भारत हेवी इलेक्ट्रिकल्स लिमिटेड
(भारत सरकार का उपक्रम)
BHARAT HEAVY ELECTRICALS LIMITED
(A Govt. of India Undertaking)

TCN - 07

Ref: PSER:SCT:HLD-B1259:TCN-07 Date: 11/01/2012

Sub	Tender change notice (TCN) 07	
Job	Package A:- Transportation of materials , storage as required , erection , grid blasting of pipes, insulation , commissioning , trial run , PG test , final painting and handing over etc of boiler , rotating machines , duct , ESP , Critical piping , misc piping etc. of unit # 1 & 3 for 3X150 MW Units at IPCL HALDIA TPP , WB. Package B:- Transportation of materials , storage as required , erection , grid blasting of pipes, insulation , commissioning , trial run , PG test , final painting and handing over etc of boiler , rotating machines , duct , ESP , Critical piping , misc piping etc. of of unit # 2 for 3X150 MW Units at IPCL HALDIA TPP , WB.	
Ref	1.0	Tender no PSER:SCT:HLD-B1259:11
	2.0	BHEL's NIT, vide ref no PSER:SCT:HLD-B1259:11 Dated 31/10/2011
	3.0	BHEL's TCN-01 vide ref. no. PSER:SCT:HLD-B1259:TCN-01 Dated 19/11/2011
	4.0	BHEL's TCN-02 vide ref. no. PSER:SCT:HLD-B1259:TCN-02 Dated 05/12/2011
	5.0	BHEL's TCN-03 vide ref. no. PSER:SCT:HLD-B1259:TCN-03 Dated 12/12/2011
	6.0	BHEL's TCN-04 vide ref. no. PSER:SCT:HLD-B1259:TCN-04 Dated 19/12/2011
	7.0	BHEL's TCN-05 vide ref. no. PSER:SCT:HLD-B1259:TCN-05 Dated 26/12/2011
	8.0	BHEL's TCN-06 vide ref. no. PSER:SCT:HLD-B1259:TCN-06 Dated 05/01/2012
	9.0	Other references (if any)

With reference to above, following points , relevant to tender, may please be noted and complied with while submitting offer.

1.0 Schedule of changes as per Annexure-I to TCN-01.
2.0 Technical Specification for Boiler & Auxiliary is attached.
3.0 Technical Specification for Insulation is attached.
4.0 Painting schedule is attached.
5.0 Painting Scheme is attached.
6.0 Annexure-B of TCC has been revised as per Annexure-B Rev-01.
7.0 Annexure-C of TCC has been revised as per Annexure-C Rev-01.
8.0 Revised `No deviation certificate' is attached. Bidder to submit `No deviation certificate' as per attached Format only.

9.0 All other terms & conditions shall remain unchanged.

Thanking you,

Yours faithfully,
for BHARAT HEAVY ELECTRICALS LTD

ENGR (SCT)

Encl

1.0 Schedule of changes as per Annexure-I to TCN-01.

पावर सेक्टर पूर्वी क्षेत्र (मुख्यालय)
POWER SECTOR EASTERN REGION, DJ-9/1, SALT LAKE CITY, KOLKATA - 700 091
फैक्स/Fax : (033) 23211960 फोन/Phone : बोर्ड/EPABX : 23211798/ 1691

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7.0 Annexure-C of TCC has been revised as per Annexure-C Rev-01.
8.0 Revised `No deviation certificate' format.

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Package A:- Transportation of materials , storage as required , erection , grid blasting of pipes, insulation , commissioning , trial run , PG test , final painting and handing over etc of boiler , rotating machines , duct , ESP , Critical piping , misc piping etc. of unit # 1 & 3 for 3X150 MW Units at IPCL HALDIA TPP , WB.

Package B:- Transportation of materials , storage as required , erection , grid blasting of pipes, insulation , commissioning , trial run , PG test , final painting and handing over etc of boiler , rotating machines , duct , ESP , Critical piping , misc piping etc. of of unit # 2 for 3X150 MW Units at IPCL HALDIA TPP , WB.

TENDER NO. PSER:SCT:HLD-Q1258:11

ANNEXURE-I TO TCN-01

SL NO	VOLUME OF TENDER	CL REF	EXISTING CLAUSE	MODIFIED CLAUSE
1	VOL-1F-TCC	Annexure-B(Sl No 82 for Package -A,Page No 30 &Sl No 82 for Package-B,Page No 32)	Strand Jacks with ropes,guides,anchors,hydraulic drive unit including control panel complete in all respect	**To be deleted .(Revised Annexure-B attached)** 2 sets of Drum lifting winch (10T) along with shieve pulley blocks and wire ropes and other accessories has been included in Annex-C. (**Revised Annexure C attached)** **Regarding Winches:-** All foundations and anchor points required for installing drum lifting winches shall be cast by the contractor using his own materials at his cost as per the sketches provided by BHEL engineer. Boiler Drum of the unit is planned to be lifted by using the winch .The necessary winch and its accessories shall be provided by BHEL free of cost as indicated in the relevant annexure of the tender. All other equipments & accessories shall have be arranged by contractor within his quoted rate. Servicing of the drum lifting winch, shieve pulley block and greasing of ropes are included in the scope of the contractor including providing necessary consumables and manpower. The anchoring of the winch at designated location is to be done by the contractor. Temporary CAT HEAD structures required for Drum lifting operation shall have to be fabricated by the contractor at site according to drawing / instruction of BHEL engineer. Necessary steel for the same shall arranged by the contractor. Fabrication and erection of the same shall have to be carried out by the contractor within his quoted rate. After completion of drum lifting, erection and alignment, the drum lifting arrangements shall be dismantled by the contractor. BHEL shall provide Drum Lifting winches with wire rope and 10 sheave pulley blocks free of charges. Receipts of these items including all accessories are to be shifted from site store to erection places and installed by the bidder. Power supply cables to these equipments are to be provided by the bidder. Entire erection commissioning, including securing/grouting wherever required and day to day maintenance is the scope of the bidder. The bidder will have to include these charges within the quoted rate.
2	VOL-1F-TCC	Sl No 4.9,Pg No 3	Final Painting of Boiler and auxiliaries along with paint supply is in vendor's scope. The surface to be painted is to be first cleared properly and to be initially painted with one layer of primer followed by two layers of final paint. The paint to be applied should be Berger paint or of BHEL approved reputed manufacturer.	Cl to be modified as under : "Final Painting of Boiler and auxiliaries along with paint supply is in vendor's scope. The surface to be painted is to be first cleared properly and to be initially painted with one layer of primer followed by two layers of final paint.**Paint to be procured from reputed suppliers with approval of BHEL/customer. Vendor has to follow approved painting schedule .Detailed approved painting schedule will be furnished later on".**
3	VOL-1F-TCC	Sl No 4.8,Pg No 3	Grid Blasting of pipelines & application of **primer** prior to erection is covered in vendor scope	Cl to be modified as under "Grid Blasting of pipelines & application of **primer /touch up painting as required** prior to erection is covered in vendor scope"

Package A:- Transportation of materials , storage as required , erection , grid blasting of pipes, insulation , commissioning , trial run , PG test , final painting and handing over etc of boiler , rotating machines , duct , ESP , Critical piping , misc piping etc. of unit # 1 & 3 for 3X150 MW Units at IPCL HALDIA TPP , WB.

Package B:- Transportation of materials , storage as required , erection , grid blasting of pipes, insulation , commissioning , trial run , PG test , final painting and handing over etc of boiler , rotating machines , duct , ESP , Critical piping , misc piping etc. of of unit # 2 for 3X150 MW Units at IPCL HALDIA TPP , WB.

TENDER NO. PSER:SCT:HLD-Q1258:11

ANNEXURE-I TO TCN-01

4	VOL-1F-TCC	Note No 4 ,Annexure-C	The T&Ps under sl. Nos. 1 & 2 shall be provided with fuel & operator as per relevant clause of the tender. Operator for T&P under Sl No 3 shall be provided **by contractor**.	Note No 4 to be modified as under "The T&Ps under sl. Nos. 1 & 2 shall be provided with fuel & operator as per relevant clause of the tender. Operator for T&P under Sl No 3 shall be provided **by BHEL for piping erection as per requirement** ".(**Revised Annexure-C attached)**
5	VOL-1F-TCC	Annexure-B	Sl No 1,2 &3	**Revised Annxure-B attached .**
6	VOL-1F-TCC	Cl 4.5 ,Pg No 3	Supply of cement and steel for any civil work involved (as detailed in this specification) shall be arranged by the contractor without any extra cost to BHEL	Cl to be modified as under "Supply of cement and steel for any civil work involved **if required** (as detailed in this specification) shall be arranged by the contractor without any extra cost to BHEL."
7	VOL-1F-TCC	Cl 4.10 ,Pg No 3	All IBR formalities including arrangement of visit of IBR authorities is covered in vendor's scope. All statutory fees for Boiler work will be submitted **by BHEL.** However, fees for radiography inspection are covered in vendor's scope. The vendor should have Form – 392 from W.B. Boiler Directorate.	Cl to be modified as under . "All IBR formalities including arrangement of visit of IBR authorities is covered in vendor's scope. All statutory fees for Boiler work will be submitted **by BHEL/customer .** However, fees for radiography inspection are covered in vendor's scope. The vendor should have Form – 392 from W.B. Boiler Directorate."
8	VOL-1F-TCC	Cl No 37.1,Pg No 18	The entire work of erection, testing and commissioning, up to handing over of unit shall be completed within18 months from start of work for Package A(1st unit in 18 months from Start of Work and 2nd Unit starting after three months form Start of Work of 1st unit and finishing in another 18 months) and 18 months from start of work for Package B.	Cl to be modified as under "**The entire work of erection, testing and commissioning, up to handing over of each unit shall be completed within 18 months from start of work for Package A (Unit-1 in 18 months from Start of Work and Unit -3 starting after three months form Start of Work of 1st unit and finishing in another 18 months) and 18 months from start of work for Package B"**

TENDER DOCUMENT NO:PSER:SCT:HLD-B1259:11

VOLUME -- II

FOR

ERECTION, TESTING AND COMMISSIONING OF BOILER, ROTATING MACHINES AND DUCT, ESP, CRITICAL PIPING, MICS. PIPING, ETC.

FOR

3 X 150MW THERMAL UNITS

AT

IPCL HALDIA PROJECT

WEST BENGAL

BHARAT HEAVY ELECTRICALS LIMITED
(A GOVT. OF INDIA UNDERTAKING)
POWER SECTOR – EASTERN REGION
PLOT NO. – 9 / 1, DJ – BLOCK,
SECTOR – II, KARUNAMOYEE,
SALT LAKE CITY,
KOLKATA – 700091.

CONTENTS

CLAUSE NO	DESCRIPTION
1.0	**GENERAL COMMON REQUIREMENTS**
1.1	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.
1.2	The terminal points indicated by BHEL should be final and binding on the contractor for deciding the scope of work and effecting payment for the work done.
1.3	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.
1.4	The work covered under this specification is of highly sophisticated nature, requiring the best quality workmanship, supervision, engineering and construction management. The contractor should ensure proper planning and successful and timely completion of the work to meet the overall project schedule. The contractor must deploy adequate quantity of tools & plants, modern / latest construction aids etc. He must also deploy adequate trained, qualified and experienced supervisory staff and skilled personnel.
1.5	Contractor shall erect and commission all the equipments and auxiliaries as per the sequence & methodology prescribed by BHEL depending upon the technical requirements. Availability of materials and fronts will decide this. BHEL Engineer's decision regarding correctness of the work and method of working shall be final and binding on the contractor. No claims for extra payment from the contractor will be entertained on the ground of deviation from the methods / sequence adopted in erection of similar sets elsewhere.
1.6	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.
1.7	The boiler shall be erected as per relevant provisions of latest Indian boiler regulations and amendments / addendums thereof, if any.
1.8	The work shall conform to dimensions and tolerances specified in the various drawings / documents that will be provided during various stages of erection. If any portion of work is found to be defective in workmanship, not conforming to drawings or other stipulations due to contractor's fault, the contractor shall dismantle and re-do the work duly replacing the defective materials at his cost, failing which the work will be got done by BHEL and recoveries will be effected from the contractor's bills towards expenditure incurred including cost of materials and departmental overheads of BHEL.
1.9	The contractor shall perform any services, tests etc. which may not be specified but nevertheless required for the completion of work within quoted rates.
1.10	All necessary certificates and licenses required for carrying out this work are to be arranged by the contractor expeditiously.
1.11	The contractor shall execute the work in the most substantial and workmanlike manner. The stores shall be handled with care and diligence. The contractor shall maintain a store and account for the materials issued by BHEL for the subject work.
1.12	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.
1.13	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 him unless otherwise specified in the relevant clauses. The contractor's quoted rates should be inclusive of all such contingencies.
1.14	Pre-assembly of equipment at the pre-assembly yard for inspection, checking and erection. It is to be noted that BHEL will provide only reasonably leveled open space for pre-assembly yard. The contractor has to arrange further desired leveling of the area at their cost. 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. Pre fabricated scaffoldings and platform materials required for quick assembly and dismantling is to be mobilised by the vendor for erection purpose. No Boiler components should be used by the vendor for making temporary platform, pre-assembly bed etc. the contractor should arrange for their own material for this purpose.
1.15	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. Claim of contractor if any, for such work will be governed by relevant section.
1.16	The structural steel required for fabrication of CAT HEAD STRUCTURE shall be provided by BHEL free of charges and shall have to be fabricated by the contractors as per direction of BHEL.
1.17	The contractor shall take delivery of the components, equipments, chemicals, lubricants etc. from the BHEL stores / storage area after getting the approval of BHEL Engineer on standard indent forms of BHEL. Complete and detailed account of the materials and equipments after usage shall be submitted to the BHEL and reconciled periodically. The contractor shall check, tally and inspect all material consignment issued to him and shall maintain proper record or the receipt of material received and such reports shall be produced by the contractor to the Engineer for verification. Any deviation from packing list or damage to any component noticed during receipt of material should be immediately brought to the notice of BHEL engineer. Any claim in this regard after receipt of material by the contractor will not be entertained.
1.18	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.
1.19	Plant materials should not be used for any temporary supports / scaffolding / preparing pre-assembly bed etc.
1.20	The details of equipments to be erected under this contract is generally as per the schedule given in **annexure – 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.
1.21	Hangers & suspensions, supports etc. for tubes, piping & ducts etc will be supplied in running / random lengths / sizes which shall be cut to suitable sizes and adjusted as required.
1.22	Spring suspension / constant load hangers may have to be pre-assembled for required load and erection carried out as per instructions of BHEL. Adjustments, removal of temporary arrests / locks, cutting of excess thread length of hanger tie-rod etc. have to be carried out as and when required. Load setting of spring hangers, as per BHEL's documents / instructions, during various stages of erection & testing and after floating of piping / ducting during cold and hot condition will have to be done. This exercise may have to be repeated till satisfactory results are achieved.
1.23	Layout of field routed / small bore(up to Nb100) piping shall be done as per site requirement. Necessary sketch for routing these lines should be got approved from BHEL by the contractor. There is a possibility of changes in routing the above pipelines even after completion of erection which shall be done by contractor as part of work.
1.24	Welding of necessary instrumentation tapping points, thermocouple pads, root valves, condensing vessels, flow metering & measurement devices and control valves to be provided on boiler & its auxiliaries and integral piping are covered within the scope of this specification. The installation of all the above items will be contractor's responsibility even if:
1.24.1	Items are not specifically indicated under the respective product groups as given in the technical specifications.
1.24.2	Items are supplied by an agency other than BHEL.
1.25	Pre-heating, NDE and post weld heat treatment for above shall be done as per the specifications as part of work.
1.26	Certain instrumentation like pressure switches, air sets, filters, regulators, pressure gauges, junction boxes, power cylinders, dial thermometers, flow meters, valve actuators, flow indicators, centrifugal / speed switches of motors, accumulators etc. are received in assembled condition as integral part of equipments. Contractor shall dismantle such instruments for calibration and hand over the same to BHEL. Storage / re-erection calibration will be done by C & I erection agency.
1.27	Fixing and seal welding of thermo-wells & plugs before hydro test / steam blowing of equipment or other piping system is within the scope of work. Contractor shall also remove the seal welded plugs by process of grinding and fix and seal weld thermo wells after hydro test / steam blowing of lines as part of work.
1.28	Actuators / drives of valves, dampers, gates, powered vanes etc. may have to be serviced, lubricated, before erection, during pre-commissioning & commissioning, including carrying out minor adjustments required as incidental to the work.
1.29	All electrical motors have to be tested for IR & PI values prior to the trial run. Where required, dry out may have to be carried out by using external heating source. Contractor shall make all arrangements in this regard and complete the work as instructed. Vendor shall arrange all necessary MMDs including the motorized insulation testers for the above test.
1.30	In installation of various equipments it may become necessary to install these on temporary supports / hanger due to various reasons including non-availability of suspension materials. Contractor shall install such temporary suspensions / hangers and later on shift the relevant equipments to their respective permanent hangers / suspensions / supports as incidental to work. Requisite materials for such temporary arrangements will be provided by BHEL on free – returnable basis. The same shall be returned to BHEL after the use.
1.31	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, fabrication of tubes and pipes, ducts, supports, as per

	general engineering practices at site cutting, 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 shall have to be supplied by the contractor.
1.32	Normally, the High Pressure Valves will have prepared edges for welding. But if it becomes necessary, the contractor will prepare new edges or re-condition the edges by grinding or chamfering to match the corresponding tubes and pipes. All fittings like T Pieces, weld neck flanges, reducers etc, shall be suitably matched with pipes for welding. The valves will have to be edge- matched, checked, cleaned and overhauled in full or in part before erection, after chemical cleaning and during commissioning, by the contractor as part of the scope of work.
1.33	Minor adjustments like removal of ovalities in pipes and opening or closing the fabricated bends of high pressure piping to the layout shall be considered part of the work and the Contractor is required to carry out such work free of cost with specified heat treatment procedures.
1.34	Suspension for entire boiler system will have to be finally tightened by using a calibrated torque wrench. The torque wrench for the purpose has to be arranged by the contractor at his own cost and calibrated as per specification listed in various drawings. Calibration is to be done from a recognized body and certificate is to be submitted to BHEL.
1.35	Extra lengths in various fabricated ducts and piping given as erection allowance, shall have to be cut to suit site conditions. Fabricated pipes are sent in standard lengths and will be cut to suit the site conditions and the layouts. Tubes or pipes wherever deemed to be convenient will be sent in running lengths with sufficient bends. For any mismatch while matching the joints in tubes cutting, adjusting, re-welding, addition of spool pieces should be done by the contractor to match site condition without any extra payment.
1.36	HANGERS & SUPPORTS
1.36.1	Installation of all supports and hangers including concreting or welding of these supports as necessary, required for piping in this scope of work have to be carried out by the contractor.
1.36.2	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. Adjustment of all hangers supports erected and providing cold pull in the piping wherever required is included in the scope of the contractor.
1.36.3	Fabrication and Erection of Auxiliary supports required for supporting the main hangers and supports shall have to be carried out by the contractor as part of the scope of work. However, secondary steel required for the above shall be provided by BHEL free of cost.
1.36.4	The hanger assembly shall not be used for attachment of rigging to hoist any equipment into position. Other means shall be used to securely hold the equipment into position till the equipment supports are completely assembled and attached to the pipe and building structure, and the spring support is set to accommodate the pipe-sway. Spring suspension/constant load hangers have to be pre-assembled and adjusted for the required loading and erected as per the instructions of BHEL Engineers. Any adjustments, removal of temporary arresters /lockers etc have to be carried out as and when required.
1.36.5	During hydraulic testing of the pipe system, all pressure parts having variable spring type supports shall be held securely in place by temporary means while constant spring type supports shall be pinned or blocked solid during test.
1.37	All the valves, dampers of ducts shall be serviced and lubricated to the satisfaction of

	BHEL Engineer, before erecting the same.
1.38	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.
1.39	The contractor shall arrange / organize for stage inspection of Boiler Components by Statutory Authority/ Boiler Directorate. It will be the sole responsibility of the vendor to arrange visit of the inspecting authority for conducting stage inspection of the components based on the Drawings / documents supplied by BHEL. Vendor is also expected to expedite the process of Lay-out drawing approval by Boiler Directorate. Technical clarification if required during drawing approval or inspection, will be extended by BHEL. The vendor should inform in advance about the inspection schedule for putting up formal invitation through Owner. Necessary inspection fees of Boiler Directorate only will be paid by BHEL / OWNER in this regard.
1.40	Temporary blanking of ducts / equipment for commissioning , if required , has to be done by contractor free of cost. Required plates will be supplied by BHEL free of cost.
1.41	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.
1.42	All the wlding, bolt connection at terminal point of this contract with other contracts (i.e interfaces points) are to be done by the contractor within the quoted rate.
1.43	Instrument tapping coming on the Ducts to be welded/fitted on the Duct to be done by the contractor within the quoted price.
2.0	**DETAILS OF SCOPE OF WORK** The scope of work under this contract covers Erection, testing and commissioning of Main Boiler and Auxiliaries, Rotating machines and ducts, ESP, various SG/Critical / TG piping etc., application of insulation & refractory, application of final painting alongwith unloading of Boiler Drum as detailed in the tender specification of Unit no. #1 & unit# 2/ Unit#3 (for Package-A/ Package-B respectively) of 3x150 MW IPCL Haldia TPP stage-II project.
2.1	**Boiler & Auxiliaries**
	The scope of work of the contractor for boiler and auxiliaries will be inclusive but not limited to following:
	• Receipt, unloading & transportation of boiler drum.
	• Receipt of boiler drum, unloading from the trailer/ wagon and transportation/dragging inside boiler cavity and positioning on ground before erection.
	• The scope of work includes receipt from open storage yard, stores, handling, pre-assembly, preservation, erection and comissioining etc of following major system -
	• Complete circulating system including down comers, cc pumps , headers, riser tubes etc.
	• Complete super-heater system, including headers connecting pipes, vents, drains, drain, funnels, pipelines up to Blow down tank nitrogen connections, safety valves, sampling connections, start up lines etc.
	• Complete Re-heater system including headers, connecting pipes, coils drains, drain funnels, drain pipes up to Blow down tank, safely valves etc.
	• De-super-heater system for super-heaters & re-heater steam temperature control, pneumatically operated diaphragm type control valves with isolating valves, block valves and bypass valves.
	• SGWC pumps complete with drive motors, high pressure coolers, lubricating system, purge & fill system, emergency cooling system, etc.
	• Economiser system including connecting pipes, headers & economiser re-circulation system.

