sponge Holiday detector or by High voltage (Votage per micron of DFT is as recommended by Paint Manufacturer subjected to minimum of 5V / Micron). Holiday test Equipment to be calibrated before testing.										
2	External Surface of CW –Buried Piping / Encased in concrete (For pipe dia-1000 mm and above) (Temporary Protection for transportation from works to site). **Further protection to be done by BHEL Erection Group as per Contract requirement.	SSPC-SP3 / Power Tool Cleaning	Red Oxide Zinc Phosphate (Alkyd base to IS 12744)	1 (30 Microns per coat)	----	----	----	----	----	----	30 Microns	
3	External Surface (over ground piping) of CW,ACW.(For all diameters)	SSPC-SP3 / Power Tool Cleaning	Red Oxide - Zinc Phosphate (Alkyd base to IS: 12744)	2 (25 Microns per coat)	----	----	----	Synthetic enamel Long oil Alkyd to IS: 2932	3 ** (35 microns per coat) (2 at shop + 1 at site)	Smoke Grey (Shade No. 692 of IS: 5)	120 at shop + 35 at site	** 1 coat of DFT-35 microns finish coat at site
4	External Surface of ECW, Plant water (For all diameters)	SSPC-SP3 / Power Tool Cleaning	Red Oxide Phosphate base to IS: 12744)			----	----	Synthetic enamel Long oil Alkyd to IS: 2932	3 ** (35 microns per coat) (2 at shop + 1 at site)	Smoke Grey (Shade No. 692 of IS: 5)	120 at shop + 35 at site	** 1 coat of DFT-35 microns finish coat at site
5	Galvanised and Stainless steel Piping	No painting										

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Notes:

1. Blast cleaning to near white metal to obtain roughness as per epoxy paint data sheet.
2. Application of Epoxy based Zinc rich Primer, Coal Tar Epoxy shall be done as per manufacturer's data sheet / recommendation, meeting the thickness requirements as per this document.
3. Witness by BHEL / BHEL nominated inspection agency.

PREPARED and REVIEWED BY : R.LOGANATHAN, Sr.Addl.Engr Grl / QA

APPROVED BY: G.PANNEERSELVAM, DGM / QA

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केन्द्रीय कार्यालय नोएडा
Corporate Centre NOIDA

Reference: AnparaD:1089:1631

Date:17-09-09

From:	Mr. Srikrisna DGM (CW-Engg)	To:	R Kannan R Kannan, Sr.Mgr, No-80 (Old No-93), GOPATHY NARAYAN SWAMY ROAD, T.NAGAR, CHENNAI-600017
		CC:	ceppmm@gmail.com secanparad@gmail.com null

SUBJECT : ANPRAD, BHEL-PIPING CENTRE

Please find enclosed following drawings/documents for necessary action at your end as indicated in purpose code.

VENDOR DRG NO:	null
NTPC DRG NO:	9464-108-01PC-PVM-H-011
REVISION NO:	01
DRG TITLE:	Painting Schedule-LP Piping
APP CATEGORY:	I
RELEASE DATE:	17-09-09
COMMENTS:	No comments.