	• Rotary Air heater complete with structure, bearings, lub system etc.
	• Steam Coil air pre-heater (SCAPH) with accessories.
	• All Boiler integral piping valves & fittings, including check valves, motorised isolating, motorised stop valves, motorised startup valves, blow-down valves, safety valves, and electromatic safety valves, control valves with pneumatic connection , for drum, super-heater and re-heater, safety valve escape pipings with silencers. Complete steam and water sampling lines with sample coolars & collectors. Chemical feed line. IBD & CBD lines, vents, RH/SH spray control station, Eco re-circulation etc.
	• All approaches to valves and mountings including platforms.
	• Applicable Air & gas duct work (Ref. wt schedule) with necessary expansion joints with protection against ash erosion insulation wherever required, dampers gates, supports, access doors etc. and support steel work.
	• All the ash hoppers for boiler, economiser, air-heater stainless steel dip plates for bottom ash hopper and shield plates with refractory. The fly ash hoppers shall be provided with suitable vibration and heating arrangement to prevent ash build up.
	• Boiler roof mountings including access / inspection doors for boiler / furnace, air-heater, economiser, and ducts etc. and also access for power operated maintenance platform.
	• Complete soot blower and wall blower system with drains, entire piping and fittings including control valves.
	• All drain lines including trap discharge outlet with drain funnels/drain receivers and pipelines from funnels discharge up to the nearest plant drainage system.
	• Temperature measuring probe for start up (at furnace outlet) along with its starter cum control panel.
	• Complete boiler and auxiliaries supporting structural steel, walkways, platforms, ladders and gratings, hand rail, stair cases at both sides of the boilers including inter connecting walkways between steam generator operating floor and main building and connecting platform for boiler and elevator including chequered plates, kicker / toe-guard plates wherever required, foundation bolts, nuts, fasteners, inserts, anchor channels, base plates, packers, shims, pipe sleeve for equipment and columns under scope.
	• Erection of Elevator structure including it's bracings, connecting members and cladding structures.
	• Erection of LDO, HFO pumps, motors, heaters etc. along with applicable pipings & structures.& hoists
	• Erection of burner block, guns, ignitor etc.
	• Erection of scanner air fan with motor and its ducting up to burners.
	• Structural steel material & purlin for boiler roof, drum level and burner operating floor.
	• Complete buck stays and tie bars for pressure part system.
	• Piping (HP/IP) work other than boiler parts but integral part of Boiler as detailed in the weight schedule.
	• All hanger components, spring cage assembly, constant load hanger and aux. steel structure will be supplied as loose items. Contractor shall pick up the correct components pertaining to a hanger, assemble the component at site and erect as per the drawing/ document. Necessary cutting of rods and aux. steel structure to the required lengths shall be done at site by the contractor within his quoted rate.
	• Pulveriser fuel piping complete with gates, hangers etc.
	• Welding, radiography, heat treatment of piping joints will be as per specification enumerated in the relevant clause.

	• All ducts (both air & flue gas) required for boiler up to chimney and inside the chimney up to limit point.
	• Primary Air (PA) fan with drives including suction and discharge duct.
	• Seal air fans and drives, Feeders including Mill/Feeder Air System.
	• Pulveriser and motors with their handling devices, monorails etc.
	• Forced Draught (FD) fans and motors including suction duct.
	• Induced Draught (ID) fans including drive motors.
	• Lube oil equipment assemblies as below:
	• For ID fan.
	• For FD fan.
	• For PA fan
	• For Pulverisers.
	• Run way beams and lifting tackles for maintenance of FD, ID, PA, mills.
	• Maintenance platform for FD, ID, PA Fans and Mills.,valves,actuaters,dampers,gates, coal burners, oil burners, PG test points for ESP & Boiler.
	• Temporary piping for steam blowing and acid cleaning,detergent flushing, temporary drain to waste
	• Corrugated sheeting of roof top and burner weather protection sheeting along with fasteners, bitumen washers etc.
	• All ducts (both air & flue gas) required for coal firing.
	• Complete water cooled furnace wall system complete with down comer including header drains, drain funnels, drain pipelines up to & including blow down tank and necessary stubs for chemical cleaning , nitrogen purging and wet lay up.
	• All interconnecting steel platforms, between Boiler & Main power house and Boiler & Mill Bunker Building with associated ladders/stairs, grating, handrails etc.
	• Drinking water, Distribution of construction Power, Development of pre-assembly yard, area lighting of pre-assembly area and Boiler area, obtaining approval from statutory authority.
	• Garbage Chute
	• Miscellaneous tanks (IBD/CBD/CC PUMP MAKE UP WATER TANK/CLEAN DRAIN FLASH TANK FOR SCAPH DRAIN,DRAIN OIL TANK IN BOILER AND FO PUMP HOUSE,AIR RECEIVER TANK FOR APH) etc.
	• Application of pourable insulation, refractory, fixing of insulation pins, related iron/steel components, lagging of insulation mattresses, claddings over insulated surfaces etc. including supply & application of black bitumen paints on inside surfaces of the insulation cladding as per specification/drawings.
	• Supply & Application of final painting over steel surfaces of boiler & aux. components (one coat of red oxide & two coats of final paints). Paints shall be taken from approved paint manufacturers & various colour codes will be decided by BHEL/Customer.
	• Hoist for ID,FD,PA,MILLS, APH bucket handling,SCAPH handling, FO pump house, ESP roof etc.

2.1.1	PRESSURE PARTS
2.1.1.1	Installation of temporary structure (CAT HEAD structure) for drum lifting is in the scope of the contractor's work the required steel for the purpose will be provided in random sizes by BHEL free of charge. These shall be fabricated to suit the requirement, erected and welded as part of work. NDT has to be carried out as per

	instructions. These structures have to be dismantled at appropriate stage and returned to BHEL as per the instructions of BHEL Engineer. Also, the relevant area of permanent structures has to be finished as instructed. Payment for above will be made at the rate accepted for structures (under NPP); no separate payment will be made for fabrication, dismantling and finishing work and return of materials.
2.1.1.2	Pressure parts components like headers, panels, coils, loose tubes etc. have to be flushed / blown with compressed air, checked for dimensional accuracy and configuration and minor rectifications, if necessary will have to be done before erection. This will involve making appropriate bed of steel structures over the concrete blocks. Steel, in random sizes, for this purpose will be provided by BHEL from the packing materials / scraps etc., where as necessary concrete blocks shall be arranged by the contractor. Bed shall be fabricated as per requirement. These shall be dismantled & returned to BHEL at appropriate stage. No separate payment for making / dismantling such bed is envisaged.
2.1.1.3	Normally the high-pressure valves will have prepared edges for welding. But, if it becomes necessary, the contractor shall prepare new edges or recondition the edges by grinding or chamfering to match the corresponding tubes and pipes. No gas cutting will be permitted. All fittings like “T” pieces, weld neck flanges, reducers etc. shall be suitably matched with pipes for welding (this is applicable to piping work also).
2.1.1.4	Welding of all attachments on pressure parts including those required for insulation work is in the scope of work.
2.1.1.5	Furnace area and heat recovery area of flue gas passage has to be made leak proof by seal welding. Air leak test by pressurization has to be conducted to prove effectiveness of the seal weld and soap bubble, kerosine or any other similar test will have to be carried out for the entire seal welds to ascertain the effective sealing is achieved. The tests may have to be repeated till satisfactory result is achieved.
2.1.1.6	If required, the pressure parts, after initial erection and tests, will have to be preserved by either dry or wet preservation procedure. Contractor shall erect the piping & valves and provide necessary assistance for the same. Required piping, valves and preservative (gas / chemicals) will be provided by BHEL as free issue.
2.1.1.7	The drum internals, if already installed, may have to be removed to facilitate inspection by statutory authorities and chemical cleaning. The drum internals are to be preserved properly and refitted afterwards as part of work.
2.1.1.8	BOILER DRUM
2.1.1.8.1	Boiler drum may come by wagon on rails upto Railway siding or by road as close as possible to site. All other arrangements and resources for unloading, transporting / dragging to the Boiler cavity are in contractor’s scope. Contractor shall be required to arrange heavy duty trailor for short duration to transport boiler drum from the railway unloading point or nearest point of the unit/ boiler cavity. The rails and sleepers & winches 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 wooden sleepers (about 400 nos. of sizes 4 inchx8 inchx8 feet approx.), slings, power jacks etc. shall be done by the contractor within his quoted rates. For this ODC consignment i.e. Boiler drum (in case, the boiler drum comes by trailer), no separate payment against unloading, handling etc. shall be made and the quoted rate for erection shall be inclusive of this scope of works. In case the Boiler drum comes by wagon, payment shall be made as per applicable item rate i.e. 9.0 of Vol-III Pkg-A/Pkg – B, as applicable. In case the drum comes by Trailor, the drum will be unloaded near boiler cavity by the contractor and BHEL shall provide Cranes, free of cost, as required for unloading / handling of the Boiler drum and no separate payment against unloading, handling etc

	of the drum shall be made. The erection & commissioning rate of applicable item shall be inclusive of the same
2.1.1.8.2	Transportation by trailer, dragging on rails of drum from the point of delivery to the boiler cavity is contractor's scope. Collecting from stores / storage yard, transporting to & handling at site, laying the sleeper bed and rails, shifting etc. are contractor's responsibility. Contractor shall, if required, fabricate the saddle for dragging of drum to the boiler cavity as incidental to work. Structural materials required for the same will be provided by BHEL on free basis.
2.1.1.8.3	The drum has to be lifted and erected in position by contractor by strand Jack method and the contractor shall tie up with specilaised agency for lifting and placement of drum in position by Strand Jack method and submit plan,procedure along with credentials and test certificate of strands used by specilaised agency for approval of BHEL .
2.1.1.9	Corrections in the profiles of scalloped plates / bars, skin casing, seal plates etc. for proper matching with matting parts, wherever required, shall be done as incidental to the work.
2.1.1.10	Flame cutting of high-pressure piping and pressure parts shall not be permitted.
2.1.1.11	Extra portions of fins in water-wall panels has to be smooth ground for making panels to panel joints. Also panel to panel tube joint alignment may require some amount of fin cutting and edge preparation/adjustment of panel. Such works shall be carried out by the contractor to the desired accuracy as part of the scope of work complete penetration of water wall (panel to panel) fin welding shall be achieved either by single side or double side welding.
2.1.1.12	Panel to panel welding in water-wall panels shall be carried out by the contractor as part of the scope of work. This shall be carried out by approved high pressure welders only.
2.1.1.13	Attachment welding of necessary seal boxes inspection windows. Instrument tapping points, thermocouple pads, root valves, condensing valves, flow nozzles and control valves etc., both for regular measurement and performance testing to be provided on boiler, its auxiliaries or pipelines 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.
2.1.1.14	The inside of all tubes, pipes, valves and fittings shall be free from dirt, and loose scales. Before being erected, all pipelines shall be thoroughly blown and/or flushed; the ball and sponge test shall be carried out. All the above works shall be carried out by the contractor as part of the scope of work. A system for recording all such operations shall be developed and maintained in a manner to ensure that no obstructions are left inside the tubes/pipes and no tubes/pipes are left non-cleaned and untested.
2.1.1.15	All attachment, welding, fixing hooks, supports, anchors, studs, plates, angles and other steel components to support insulation and refractory over the pressure parts components erected 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 high pressure welders only.
2.1.2	TRIM & INTEGRAL PIPING OF BOILER {PG 21, 24 AND 80(PART)}
2.1.2.1	The work on various piping systems will include cutting to required length, edge preparation, laying, fixing & welding of the pipes / elbows / fittings / valves etc. in the pipeline, fixing & adjustment of supports / anchors / shock absorbers and carrying out all other activities / work to complete the erection and also carrying out all pre-commissioning / commissioning operations mentioned in the specification as per BHEL Engineers instructions and / or as per approved drawings / documents.
2.1.2.2	Tubes or pipes wherever deemed convenient, will be sent in random lengths. These shall be cut and edge prepared to suit the site conditions and the layouts. Fittings like bends tees, elbows, reducers, flanges etc. will be supplied as loose items. However,

	bends of tube size up to Nb 65 mm will have to be formed at site as incidental to work.
2.1.2.3	All drains / vents /relief / escape / safety valve exhaust piping etc. to various tanks / sewage / drain canal / flash box / sump / atmosphere etc. from the stubs on the piping and equipments are covered in the scope of work.
2.1.2.4	Connection (either flanged / bolted or welded) of piping to the terminal points / equipments etc. is in the scope of work even though such terminal point / equipment may not form part of this work. All NDE including radiography/UT with recording/MPT/DPT of joints so made, post-weld-heat-treatment if any, are also within the scope of work / specification. The terminal points work is inclusive of cutting of existing lines, if required, edge preparation, welding / blanking and hook up work.
2.1.2.5	It should be ensured that all the terminal point connections are done without transferring any undue load or strain to the other equipments. Necessary protocols have to be prepared for such fit-up along with BHEL / customer representative before connecting. All NDE including radiography of joints so made, post weld heat treatment if any, are also within the scope of work / specification.
2.1.2.6	Mechanical freeness of valves has to be ensured prior to erection.
2.1.2.7	The above provisions shall be applicable mutatis – mutandis, to other piping systems e.g. oil piping of rotating M/cs, ACW lines etc.
2.1.2.8	All drain points shall be laid by the contractor to the drain pit with necessary support as advised by BHEL Engineer as part of the scope of work.
2.1.3	ROTATING MACHINERY
2.1.3.1	Specifications covered under the following paragraph and also other relevant specifications contained in other paragraphs elsewhere in this tender document will be applicable for rotating machines like FD / ID / PA / Seal Air Fans /Scanner fans, blowers, coal mills, fuel feeders, HP dosing pump skids and other similar auxiliaries.
2.1.3.2	All lubricants for testing, preservation and lubricants for trial runs of the equipments shall be supplied by BHEL as free issue. All services including labour shall be provided by the contractor for drawing these from BHEL / customer's stores, transporting, handling, filling, emptying, re-filling, accounting and return of surplus lubricants / empty containers / old & used lubricants after draining etc. Contractor should clean the spilled / leaking lubricants thoroughly; consumables for such cleaning will be in contractor's scope.
2.1.3.3	All rotating machinery and equipments shall be cleaned, lubricated, checked for their smooth rotation, if necessary, by dismantling and re-fitting before erection. Also, the equipments may have to be checked for clearances, tolerances at any stage of the work including during testing, commissioning etc. Shaft of the rotating machines shall be rotated periodically to avoid damages.
2.1.3.4	Trial run of the drives in un-coupled state and then coupled with equipment has to be done after necessary alignment.
2.1.3.5	Forced lube oil systems including lube oil piping of drives, rotating equipments etc. form part of the work under these specifications. Hydraulic test of oil coolers, oil piping etc. are in the scope of work. Where required cooler may have to be dismantled for hydraulic test and re-erected thereafter as part of work.
2.1.3.6	Certain rotating machinery, after testing, pre-commissioning may have to be re-aligned / hot aligned and vital clearances re-set. This may necessitate disconnection of cabling, removal of certain instruments etc. and restoration thereafter.
2.1.3.7	Protective lubricant coats / fill provided on / in the critical area of equipments have to removed at appropriate stage and regular lubricants, after removal / cleaning of protective coat / fill, as per specifications should be filled / applied. Cleaning / flushing agents / oils will be provided by BHEL.
2.1.3.8	Chemical cleaning, steam blowing and air drying of the connecting pipes for the lube oil system has to be carried out wherever required as per instruction manuals / drawings. Chemicals will be provided by BHEL
2.1.3.9	Even though rotating machines may be grouted to foundation using non-shrink grout mix, blue matching of packer plates / shims with foundation / between packers /

	equipment base should be done as incidental to work.
2.1.3.10	Skid mounted equipments may need checking, re-setting due to various reasons as incidental to work.
2.1.3.11	All the shafts of rotating equipment shall be properly aligned to those of the matching equipments to as perfect an accuracy as practicable. The equipment shall be free from excessive vibration so as to avoid overheating of bearings or other conditions which may tend to shorten the life of the equipment. The vibration level of rotating equipments measured at bearing housing shall not exceed forty (40) microns and shall conform to VDI 2056.All bearings, shafts and other rotating parts shall be thoroughly cleaned and suitably lubricated before starting.
2.1.4	MAIN SUPPORTING STRUCTURES, EXTERNAL STRUCTURES, STAIRWAYS, GALLERIES & PLATFORMS & HANDLING ARRANGEMENT
2.1.4.1	Boiler main supporting structures have to be erected in a sequential manner.
2.1.4.2	Quality norms with regard to vertically of column, inter-alia, have to be adhered to strictly, at various stages of erection.
2.1.4.3	Stiffening / strengthening of main supporting structure, if any, due to deviation in verticality of columns post drum lifting, shall be carried out by the contractor. Necessary steel for this will be provided by BHEL as free issue. Payment for such stiffening / strengthening shall be made for weight certified by BHEL Engineer at the item rate applicable to structures, provided the deviation has occurred for the reasons not attributable to the contractor.
2.1.4.4	Each of the ceiling girders will be sent in 3 pieces and will have to be assembled, welded and NDE & PWHT (SR) done on ground prior to their erection in position.
2.1.4.5	It is likely that in deviation from prescribed sequence, erection of certain elements of structure may be deferred for later stage, to facilitate, say crane boom reach to higher elevation, passage of drum during drum lifting etc. This may necessitate temporary installation of some structural steels at appropriate locations to keep the stability of structure intact. Such temporary installation shall be removed subsequently and returned permanent structures shall be done as per the instruction of BHEL Engineer. BHEL will provide necessary steels on free issue basis in random sizes for such installations, which shall be fabricated by the contractor to suit the requirement.
2.1.4.6	Payment for such installations shall be made on the accepted tonnage rate of structures. No separate payment will be made for fabrication, removal & return of the materials to BHEL stores.
2.1.4.7	In some cases, the structural material will be supplied in random lengths, which have to be fabricated to suit the requirement as incidental to work. Also, it may sometimes be necessary to remove some of the erected members to facilitate erection of bigger / pre-assembled equipments. In such cases, the removal and re-erection of such members as agreed by the BHEL Engineer, will have to be done by the contractor as incidental to work.
2.1.4.8	Temporary ladders & working platforms during erection of columns, platforms and other structural components. Such arrangements shall be only of clamping & bolting type as welded on columns etc. will not be permitted. After the completion of work these shall be removed. Contractor shall arrange materials required for arrangements as above.
2.1.4.9	All the handrails and toe guards shall be provided as per drawings and site requirement. Handrails supplied in running lengths shall be suitably cut, edge prepared and welded. Also, hand rails / guard may have to be provided from the safety point of view in certain places though not indicated in the erection drawings. The weld joints of handrails shall be ground to flush finish.
2.1.4.10	Additional platforms of permanent nature for approaching different equipment as per the site requirement, though not indicated in drawings, shall also be installed by the contractor. Materials required for such platforms will be supplied by BHEL in random sizes on free issue basis. These have to be fabricated to suit the requirement. Payment only for erected weight as certified by BHEL Engineer shall be made at the

	applicable item rate (under 6.7 of rate schedule).
2.1.4.11	All relevant provisions as above shall apply to work of external structures, interconnecting structures & equipment handling system.
2.1.4.11.1	The contractor shall carry out burner alignment and Burner nozzle setting as directed by BHEL Engineer. Burner tilt mechanism will be checked for freeness, serviced and adjusted, if necessary to obtain optimum tilt before and after installation for which all necessary arrangement for providing safe approach inside the furnace has to be taken care of by the bidder.
2.1.4.11.2	HSFG bolts of boiler supporting structure are to be tightened, by turn of nut method, as per the instructions of BHEL Engineer. The bolted joints should be jointly checked by the BHEL/Customer and contractor's personnel for the required tightness and re-tightened wherever necessary. The tightened bolts should be identified by colour paints. Facility for random checking with calibrated torque wrenches shall also be provided by contractor.
2.1.5	OTHER PRODUCTS AND SYSTEMS
2.1.5.1	Ducts/ expansion bellows (metallic & non-metallic) are normally supplied in loose wall plates/ segments and these are to be assembled and welded at site before erection. Correction of ovalities/ distortion of ducts, expansion bellows etc occurred during transportation/ handling are to be carried before erection as part of work. Erection of mechanical components of non-metallic joints is included in the scope of work. All joints connecting ducts, expansion pieces and dampers shall be seal welded. These welds have to be made leak proof and tested as per technical instruction / requirement.
2.1.5.2	Certain structural items like silencer supports, roof cladding structure, platform etc. will be supplied in running lengths which shall be cut to required suitable sizes and adjusted / trimmed as part of work.
2.1.5.3	Contractor has to make canopies for motors, actuators, lub oil units, control valves etc. Material for this will be supplied in random lengths / sizes. No separate payment for fabrication is envisaged. Only the erection tonnage rate applicable for structure will be paid for this work (under NPP group).
2.1.5.4	ID fans are provided with variable frequency drives. Contractor has to erect & commission only the motor and other mechanical components like coupling etc. Panels, transformers, cabling etc. are not in this work specification.
2.1.5.5	Fine fittings, boiler drain piping, oil system & other small bore piping have to be routed according to site conditions and hence shall be done only in position. As such, layout of small bore piping in boiler and oil system including bending, cutting edge preparation etc. 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 change in routing the above pipelines even after completion, to suit the site condition which shall have to be done by the contractor at no extra cost. On completion of piping, erection Vendor should submit `AS-BUILT' drawings with RTF for necessary record.
2.1.5.6	Oil system main lines supports shall be supplied at random lengths and fabrication, erection etc of these supports shall be included in the scope of the contractor within the quoted rates.
2.1.5.7	The air heater baskets have to be thoroughly cleaned by compressed air and preservative to be spread as part of responsibility of the contractor.
2.1.6	**PREPARATION OF FOUNDATIONS, AND GROUTING OF EQUIPMENTS OF BOILER & AUXILIARIES.**
2.1.6.1	Building foundations and other necessary civil works for supporting structures, equipments etc. will be provided by BHEL / customer. The dimensional accuracy, axes, elevation, levels etc. with reference to benchmarks of foundations and anchor blot pits have to be checked and logged by the contractor. The permanent benchmark / reference marks will have to be transferred to new locations with sufficient care to maintain the accuracy and protected / preserved with adequate care (to enable

	rechecking at later dates) as per BHEL instruction.
2.1.6.2	Minor adjustments of foundation level dressing and chipping of foundation surfaces and blue-matching (wherever required) for all equipments as per BHEL Engineer's instructions, should be done by the contractor as part of the work. Dressing and chipping of foundations to the extent of 30 mm for achieving proper levels is within the scope of work.
2.1.6.3	All temporary foundations and anchor points required for installing erection equipments and winches etc. are in the scope of contractor. All building materials like cement, steel etc. for such temporary foundations shall have to be arranged by the contractor within the quoted rates. All such foundations shall be demolished and normal ground conditions restored after the usage.
2.1.6.4	Contractor shall carry out scrapping and blue matching of embedded plates / packers of rotating equipments. Chipping and the leveling of concrete surfaces, fine dressing up to the extent required to obtain contact between packer and concrete, is also covered in the scope of this work. Scrapping, chipping and matching shall be done so as to achieve prescribed percentage of contact between the two surfaces.
2.1.6.5	BHEL will provide free of cost only the shims and packer plates (either machined or plain) which go as permanent part of the equipment. Certain packer plates and shims over and above the quantity received as a part of supplies from manufacturing units of BHEL, will have to be cut out from steel plates / steel sheets at site to meet site requirement. Contractor shall cut and prepare packers and shims by gas cutting /chiseling / grinding and de-burr the same. However, machining of the packers wherever necessary will be arranged by BHEL.
2.1.6.6	Complete grouting of structures equipments, including anchor / foundation bolts, beneath base, base hollows etc. as may be applicable, is included in the scope of contractor. Arranging all labour, building materials including cement, ordinary Portland as well as quick setting – free flow – non-shrink grout mix (e.g.srinkcomp , conbextra etc), form work, shuttering, and any other requirements is in the contractor's scope. Contractor shall obtain approval of BHEL for cement (ordinary as well as quick setting – free flow – non-shrink grout mix) prior to use. Cleaning of foundation surfaces, pocket holes and anchor bolt pits and de-watering and making them free of oil, grease, sand and other foreign materials by soda washing, water washing, compressed air and other approved methods, are within the scope of this specification / work.
2.1.6.7	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.
2.1.6.8	Foundation and other necessary civil works for supporting structures, equipment etc, will be provided by BHEL/ customer. 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 30 mm as may be required for the erection of equipment/plants will be carried out by the contractor without any extra cost. All foundations and anchor points required for installing winches, shall be cast by the contractor using his own materials at his cost . Installation of starters, distribution etc, shall be done by the contractor while only incoming supply to the common isolating switch will be arranged by BHEL.. Grouting of all columns, equipment base plates, anchor bolt holes etc are included in the scope. The grouting mixture shall be either composed of port land cement or ready mix grout of proved quality. However, in both the cases Contractor will supply portland cement and ready mix grout component respectively. 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, labours 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.
2.1.6.9	The grout shall be high strength grout having a minimum characteristic compressive strength of 60 N/mm2 at 28 days. The grout shall be chloride - free, cement based, free flowing, non-metallic grout.
2.1.6.10	The Grout shall have good flowability even at very low water/ grout powder ratio.
2.1.6.11	The Grout shall have characteristics of controlled expansion to be able to occupy its original volume to fill the voids and to compensate for shrinkage. Grout shall be of pre-mix variety so that only water needs to be added before use.
2.1.6.12	The mixing of the Grout shall conform to the recommendations of the manufacturer of the Grout.
2.1.6.13	After the base has been prepared, its alignment and level has been checked and approved and before actually placing the grout, a low dam shall be set around the base at a distance that will permit pouring and manipulation of the grout. The height of such dam shall be at least 25mm above the bottom of the base. Suitable size and number of chains shall be introduced under the base before placing the grout, so that such chains can be moved back & forth to push the grout into every part of the space under the base.
2.1.6.14	The grout shall be poured either through grout holes if provided or shall be poured at one side or at two adjacent sides to make the grout move in a solid mass under the base and out in the opposite side. Pouring shall be continued until the entire space below the base is thoroughly filled and the grout stands at least 25 mm higher all around than the bottom of the base. Enough care should be taken to avoid any air or water pockets beneath the bases.
2.1.6.15	In addition to the above, recommendations of Grout manufacturer shall also be followed.
2.1.6.16	The poured grout should be allowed to stand undisturbed until it is well set. Immediately thereafter, the dam shall be removed and grout which extends beyond the edges of the structural or equipment base plates shall be cut off, flushed and removed. The edges of the grout shall then be pointed and finished with 1:2 cement mortar pressed firmly to bond with the body of the grout and smoothened with a tool to present a smooth vertical surface. The work shall be done in a clean and scientific manner and the adjacent floor spaces, exposed edges of the foundations, and structural steel and equipment base plates shall be thoroughly cleaned of any spillage of the grout.
2.1.6.17	After the grout is set and cured, the Contractor shall check and verify the alignment of equipments, 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 such 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 BHEL / Employer.
2.1.7	**WELDING, RADIOGRAPHY AND OTHR NON-DESTRUCTIVE TESTING, POST WELD HEAT TREATMENT**
2.1.7.1	Installation of equipment involves good quality welding, NDE checks, post weld heat treatment etc. Contractor's personnel engaged should have adequate qualification on the above works. Qualified minimum 2 nos. NDT Engineers are to be deployed at site with ASTM/ISMT level II certification in RT, UT, LPT, MPI.
2.1.7.2	The method of welding (viz) arc,TIG or other method will be indicated in the detailed drawing / documents. BHEL Engineer will have the option of changing the method of welding as per site requirement.

2.1.7.3	All welders shall be tested and approved by BHEL Engineer 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 welder identification code as approved by the BHEL Engineer shall be stamped by the welder on each joint done by them. Suitable recording shall be made available by the contractor to identify which joint has been welded by which welder. The contractor will be responsible for the periodic renewal, re-testing of the welders as demanded by BHEL/statutory body /customer.
2.1.7.4	All welded joints shall be subjected to acceptance by BHEL Engineer/statutory body/customers. Joints coming under the purview of IBR need to be cleared by Testing laboratory of Boiler Directorate. Contractor has to arrange for such regular evaluation of radiographs without accumulation of any backlog. Necessary evaluation fees only will be paid by BHEL / Customer in this regard. Repair work and re-sampling also shall be taken up promptly, without piling any backlogs.
2.1.7.5	Welding of high-pressure joints shall be done by IBR certified high-pressure welders who have been permitted by CIB of state concerned for deployment at the site of work after conducting simulation tests in presence of representative of boiler directorate.
2.1.7.6	Welding of all attachments to pressure parts, piping shall be done only by the qualified and approved attachment welders only.
2.1.7.7	All the welders (structural and high pressure) shall be tested and approved by BHEL Engineer before they are actually engaged on work though they may possess the IBR / other certificate. BHEL reserves the right to reject any welder without assigning any reason. Pipe & Tubes for simulation test of HP welders shall be supplied by BHEL free of cost. However, for revalidation test of these welders as well as Non-IBR welders, the required Pipe / Tube / Plate is to be arranged by the contractor.
2.1.7.8	Unsatisfactory and continuous poor performance may result in discontinuation of concerned welder.
2.1.7.9	The welded surface shall be cleaned of slag and painted with primer paint to prevent rusting, corrosion. For this consumables like paint / primer etc. will be in the contractor's scope.
2.1.7.10	HP joint fit-ups, should be protected, where required, by use of tapes / protective paint as may be prescribed by BHEL. The contractor shall supply consumables like protective paints / tapes etc.
2.1.7.11	The contractor shall maintain welding records in the form as prescribed by BHEL containing all necessary details, and submit the same to the BHEL Engineer as required. Interpretation of the BHEL Engineer regarding acceptability of the welds shall be final.
2.1.7.12	In execution of this work, considerable number of socket weld joints is involved. The exact quantity of such socket welds or probable variation in the quantum cannot be furnished. The tenderer shall take notice of this while quoting, as no extra claim on this account will be entertained at a later date. The socket welding on HP parts / HP piping shall be done by the IBR qualified welders. In case the contract provides for payment / recovery on account of variation in the quantity of butt weld joints. Modification work, involving socket weld joints will be paid on the basis of extra man-hour rate only. Contractor has to adhere to the procedures / specification as indicated in the drawing for socket welding.
2.1.7.13	All butt joints of high pressure tubular system of boiler and piping shall be carried out by TIG root-run and subsequent runs by arc welding. Full TIG welding, wherever necessary shall be carried out within the quoted rates. For oil system piping, root run of all the butt joints shall be carried out by TIG welding only. While all the filler wires required for TIG welding of Boiler tubular joints will be supplied by BHEL free of cost, Filler wires required for the Piping works to be arranged by the Vendor within his quoted price.
2.1.7.14	Contractor shall provide all resources and make all arrangements for the radiographic examination of welds for this work. For reasons of safety, invariably the radiography

	work will be carried out after the normal working hours and close of other site activities only.
2.1.7.15	Radiography inspection of welds shall be performed in accordance with requirements and recommendation of BHEL Engineer. The quantum of radiographic inspection shall be as per provision of IBR / BHEL's Erection Welding Schedule (EWS). They may, however be increased depending upon the performance of the individual welder at the discretion of BHEL Engineer / boiler inspecting authority.
2.1.7.16	All X-ray / gamma ray films of weld joints shall be preserved properly and be handed over to BHEL / IBR authorities and requisite clearances shall be obtained by the contractor. The contractor shall be fully equipped with radiography equipment, films, chemicals and other dark room facility. There must be a number of radio-graphic personnel with sufficient experience and certified by BARC for field radiographic inspection. Further, the contractor must follow strictly the safety rules laid down by BARC, from time to time. Contractor's radiographers shall also be registered with BARC for film badge service. For preliminary evaluation of radiographic films, the contractor must deploy competent personnel having at least ASNT / ISNT Level-II certification. He should also ensure compliance of all statutory requirement with respect to health hazard in handling the radiographic sources. The contractor shall also furnish along with their offer, the names of approved high pressure welders in TIG welding and alloy steel arc welding.
2.1.7.17	Test facilities shall be established / sourced expeditiously and testing shall be conducted regularly ensuring that no backlogs are piled up. If the contractor does not carry out radiography work in time due to non-availability of film, chemicals, etc, BHEL may get the work done through some other agency at the risk and cost of the contractor.
2.1.7.18	The field welded joints shall be subject to dye-penetrant / other non-destructive examination as specified in the respective engineering documents / as instructed by BHEL.
2.1.7.19	Where required, surface preparation, like smooth grinding of welded area, prior to radiography shall be done. It may also become necessary to adopt inter-layer radiography / MPT / UT depending upon the site / technical requirement necessitating interruptions in continuity of the work and making necessary arrangements for carrying out the above work. The contractor shall take all these into account in his offer.
2.1.7.20	Pre-heating, inter-pass heating, post weld heating and stress relieving after welding are part of erection work and shall be performed by the contractor in accordance with BHEL Engineer's instructions. Radiography / Ultrasonic testing / Stress relieving vendors may be deployed at site after obtaining concurrence from BHEL site/IBR authority. Normally the electric resistance heating method will be adopted. Contractor shall arrange to supply heating equipment with automatic recording devices. Also, the contractor shall have to arrange for labour, all heating elements, thermocouples and attachment units, graph sheets, non contact thermometers, thermal chalks & insulating materials like mineral wool, asbestos cloth, ceramic beads, asbestos ropes etc. required for all heating and stress relieving works. For main steam line upto boiler stop valve, induction heating machine has to be used for the above purpose.
2.1.7.21	During preheat/stress relieving operations, the temperature shall be measured at one or more than one points as required by attaching thermocouples and recorded on a continuous printing type recorder. All the recorded graphs for the heat treatment works carried out shall be got signed by the BHEL Engineer prior to the commencement of each cycle and handed over to BHEL on completion. The graphs will be the property of BHEL. The contractor has to provide thermal chalks, non contact thermometers, temperature recorders, thermocouple attachment units, graph sheets, etc., required for the job and maintain them in good condition. All temperature recorders should be calibrated by approved agency of BHEL/ respective state Boiler Directorate, before use and validity renewed at appropriate intervals, Required fees to be paid for initial and periodic calibrations should be borne by the

	contractor.
2.1.7.22	Heat treatment may be required to be carried out at any time (day and night) to ensure the continuity of the process. The contractor shall make all arrangements including labour required for the work as per direction of BHEL. For post weld heat treatment of main steam piping, the induction heating process shall continue un-interrupted. Therefore, contractor shall arrange DG set for the same to take care of power failures.
2.1.7.23	Methodology for sampling for testing of repaired weld joints is given below.
2.1.7.23.1	Whenever the quantum of check in any NDT is less than 100 %, guidelines for sampling / resampling procedure for NDT as formulated by BHEL will prevail including the following features :
2.1.7.23.2	The group of welds for sampling shall be based on welding done by welder in specified continuous time (say work done in a shift or in a day). For further analysis, acceptance or rejection, this group shall be treated as an entity.
2.1.7.23.3	From above weld group, the selection of weld joint / weld spot shall be done by BHEL/HNPCL as per the quantum of check specified.
2.1.7.23.4	For acceptance of the weld group, all samples selected in this group should meet the acceptance norms. In case of any sample(s) found not meeting acceptance norms, following actions shall be taken :
2.1.7.23.5	Rectification of defective welds and re-testing of the repair.
2.1.7.23.6	Re-sampling by BHEL/ HNPCLfrom the same group of welds, with quantum of NDT being double of originally specified quantum (with minimum 2 welds for every defective weld).
2.1.7.23.7	In case of any weld from the re-sample, as per above found not meeting acceptable norms, following action shall be taken :
2.1.7.23.8	NDT of all the welds of the group, which were not tested in first and second samples. Repair and re-testing of all defective welds. Necessary action on process control and on welder for eliminating recurrence of defects.
2.1.7.23.9	For the purpose of sampling, the weld group shall be defined as number of welds in case of smaller diameter of tubes/ pipes (or small welds on structures) while for very large diameter pipes e.g. CW piping or for vessels/ long welds, the length of weld may be taken as basic unit. Sampling shall also be accordingly in terms of no. of weld joints or length of weld.
2.1.7.23.10	From the time of readiness of weld group, suitable time limits shall be prescribed for first sampling testing, re-sampling, repairing, re-testing etc. (normally not more than 1 day's backlog should be piled up at every step).
2.1.7.23.11	Illustration : Radiography of welds : welding completed on day-1 should be tested by day-2 and repair and re-sampling of the group should be done by day-3 and further testing / repair should be by day-4.
2.1.7.23.12	Sampling and re-sampling procedure shall be applicable for all the NDT viz RT, UT, DPT, MPI.
2.1.7.23.13	Wherever radiographs are not accepted on account of poor exposure, joints shall be re-radio-graphed and new films submitted for evaluation. Radiographs shall be taken again on joints after carrying out repairs. However, if the defect persists after first repair as per radiograph, carrying out radiography shall be repeated till the joint is made acceptable. In case the joint is not repairable, the same shall be cut, re-welded and re-radiographed at Contractor's cost. The evaluation charges in respect of such repeated evaluation shall have to be borne by the contractor.
2.1.7.24	Results of these processes shall be verified / validated as per requirements of BHEL / client.
2.1.7.25	Welding electrodes have to be stored in enclosures having temperature and humidity control arrangements. A separate Electrode storage room alongwith dehumidifier with humidity indicator in the room shall be provided for storing all kinds of electrodes. This enclosure shall meet BHEL specifications.
2.1.7.26	Welding electrodes, prior to their use, call for baking for specified period and will have to be held at specified temperature for specified period. Also, during execution, the

	welding electrodes have to be carried in portable ovens.
2.1.7.27	One air conditioned dark room and pit for radiography source of 2 nos. as per BARC standard is to be provided at site.
2.1.8	**TESTING, PRE-COMMISSIONING AND COMMISSIONING**
2.1.8.1	Testing, pre-commissioning & commissioning will involve, though not limited to these, various testing e.g. hydro-static pressure, pressure decay tests, leak test, trial run of equipments; flushing by air, water, oil or steam as applicable; checking / setting various clearances / parameters, ensuring operation of various equipments free of undue restrictions, Boiler light up, chemical cleaning & boil out of boiler, steam blowing of the boiler, floating of safety valves, coal firing, trial operation and loading etc. are some of these activities. All the activities for commissioning of the set, as informed by BHEL from time to time shall be completed.
2.1.8.2	The contractor shall carry out the required tests up to the battery limit on the boiler and the pipelines such as hydrostatic test of the main boiler, gas tightness test for ducts by kerosene or smoke bombs methods, hydrostatic test of pipelines , furnace pressure tightness test/air leak test etc. It may be required to do the gas tightness test of ducting and boiler furnace by filling up air and pressurising with the help of compressor/ fan. All the above tests shall be repeated till the successful completion of tests is certified by BHEL as a part of the work.
2.1.8.3	Contractor shall lay all necessary temporary piping with valves, pressure gauges, blank plate supports at the duct & pipes terminals etc and install the pumps required for the test. After the test all the temporary piping, pumps etc will be removed and returned to BHEL stores.
2.1.8.4	All the above tests should be repeated till all the equipments satisfy the requirement / obligations of BHEL to their client and also the relevant statutory authority.
2.1.8.5	Contractor shall lay / install necessary temporary piping, pumps, valves, blanks, gauges, cables, switches etc. for conduct of hydraulic / pressure test, chemical cleaning, steam / air blowing etc. This may involve cutting of some portion of existing piping / valves, placing of rubber wedges / blanks in the valves and other openings, fabrication and installation of temporary tanks for chemical mixing, temporary access platforms to mixing tanks etc. where required, bends have to be fabricated / formed at site from random length / size of pipes / structural steel. Temporary installation itself has to be tested, tried and subject to non-destructive examinations as per the instructions of BHEL as part of work.
2.1.8.6	For the purpose of payment various equipments / items of temporary system for chemical cleaning / alkali boil out / steam blowing will be categorized as under:
2.1.8.6.1	Detaills indicated in annexure- I (weight schedule)
2.1.8.6.2	No payment will be made for temporary installations made for hydraulic testing of various systems.
2.1.8.7	All materials, equipments necessary for installation of temporary system as above will be supplied by BHEL as free returnable issue in random sizes / lengths. However, servicing, fabrication, erection, dismantling of the same after completion of the process and handing over back to BHEL stores will be the responsibility of the contractor. Moreover the electrical distribution network, cables and accessories required for commissioning of the chemical cleaning pumps to be arranged by the contractor at his cost.
2.1.8.8	The tank required for pouring and mixing the chemicals need to be fabricated by the contractor within his quoted rate. The tank size will be communicated before fabrication at site and required Plate for fabrication of the tank will be supplied by BHEL free of charges on returnable basis. Similarly the Steel required for supporting the tank will be supplied free of charges on returnable basis. Payment against erection will be paid under NPP. Contractor to take special note of the fact that no charges towards fabrication and supporting of the tank will be paid by BHEL and the same need to be executed within the quoted rate of the vendor.

2.1.8.9	Fabrication, fit-up, pre-heating, welding and post-weld-heat treatment if any, of requisite blanks for conduct of hydraulic test / leakage test is part of work. Similarly, removal of blanks, restoration and normalization of the concerned system / line is to be done as part of work. BHEL will provide the material for blanks free of charge. No separate payment is envisaged for these activities.
2.1.8.10	Over hauling, cleaning, servicing of tanks, pumps, equipments, valves, during erection and commissioning stages are in the scope of work. Gaskets, packing & spares for replacement will be provided free of charges by BHEL.
2.1.8.11	After chemical cleaning / pickling of lubricating system (including oil piping, oil tank and other fittings) of rotating machines, oil flushing for lubricating systems as per instructions of BHEL Engineer shall be carried out. Cleaning of oil tank of lubricating oil system of rotating machinery before and after oil flushing is in the scope of work.
2.1.8.12	Transportation of oil drums from customer's / BHEL's stores, filling of oil for flushing, first fill of lubricants and subsequent topping up during trials, tests and commissioning is included in the scope of this contract. The contractor shall have to return all the empty drums to the customer / BHEL stores. Similarly, for various pre-commissioning / commissioning activities / processes mentioned in various clauses, transport of chemicals into the system and returning of remaining chemicals and the empty containers of the chemicals to customer / BHEL stores is the responsibility of the contractor.
2.1.8.13	During trials/ tests, pre-commissioning/ commissioning, replacing/ changing mechanical / other seals of equipments like pumps, removal and cleaning / replacing of filters etc. is within the scope of work. Replacement spares for this purpose will be provided by BHEL.
2.1.8.14	In case any defect is noticed during tests, trial runs of all equipments and their auxiliaries, such as interferences, rubbing, loose components, abnormal 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 instructions. Claim, if any, for these works shall be governed by Section 13 provided the cause of such work is nor attributable to the contractor.
2.1.8.15	Contractor shall cut / open / dismantling work, if needed, as per BHEL Engineer's instructions during commissioning for inspection, checking and make good the works after inspection is over.
2.1.8.16	Similarly, during the course of erection, if certain portion of equipments erected by the contractor has to be undone for enabling other contractors / agencies of BHEL / customer to carry out their work, contractor shall carry out such job expeditiously and promptly and make food the job after completion of work by other contractors / agencies of BHEL / customers instruction. Claims, if any, in this regard shall be governed as per relevant section/clause.
2.1.8.17	During this period, though BHEL / client's staff will also be associated in the work, the contractor's responsibility will be to arrange for complete requirement of men and required tools and plants, consumables, scaffolding and approaches etc. till such time the commissioned unit undergoes trial operations.
2.1.8.18	Commissioning activities will continue till the completion of trial operation. During this period contractor shall make available the services of separate dedicated workforce comprising of suitable skilled and semi-skilled / un-skilled workmen and supervisory staff along with necessary tools and plants, consumables etc.
2.1.8.19	It shall be specifically noted that the contractor may have to work round the clock during the pre-commissioning and commissioning period along with BHEL Engineers and hence considerable overtime payment is involved. The contractor's quoted rates shall be inclusive of all these factors.
2.1.8.20	At various stages of completion boiler has to be preserved against corrosion either by wet The contractor shall carry out any other tests as desired by BHEL Engineer on erected equipment covered under the scope of this contract during testing, pre-

	commissioning and commissioning, to demonstrate the completion of any part or whole of work performed by the contractor.
2.1.8.21	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 pressurizing the system to the required pressure, change of gas refills etc. The boilers have a permanent N_2 blanketing arrangement.
2.1.8.22	Chemical cleaning will involve cutting of some of the existing valves, placing the rubber wedges in the boiler drum, and cutting of hand-hole plugs of bottom ring header. Boiler drum internals also shall be removed before chemical cleaning within the quoted price.
2.1.8.23	Re-welding of the hand-hole plugs and the valves which were cut, re-fixing of boiler drum internals etc after completion of chemical cleaning shall be done by the contractor at his cost.
2.1.8.24	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 over time payment may be involved. The contractor's quoted rate shall be inclusive of all these factors also.
2.1.8.25	Performance of guarantee test: The final performance and guarantee tests of the unit (s) to establish the guaranteed parameters shall be carried out by BHEL. Contractor shall assist BHEL by providing required manpower, tools and consumables for carrying out the above tests. All preparatory works and temporary connections required for performing the above tests shall be carried out by the contractor free of cost.
2.1.8.26	The instruments required for conducting PG test shall be provided by BHEL free of charges and the contractor has to provide manpower assistance and other necessary inputs like scaffolding, hand tools & related consumables etc. for the same with a deployment of about fifty man-months approximately.
2.1.8.27	Supply and application of Touch up painting, preservative painting and final painting is in the scope of contractor.

2.2 ELECTROSTATIC PRECIPITATOR

2.2.1 SCOPE OF WORK

2.2.1.1 The work to be carried out under the scope of this specification covers the complete work of handling including receipt from stores/yard, arranging their issue, site transportation, temporary storage prior to erection, if required, cleaning , preservative painting, erection, alignment, welding, leveling, adjustment, chipping & leveling of foundation, welding of hooks, plates etc., Gas distribution test, Gas tightness test, all pre-commissioning tests, start-up and trial run of individual equipment, final commissioning, and trial run of individual equipments, trial run of total ESP etc. for U#1& #2 / U#3 (for Package-A/Package-B respectively) of 3x150 MW IPCL Haldia project .Electrostatic Precipitator up to handing over of the unit to BHEL/their customer including PG test of the unit. The work shall conform to dimensions and tolerances given in 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.

2.2.1.2 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.

2.2.1.3 NO DEVIATION IN SCOPE OF WORK, WHATSOEVER, SHALL BE ALLOWED BY BHEL.

2.2.1.4 The work to be carried out under this scope covers the complete work of Electrostatic Precipitator (ESP) of 3x150 MW IPCL Haldia project housed in four nos of independent casings 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.

2.2.1.5 The work to be carried out under the scope of this specification shall broadly comprise of but not to be limited to the following:

2.2.1.6 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 portland cement or ready mix grout of proved quality. However, in both the cases the vendor has to arrange portland cement and ready mix grout component respectively within the included cost 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, labours etc at his cost. The contractor shall prepare the required test pieces/test cubes to ensure the strength of grout and get the same shall be 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. Necessary arrangements along with watering till complete curing has to be arranged by the vendor.

2.2.1.7 The contractor shall take delivery of material/equipment at projects store/yard. As soon as the material is issued to the contractor, all responsibility of proper handling and storage shall be the responsibility of the contractor and thereafter any loss/damage to the equipment and material due to faulty handling and storage or any other reason attributable to contractor, shall be made good by the contractor at his own cost.

2.2.1.8 The contractor shall check, tally and inspect all material consignment issued to him and shall maintain proper record of the receipt of material received and such reports shall be produced by the contractor to the Engineer for verification. Any deviation from packing list or damage to any component noticed during receipt of material should be immediately brought to the notice of BHEL engineer. Any claim in this regard after receipt of material by the contractor will not be entertained.

2.2.1.9 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**.** 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.

2.2.1.10 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.**

2.2.1.11 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.

2.2.1.12 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.

2.2.1.13 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.

2.2.1.14 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.

2.2.1.15 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.

2.2.1.16 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.

2.2.1.17 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.

2.2.1.18 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.

2.2.1.19 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.

2.2.1.20 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.

2.2.1.21 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.

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

2.2.1.23 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.

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

2.2.1.25 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.

2.2.1.26 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.

2.2.1.27 Erection of electrical equipment like high voltage rectifier transformer, heating elements, rapping gear motor etc. are included in the scope of the contractor. Filtration of the Transformer oil is excluded from the scope of contract. Laying of cables, cable

trays, termination of cables, glanding of control panels etc. are excluded from the scope of the contract.

2.2.1.28 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.

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

2.2.1.30 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.

2.2.1.31 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.

2.2.1.32 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.

2.2.1.33 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.

2.2.1.34 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.

2.2.1.35 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.

2.2.1.36 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.

2.2.1.37 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.

2.2.1.38 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.

2.2.1.39 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.

2.2.1.40 The details of equipments to be erected under this contract is generally as per the schedule given **in annexure – 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.

2.2.1.41 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 by Contractor for calibration and shall be handed over to BHEL. Storage / re-erection, calibration will be done by C & I erection agency of BHEL.

2.2.1.42 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.

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

2.2.1.44 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.

2.2.1.45 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.

2.2.1.46 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.

2.2.2 ERECTION OF ELECTROSTATIC PRECIPITATOR

2.2.2.1 The details of equipments to be erected under this work are generally as per the weight schedule given in annexure-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.

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

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

2.2.2.4 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.

2.2.2.5 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.

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

2.2.2.7 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.

2.2.2.8 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.

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

2.2.2.10 Installation of interlocks is in the scope of work.

2.2.2.11 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.

2.2.2.12 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 work rate of NPP as per rate schedule. BHEL will supply the material required for platforms/canopies in random lengths & sizes.

2.2.2.13 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.

2.2.2.14 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.

2.2.2.15 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 will be arranged by BHEL.

2.2.2.16 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 recognised 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.

2.2.2.17 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.

2.2.2.18 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.

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

2.2.2.20 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.

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

2.2.2.22 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.

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

2.2.2.24 Erection of all electrical equipment/item like high voltage rectifier transformer sets(filled with non-inflammable silicon fluid having flash point higher than 300 deg centigrade), , 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.

Erection of ESP electrical items coming under ESP control room like panels, controllers as well as ESP cables is excluded from the scope of contract.

Testing and commissioning of all the electrical items of ESP is excluded from the scope of contract.

2.2.2.25 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.

2.2.2.26 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.

2.2.2.27 BHEL Engineer/ customer is entitled to 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.

2.2.2.28 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.

2.2.2.29 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 neccessity, necessary written permission from BHEL / Customer need to be obtained.

2.2.2.30 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.

2.2.2.31 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.

2.2.3 PRE–COMMISSIONING TESTS AND COMMISSIONING OF THE UNIT/ EQUIPMENTS.

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

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

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

2.2.3.4 Checking IR value of the ESP fields.

2.2.3.5 Air load test of ESP along with all fields.

2.2.3.6 Charging of ESP with flue gas during light-up / sychronisation / coal firing.

2.2.3.7 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.

2.2.3.8 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.

2.2.3.9 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.

2.2.3.10 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.

2.2.3.11 It shall be specifically noted that the above employees of the contractor may have to work round the clock alongwith 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.

2.2.3.12 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.

2.2.3.13 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.

2.2.3.14 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.

2.2.3.15 Performance of guarantee test : The final performance and guarantee tests of the unit(s) to establish the guaranteed parameters shall be carried out by BHEL. Contractor shall assist BHEL by providing required manpower tools and consumables for carrying out the above tests. All preparatory works and temporary connections required for performing the above tests shall be carried out by the contractor free of cost. A deployment of 20 man-month approximately may be assumed by the vendor for this purpose and separate price may be quoted against the same in the rate schedule. In case assistance during performance guarantee test is not required, this amount will not be paid to the contractor.

2.2.3.16 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.

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

2.2.3.18 Checking I. R . value of ESP fields.

2.2.3.19 Air load test of ESP along with all fields .

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

2.2.3.21 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.

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

2.2.3.23 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.

2.2.3.24 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.

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

2.2.3.26 The various categories of workman required for assistance in pre - commissioning , commissioning and post commissioning activities are 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.

2.2.3.27 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.

2.2.3.28 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.

2.2.3.29 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.

2.3 PIPING(CRITICAL,SG AND TG PIPING)

2.3.1 Brief list of System / sub-system to be erected by the contractor & approximate weight individual PGMAs and number of joints are given in the appendices and are meant for giving general idea to the tenderer only about magnitude of the work involved. The piping components are sent in parts for convenient transportation / layout requirements. They are to be cleaned, pre-assembled in stage by stage, welded, erected and aligned as per the drawing dimensions / tolerance and instructions of BHEL Engineers.

2.3.2 For erection & welding of SA335 P91 material please refer the “PROCEDURE FOR ERECTION & WELDING OF SA335 P91 MATERIALS” given in this specification.

2.3.3 Pre-assembly of equipment at the pre-assembly yard for inspection, checking and erection. It is to be noted that BHEL will provide only reasonably leveled open space for pre-assembly yard. The contractor has to arrange further desired leveling of the area at their cost. 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.

2.3.4 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.

2.3.5 Contractor should obtain the formal clearance from Chief Inspector of Boilers of respective state 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. Inspection fee, if any shall be paid by BHEL/Customer.

2.3.6 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. Necessary co-ordination with statutory authorities including transportation, as required, for regular visit to site, is included in the scope of the contractor. However, inspection fee, if any will be paid by BHEL/Customer.

2.3.7 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.

2.3.8 All the works such as cleaning, inspection, edge preparation if required, cutting, weld depositing, grinding, straightening, chamfering, filling, chipping, drilling, reaming, scrapping, lapping, fitting-up etc., as may be applicable in such erection works and are necessary to complete the work satisfactorily, shall be carried out by the contractor as part of the work with in the quoted rate. Major machining work(which can be carried out in workshops only, as decided by BHEL, like tie-rod machining, any job to be carried on lathes, shapers etc. etc.) shall be done/arranged by the contractor at his cost.

2.3.9 Normally weld neck valves will have prepared edges for welding. It may be occasionally necessary to prepare new edges, re-prepare the edges to suit site conditions, which shall be done by the contractor at no extra cost. All fittings like elbows, tees, reducers, flanges, inserts etc., shall be matched with pipes for welding which may require re-edge preparation, grinding etc.

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

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

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

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

2.3.14 Suction filters of BFPs ,Booster Pumps are to be cleaned, as and when required during flushing/commissioning till the unit is handed over to customer by the contractor at his cost.

2.3.15 During connection & floating of TG, Pump decks Condenser etc., before and after pipe connections, readjusting of piping hangers is covered in this scope of work.

2.3.16 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.

2.3.17 All dimensions / elevations refers to centerline of pipe unless otherwise specified, the pipe routing shall be carried out as per the drawing. Wherever the dimensions are not specified / shown as approximate the same may be routed as per site requirement / convenience as per site engineer's advice.

2.3.18 For pipes nominal size 2'' and below routing shall not be shown in piping layouts or in isometrics and the same to be routed / connected as shown in schematics. For the above sizes if the routing is shown in layouts it is only for guidance and the same shall be routed and supported as per site requirement / convenience as per site Engineer's advice. Piping below size 2'', valves, flanges, fittings etc., shall be supplied as commercially available. Hence fit-ups, edge preparation including welding of stubs, shall be included in the contractor's scope.

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

2.3.20 Slope of 1:500 shall be maintained towards drain unless otherwise specified.

2.3.21 All site-fabricated pipes will be issued in running metres as straight length. These are to be cut and edge prepared at site to required length to suit layout as given in the erection drawing. In some cases attachments like lugs, stoppers, cleats etc., will be supplied as loose items and to be cut and welded to the pipes at site as per erection drawing. Necessary drilling of holes on main pipe for welding stubs shall also be done at site by the contractor.

2.3.22 Fittings like bends, tees, elbow/bends, reducers, flanges etc., will be supplied as loose items.

2.3.23 Certain adjustments in length may be necessary while erecting pipelines and the contractor should remove the extra lengths/add extra lengths / to suit the final layout after preparing edges afresh and adopting specified heat treatment procedure, are in the scope of work.

2.3.24 Adjustment like removal of ovalities in pipes and opening or closing of the fabricated bends by process of heat correction or any other method approved by BHEL Engineer to suit the layout, with specified heat treatment procedure with in the quoted rate.

2.3.25 Pipes above 2'' diameter have to be cleaned by means of wire brush as per the instruction of BHEL Engineer and subsequently flushed with air before lifting them into position. For pipes below 2'' diameter, shall be cleaned by sponge with air flushing.

2.3.26 Hangers & suspensions, supports etc. for tubes, piping etc will be supplied in running / random lengths / sizes which shall be cut to suitable sizes and adjusted as required within the quoted price.

2.3.27 Contractor shall arrange all the equipments, alignment bolts, tools, consumables like welding electrodes (all type), and argon gas cylinders etc., for welding of pipes at his cost. Consumables like jute, cotton waste, hacksaw blades, petrol, Kerosene oil etc. are in contractor's scope.

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

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

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

2.3.31 Flame cutting of piping shall be strictly done as per BHEL Engineer's instructions and in his presence only.

2.3.32 Wherever elbows of 45 deg or any other angle (>2" dia pipe) are required, the same shall be cut from 90 deg. Elbow supplied and used. No extra cost shall be paid.

2.3.33 The work on piping systems (air, water, oil steam, gas etc.) will include laying, edge preparation, fixing and welding of the elbows / fittings / valves etc., welded on the lines, fixing and adjustment of supports / hangers / shock absorbers and carrying out all other activities / works to complete the erection and also carrying out all pre-commissioning / commissioning operations mentioned in the specification as per BHEL Engineer's instructions and / or as per approved drawings/ documents.

2.3.34 Erection of HP Bypass Oil Unit , Valves and related site routed oil pipings are included in the scope of this specification. Welding of oil pipelines /Ferrule joints applicable for oil pipings are to be executed with due care for making it leak-proof.

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

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

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

2.3.38 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.

2.3.39 Contractor should fabricate bends at site from running metres of piping for the above and cut, edge prepare and lay the piping as per BHEL Engineer's instructions.

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

Thermo-wells erected on the pipelines by other agencies shall be welded by Piping vendor treating it within piping vendor's scope.

2.3.41 Plate / Pipe shoes for piping supports shall be fabricated at site by the contractor. Other supports namely Hangers, U-clamps etc. shall be supplied by BHEL duly bent and threaded. Assembly and necessarily cutting work shall be carried out at site by contractor within the quoted rate.

2.3.42 For Hangers and support the instruction given in the drawing & documents must followed for handling, erection, setting of COLD / HOT values and logging etc.

2.3.43 Wherever hanger and support materials of piping are not received from manufacturing unit in time to suit the erection schedule, contractor shall erect the piping system on temporary supports to ensure the progress of work within quoted rate. The required structural steel materials will be issued on free of charges by BHEL, either from scrap / spare materials. The same shall be removed and returned to BHEL store after erection of permanent supports. No additional payment shall be considered for such contingency measure.

2.3.44 The contractor has to erect control valves and other items received from other Units of BHEL and to be erected on the piping system and approx. tonnage per 500 MW Unit is around 200 MT

2.3.45 Fabrication and erection of the approach platforms for accessing eqpts/valves/systems erected by the contractor are included in the scope of work.The approximate weight will be 100MT with a variation limit of +/- 20% for each 500MW unit.Necessary structural materials will be provided by BHEL.The work shall be paid as per relevant rates of the rate schedule.

2.3.46 Contractor shall be supplied with two extra blue prints of the layout & isometrics. Contractor to incorporate in one of the blue prints with red ink all the charges / deviations / alterations etc. carried out at site due to various reasons, with site

engineer's endorsement. Marked up drawings shall be submitted to BHEL for approval.

2.3.47 PRESERVATION / TOUCH UP PAINTING

2.3.47.1 Contractor shall carryout cleaning and preservation / touch up painting as a part of erection work for the materials / equipments under this tender specification right from pre-assay stage, during erection and after erection till the equipment is cleared for final painting, wherever deficiency in painting / rusting is noticed. The primer paint shall be matching shop primer. supply and application of touch up paint, required manpower, other required consumables, T&P etc shall be provided by the contractor with in the quoted rate.

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

2.3.47.3 Any failure on the part of contractor to carry out work according to above clauses will entitle BHEL to carryout the job through any other party and recover the cost from contractor.

2.3.48 PROGRESS OF WORK

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

2.3.48.2 The contractor shall submit daily, weekly and monthly progress reports, manpower reports, material reports, consumables report and other reports considered necessary by the Engineer.

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

2.3.48.4 The progress reports shall indicate that progress achieved against planned with reasons indicating delays if any, shall give remedial action which the contractor intends to make good the slippage or lost time, so that further works can proceed as per the original programme and the slippage do not accumulate and affect the overall programme, in al format designed and approved by BHEL site Engineer.

2.3.48.5 The contractor shall arrange for weekly progress review meetings with the "Engineer" at site during which actual progress during the week vis-à-vis schedule programme shall be discussed for action to be taken for achieving targets. The programme for subsequent week shall also be presented by the contractor for discussions. The contractor shall constantly update / revise his

work programme to meet the overall requirement and suit the material availability.

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

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

2.3.48.8 In the interest of achieving project milestones, certain rescheduling of activities are to be done as per decision of BHEL. The vendor has to arrange for additional resources from time to time to achieve such milestones. No payment on whatsoever account shall be entertained by BHEL in this account.

2.3.48.9 The vendor has to submit the rolling plan for requirement of materials on regular basis for materials on weekly, monthly and quarterly basis.

2.3.48.10 The vendor should submit only computerized reports.

2.3.49 HYREAULIC TEST, PRE–COMMISSIONING & COMMISSIONING

2.3.49.1 Hydraulic testing pumps for pipelines/systems/equipmet shall be provided by BHEL free of hire charges. The servicing, installation, electrical connection, erection, testing and dismantling and returning to BHEL stores etc. shall be carried out by the contractor as part of this work without any extra charges.

2.3.49.2 All pressure parts and some of the Low Pressure parts shall be subjected to hydraulic test as per the Standard / statutory requirements. The contractor shall make necessary arrangements and other services to carry out the required tests as per the instructions and directions of the BHEL Engineers.

2.3.49.3 Contractor at his cost shall lay all necessary temporary piping, install the pumps, blanks, valves required for the test, pressure gauges etc. Required pipes, valves, plates etc., will be given by BHEL free of charges. Temporary piping, pumps, valves, flanges, blanks etc shall be removed by him and returned to BHEL. All Temperature Element points are to be seal welded, with plug in position. All Temperature Element points are to be provided with blanks and welded. Necessary blanks will be provided by BHEL free of charges.

2.3.49.4 Welding and stress relieving of temporary blanks or suitably fixing temporary blank flanges with gaskets and fasteners and welding and providing suitable deaeration / venting / draining points with valves as per BHEL Engineer’s instructions, for performing hydro-test of piping and other equipments is within the scope of work. Gaskets, valves, fasteners will be provided free of cost by BHEL. Contractor shall cut steel blanks from steel provided within quoted rate.

After completion of hydraulic test, welded blanks shall be cut and removed and weld burrs ground finished and cavities / scars of cutting weld filled and ground as per BHEL Engineer's instructions. Seal welding of thermo wells and blanks of Temperature Element are to be removed by grinding only after steam blowing.

2.3.49.5 The hydraulic testing of the equipment and piping, covered under this scope of work has to be carried out by the contractor as per instructions of BHEL Engineer. The contractor shall provide all facilities required for hydraulic testing. Filling pump of suitable capacity shall be arranged by the contractor at their cost before hydraulic test, all the hangers are to be locked by locking pin/plate or temporary support. After completion of Hydraulic test, these are to be removed and all hangers are to be readjusted if required, to the desired valve within quoted valve.

2.3.49.6 All the above tests shall be repeated till all the equipment satisfy the requirement of BHEL to their customer. As far the hydraulic pressure test is concerned and same shall be conducted to the specification of Boiler Inspector wherever applicable. Any rectifications required shall have to be done / redone by the contractor at his cost.

2.3.49.7 HP by pass oil lines shall be oil flushed. Contractor shall have to lay temporary piping to connect the entire system irrespective of whether the equipment / system connected has been erected by the contractor or not. Decisions of BHEL Engineer in this regard will be final and binding on the contractor.

2.3.49.8 Commissioning of HP Bypass valves, systems, equipment are also included in vendor's scope at no extra cost to BHEL. The vendor has to maintain skilled manpower for doing this job. Adequate consumables like CTC, Petrol, markin clothes and others items as applicable to carry out this job is in vendor's scope.

2.3.49.9 Transportation of oil drums from customer's / BHEL's stores, filling of lubricants and filling of oil for flushing and first filling and subsequent topping up during commissioning and post commissioning is included in the scope of this contract. The contractor shall have to return all the empty drums to the customer / BHEL stores. Similarly, transport of chemicals for various pre-commissioning activities / processes mentioned in the above clauses and returning of remaining and / or the empty containers of the chemicals to customer / BHEL stores is the responsibility of the contractor.

2.3.49.10 Replacing / cleaning of filters of the erected equipments and piping system etc. during pre-commissioning / commissioning stage is within the scope of work.

2.3.49.11 Contractor shall lay the temporary pipelines with fittings, accessories and erection / commissioning pumps, tanks, valves, fittings, hangers and supports and other installations as instructed by BHEL, Engineer for the purpose of chemical cleaning / alkali flushing / steam blowing / steam washing / steam flushing / water flushing / water washing / oil flushing etc. of piping and other equipments are in the scope of work. Necessary, materials for this will be provided by BHEL. Overhauling / cleaning / servicing of valves, pumps, fittings in temporary system and acid cleaning tanks etc prior to the above operations /

activities will also be carried out by the contractor at his cost. All the chemicals will be supplied by BHEL free of cost.

2.3.49.12 Chemical cleaning like Pre-Boiler system flushing will involve the installation of temporary piping, valves, cutting of some of the existing valves, placing the rubber, wedges in the valves, gagging of valves etc. Necessary temporary access platforms to mixing tank are to be made by the contractor. Required materials will be provided by BHEL free of cost. Chemicals for chemical cleaning will be provided by BHEL free of charges and handling of chemicals & other consumables and other connected activities has to be carried out by the contractor at their cost. All other consumable would have to be provided by the contractor.

2.3.49.13 Laying of insulation of this temporary pipings are to be carried out by the contractor within quoted rate and required insulation materials will be provided by BHEL. The welding joints in the temporary pipelines are to be welded by qualified welders only. Required NDT tests are to carried out for the above joints within quoted rate as per customer / BHEL requirement.

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

2.3.49.15 During steam blowing operations the required manpower for fixing the target plates shall be arranged by the contractor as per the instructions of BHEL Engineer within the quoted rates. The manpower for the above operation may be required round the clock if necessary. The contractor shall carry out the above operation as per the instructions of BHEL Engineer within the quoted rates.

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

2.3.49.17 After the chemical cleaning has been successfully completed, removing all temporary piping, fittings of tanks etc checking all the valves for any accumulation of foreign materials, welding the valves, pipes which were cut and cleaning, re-fixing as per BHEL Engineer's instructions is within the scope of work / specification.

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

2.3.49.19 Raw materials for all temporary piping necessary for conducting hydraulic test, chemical cleaning, some steam blowing work, flushing, effluent disposal etc. will be provided by BHEL free of cost. However, fabrication servicing, erection and dismantling the same and return of the temporary piping, flanges, valves etc. to BHEL stores is the responsibility of the contractor without any extra charges. Those items that are issued along with the piping components specified under despatchable Unit for temporary piping including tanks, pumps, valves, fittings,

hangers and supports etc. supplied by BHEL or other agencies alone will be paid at the quoted rates for erection. Charges for dismantling of temporary lines etc. should be included with in the quoted rates.

2.3.49.20 Contractor may have to replace old / damaged gaskets / packing etc. for equipments and the same shall be carried out by contractor as per requirement without any extra cost to BHEL.

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

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

2.3.49.23 Main Steam Line & Hot Reheat line Strainers bodies are erected first by other agency and the lines will be erected by piping contractor. All the connecting joints are to be welded by the Piping Contractor adopting special precautions. After Hydraulic Test, the strainer elements are to be fixed by other agency. During trial operation, if required, the strainers are to be removed for inspection of debries & cleaning. During all these operation piping contractor shall extend all assistance by providing necessary manpower, T&P and required materials. Installation of strainer is NOT in the scope of this contract, however its welding with pipelines etc. are included in the scope.

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

2.3.49.25 During this period, though BHEL's and customer's staff will also be associated in the work, the contractor's responsibility will be make available resources in his scope till such time the commissioned units are taken by the customer.

2.3.49.26 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. During commissioning opening of valves, changing of gaskets, attending to leakages, minor modification / rectification works may arise. The contractor has to carry out these works at his cost by providing required manpower in all the three shifts. In case any rework is required because of contractor's faulty erection and which is noticed during commissioning the same has to be rectified by the contractor at his cost.

2.3.49.27 Contractor to provide necessary commissioning assistance from pre-commissioning state onwards and up to continuous operation of the unit & handing over to customer. The category of personnel to be as per site

requirement and to meet the various pre-commissioning and commissioning programmes made to achieve the schedule agreed with customer.

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

2.3.49.29 It shall be specifically noted that the contractor may have to work round the clock during the pre-commissioning period along with BHEL Engineers and hence considerable overtime payment is involved. The contractor's quoted rates shall be inclusive of all these factors.

2.3.49.30 During commissioning any improvement / repair / rework / rectification / fabrication / modification due to design improvement / requirement is involved, the same shall be carried out by the contractor promptly and expeditiously.The activities under this clause which are not due to the contractor's fault shall be treated as extra work and shall be paid accordingly.

2.3.49.31 Hanger adjustment / re-adjustment during erection, before and after Hydraulic Test, before and after steam blowing, during and after full load operation, are to be carried out by the contractor within Quoted Rate. For this purpose, the vendor has to arrange refixing of scaffolding alongwith other resources and this exercise may have to be repeated till satisfactory acceptance by BHEL. This is treated as vendor's normal scope of work at no extra cost to BHEL.

2.3.49.32 The contractor has to provide required man power assistance during pre-commissioning and commissioning checks of motor operated valves, actuators, control valves etc without any extra charges for working round the clock in normal working hours on working days, holidays, Sundays etc.

Exclusive Supervisors with two nos. minimum electrician has to be arranged within his quoted rate to carry out pre-commissioning, commissioning and handing over job.

2.3.50 THE SCOPE OF WORK IS FURTHER DETAILED AS UNDER.

2.3.50.1 COLLECTION AND RETURN OF MATERIALS

- The Contractor identify, arrange issue and shall collect the materials from storage yard/Stores/Sheds of BHEL/ Client. He shall verify the materials being issued to him, keep them in safe custody, watch and ward of materials after it has been handed over to him till these are fully erected, tested and commissioned and taken over by the Client. The contractor shall note that the transport of equipments to erection site, assembly yards etc., should be done by the prescribed route, without disturbing the other works and contractors and in the most professional manner. Special equipments such as laboratory equipments, measuring and controls equipments, special electrodes, valves, shims, packing materials for joints and seals, lubricants, actuators, etc., shall be stored, when taken over by the contractor,

in appropriate manner as per BHEL's instructions and as per BHEL's Storage and Preservation Manual.

- BHEL is operating Computerized Site Operations Management System (SOMS) that includes materials management, progress reporting, sub-contractor billing and material reconciliation through a computerized data base management system. Contractor shall engage personnel with proficiency in operation of such Computerized System for the purpose of usage and regular updation of data base Management System. The SOMS/software package shall be provided by BHEL to the contractor on free of cost basis.However the contractor shall deploy their manpower for its usage etc. at their cost, for carrying out their portion of work as per tender condition.

- The contractor may note that all operations in their scope which have interfaces with BHEL systems will have to be done only through this computerized system. The vendor has to make all arrangements for connectivity, computing equipment, personnel, software, etc. To operate and interact with BHEL system. No manual systems other than what is not covered by computerized system will be acceptable at site.
- The contractor has to make their own separate arrangements for their portion of /MIRs/other activities.

- In the event the computerized SOMS is inoperative for any reasons, the contractor shall take delivery of materials from the storage area/sheds of BHEL/Customer after getting the approval of the Engineer/Customer on standard indent forms to be specified by BHEL/Customer. All these records however shall be updated in the SOMS as and when the SOMS is reactivated/normalized by the contractor treating at his scope of work.

- The contractor shall handover all materials remaining extra over the normal requirement with proper identification tags in properly segregated and cleaned condition to BHEL sites. Smaller materials, Lubricants, Chemicals etc. shall be returned in neatly packed condition in addition to the above requirements. In case of any misuse or use over actual design requirement, BHEL will recover the cost of parts / materials used in excess or misused. Decision of BHEL Engineer in this regard will be final and binding on the contractor.

- All materials shall be handled very carefully to prevent any damage or loss. No bare wire ropes, slings, etc., shall be used for handling of the materials. **Use of polyester webbed flat slings with proper capacity shall be mandatory for all delicate materials**. The equipment from the storage yard shall be moved to the actual site of erection / location at the appropriate time as per the direction of BHEL Engineer so as to avoid damage / loss of such equipment at site.

- Contractor shall remove all scrap materials at least once in a week from various levels of Boiler/ TG Floors, working area of Boiler / Piping around Power Station and deposit the same at the place earmarked for this purpose. In case of contractor's failure to do the same, BHEL reserves the right to remove scrap at contractor's cost and risk.

- All the damaged materials, package materials/containers, special transporting frames, gunny bags, etc., shall be returned to BHEL stores / Client's stores by the contractor and proper receipt obtained for accounting/reconciliation.

- All pipes and tube ends of pipes/tubes issued to contractor and kept at site for erection shall be covered with plastic caps/ steel caps or shall be closed with wooden plugs by the contractor. The plastic caps / Steel caps / wooden plugs will be provided by BHEL free of cost.

- The contractor shall ensure that all the packing materials and protection devices used for the various equipments during transit and storage are removed before these equipments are erected in position.

- Contractor shall plan and transport equipments/components from storage yard/sheds to erection site and erect them in such a manner and in a sequence that material accumulation at site should not lead to congestion. Material shall be stacked neatly, preserved and stored in the contractor's shed and work areas in an orderly manner. It may be specifically noted that the space available for putting up the Thermal Plant is very limited and accumulation of material may lead to the necessity of shifting and re-stacking the materials to enable other agencies to carry on with their work or to comply with customer's requirements. If required the contractor shall arrange shifting of surplus material expeditiously failing which the same will be arranged by BHEL and all charges together with departmental charges at 30 % will be recovered from his bill.

2.3.50.2 Taking Over and Dressing of Foundations, Grouting of Equipments / Tanks etc.

- Building and foundation for supporting structures, equipments under scope of Critical Piping system in this tender specification will be provided by BHEL. The dimensional accuracy, axes, elevation, levels etc, with reference to benchmarks of foundations and anchor bolt pits have to be checked and logged. The contractor as part of the work should do adjustments of foundation level, dressing and chipping of foundation surfaces of all equipments as per BHEL engineer's instructions. Contractor should log before taking over the foundations. Dressing and chipping of foundations to the extent of 25mm for achieving proper levels is within the scope of work.

- Fixing of anchor points required for installing pipes, supports, hangers, equipments are in the scope of contractor including associated civil work of drilling, fixing anchor bolts, chipping holes, grouting etc. shall be in the scope of regular work. Necessary steel and anchor bolts will be provided by BHEL. However contractor shall arrange the grouting cement, quick-setting free-flow grout compound alongwith related materials, shuttering materials and other resources as applicable within the quoted price.

- Contractor shall carry out all works necessary for Grouting of Static and Rotating equipments / Tanks & Vessels as a part of the work in scope herein. The scope shall include cleaning the main foundation/pedestal of oil, grease and other unwanted contaminants & deposits; compressed air blowing, water washing,

roughening the surface, form-work/mould, mixing and pouring of grout mix, smooth finishing, curing, preparation of test coupons, getting them tested in an approved laboratory. Contractor shall use only approved grout materials like Conbextra GP-1 and Conbextra GP-2 or equivalent non-shrink free flow cement , ordinary Portland cement as applicable or other equivalent materials as approved by BHEL and this has to be supplied by contractor within his quoted rate.

- Normally, the cut out, pockets in the civil foundation, walls and other related areas shall be arranged by BHEL's customer. However, in case certain cut outs are to be enlarged or relocated, the same shall be carried out by the vendor treating it as his own work within his quoted rate.

2.3.50.3 ERECTION OF PIPING SYSTEM

- The scope of work in piping system (Air, Water Oil, Chemical and Steam, etc.) will include laying, edge preparation, fixing and welding of the elbows / Fittings / Valves etc., welded on the lines, fixing supports / hangers / shock absorbers, etc., and carrying out all other activities / works to complete the erection and also carrying out all pre-commissioning / commissioning operations mentioned in the various paras of these specifications as per approved drawings.

- Laying of pipelines as per the specifications, between equipments constituting Terminal point, whether the terminal equipments fall within the scope of the work / specification or not, is within the scope of the work / specification. The contractor shall complete terminal joints at both ends for all the piping schemes covered in the specification.

- Aligning, Matching and welding of piping to the terminal points (such as stubs, on terminal equipments, stubs on headers, battery limits etc.) forming part of the scope of work / specification and stress relieving and radiography of joints so made is also within the scope of work / specification. Also, where the piping connection to the terminal points involves flanged joints mounting and welding of flanges on piping as well as terminal equipment matching of flanges fixing of gaskets, bolting and tightening as per BHEL Engineer's instruction is also in this scope of work / specifications. Required fasteners and gaskets will be supplied by BHEL free of cost.

- Laying, aligning, welding, fixing, radiography, ultrasonic testing, stress relieving, chemical cleaning. Flushing, pickling of all the pipe lines shall be in the scope of contractor's work and forming part of piping erection.

- The contractor has to arrange at least two no. of dewatering pumps of suitable capacity to take care of piping erection, commissioning jobs. This facility has to be retained by the vendor till handing over of the respective 500 MW Unit(s) to the customer.

- Installation of Isolating Devices and removal & re-fixing of internals required for Hydraulic Testing, Pre-commissioning and Commissioning activities are also to be done by the contractor within his quoted rate. Required gaskets will be supplied by BHEL free of cost.

- Erection, welding, radiography and stress relieving of flow nozzles after completion of steam blowing. Removal of portions from the already erected pipelines in order to introduce Flow Nozzles, Valves and other such equipments/devices and resultant edge preparation shall form part of normal scope of work. However contractor will be paid both for the portion of pipeline erected and later removed, as well as the equipment introduced later on in the pipeline. The removed pieces of pipes shall be returned to BHEL stores with proper cleaning, dressing and identification marking and no payment for removal and return of materials shall be made.

- Carrier plates fit up and welding on to the pipes.

- The following items of work shall form part of piping erection :

a) Matching of flanges for achieving parallelism and alignment resorting to heat correction or other suitable methods as per instructions of BHEL Engineers.

b) To locate the cause of vibrations in pumps or other auxiliaries and to carry out necessary corrections in piping and its supports. This may involve cutting, fresh edge preparation, welding, radiography, stress relieving, etc., of suction, discharge, re-circulating and other connected piping and its supports at a number of place.

c) Increase or decrease in length of piping including change in layout to suit site conditions.

d) Adjustment like removal of ovalities, opening and closing of bends by process of heat correction or other suitable method as directed by BHEL Engineer.

e) Fabrication and erection of racks and steel supports for all the piping including of system piping. Steel for this purpose will be supplied by BHEL.

f) Erection of flow switches, steam traps, filters, flow meters flow nozzles, other metering elements, flow orifices, flow indicators, valves and other instrument fittings supplied either by BHEL or their customer and forming part of the system. This may involve cutting of pipe lines, fresh edge preparation and welding with stress relieving.

g) Fabrication/Forming of bends for pipes having dia upto 65 mm OD.

h) Matching of all fittings like tees, bends, flanges, reducers, valves, socket fittings, etc., with pipes for welding. This may involve weld build up, edge preparation, etc.

i) Servicing of valves, actuators and fittings.

j) Cleaning of all pipes by wire brush and flushing of compressed air.

k) Removal of welding slag and burrs by hand files, with brushes and / or flexible grinders.

l) Welding of root valves with small length of piping to the pressure, flow and level tapping points on piping or flow nozzles / orifices / motoring elements fixed on piping.

m) Welding of supports to pipes using high pressure welders.

n) Welding of weld blanks with stress relieving if required on a temporary basis.

o) Opening of valve actuators, dismantling of actuators from the valves, refitting and rendering assistance connected with the electrical and mechanical problems.

p) On all steam piping, water (DM / Raw / Condensate / Cooling) Piping, Oil Lines / Piping, Instrument air piping. Etc., where butt welding is involved, root TIG Welding and subsequent Arc Welding shall be adopted as instructed by BHEL Engineer. The decision of BHEL Engineer regarding welding procedure for welding of above lines will be binding on the contractor.

q) Pipes / Tubes / Structural Materials, which are issued in running meters, may not be sent in standard lengths.

r) Pipe lines of Oil, Air, Steam and Water of less than NB 65 mm will be field routed as per schemes approved at site or as per the instructions of BHEL Engineer, and will be supplied in random lengths / Running lengths. The contractor shall have to lay the piping according to instructions at sites, after carrying out the necessary fabrication, edge preparation, routing etc., in best professional manner and as per instructions. The supports for field routed piping will be fabricated and erected by the contractor as per the requirement of the work. **On completion of such Pipings, AS-BUILT Drawings to be prepared and submitted for record. The RTF of all such Drawings needs to be submitted along with 4 copies of the drawings**. Contractor shall use only bolted clamps for achieving alignment of small bore piping.

s) 'L'/'C' Bridges may be used for alignment of higher size pipelines with prior approval of BHEL. Contractor shall remove the bridges, stoppers, etc. after completion of welding by gas-cutting, followed by grinding the spot smooth and free of any surface defects. Such stoppers shall not be removed by hammering. Any

scar or cavity shall be made good by welding and grinding as per the instructions of BHEL Engineer.

t) All weld joints on piping shall be ground or filed on completion of welding and before radiography as per instructions BHEL engineer so as to achieve smooth surface free of notches, ripples, undulations, etc. and to limit the reinforcement as per the codes.

u) Contractor shall erect the piping by doing pre-assembly on ground if possible at the first instant. The pipe laying shall be carried out from the available terminal point / points or any other area between the terminal points. The erection can be carried out on temporary supports to obtain proper alignment and welding. After fixing the permanent supports, all the temporary supports shall be removed. The alignment, distances and loading of the supports shall be checked and the required spring compression achieved in the case of spring hangers.

v) Contractor shall carryout edge preparations for welds joints in accordance with BHEL Drawings / BHEL Standards / BHEL Engineer's instruction.

w) The location of drain headers, valves, stations, steam traps of piping as indicated in the BHEL drawings are suggestive only. The final location and routings shall be decided to suit the site conditions. While routing such lines and fixing the stations, it has 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 changed as per the site conditions. All such works shall be carried out expeditiously as per the instructions of BHEL Engineer. The decision of BHEL Engineer is final and binding on the contractor.

x) It may be necessary to initially erect the pipes on temporary supports and after alignment and welding transfer the load on permanent supports.

y) The rate quoted in rate schedule is also inclusive of pre-heating, welding, post heating, stress relieving and NDE of piping.

z) Hanger rods shown in the piping arrangement drawing may have to cut and welded to suit site condition. Cutting and welding of these hanger rods will be done by the contractor. The stress relieving required on welded hanger rods shall be carried out. The hanger for piping will be tested for even distribution of load with the help of torque wrench.

aa) The piping is provided with hand holes. The hand holes will be opened up for inspection and seal welded prior to operation.

bb) Structural materials required for the supporting / operating platforms required for the valves/equipments at various levels for the safe operation will be issued to the contractor free of cost. However, the contractor's quoted rate shall include fabrication and erection of all such of platforms at site and no extra payments shall be allowed for this and only tonnage rate applicable will be payable.

cc) Erection of piping systems shall be coordinated by the contractor as required, with the erection of the turbine generator, condenser, boiler, boiler feed pumps and other major equipments, approval must be obtained from the Construction Manager and the equipment manufacturer's field engineering representative prior to making piping interface connections to the aforementioned equipments. Sequence of work shall be carefully planned to minimize interference with other groups working in the same area. Actual sequence to be followed shall be subject to the approval of engineer and engineers may, at time, direct the contractor to reschedule his work as per status of the site work.

dd) While erecting the field run pipes, the contractor shall check the accessibility of valves, instruments tapping points and maintain minimum head room requirement and other necessary clearance from the adjoining work areas to avoid interferences.

ee) All pipe lines shall be given proper slope towards the drain points during erection.

ff) All pipe lines shall be provided with suitable vent and the drain points with valve (s) on the highest and lower points of the pipe run although may not be specifically mentioned in the drawing as per the instructions of BHEL Engineer.

gg) For instrument connections, pipe stubs including the instrument tubing upto the root valve(s) shall be installed by the contractor. Root valves 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.

hh) Wherever piping erected by the contractor is connected to piping or equipment erected by some other agencies, the joint at the connecting point shall be done by the contractor of this specification.

ii) The contractor shall be responsible for correct orientation of all valves so that flow direction, seats, stem and hand wheel are in desired locations. Information regarding orientation of valves, not fully located on drawings, may be obtained from the BHEL Engineers.

jj) The piping systems which come under the purview of IBR should generally meet the requirement of IBR. The contractor shall be well versed with all the latest amendments of Indian Boiler Regulations.

kk) All piping shall be grouped wherever practicable and shall be routed to present a neat appearance.

ll) Overhead piping shall have a minimum overhead clearance of 2.3 Meters above walkways and working areas and 6 Meters above roadways unless otherwise approved by the BHEL Engineer.

mm) For field run piping, contractor shall fabricate and erect all hangers and supports as required with due regard to general arrangement layout of other pipes, hangers, cable trays, ducting, structural members, etc.

nn) For maintaining the slopes as given in the drawings for larger thickness and larger dia pipelines, edge preparation for welding may have to be altered suitably to achieve the slope.

oo) It may become necessary to make temporary spool pieces for the location of valves, flow measurement devices, delicate equipment etc. Contractor's scope shall include preparation, erection and dismantling of such spool pieces without any additional payment.

pp) In pipelines like CRH lines, extraction lines, etc., the NRVs will be erected by the vendor. Alignment of these valves to match the pipe ends (Both sides), welding, heat treatment and NDE etc., shall be carried out by the contractor within their quoted rates.

qq) All temporary lines required for Chemical Cleaning of Pre-Boiler system, Condensate pipings, Heater Drip system etc. ,Hydraulic testing, etc., shall be supplied in 'As is Where is' condition. The contractor shall arrange to carryout the required dressing, grinding, cleaning, cutting, edge preparation etc., while carrying out erection. No extra claim on this account will be entertained. For human protection, temporary insulation over piping to be applied at no extra cost.

rr) Before laying the piping on supports, the coordinates and elevations of all supports shall be checked by the contractor for correctness. Discrepancies from the execution drawings, if any, shall be promptly brought to the notice of BHEL engineer in writing and correction shall be carried out as per his instructions.

ss) Normally, hangers setting in cold condition is done by simulation adding additional temporary weight which will be roughly equal to the weight of the insulation. Attachment of temporary weights and floating of the joints in the simulation test to be treated as part of job. Hanger settings have to be repeated for achieving free floating joints. Hanger adjustments to be repeated for steam blowing by resetting hot and cold values if required. This may have to be repeated several times after steam blowing and synchronization. The weights will be supplied by BHEL. Contractor has to transport from BHEL stores and return the same after completion of work. No extra claim on this account will be entertained.

tt) All the instrumentation Tap-off points like thermowells, Root Valves, Impulse lines, nipples, PG-test thermowells etc., shall also be erected and welded by the contractor irrespective of whether such materials are supplied by BHEL or any other agency.

uu) For all the control valves, mechanical commissioning to be done by the contractor.

vv) The weld Grooves of MS Line, HRH Line, CRH Line, BFD Lines and other pipes will be as per BHEL standard specifications. Further, the edge preparation shall be done as per instruction of BHEL site Engineer and same shall be binding on the contractor.

ww) All equipments / works shall be preserved and protected properly during and after erection. Instructions / directions given by BHEL in this connection will have to be observed by the contractor.

xx) The contractor has to do contingency work like laying of pipe, valves, pipe fittings and other items, in case they are received late to achieve milestone. The contractor on a later date shall re-install the actual items on a later date as per arrival of the materials at BHEL/Site. For this purpose, the old items are to be removed and returned to BHEL/other designated places as decided by BHEL. The payment shall be regulated for erection of temporary piping tonnage rate. However for removal and returning of the contingency items, no extra payment shall be done by BHEL and the contractor has to do it treating as his normal scope of work.

yy) The contractor within his quoted rate has to arrange for welding of SS Pipelines with TIG Welding as per applicable code .

zz) The following works shall also be in the scope of this contract :

- Cutting of suspension for piping etc., to suitable sizes and adjustment as required.
- Matching of expansion / walls / places/ pieces, their assembly bolting and welding.
- Pre-assembly of spring suspension / hangers and shock absorber for the required load of piping etc.
- Cutting of extra length of fabricated pipes or addition of spool piece to suit site conditions and layout and tie rods threads checking / length adjustment if any including rethreading.
- Locking of spring hangers during erection, removal of locking, adjustment of spring tension for cold and hot condition and subsequent adjustment and final adjustment wherever required. Logging of spring tension readings.

2.3.50.4 **WELDING, HEAT TREATMENT AND NON DESTRUCTIVE EXAMINATION (NDE)**

2.3.50.4.1 WELDING :

a) The piping shall be erected in conformity with the provision of Indian Boiler Regulations and as may be directed as per other standard / Specifications / Codes in practice. Method of welding (Viz) Arc, TIG or other methods as indicated in the erection welding schedule shall be followed, BHEL engineer will have the option to change the method to suit site conditions.

b) Welding and Tacking of High Pressure joints shall be done by certified High Pressure Welders who possess valid certificate of Chief Inspector of Boilers of the state in which Boiler is being erected. Welder shall also appear in advance, before chief inspector of Boilers of the state for re-qualification tests before expiry of the validity of the certificate, as per the provisions of Indian Boiler Regulations and keep the certificate valid till the completion of the work. The Services of such welders whose validity of certificate is expired should not be engaged on the works.

c) In the case of P-91 Pipe welding, Contractor shall deploy welders having experience in welding of P-91 material. The welders engaged by contractor if not qualified for P-91 Welding will be trained by BHEL at BHEL Welding research institute (WRI) Trichy and allowed to work only after passing the required test arranged by BHEL. All the expenditure towards such qualification including cost of training, traveling expenses, stay etc., shall be borne by the contractor. A separate annexure is attached for the details of P-91 welding process requirements.

d) All welders shall be tested and approved by BHEL engineer/Customer before they are actually engaged on work though they may possess the requisite experience certificate. BHEL reserves the right to reject any welder without assigning any reasons.

e) All expenses for welders qualification testing of contractor’s welders including destructive and non-destructive tests conducted by BHEL at site shall have to be borne by the contractor. BHEL will provide the raw pipes and plates for preparation of test coupons free of charges.

f) BHEL Engineer is entitled to stop any welder from his work if his work is unsatisfactory for any technical reason or if there is a high percentage of rejection of joints welded by him, which in the opinion of BHEL Engineers, will adversely affect the quality of welding though the welder has earlier passed the tests prescribed. The facts that the welders have passed the test, does not relieve the contractor from his contractual obligations to check the performance of the welders. Contractor shall submit a monthly performance record of all welders.

g) All welded joints shall be subject to acceptance by BHEL Engineer whose decision will be final and binding.

h) The High Pressure welders who possess necessary certificate shall appear well in advance before expiry of the validity of his certificate for re-qualification test as per relevant provision 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 have to be terminated forthwith.

i) Two pieces to be joined shall be individually checked for the weld edge preparation and profile dimensionally and to the template. Dye penetrant check shall be carried out on edge prepared surfaces at random. The percentage shall depend on piping system as specified by BHEL Engineer.

j) Joint fit up will be a stage of inspection. Misalignment after fit up may vary from 0.3 mm to 1.6 mm depending on outside diameter and thickness.

k) For protection of all pipe joints against rusting between the fit up and actual time of welding, special de-oxidised weldable aluminium painting, as approved by site engineer, shall be done as part of work.

l) All H. P joints shall be subject to visual inspection after root run and subsequent welding shall be carried out after due clearance.

m) Welding electrodes have to be stored in enclosures having temperature and humidity control arrangement. This enclosure shall meet BHEL specifications.

n) Welding electrodes, prior to their use, call for baking for specified period and will have to be held at specified temperature for specified period. Also, during execution, the welding electrodes have to be carried in portable ovens during shifing from backing and holding oven. Contractor has to make sufficient number of backing ovens to meet the requirement.

2.3.50.4.2 HEAT TREATMENT:

a) Pre-heating, Post Heating and Stress Relieving are part of erection work and shall be performed by the contractor in accordance with instructions of BHEL Engineer. During preheat and stress relieving operations the temperature shall be measured as per the instructions of BHEL Engineers by Thermocouples and recorded graphs for the heat treatment works carried out shall be the property of BHEL. The contractor has to provide thermo-chalks for checking preheat temperature for welding or for monitoring temperature of metal for hot correction as per BHEL Engineer’s instructions.

b) For the purpose of stress relieving, thermocouples have to be attached to the weld joint. The number of temperature measuring points and locations are as per the standards of BHEL. Thermocouples have to be attached using Capacitor Discharge type portable thermocouple attachment unit and **not by manual Arc Welding**. Contractor shall arrange sufficient number of thermocouple attachment units.

c) Wherever necessary, contractor should provide temperature indicator / Temperature recorder as required by BHEL Engineer for measuring heat treatment temperature for welding or for controlling temperature of metal for hot correction etc. the temperature recorders should be preferable of solid state type. Decision of BHEL Engineer on method and of checking preheat temperature of controlling temperature for hot correction and welding shall be final and binding on contractor.

d) Heat Treatment may be required to be carried out at any time (day or night) to ensure the continuity of the process. The contractor shall make all necessary arrangements including labourer required for the same as per directions of BHEL.

e) Wherever heat treatment / stress relieving is not mentioned, but pre-heating is required on joints, the same shall be carried out as part of the work.

f) For weld joints of heavy structural sections, if heat treatment is required, the same shall be carried out as part of the work.

g) Checking effectiveness of stress relieving by hardness tests (by digital hardness tester or other approved test methods as per BHEL engineer's instruction) including necessary testing equipments is within the scope of the work / specification.

h) Only Electrical Resistance Coils or Induction Coils shall be used for Pre-heating, Post Heating, Post Weld Heat Treatment and maintaining Inter-pass temperature. The coils shall be properly wrapped with asbestos or insulation material.

i) Oxy-Acetylene flame or exothermic chemical heating for Heat Treatment shall not be permitted. Heating shall be by means of Electric Induction Coil or Electric Resistance Coil using Copper heat Finger Elements / copper heat element pads whichever and wherever applicable should be arranged by the contractor at his own cost. The areas of the use of copper heat elements / pads will be instructed by BHEL Engineer at site to the contractor. The decision of BHEL Engineer shall be final and binding in this regard.

j) In the case of heat treatment for P-91 material, Ceramic Pads / Ceramic Wool of appropriate size and thickness shall be provided by contractor. Contractor has to include such requirement in his quoted rates. Thermocouple of 0.5 mm dia Teflon protected wire should be used as mentioned in the P-91 welding details.

2.3.50.4.3 NON DESTRUCTIVE EXAMINATION :

a) Radiographic inspection of welds shall be arranged by the contractor including all consumables like isotope camera, Film, Chemicals etc. Scaffolding and approaches for taking radiographs. The necessary skilled technician and labourers for taking the radiographs shall be provided by the contractor. While taking radiographs, the contractor has to use proper penetrameter / image quality indicators as instructed by the BHEL Engineer. All the processed and accepted films will be the property of BHEL. In this regard, the contractor has to adhere to the safety rules / regulations laid by BARC authorities from time to time. It may please be noted that invariably the radiographic work will be carried after the normal working hours.

b) Tenderer shall note that 100% radiography shall be taken on all high pressure welding till such time the welders' performance is found by BHEL Engineers to be satisfactory. Subsequently, subject to consistency in welder's performance. The percentage of radiography will be based on BHEL's standard practice/code requirement. The defects shall be rectified immediately and to the satisfaction of BHEL Engineer. The decision of BHEL Engineer regarding acceptance / rejecting the joints will be final and binding on the contractor.

c) Wherever radiographs are not accepted, on account of bad shot, joints shall be re-radiographed and re-shots submitted for evaluation. Radiographs shall be taken on

joints after carrying out repairs. However, if defect persists after first repair, as per radiograph, carrying out repairs and radiography shall be repeated till joint is made acceptable. In case, the joint is not repairable, the same shall have to be cut and repaired at contractor's cost. Decision of BHEL Engineer in all these matters is final and binding on the contractor. Payment is considered only for radiography after clearing all defects.

d) 100% Radiograph of certain sizes in piping have to be taken as per BHEL standards/ drawings. Radiography source deployed for should meet the requirements of BARC. All Radiographies are to be done by the Contractor within his quoted rates and no additional payment shall be entertained on this account

e) All field welded joints shall be subjected to dye-penetrant examination as specified in respective drawings and shall have to be accepted by BHEL Engineer. Any rectification required shall have to be done by the contractor at his cost.

f) For carrying out ultrasonic testing of welding joints, large size tubes and pipes, it will be necessary to prepare surface by grinding and buffing a smooth finish and contour as necessary. The contractor's scope of work includes such preparation and no extra charge is payable for this.

g) It may also become necessary to adopt inter layer Radiography/MPT/UT and final NDE combining Radiography/MPT/UT depending upon the site/technical requirement necessitating interruptions in continuity of the work and making necessary arrangements for carrying out the above work. The contractor shall take all this into account.

h) After stress relieving 5% of UT for all critical lines and 2% of UT for other alloy steel lines to be taken to ensure soundness of joints particularly stress relieving cracks. No separate payment will be made.

i) All the welded joints of steam admission pipelines to HPT, IPT and LPT shall have to be subjected to non-destructive tests viz. Magnetic particle test, dye penetration test and hardness test in Addition to radiography and ultrasonic testing. All the weld seams shall be properly ground and subjected to 100% Radiographic examination.

j) Contractor may have to undertake Radiography with Cobalt-60 isotope camera. In case due to unavoidable circumstances Cobalt-60 is not possible to be used, the same joints shall be checked by 'Ultrasonic Test'. After completion of suitable part of the thickness, radiography with Ir–192 or other suitable source as acceptable to BARC to be done in case Cobalt-60 source cannot be used, subsequently after completing the joint UT to be done. For this contractor has to deploy Level–II operator certified by BARC.

k) In the case of P-91 Piping NDT requirement, since no radiography is possible, alternatively Ultrasonic Test has to be carried out apart from other NDE.

l) For piping of thickness less than 25 mm no radiography plugs will be provided. Radiography shots to be taken by double wall technique or any other method to be adopted in consultation with BHEL Engineer at site.

m) Wherever radiographs are not accepted on account of poor exposure, joints shall be re-radiographed and new films submitted for evaluation. Radiographs shall be taken again on joints after carrying out repairs. However, if the defect persists after first repair as per radiograph, carrying out radiography shall be repeated till the joint is made acceptable. In case the joint is not repairable, the same shall be cut, re-welded and re-radiographed at Contractor's cost. The evaluation charges in respect of such **repeated evaluation shall have to be borne by the contractor.**

n) Conductance of all kind of NDTs are included in vendor;s scope including arrangement of all types of resources, trained manpower, proper approach is included in the contractor's scope at no extra cost to BHEL.

2.3.50.4.4 PROCEDURE FOR ERECTION & WELDING OF SA335 P91 MATERIAL

Prior to erection, supplied pipes shall be inspected thoroughly and if any defect like crack, lamination, deposit noticed, the same shall be confirmed by Liquid Penetrant Inspection. If confirmed, same shall be referred to supply unit of BHEL for required repair.

2.3.50.4.4.1 **EDGE PREPARATION AND FIT UP**.

I. Cutting of P-91 material shall be done by hand saw / hack saw / machining / plasma cutting / grinding only.

II. Edge preparation shall be done only by machining and the required edge preparation machine shall be arranged by contractor at his cost. In extreme cases, edge can be prepared by grinding with prior approval of BHEL. During edge preparation care should be taken to avoid excessive pressure to prevent heating up of the pipe edges.

III. All edge preparation done at site shall be subjected to Liquid Penetration Test. Weld built-up on edge preparation is prohibited.

IV. The weld fit-up shall be carried out properly to ensure proper alignment and root gap. Neither tack welds nor bridge piece shall be used to secure alignment.

V. Partial root weld of minimum 20mm length by GTAW and fit-up by a clamping arrangement is recommended. Use of site manufactured clamps for fit-up is acceptable. The necessary pre-heat and purging shall be done. The fit-up shall be as per drawing. Root gap shall be 2 to 4 mm. Root mismatch

shall be within 1 mm. Suitable reference punch marks shall be made on both the pipes (at 200 mm from the EP) at least on four axis to facilitate U. T on weld joint.

2.3.50.4.4.2 **FIXING OF THETMOCOUPLES AND HEATING ELEMENTS DURING PRE-HEATING AND POST WELD HEAT TREATMENT**.

No pre-heating is required for fixing T/Cwith resistance spot welding. Following are the equipment / facilities for heating cycles.

1. Heating Method : Induction Heating

2. Thermo couples : Ni-Cr / Ni – Al of 0.5 mm gauge size.

3. Temp. Recorder : 6 Points / 12 Points.

2.3.50.4.4.3 ARRANGEMENT FOR PURGING :

I. Argon gas with requisite quality shall be used for purging the root side of weld. 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. Purging is not required in case of nozzle and attachment welds, when they are not full penetration joints. The Argon gas to be used shall be dry. The flow rate is to be maintained during purging is 10 to 25 litres / minute and for shielding during GTAW is 8 to 14 ltres / minute.

II. 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 pre-flushing time for purging before start of welding shall be 5 minutes, irrespective of the pipe size. 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. Plastic foils that are water soluble are **not acceptable**.

2.3.50.4.4.4 WELDERS QUALIFICATION

Only qualified welding procedures are to be used. Welders qualified as per ASME Section – IX and IBR on P-91 material shall only be engaged. Welders logbook to be maintained and welders performance shall be monitored by BHEL site welding engineer / Quality assurance engineer.

2.3.50.4.4.5 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 additional square thermocouple are to be fixed for emergency use. Gas burners shall employed to maintain the temperature until the power resumes.

2.3.50.4.4.6 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. Argon gas to be used both for purging as well as shielding shall be of 99.99 purity level conforming to IS 5760-1998.

2.3.50.4.4.7 **STORAGE OF WELDING CONSUMABLES** :

I. Welding consumables are received with proper packing and marking which includes the relevant batch number for easy identification.

II. Electrodes are stored in their original sealed containers / packages until issued and kept in dry and clean environment taking care of shelf life.

III. Welding filler wires are received with proper packing and marking which includes the relevant batch number for easy identification.

IV. The filler wires are stored in original packages until issued and kept in dry and clean environment.

V. The electrode GTW wires issued to the welders should be controlled through issue slips. SMAW electrodes used must be dried in drying ovens with calibrated temperature controller. The drying temperature shall be as recommended by the electrodes manufacturer. The drying temp. shall be 200 – 300 deg. Centrigrades for two hours if it is not specified by manufacturer. Portable flasks shall be used by the welders for carrying electrodes and shall be kept at 100 deg. Centrigrades. Welding shall be carried out with short arc and stringer bead technology.

VI. The inter-pass temperature shall not exceed 350 deg. Centigrades. After completion of welding bring down the temperature to 80 – 100 deg. C and hold it at this temperature for one hour minimum. The PWHT shall commence after completion of one hour of soaking.

2.3.50.4.4.8 **POST WELD HEAT TREATMENT** :

I. A minimum of four thermocouples shall be placed such that at least two are on the weld and the other twoon the base material on either side of the weld within the heating band at 180 deg C apart about 50 mm from the weld joint. One stand by thermocouple shall also be provided on the weld in case of any failure of the thermocouple. The width of the heated circumferential band on either side of the weld must be al least 5 times the thickness of the weld. In case of fillet joints the heating band shall be six times the thickness of the base material. An insulation of about 10mm thickness shall be provided between the cables and the weld joints.

II. Obtain the clearance for post weld heat treatment cycle from BHEL QAE / welding engineer. The PWHT temp. 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. All records shall be reviewed by BHEL welding engineer prior to PWHT clearance. Heating shall be done by Induction heating only. The rate of Heating / Cooling :

Thickness up to 50 mm	110 deg. Centrigrades
Thickness up to 50 – 75 mm	75 deg. Centrigrades / hr. (max)
Thickness more than 75 mm	55 deg. Centrigrades / hr. (max)

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

IV. 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 a site authorized personnel.

2.3.50.4.4.9 **PREVENTIVE MEASURES DURING POWER FAILURE AND NON-FUNCTIONING OF EQUIPMENT** :

No interruption is allowed during welding and PWHT. Hence all equipment for the purpose of power supply, welding, heating etc. shall have alternative arrangements, (

Diesel generator – 215 KVA for providing power to the welding and heating equipment, reserve thermocouple connections, gas burner arrangement for maintaining temperature etc.). Following preventive measures shall be adopted until normal power supply or backup power supply through diesel generator is restored.

(a) During start of pre-heating :

Weld fit-up arrangement shall be immediately covered with insulation along with complete circumference of the pipe and maintained at the temperature 80 to 100 deg. C until the power resumes. The temperature shall not be allowed to fall below 80 deg. C. Gas burners shall be employed to maintain the temperature till the power resumes. Preheating may be continued after power is resumed / alternate arrangement is made.

10. During GTAW / SMAW

Use gas burner arrangement to maintain the temperature at 80 to 100 Deg C up to a length of 50 mm on either side from weld center line along the complete circumference of the pipe. Root welding shall be continued after power is restored and preheating temperature is raised to 220 deg. C. During the above period temperature shall be recoded through contact type theromometer.

(c) During cooling cycle after SMAW welding to the holding temperature at 80 to 100 deg. C for one hour.

(d) During post weld heat treatment the following shall be followed

During heating cycle ---- The whole operation to be repeated from the beginning.

During soaking cycle ----- Heat treat (soak) subsequently for the entire duration.

During cooling (above 335 deg. C) --- Reheat to soaking temperature and cool at the required rate.

In all the cases mentioned above the temperature measurement on the weld joint by means of contact type calibrated temp. gauges shall be employed to record the temperature at regular interval of 15 minutes.

2.3.50.4.4.10 TEMPERATURE MONITORING

The welding and heat treatment chart shall be recorded for the following details. The actual PWHT chart shall be monitored for the following :

a) Pre-Heating
b) Interpass Temperature (GTAW + SMAW)
c) Cooling and holding at 80-100 deg. C for minimum one hour. Start PWHT after minimum one hour of soaking.

d) Heating to PWHT.

2.3.50.4.4.11 CAUTION

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 pre-heated portion of the pipe.

2.3.50.4.4.12 CALIBRATION

All equipment like recorder, thermocouple, compensating cable, 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.

2.3.50.4.4.13 NON DESTRUCTIVE EXAMINATION

I. Non destructive examination shall be done after PWHT. Prior to testing all welds shall be smoothly ground.

II. All welds (Butt and Fillet) shall be subjected to MPI. In addition to MPI, butt-welds and all full penetration welds shall be examined by UT.

III. LPI penetrant material (Dye penetrant, Solvent cleaner & developer) and medium (dry / wet particles) used in MPI shall be of BHEL approved brands only.

IV. For Ultrasonic Testing calibration blocks used shall be of the same material specification, dia and thickness.

V. The UT equipment shall be calibrated prior to use and should be of digital type -- Krautkramer model USN 50 or equivalent , capable of storing calibration data as well as ultrasonic results.

VI. All recordable indications will be stored in memory of digital flaw detector and PC for review at a later period.

VII. The equipment calibration data for specific weld as well as the hard copy of 'Static echo-trace pattern' - showing the flow echo amplitude with respect to DAC, flaw depth, projection surface, distance and beam – path shall be attached to UT test report. This hard copy of echo-trace with equipment calibration data will form part of test documentation.

VIII. The examination as well as evaluation shall be performed by a qualified Level – II personnel and a test report shall be submitted. Any defect noticed during NDE shall be marked with a marker.

2.3.50.4.4.14 REPAIR OF WELD JOINTS

(a) WELD REPAIR AT ROOT

On visual examination during root welding if it reveals any surface defects, the same shall be removed by grinding maintaining temperature 80 – 100 deg. C and rewelded with GTAW maintaining 220 deg. C before starting SMAW.

(b) WELD REPAIR ON COMPLETION

Any defect observed on the weld shall be brought to the notice of Quality Assurance Engineer. The size and nature of the defect shall be reviewed. Any repair on weld to be carried out on their approval. If some defects are noticed on fully completed joint while performing UT after completion of PWHT, the same may be assessed in order to find the seriousness of the defect and to locate where exactly the defect lies from the weld outside the surface. The defect area shall be marked and repaired as below:

1) The weld shall be removed by grinding (gouging not permitted) such that the area for repair welding is free from sharp corners and provided with sufficient slope towards the weldface sides. Incase of cut and weld joints HAZ will have to be removed by grinding.

2) Surface examination (MPI/ LPI) on the ground weld area to be performed to ensure a sound base material before depositing weld layers using SMAW.

3) The temperature of the weld is to be maintained at pre-heat temperature.

4) Carry out SMAW using the same procedure as that of welding.

5) All the specified precautions with respect to welding consumables, heating cycles, post weld heat treatment etc. as followed for original welding shall be strictly adhered.

6) The NDE shall be conducted for the entire weld joint.

7) If any further defects are observed on the repaired weld, the same may be further reworked as mentioned above.

2.3.50.4.4.15 HARDNESS SURVEY

The equipment recommended to measure the hardness are EQUOTIP or MICRODUR make or equivalent portable equipment, which is to be arranged by the bidder at their cost. The equipment used for the hardness measurement shall be calibrated as recommended by the manufacturer and also on a P-91 calibration block provided by BHEL. The surface shall be cleaned and prepared as per hardness test instrument manufacturer's recommendation prior to hardness survey. Hardness survey shall be done at each joint at three locations along the circumference. At each location three ratings on weld and parent material shall be carried out. All the hardness values shall be recorded. 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. If hardness is still more, refer the case to Unit.

2.3.50.4.4.16 COMBINATION WELDING

For the combination of material like P-22 with P-91 and X-22 with P-91 the WPS as approved by WTC shall be given by PC for adoption.

Material	Temperature	Soaking Time
P-91 + P-22	745 $\pm$ 15 deg. C	2.5 Minutes / mm (minimum 1 Hr.)
P-91 + X-22	750 $\pm$ 10 deg. C	2.5 Minutes / mm Minimum 2 hour for thickness up to 50 mm and 4 hrs. for thickness more than 50 mm.

Precautions as required for P-91 shall be fully taken care of.

2.3.50.4.4.17 SPECIFIC TRAINING FOR WELDERS

I. The qualified welders who will be engaged in P-91 welding shall be given training on pipe joints simulated with P-91 welding and heating cycle conditions.

II. The acquaintance on welding positions, as applicable shall be given using P-91 pipes and P-91 welding consumables, Welding techniques and instructions on Dos and DON'T's of P-91 welding. Welders who are qualified only on P-91 welding shall be engaged. Welders shall have to undergo all the training all the training above. It may be required that the welders shall have to be tested and and qualified at BHEL / WTC / TRICHY. Contractor shall arrange for the same and entire expenditure towards this shall be borne by the Contractor.

2.3.50.4.4.18 CONTROL ON WELDERS

The welders during welding at site shall follow the correct procedures. The welders shall interact with the HT operator (Induction / Resistance equipment operator) to ensure that preheat and inter-pass temperature during welding are maintained as per requirement. The welders shall not mix the welding electrodes with that of the other welder. At the end of the shift, the unused electrodes shall be returned to the stores.

2.3.50.4.4.19 PERSONNEL ENGAGED FOR HEATING CYCLE (HT OPERATOR)

Contractor shall deploy adequate no of heat treatment operator / technicians and electricians exclusively in shifts, who shall have adequate heat treatment experience on P-91 or similar material. HT operator shall be aware of the followings :

1. The equipment used and its working principle.
2. The procedure to be followed in using heating equipment.
3. Procedures to be followed in case of power failure or equipment non-functioning.
4. Calibration of equipment
5. Method of fixing the thermocouples and compensating cablesleading to HT recorder.
6. Fixing of heating pads or elements on the pipe joints and also in maintaining the temperature within the specified limits.

2.3.50.4.4.20 NDE PERSONNEL QUALIFICATIONS

All the Non-Destructive Examinations shall have to be performed by Qualified NDE personnel only. Ultrasonic Testing , Magnetic Particle Inspection and Liquid Penetrant Inspection shall be carried out by ASNT / ISNT Level – II qualified personnel only.

2.3.50.4.4.21 SUPERVISION

Contractor shall deploy exclusive Engineer and Supervisor 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.

2.3.50.4.4.22 DO'S AND DON'T'SDURING P-91 WELDING, HEAT TREATMENT AND NDE AT CONSTRUCTION SITE.

DO'S :

1. Cutting by Band saw / Hack saw / Machining / Plasma cutting.
2. Pipe edge preparation by machining. Machining shall be done without excessive pressure to prevent heating up of pipe.
3. Grinding may be done on exceptional cases taking adequate care to prevent overheating.
4. Thermocouple wire (hot / cold junctions) shall be welded with condenser discharge portable spot-welding equipment.
5. Reserve thermocouples shall be made available, in case of failure of connected thermocouple elements.
6. Ensure adequate Argon gas for complete purging of air inside the pipe before starting GTAW root welding.
7. Ensure preheating at 220 deg. C minimum before GTAW root welding.
8. Start preheating only after clearance from welding engineer / Quality assurance engineer for weld fit-up and alignment of the joint as well as fixing of Thermocouples (for Induction heating).
9. Do visual inspection on root weld maintaining weld preheat temperature.
10. Continue Argon purging until the GTAW root welding followed by minimum two filler passes of SMAW is complete.
11. Perform partial root welding to facilitate fit-up, if necessary.
12. Ensure that only one layer of root welding using TGS 2CM filler wire is deposited wherever necessary.
13. Ensure proper use of TIG wires as identified by colour coding or suitable hard punching.

14. Keep the GTAW wires in absolutely clean condition and free from oil , rust etc.

15. Dry the SMAW electrodes before use.

16. Ensure inter-pass temperature is less that 350 deg. C.

17. Hold at 80-100 deg. C for a period of minimum 1 Hr. before start of PWHT.

18. Record entire heating cycle on chart through recorders.

19. Exercise control during grinding of weld and adjoining base metal while removing surface surface / sub-surface defects or during preparation of NDE.

20. Ensure no contact with moisture during preheat, welding , post heat and PWHT of weld joints.

21. Ensure removal of Argon purging arrangements after welding.

22. Use short Arc only. The maximum weaving shall be limited to 1.5 times the dia of the electrode.

23. Obtain WPS from equipment / piping supplier (combination welding) for welding of Pipe with equipment.

DON'T'S

1. Avoid Oxy-Acetylene flame cutting.

2. Avoid weld-build up to correct the weld end or to set right the lip of the weld bevel.

3. Avoid Arc strike on materials at the time of weld fit-up during welding.

4. Do not tack weld the thermocouple wires with manual ARC / TIG welding.

5. No GTAW root welding without thorough purging of root area.

6. Do not use Oxy-Acetylene flame heating for any heating requirement.

7. Do not use thermal chalks on the weld groove.

8. Do not stop Argon purging till completion of GTAW root welding and two layers of SMAW.

9. No tack welding or Bridge piece welding is permitted.

10. Do not use unidentified TIG wires or electrodes.

11. Do not exceed the maximum inter-pass temperature indicated in WPS.

12. Do not allow moisture, rain, water, cold wind, cold draft etc. to come in contact with the weld zone during the entire cycle from preheat to PWHT.

13. Do not exceed the limits of PWHT soaking temperature.

14. Do not interrupt the welding / heating cycle except for unavoidable power failures.

15. Do not use uncalibrated equipment for temperature measurement during heating, welding, post-weld heat treatment etc.

2.3.50.4.4.23 FACILITY TO BE PROVIDED BY BHEL FOR P-91 WELDING, FREE OF CHARGES:

1. Required No. of Induction Heating Machines with accessories.
2. The following consumables :
   - (i) Annealing Cables
   - (ii) Compensating Cables
3. Welding electrodes for P-91 welding.
4. Digital Temperature indicator.

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.

2.3.50.4.4.24 FACILITY TO BE PROVIDED BY THE CONTRACTOR FOR P-91 WELDING

1. Required numbers of operators / technicians / electricians for installation, commissioning and operation continuously.

2. Gas burner arrangement with required gas for maintaining temperature in the event of power failure.

3. Ultrasonic flaw detector with recording Device & Complete accessories (Digital Type - Krautkramer model USN 50 or equivalent) capable of

storing calibration data. All recordable indications will be stored in the memory of the digital flaw detector and in PC (to be arranged by contractor within his quoted rate) for review at a later period.

4. Spot welding Machine for fixing Thermo-couples.
5. EQUOTIP or MICRODUR make or equivalent portable hardness tester.
6. MPI & LPI kit with required consumables.
7. DG Power supply within 500 mtrs. From Boiler (Only for power failure during welding) including necessary cables and switches etc.
8. Consumables :

(i) Glass Fibre Cloth - 1 mm x 1000 mm - Temperature rating 1260 deg. C.

11. Glass Fibre cord - Dia 3 mm (Twisted) - Temperature rating - 1260 deg. C.

12. Ceramic Fibre Blanket - RT Grade, Density 96 KG / Cub. M - Temperature rating - 1260 deg. C.

(iv) Ceramic Fibre rope - Fibre glass braided, dia 12mm - Temperature rating 1260 deg. C.

(v) K- Type Thermocouple - 0.5 mm Dia single strand individual fibre glass insulated.

(vi) Heavy duty TC connectors for K- Type Thermocouples – Size 0.5 mm dia single strand individual fibre galss insulated.

(vii) All other consumables / equipment required to carry out the work.

2.3.50.4.4.25 **TECHNICALLY APPROVED BRANDS BY BHEL / HPBP / TRICHY**.

Liquid penetrant , penetrant remover (solvent cleaner) and Aerosol Developer from the same manufacturer considered as a family group.

VENDOR	**PENETRANT**	**BRAND**	
		PENETRANT REMOVER	DEVELOPER
ITW SIGNODE (I) LTD.	STOPCHECK SKL – SP	STOP CHECK SKC – 1	STOP CHECK SKD – S2

P – MET CO.	FLAW CHECK I) PP – 15 II) PP – 110	FLAW CHECK I) PP- 21 II) PP – 120	FLAW CHECK I) PP - 31A II) PP – 131A
CHECKMATE CHEM. PVT. LTD.	CHECKMATE SUPER PT – 97	CHECKMATE SUPER CL – 96	CHECKMATE SUPER DV – 98
PRADEEP METAL TREATMENT	FLAW GUIDE GP	FLAW GUIDE GP	FLAW GUIDE GP
FERRO CHEM	CRACK CHECK FC – 911	CRACK CHECK FC – 911	CRACK CHECK FC – 911

DRY MAGNETIC POWDER :

1. MAGNAFLUX - PRODUCT GREY , 8A -- RED
2. FERROCHEM PRODUCT NO. 256
3. K – ELECTRONICS PRODUCT -- RD -- 200 (SPECIAL)

NON – FLOROSCENT MAGNETIC INK
(PREPARE BATH AS INSTRUCTED BY SUPPLIER)

1. MAGNAFLUX -- PRODUCT 9C RED WITH MX/MG CARRIER II OIL VEHICLE.
2. FERROCHEM -- PRODUCT NO. 146A WITH OIL VEHICLE (WITH HIGH FLASH POINT 92 DEG. C.)
3. SARDA MAGNA CHECK INK WITH OIL VEHICLE (WITH HIGH FLASH POINT 92 DEG. C)

FLUOROSCENT MAGNETIC INK
(PREPARE BATH AS INSTRUCTED BY SUPPLIER)

1. MAGNA FLUX -- PRODUCT 14 A WITH MX/MG CARRIER II OIL VEHICLE.
2. MAGNA FLUX -- PRODUCT 14 AM - PREPARED BATH OF 14 A

   AND MG / MX CARRIER-II READY TO USE WITHOUT MEASURING AND MIXING IN AEROSOL

CONTAINER WITH MX/MG CARRIER-II OILL VEHICLE.

2.3.50.4.5 PRE-COMMISSIONING, COMMISSIONING AND POST COMMISSIONING OF THE UNIT :

I. The Piping work is related to various commissioning activities of the power station as follows

1. Trial run of individual equipments.

2. Alkali Flushing/other suitable chemical cleaning of Boiler Feed Piping and other piping with systems and equipment and restoration.

3. Hydraulic test of Boiler

4. Hydraulic test of Pipings

5. Light up of Boiler

6. Boiler Alkali Boil Out

7. Boiler Acid Cleaning.

8. Alkali Flushing/other suitable chemical cleaning of TG Piping

9. Turbine Barring Gear

10. Turbine Rolling

11. Steam Blowing of Boiler Super Heater and Steam Piping

12. Safety Valve Floating

13. Synchronization of Unit

14. Coal Firing of Boiler

15. Full Load Operation ,trial run and handing over of the Unit (s).

II. The above 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.

III. 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 are necessary, the same shall be done as per BHEL Engineer's instructions.

IV. During each stage of commissioning, if any part of the piping needs repair / rectification / re-work / 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 relevant clauses of Special Conditions of Contract . The parts to be replaced shall however be provided by BHEL free of cost.

V. The pre-commissioning activities will start prior to light up of the boiler and various trials, commissioning operations shall continue till the individual 500 MW Unit(s) is handed over to customer. Simultaneous commissioning checks, activities will be in progress in various areas like trial run of various equipment, checking of equipment erected, making ready for trial runs, filling up of lubricants, chemicals etc., all these works need specialized gangs including electricians 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. The mobilization of these commissioning gangs shall be sufficient so that planned commissioning 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 the 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 any time the requisite manpower, consumables, T&P are not arranged then BHEL shall make alternate arrangements and necessary recoveries will be made alongwith overhead charges of BHEL.

VI. 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.

VII. After the start of continuous operation with coal firing, the commissioning tests and maintenance activities will continue. It shall be the responsibility of the contractor to provide the following category of workers with necessary consumables, tools and tackles and supervision till handing over of the unit to the customer.

A.	Pipe Fitters / General Fitters / Millwright Fitters	- 2 nos.
B.	Rigger / unskilled workers	- 5 Nos.
C.	Electricians	- 2 Nos.
D.	Supervisor	- 1 No.
E.	Valve Technician	- 2 Nos.
F.	HP Welder	- 1 No.

VIII. The above figures shows only minimum required over and above labour required for completing pending erection commissioning works and clearing check and

punch lists. Contractor has to provide number of personnel of various categories as per work demand and necessity at site. These skeleton staff are required after synchronization of the unit for attending to commissioning, post commissioning, operation and maintenance problems and no over run charges will be payable for providing these services unless left over jobs are also done during this period and the delay in the completion of these jobs is not attributable to the contractor.

IX. It shall be specifically noted that above employees of the contractor may have to work round the clock alongwith BHEL Commissioning Engineers involving considerable payment of overtime.

X. During commissioning, opening of valves, changing of gaskets, checking, resetting of hangers, realigning of rotating and other equipment, attending to leakages in valves etc., and adjustments of erected equipment may arise. All the valves shall be serviced and lubricated to the satisfaction of BHEL Engineer during the erection and commissioning as per BHEL Engineer's instructions.

XI. In case any re-work / repair / rectification / modification / fabrication, etc., is required because of contractor's faulty erection which is noticed during commissioning of at any stage, the same has to be rectified by the contractor at his cost. If during commissioning, any improvement/repair/re-work/rectification/Fabrication / Modification due to design improvement / requirement are involved, the same shall be carried out by contractor promptly and expeditiously. Claims, if any, for such works from the contractor shall be governed by relevant Clauses of Extra work.

XII. It is the responsibility of the contractor to provide for necessary labour, tools and tackles and consumables till the completion of work under these specification, even in case erection, testing and commissioning of the piping and other equipments are delayed due to reasons not attributable to the contractor.

XIII. Contractor should specifically have electrical and mechanical technicians for servicing and maintenance of valves, actuators and strainers. The Technicians should have the expertise in dismantling the valves, re-assembly and also attending to the problems.

XIV. Contractor shall lay/install necessary temporary piping, pumps, valves, gauges, cables, switches etc, for conduct of hydraulic test, This may involve cutting of some portion of existing piping/valves, placing of rubber wedges/ blanks in the valves and other openings Where required, bends have to be fabricated at site from running length of pipe. Temporary installation itself has to be tested, tried, and subject to non-destructive examinations as per the instructions of BHEL as part of work.

XV. All materials, equipments necessary for installation of temporary system as above will be supplied by BHEL in random sizes/lengths. However, servicing, fabrication,

erection, dismantling of the same after completion of the process, and returning to BHEL stores shall be the responsibility of the contractor.

XVI. Fabrication, fit-up, welding, if any, of requisite blanks for conduct of hydraulic test is art of work. Similarly, removal of blanks, restoration and normalization of the concerned system/line is to be done as part of work. BHEL will provide the material for blanks free of charge. No separate payment is envisaged for these activities.

3.0	**GENERAL RESPONSIBILITY OF THE CONTRACTOR**
3.1	The contractor shall have total responsibility for all equipment and materials in his custody at contractor's stores, loose, semi-assembled, assembled or erected by him at site. He shall effectively protect the finished works from action of weather and from damages or defacement and shall also cover the finished parts immediately on completion of work as per BHEL Engineer's instructions. The machine surfaces / finished surfaces should be greased and covered.
3.2	PRESERVATION & PROTECTION OF COMPONENTS
3.2.1	At all stages of work, equipments / materials in the custody of contractor, including those erected, will have to be preserved as per the instructions of BHEL. Necessary preservation agents, if required for the above work shall be provided by BHEL as free issue.
3.2.2	The contractor shall make suitable security arrangements including employment of security personnel and ensure protection of all materials / equipment in their custody and installed equipments from theft / fire / pilferage and any other damages and losses.
3.2.3	Contractor shall collect all scrap materials periodically from various area of work site, deposit the same at one place earmarked at site or shift the same to a place earmarked in BHEL / client's stores. In case of failure of contractor in compliance of this requirement, BHEL will make suitable arrangement at contractor's risk and cost.
3.2.4	The entire surplus, damaged, unused materials, packaging materials / containers, special transporting frames, gunny bags etc. shall be returned to BHEL stores by the contractor.
3.2.5	The contractor shall not waste any materials issued to him. In case it is observed at any stage that the wastage / excess utilization of materials is not within the permissible limits, recovery for the excess quantity used or wasted will be effected with departmental charges from the contractor. Decision of BHEL on this will be final and binding on the contractor.
3.2.6	For any class of work for which no specifications have been laid down in these specifications, work shall be executed as per the instructions of BHEL.
4.0	**EXCLUSIONS**
	The following main items are specifically excluded from the subcontractor's scope.
4.3	C&I items appearing in product Group 95,96 & 97. However some items appearing in 95, 96 & 97 PG related to pressure parts welding like soot blower orifice, metal temp pads and clamps etc are in the scope of the contractor. seal welding of screwed type thermowells and socket type thermo wells have to be done by the contractor without any extra cost
4.4	Testing and commissioning of all HT /LT motors, actuators of valves/gate/dampers, as well as testing and commissioning of all electrical items of ESP (This supercedes any contradictory clauses, if any, appearing elsewhere in this specification regarding Electrical scope of work).
4.5	Erection of power cylinders & Commissioning of Control valves
4.6	Boiler Elevator.

5.0	**DRAWINGS AND DOCUMENTS**
5.1	The detailed drawings, specifications, quality plans available with BHEL Engineers will also form part of this tender specification. Revision of drawings / documents may take place due to various considerations as is normal in such large project. Work will have to be carried out as per revised drawings / documents. These documents will be made available to the contractor during execution of work at site.
5.2	One set of necessary drawings / documents to carry out the erection work will be furnished to the contractor by BHEL on loan which shall be returned to BHEL after completion of the work. Contractor's personnel shall take care of these documents given to them.
5.3	The data furnished in various sections and appendices and the drawings enclosed with this tender specification describe the equipment to be installed, tested and commissioned under this specification, briefly. However, the changes in the design and in the quantity may be executed to occur as is usual in any such large scale of works.
5.4	If any error or ambiguity is discovered in the specification / information contained in the documents / drawings and tender, the contractor shall forthwith bring the same to the notice of BHEL before commencement of the work. BHEL's interpretation in such cases will be final and binding on the contractor.
5.5	In case of any conflict between general instructions to tenderers and general conditions of contract respectively and other special conditions of contract and appendices, provisions contained in special conditions of contract and appendices shall prevail.

TECHNICAL SPECIFICATION FOR INSULATION JOB

1. Scope of work

1.1. The work shall conform to dimension and tolerances specified in the various drawing. If any portion of the work is found to be defective in workmanship or not conforming to drawings or other specifications, the contractor shall dismantle and re-do the work duly replacing the defective materials at his cost. Failing which, the work will be got done by engaging other agencies or departmentally and recoveries will be deducted from contractor's bills towards expenditure incurred including BHEL's departmental overhead charges.

1.2. Special equipment/materials such as cladding sheets, pourable refractory, mineral wool etc. shall be stored when taken over by the contractor in appropriate manner as per BHEL's instructions. Relocation/shifting if necessary, of material, T&P etc. due to site conditions/ customer requirement shall be done expeditiously as incidental to work.

1.3. The contractor shall handover all parts/ materials remaining extra over the normal requirement with proper identification tags in a packed condition if so specified, to BHEL stores, in case of any misuse or excess use over design requirements, BHEL reserve the right to recover the cost of parts /material used in excess or misused. Decision of BHEL engineer in the regard will be final and binding on the contractor.

1.4. All the pourable and castable insulation bags issued to the contractor have to be properly stored and the same should be kept in a covered storage without exposing to atmospheric conditions. For this purpose, contractor should arrange sufficient quantity of fire retardant tarpaulins or temporary covered shed.

2. Lining and Insulation works

2.1. All insulation and refractory materials including iron components and outer sheet casing materials, cladding sheets etc. required will be supplied by BHEL and the same have to be erected/ applied as per the drawings and specifications of BHEL by the contractor.

2.2. The contractor shall provide the required quantity of wire, nails, and planks for formwork and other materials for shuttering and curing works.

2.3. Contractor shall observe all precaution for laying, curing etc of pourable insulation. The contractor at his own cost shall redo any defective works found later.

2.4. Wool insulation is received at site as loose bounded and unbounded mattresses in standard sizes. These are to be dressed/cut to suite the equipments.

2.5. Dressing of insulation bricks to suit the site area application is incidental to work.

2.6. Removable type of insulation has to be provided for valves fittings, expansion joints etc. As per drawing or as directed by BHEL engineer.

2.7. The cladding and outer casing for main boiler, integral piping, non-pressure parts, other auxiliaries, piping, TG equipment, TG piping, other vessels etc, are of aluminum sheets. All

relevant specifications and procedures with regards to beading, sealing etc for alunimium sheets have to be adhered to.

2.8. The contractor should ensure that the finished work conforms to the dimension and tolerance given in the drawings.

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

2.10. A log book shall be maintained by the contractor for the clearance of the area for application of refractory and insulation. If the contractor does the work on his own without prior permission, the work should be re-done where necessitated, at his cost.

2.11. Wastage allowance for the material issued are envisaged as follows:

A pourable & castable insulation	-3%
B insulation bricks and mortar	-3%
C wool mattresses	-4%
D cladding sheets	-3%

The wastage allowance will be applicable on the net issued quantity i.e. total quantity issued reduced by the quantity returned to stores as unused/fresh item. Contractor shall reconcile the material issues periodically as prescribed by BHEL site. Payment for the work done will be regulated as per provision of contract.

2.12. Cladding/outer casing shall be fixed expeditiously, so as to avoid damage to the insulation from the weather.

2.13. The overlapping surface of outer casing/cladding sheet shall be coated with sealing compound, which will be supplied by BHEL free of cost.

2.14. To take care of bimetal corrosion due to variety of metals in contact of each other viz. Retainer to support, support to outer casing/cladding, cladding-to-cladding etc, suitable paints specified by BHEL, to be applied and /or neoprene rubber packing/strips or any other insert may have to be fixed as required.

2.15. Multiple layers of mineral wool have to be applied as directed and as per drawings and specifications for boiler, TG and their auxiliaries, pipelines, valves, hanger, support items and other vessels etc, covered under the scope of work.

2.16. Contractor shall cut open works as needed as per BHEL engineer's instructions during commissioning, for inspection, checking and shall make good the works after inspection is over, without any extra cost.

2.17. In case, the insulations are to be removed for checking purpose, the same has to be removed and restored as per decision of BHEL. In case, certain insulation materials get damaged during this process, BHEL will issue additional insulation materials free of cost. This exercise may have to be repeated as per requirement of BHEL till satisfactory

completion. However, the requirement of additional insulation shall be as per decision of BHEL and binding on the contractor. No extra payment shall be released by BHEL in this account.

2.18. For insulation of oil system lines having electrical tracing attached, instrument tapping, thermocouples, alunimium foil is to be wrapped around the pipeline and instruments, before applying the mineral wool. Necessary aluminium foil shall be arranged by contractor at his own cost. No separate payment will be made by BHEL for this work, including for supply of aluminium foil.

2.19. The following works are also included in the scope of this contract within his quoted rate:

i) cutting of cladding sheets as per the profile of the equipment and painting on inner surface (two coats of bituminous paint)
(ii) cutting and welding of angles, channels, running steel and sizing the same as per the site requirement.
(iii) cutting of the wool mattresses to the required shape and application of finishing cement of required thickness wherever required.
(iv) making of wool mattresses of required thickness and density as per requirement (if any) as per relevant application drawing / documents as part of site work.

2.20. Insulation of work of temporary piping for alkali boil out, steam blowing and acid cleaning has to be carried out at site. The same have to be removed and returned to the BHEL stores after the completion of activity. Rates quoted for application of mineral wool for boiler and auxiliaries will be applicable for this work also. No separate payment will be made for removal of temporary insulation.

2.21. Complete support and framework structure of furnace bottom enclosure, furnace rear arch enclosures, furnace extended side & bottom enclosures, vertical roof framing, deck supports and seal etc. are specially included in the scope of work.

2.22. Application of castable refractory/insulation on pressure parts before fixing and welding of inner sheet casing on rear arch tube portion of water wall, furnace bottom hopper portion of water wall upper and lower transition tube portion of water walls, radiant roof, super heater coils, rear roof super heater, rear/ front/ side/ extended side steam cooled super heater panels and any pressure part work requiring application of castable refractory directly and filling of castable refractory in seal boxes of manhole doors, peep holes, elliptical doors, etc. Gas distribution baffles, burner corner boxes or any fitting/part requiring filling of castable refractory and insulation and casting of castable refractory and insulation works of boiler, piping and auxiliaries cladding and outer sheet casing works are specially included.

2.23. Prior to application of refractory, bitumen painting on the pressure parts and other area is under contractor scope. The paints required for painting shall be supplied by the contractor at his cost, and shall be procured from BHEL approved vendors. No separate payment will be made for application of paint.

3. General

3.1. All extraneous steel and scaffolding materials, electricals, ladders steps, etc. welded on the supports, structural of other components during erection should be cut and removed. Burrs left behind after removal of the above should be ground as per BHEL engineer's instructions. Scars/cavities left behind should be filled up by welding and ground as per BHEL engineer's instructions.

3.2. All welded joints should be painted with anticorrosive paint immediately on completion of welding, supply of paint for this is in contractor's scope, within his quoted rate.

3.3. The preservation painting is to be carried out on materials taken from stores and also on material erected wherever the shop painting has given away. Periodical inspection shall be made as per the instructions of BHEL engineer. The contractor till the completion of the work shall provide this facility. Necessary preservation paint will be supplied by the contractor within his quoted rate.

3.4. Corrosion resistant paints

3.4.1. Black bituminous paint
Contractor shall arrange the required paint black bituminous paint wherever required for application on the seal box, pressure parts, cladding and outer casing sheets, within his quoted rate.

3.4.2. Contractor shall arrange the required paint for application for the purpose of bimetal corrosion protection within his quoted rate.

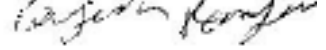
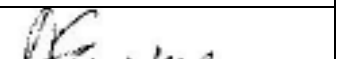
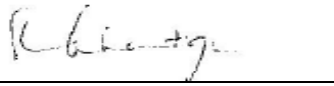
3.4.3. All paints, viz. Bitumen paint, preservation paint, corrosion resistant paint etc., as detailed in the tender specification, in the scope of contractor, shall be procured by the contractor from BHEL approved make vendors only.

BHARAT HEAVY ELECTRICALS LIMITED
RAMACHANDRAPURAM::HYDERABAD-32

PULVERISERS ENGINEERING

IPC(H)L / HALDIA TPP, 3 x 150MW

PAINTING SCHEDULE FOR BOWL MILLS

PREPARED BY	RAJESH RANJAN		DOCUMENT NO:BA/PS/IPCL/00 REV. NO: 00, DATED 20.05.2011 SHEET : 01 OF 08
REVIEWED BY	AMAN SURIN		
APPROVED BY	SATISH GHATGE		

PAINTING SCHEME FOR XRP 1003 BOWL MILL- IPC(H)L / HALDIA TPP, 3 x 150MW

SL. NO	SURFACE LOCATION & PGMAs	SURFACE PREPARATION	PRIMER		INTERMEDIATE		FINISH COAT			TOTAL DFT
			PAINT (mat.code)	NO.OF COATS	PAINT (mat.code)	No. OF COATS	PAINT (mat.code)	NO.OF COATS	SHADE	µm min.
01	Journal Assembly 61-080									
	a) Oil swept inside unmachined surfaces	Kerosene Cleaning	-	-	-	-	-	-	-	-
	b) Outer Surfaces	Abrasive blast clean to Sa2½ (IS0:8501-1:)	Zinc Rich Epoxy Primer	2 to a DFT of 75 µ	-	-		-	-	75

PAINTING SCHEME FOR XRP 1003 BOWL MILL- IPC(H)L / HALDIA TPP, 3 x 150MW

SL. NO	SURFACE LOCATION & PGMAs	SURFACE PREPARATION	PRIMER		INTERMEDIATE		FINISH COAT			TOTAL DFT
			PAINT (mat.code)	NO.OF COATS	PAINT (mat.code)	No. OF COATS	PAINT (mat.code)	NO.OF COATS	SHADE	µm min.
02	Mill Drive and Bowl Assembly (including planetary gearbox) 61-180 a) Inside surfaces	Abrasive blast clean to Sa2½ (ISO:8501-1)			-	-	Amine Adduct Cured Epoxy Paint (HY561000 5949)	2	WHITE	50
	b)Outer Surfaces	Abrasive blast clean to Sa2½ (ISO:8501-1)	Zinc Rich Epoxy Primer	2 to a DFT of 75 µ	Polyamide epoxy paint	2 to a DFT of 140µ	Aliphatic polyester urethane	3* to DFT of 50 µ	Grey IS:5	265

*** Out of 3 Finish coats, 2 are to be done in shop/Subcontract to a DFT of 40 µ and 3rd coat of 10 µ to be done at site. With this 80µ (70µ primer + 140µ Inter paint+40 µ finish paint) DFT is to be done at shop and 10µ at site. Thus a total of 265µ DFT is achieved.**

PAINTING SCHEME FOR XRP 1003 BOWL MILL- IPC(H)L / HALDIA TPP, 3 x 150MW

SL. NO	SURFACE LOCATION & PGMAs	SURFACE PREPARATION	PRIMER		INTERMEDIATE		FINISH COAT			TOTAL DFT
			PAINT (mat.code)	NO.OF COATS	PAINT (mat.code)	No. OF COATS	PAINT (mat.code)	NO.OF COATS	SHADE	µm min.
03	Mill Side and Liner Assembly 61-280									
	a) Inside surfaces	Abrasive blast clean to Sa2½ (ISO:8501-1)	Zinc Rich Epoxy Primer	2 to a DFT of 75µ	-	-		-	-	75
	b) Outer Surfaces	Abrasive blast clean to Sa2½ (ISO:8501-1)	Zinc Rich Epoxy Primer	2 to a DFT of 75µ	Polyamide epoxy paint	2 to a DFT of 140µ	Aliphatic polyester urethane	3* to DFT of 50 µ	Grey IS:5	265

PAINTING SCHEME FOR XRP 1003 BOWL MILL- IPC(H)L / HALDIA TPP, 3 x 150MW

SL. NO	SURFACE LOCATION & PGMAs	SURFACE PREPARATION	PRIMER		INTERMEDIATE		FINISH COAT			TOTAL DFT
			PAINT (mat.code)	NO.OF COATS	PAINT (mat.code)	No. OF COATS	PAINT (mat.code)	NO.OF COATS	SHADE	µm min.
04	Separator Assembly 61-380									
	a) Inside surfaces	Abrasive blast clean to Sa2½ (ISO:8501-1)	Zinc Rich Epoxy Primer	2 to a DFT of 75µ	-	-		-	-	75
	b) Outer Surfaces	Abrasive blast clean to Sa2½ (ISO:8501-1)	Zinc Rich Epoxy Primer	2 to a DFT of 75µ	Polyamide epoxy paint	2 to a DFT of 140µ	Aliphatic polyester urethane	3* to DFT of 50 µ	Grey IS:5	265

PAINTING SCHEME FOR XRP 1003 BOWL MILL- IPC(H)L / HALDIA TPP, 3 x 150MW

SL. NO	SURFACE LOCATION & PGMAs	SURFACE PREPARATION	PRIMER		INTERMEDIATE		FINISH COAT			TOTAL DFT
			PAINT (mat.code)	NO.OF COATS	PAINT (mat.code)	No. OF COATS	PAINT (mat.code)	NO.OF COATS	SHADE	µm min
05	Mill Discharge Valve Assembly PGMA-61480 a) Outer Surfaces	Abrasive blast clean to Sa2½ (ISO:8501-1)	Zinc Rich Epoxy Primer	2 to a DFT of 75µ	Polyamide epoxy paint	2 to a DFT of 140µ	Aliphatic polyester urethane	3* to DFT of 50 µ	Grey IS:5	265

PAINTING SCHEME FOR XRP 1003 BOWL MILL- IPC(H)L / HALDIA TPP, 3 x 150MW

SL. NO	SURFACE LOCATION & PGMAs	SURFACE PREPARATION	PRIMER		INTERMEDIATE		FINISH COAT			TOTAL DFT
			PAINT (mat.code)	NO.OF COATS	PAINT (mat.code)	No. OF COATS	PAINT (mat.code)	NO.OF COATS	SHADE	µm min.
06	Coupling Guard 61-780 b) Inside surfaces	Abrasive blast clean to Sa2½ (ISO:8501-1)	Zinc Rich Epoxy Primer	2 to a DFT of 75µ	-	-		-	-	75
	b) Outer Surfaces	Abrasive blast clean to Sa2½ (ISO:8501-1)	Zinc Rich Epoxy Primer	2 to a DFT of 75µ	Polyamide epoxy paint	2 to a DFT of 140µ	Aliphatic polyester urethane	3* to DFT of 50 µ	Grey IS:5	265

PAINTING SCHEME FOR XRP 1003 BOWL MILL- IPC(H)L / HALDIA TPP, 3 x 150MW

SL. NO	SURFACE LOCATION & PGMAs	SURFACE PREPARATION	PRIMER		INTERMEDIATE		FINISH COAT			TOTAL DFT
			PAINT (mat.code)	NO.OF COATS	PAINT (mat.code)	No. OF COATS	PAINT (mat.code)	NO.OF COATS	SHADE	µm min.
07	Seal Air Assembly, Coal Sampling Platform, PGMA-67400, Lube Oil System and Loose Items a) Outer Surfaces	Abrasive blast clean to Sa2½ (ISO:8501-1)	Zinc Rich Epoxy Primer	2 to a DFT of 75 µ	Polyamide epoxy paint	2 to a DFT of 140µ	Aliphatic polyester urethane	3* to DFT of 50 µ	Grey IS:5	265

BHARAT HEAVY ELECTRICALS LIMITED
Tiruchirappalli - 620 014

PAINTING SCHEME FOR
M/s. BHARAT FORGE INFRASTRUCTURE LIMITED
3 X 150 MW
HALDIA, MIDANPUR DIST. WEST BENGAL
CUSTOMER NO: U1/0178,U1/0179 & U1/0180

Prepared by	**L. Gragori** **Manager / P. Lab**		**Document No: PL: C3 - PS /0178**
Reviewed by	**S.Dhanabal** **SDGM/PE / FB**		**Revision No: 00 Dated: 06-12-2010**
Approved by	**Dr.G.Ravichandran** **AGM /P. Lab**		**Sheet No. : 1 of 11**

N/ CHEM/CONTRACTS 09/HALDIA-IPCL-3 X150 MW_00.DOC.

RECORD OF REVISIONS

Rev. No	Date	Details of revision	Remarks
00	**06-12-2010**	**NEW**	**Prepared in line with agreed resolutions between BHEL and IPCL&, DCPL.**

Sl. No.	Scheme No.	PGMA / Description	Surface Preparation & Surface Profile	Primer coat		Intermediate Coat		Finish coat			Total DFT µm (min)
				Paint	No. of Coats / DFT	Paint	No. of coats	Paint	No. of coats	Shade	
1.1	1AC	Drum (Except Internals) 04 – 114, 116, 118, 124, 126, 128, 210, 212, 214, 270	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744	1 / DFT= 30µm per coat	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932	2 DFT= 20µm per coat	Inter-national Orange Shade No: 592 of IS 5	70
1.2	1AC	Drum Suspension 04 -142, 144, 146, 148	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744	1/ DFT= 30µm per coat	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932	2 DFT= 20µm per coat	Inter-national Orange Shade No: 592 of IS 5	70
1.3	5	Drum Internals 04 – 134, 136, 138 Other Machined Components:& Retainers. 43 – 101, 102, 103, 104, 105, 106, 107	SSPC-SP1 or SP3 Solvent / Power Tool Cleaning	Rust Preventive Fluid to PR: CHEM: 09 – 04	1 DFT=25µm per coat	--	--	--	--	--	25
1.4	1AE	Drum Transport Structures 04 - 194, 196, 35 - 391, 810	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744	1 DFT= 30µm per coat	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932	2 DFT= 20µm per coat	Yellow Shade No: 356 of IS 5	70
2.1	11	Foundation Materials and Pin: 35 - 010, 011, 012, 013, 020, 030, 190 38 – 010 39 - 010, 011, 012, 020, 030, 040 48 – 019 & Columns below " 0 " level of PG 35,36, 38 & 39	- -	No Paint	- -	- -	- -	No Paint	- -	- -	- -

Sl. No.	Scheme No.	PGMA / Description	Surface Preparation & 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	
2.2	25B	Buck Stays and Structural Items: Buck stays 08 – 001, 003, 006, 007, 101, 104, 107, 111, 380, 382, 400, 500, 501, 503, 700, 900, 901, 904, 907, 910 Boiler Supporting Structures 35 – 100, 110, 111, 112, 120, 121, 122, 130, 131, 132, 133, 134, 135, 136, 140, 141, 142, 143, 144, 150, 151, 152, 153, 160, 161, 162, 171, 172, 173, 174, 181, 182, 183, 184, 185, 186, 191, 192, 193, 194, 195, 196, 210, 211, 212, 213, 214, 220, 221, 222, 230, 231, 232, 240, 250, 310, 311, 312, 320, 321, 322, 330, 331, 332, 340, 341, 342, 350, 351, 352, 360, 361, 362, 380, 381, 382, 383, 390,392, 410, 420, 430, 440, 441, 442, 443, 451, 452, 453, 461, 462, 463, 471, 472, 473, 481, 482, 483, 500, 510, 511, 512, 513, 514, 520, 521,522, 523, 524, 530, 531, 532, 533, 540, 541, 542, 550, 551, 552, 561, 562, 563, 571, 572, 573, 581, 582, 583, 591, 592, 593, 594, 595, 596, 597, 598, 599, 610, 612, 613, 710, 711, 712, 713, 715 36 – 110,120, 130, 150, 200, 210, 211, 212, 220, 221, 222, 230, 231, 232, 240, 241, 242, 250, 251, 252, 260, 261, 262, 270, 271, 272, 280, 281, 282, 290, 291, 292, 300, 301, 302, 310, 311, 312, 313, 314, 315, 316, 320, 321, 322, 323, 324, 325, 326, 327, 330, 331, 332, 333, 334, 335, 340, 341, 342, 343, 344, 345, 346, 347, 348, 350, 351, 352, 353, 354, 355, 360, 361, 362, 363, 370, 371, 372, 380, 381, 382, 383, 390, 391, 392, 393, 394, 395, 396, 397, 410, 420, 430, 490, 491, 492, 510, 520, 610, 612, 620, 621, 630, 631, 632 38 – 110, 120, 130, 210, 211, 299, 310, 311, 380, 381, 390, 410, 510, 511, 512, 513, 521, 522, 610, 611, 612, 620, 710, 712, 720, 730 39 - 100, 101, 102, 110, 120, 121, 130, 140, 141, 142, 143, 150, 160, 200, 210, 300, 301, 303, 304, 305, 306, 311, 312, 323, 390, 391, 392, 393, 901 Duct Supports 48 – 005, 015, 025, 045, 055, 065, 085, 105, 115, 125, 145, 155, 185, 195, 200,205, 215, 225, 235, 245, 255, 265, 275, 295, 305, 315, 325, 335, 345, 355, 365, 375, 385, 415, 425, 435, 445, 455, 465, 475, 485, 495, 665, 805, 815, 825, 845, 855, 865, 875, 885, 995 Piping Centre: 80-800 to 882, 920 to 933, 940	Abrasive blast cleaning to Sa 2 ½ 35- 50 microns	Epoxy Zinc Phosphate Primer DFT 50µm per coat	2	Epoxy TiO2/ MIO Pigmented Intermediate Coat DFT 100µm per coat	1	Epoxy Polyamide cured Finish paint DFT 35µm per coat AND Ali.Acrylic PU Paint DFT=30µm per coat	2* + 1*	Smoke Grey Shade No: 692 of IS 5	300

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.	Scheme No.	PGMA / Description	Surface Preparation & 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	
2.3	1BA	Hangers: 36 - 740, 741, 742, 743, 744	SSPC-SP3/ Power Tool Cleaning	HB Chlorinated Rubber based Zinc Phosphate Primer DFT= 50µm per coat	1	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20µm per coat	2	Smoke Grey Shade No: 692 of IS 5	90
2.4	1BB	Hand Rails & Posts 35 - 850, 851 36 - 850, 851, 852, 853 38 - 850, 851 39 - 850, 851	SSPC-SP3/ Power Tool Cleaning	HB Chlorinated Rubber based Zinc Phosphate Primer DFT= 50µm per coat	1	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20µm per coat	2	Black	90
2.5	6	Floor grills, Guard plate** 35 – 811 36 - 010, 810, 811, 812, 813, 814, 815, 816, 840 38 - 810, 811 39 – 810, 811, 840, 841	Floor Grills : Hot dip Galvanizing to a coating weight of 610 gm per sq.m (minimum) and to a coating thickness of 85.0 microns (minimum). ** Guard plates will be painted as given in Sl. No. 2.2.								
2.6	1BB	Ladders & Stairs 35 – 820, 821, 822, 823 36 – 820, 821, 822, 823 38 – 820, 821 39 – 820, 830, 831 48 - 466	SSPC-SP3/ Power Tool Cleaning	HB Chlorinated Rubber based Zinc Phosphate Primer DFT= 50µm per coat	1	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932 DFT= 20µm per coat	2	Black	90

Sl. No.	Scheme No.	PGMA / Description	Surface Preparation & 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	
3.1	10	Components >95° C Un-insulated other than components coming in Gas Path 09 - 001, 002, 003 21 - 800, 850, 875, 997 24 – 120, 160, 173, 180, 185, 190, 195, 220, 260, 273, 280, 285, 290, 320, 345, 360, 373, 380, 385, 390, 395, 420, 460, 480, 485, 490, 495, 520, 560, 573, 580, 585, 590, 660, 680, 685, 690, 820, 860, 880, 885 28 – 220 42 – 300, 318, 328, 348, 358 48 - 380	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Grade-I	1 (DFT =20 microns)	- -	- -	Heat Resistant Aluminium Paint to IS 13183 Grade-I	1 (DFT =20 µm per coat)	Aluminium	40
3.2	3	Components >95° C Insulated 05 - 137, 139, 147, 153, 154, 155, 158, 159, 175, 188, 195, 220, 227, 229, 231, 236, 241, 246, 251, 265, 281, 283, 296, 330, 340, 341, 350, 493, 879, 900 07 - 101, 102, 104, 106, 107, 108, 109, 200, 201, 202, 203, 204, 211, 212, 214, 215, 216, 217, 218, 221, 222, 223, 225, 226, 229, 231, 232 10 – 100, 120, 122, 135, 136, 140, 141, 151, 170, 174, 178, 179, 180, 191, 195, 218, 220, 222, 235, 236, 240, 241, 251, 270, 274, 278, 279, 280, 283, 284, 291, 295, 315, 687 15 – 136, 138, 147, 174, 177, 192, 193, 236, 238, 274, 279, 292, 293, 999 17 – 138, 177, 776, 807, 900, 903 18 – 001, 002, 003, 010, 020 19 – 701, 702, 753, 903 21 – 600 24 – 100, 115, 175, 200, 215, 275, 295, 300, 315, 375, 475, 500, 568, 600, 620, 675, 42 - 020, 021, 025, 030, 031, 032, 033, 036, 037, 038, 128, 150, 153, 158, 159, 48 –032,034,035,132,135,202, 204, 207, 208, 212, 214, 217, 221, 222, 224, 227, 228, 229, 232, 234, 242, 244, 252, 254, 261, 262, 264, 267, 272, 274, 276, 282, 284, 292, 294, 302, 304, 307,308, 309, 311, 312, 314, 318, 319, 322, 324, 332, 334, 342, 352, 362, 364, 372, 374, 381, 382, 384, 386, 388, 389, 392, 412, 414, 422, 424, 426, 432, 434, 438, 439, 442, 444, 452, 454, 462, 464, 467, 468, 469, 472, 474, 482, 484, 486, 487, 488, 489, 491, 492, 494, 496, 497, 498, 499, 602, 612, 622, 632, 646, 652, 654, 656, 662, 664, 666, 667, 668, 669, 676, 686, 696	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744	2 DFT= 30µm per coat	-	- -	- -	- -	Red Oxide	60

Sl. No.	Scheme No.	PGMA / Description	Surface Preparation & 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	
3.3	2	Heat Exchanger Coils: (SH, RH & Economiser Coils) 11 - 036, 037, 038, 074, 077, 078, 095, 135, 136, 138, 170, 174, 175, 178, 179, 235, 236, 237, 238, 248, 250, 251, 271, 272, 274, 275, 277, 278, 279, 280, 336, 337, 338, 340, 342, 356, 358, 370, 374, 377, 378, 395, 585, 587, 591, 606, 608, 616, 618, 682, 683, 684, 685, 686, 687, 688, 691, 694, 716, 717, 718, 767, 768, 769, 787, 791, 882, 883, 884, 885, 887, 916, 917, 918, 967, 968, 969, 986, 987, 988, 991, 994, 999 12 – 135, 136, 170, 174, 178, 184, 187, 335, 395, 495, 515, 535, 551, 619, 800, 803, 805, 850, 851, 852, 900, 901, 903, 906, 914, 917, 924, 927, 928, 944, 948, 954, 968, 988, 999 16 – 077, 079, 132, 235, 236, 237, 238, 256, 275, 277, 279, 281, 377, 379 19 - 001, 104, 105, 114, 124, 184, 802, 814, 824, 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	1 DFT= 35µm per coat	--	--	--	--	--	35
3.4	3	Components coming in Gas Path other than Coils 06 - 033, 036, 037, 041, 043, 046, 047, 052, 054, 089, 090, 091, 092, 093, 094, 130, 133, 136, 137, 141, 143, 146, 147, 152, 154, 189, 190, 191, 192, 193, 194, 231, 331, 350, 400, 430, 466, 467, 500, 530, 609, 611, 613, 614, 616, 620, 621, 623, 624, 630, 631, 633, 634, 636, 637, 639, 640, 641, 643, 644, 646, 647, 649, 650, 651, 652, 653, 654, 655, 657, 658, 659, 670, 689, 690, 691, 692, 693, 694, 695, 709, 713, 714, 715, 716, 720, 723, 730, 731, 733, 734, 737, 740, 741, 743, 744, 747, 749, 750, 751, 753, 755, 789, 790, 830, 840, 850, 851, 857, 895, 896, 897 10 – 182, 183, 184, 185 16 – 988, 999 19 – 703, 704, 708, 763, 783, 850, 851, 900, 988, 999 30 – 010, 104, 105, 211, 212, 216, 217, 218, 219, 220, 223, 227, 228, 233, 235, 993, 31 – 010,101, 102, 103, 104, 105, 108, 301, 993 32 – 001, 002, 005, 006, 007, 008, 009, 011, 012, 021, 022, 023, 024, 025, 026, 027, 031, 033, 041, 042, 043, 044, 050, 055, 061, 073, 110, 120, 210, 620, 720, 810, 910, 993 42 - 129	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744	2 DFT= 30µm per coat	- -	- -	- -	- -	Red Oxide	60
3.5	8A	Uninsulated Fuel Pipes 47 – 229, 265, 266. 267, 268, 269 Duct for Tube Mill: 48 – 802, 804, 812, 814, 817, 822, 824, 832, 834, 842, 844, 852, 854, 857, 862, 864, 867, 872, 874, 882, 884,	SSPC-SP3/ Power Tool Cleaning	General purpose Aluminium paint to IS 2339	2	--	--	--	--	Alumunum	40

Sl. No.	Scheme No.	PGMA / Description	Surface Preparation & 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	
4	15	Constant Load and Variable Load Hangers (CLH / VLH) (See NOTE 14) 07 - 400, 401, 402, 403, 404, 405, 410, 420, 431 10 - 200 17 – 904, 906, 919, 929 19 – 901, 904, 905, 906, 907 24 - 346, 351	Abrasive blast cleaning to Sa 2 ½ 35- 50 microns	Epoxy zinc rich primer to IS 14589 Gr. II %VS=35 (min)	1 DFT=40 µm / coat	--	--	Aliphatic acrylic Poly-urethane paint %VS=40 (min) t	1 DFT=30 µm per coat	Phirozi Blue Shade No. 176 of IS5	70
5.1	1A	Miscellaneous and Casing Sheets: 07-500, 501, 600, 601, 997, 999, 19 – 101, 102,21 - 601, 987, 24 - 101, 125, 130, 135, 140, 201, 225, 230, 235, 240, 301, 325, 335, 340, 350, 370, 374, 400, 401, 425, 430, 435, 440, 470, 471, 473, 501, 525, 535, 540, 570, 601, 625, 635, 640, 800, 801, 815, 825, 987, 989, 996, 998 35 - 994, 995, 36 - 613, 903, 999, 37 - 010, 110, 210, 310, 410, 510, 610, 39 - 302, 924 Fuel Firing: 41 – 100, 110, 200, 310, 320, 330, 340, 350, 390, 410, 420, 430, 450, 460, 470, 997 Steam Blowing Piping: 42 – 002, 003, 005, 010 42 – 040, 045, 050, 055, 060, 065, 070, 111, 112, 113, 114, 118, 119, 120, 121, 122, 123, 124, 130, 131, 132, 151, 152, 154, 155, 156, 157, 160, 165, 170, 176, 180, 195, 196, 989, 997, 998 43 – 000, 001, 002, 003, 004, 005, 006, 007, 008, 997, 999 45 – 050, 120, 160, 161, 180, 181, 220, 221, 260, 261, 321, 325, 326, 401 47 – 121, 122, 123, 124, 125, 129, 140, 141, 142, 143, 144, 145, 146, 149, 161, 162, 163, 164, 165, 169, 180, 181, 182, 183, 184, 185, 189, 200, 201, 202, 203, 204, 205, 209, 221, 222, 223224, 225, 241, 242, 243, 244, 245, 246, 247, 248, 249, 261, 262, 263, 264, 647, 648, 649, 650, 746, 953, 959, 963 Duct Plates and Expansion Joints: 48 – 002, 004, 007, 011, 012, 014, 017, 018, 022, 024, 028, 032, 034, 040, 042, 044, 052, 054, 062, 064, 066,072, 074, 082, 084, 092, 094, 102, 104, 107, 112, 114, 116, 122, 124, 132, 142, 144, 152, 154, 162, 172, 182, 184, 192, 194 Coal Handling: 65 – 051, 060, 070, 260, 402, 403, 460, 724, 736, 738, 786 67 – 204, 251, 256, 261, 266, 271, 272, 276, 277, 283, 286, 400, 801, 802, 803, 804, 999 99 – 201, 299	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744	1 DFT= 30µm per coat	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932	2 DFT= 20	Smoke Grey Shade No: 692 of IS 5	70
5.2	3	Erection Materials and Commissioning Components: 04 - 988, 05-993, 06-993, 07 – 988, 993, 12-993, 24 – 993, 28 – 993, 35 – 993, 36 – 993, 37 – 993, 38 – 993, 39 – 993, 48 – 988, 993, 65 – 988, 97-585,99 – 045, 099, 501, 502	SSPC-SP3/ Power Tool Cleaning	Red Oxide Zinc phosphate Primer (Alkyd Base) to IS 12744	2 DFT= 30µm / coat	- -	- -	- -	- -	Red Oxide	60

Sl. No.	Scheme No.	PGMA / Description	Surface Preparation & 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	
6.1	10	Cast carbon steel valves (Conventional) Cast alloy steel valves (Conventional) All API valves, QCNRV, SV & SRV Silencers, Water Level gauge HP / LP system 22-101,889	SSPC-SP3/ Power Tool Cleaning	Heat Resistant Aluminium Paint to IS 13183 Gr.I	2	--	--	--	--	--	40
6.2	--	Forged valves	Phosphating	Coating weight of 1500 mg per sq.ft.	--	--	--	--	--	--	--
6.3	1AS1	Soot Blower components 20-001,003,004,021,051,054,201,204,301,304,331,511,794,801,821,831,962,972	SSPC-SP3/ Power Tool Cleaning	HB Chlorinated Rubber based Zinc Phosphate Primer DFT= 50µm per coat	1	--	--	Synthetic Enamel paint (Long Oil Alkyd) to IS 2932	2 DFT= 20	Verdigris Green Shade No. 280 of IS5	90

NOTES:

1. This painting scheme covers a comprehensive list of PGMAs being used in 125 / 210 / 250 / 500/ MW and Industrial Boilers under Fossil Boilers working in normal environment, in an effort to standardise the painting scheme. Therefore, the entire list of PGMAs will not be applicable for any specific project and only those PGMAs applicable for the project may be used, while choosing the painting scheme applicable.
2. Rust Preventive coating should be given on HSFG Bolt & Nut threads.
3. All threaded & machined surfaces and all retainers 'A' & ''C' types are to be applied with a coating of Temporary Rust Preventive oil.
4. All surfaces of foundation materials, insulation pins, Anchor channels, Sleeves 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.
5. PGMAs under Sub-Vendor items are not indicated. Please refer respective Engineering Document for all sub-vendor items. Wherever it is not specified, it shall be as per the painting scheme of the applicable PGMA.
6. No painting is required for Aluminium, Stainless Steel components and galvanized items. Abrasive blast cleaning to SSPC-SP6 (Sa 2) grade shall be done to prepare the surface of hot worked pipes prior to application of primer.
7. Wherever inside surfaces of components under PGMA 48 – XXX, need protection till erection, and all running meter items for spares and main item two coats of Red-oxide zinc phosphate primer paint to IS12744 to a DFT of 60 microns shall be applied, after power tool cleaning. For items meant for Spares and subcontracting where no further processing is involved, the painting scheme selected shall be the same as that of similar product configuration/ description.
8. The Temporary Rust Preventive coating that has already been applied on any component, tubes, pipes etc., shall be visually inspected for good adherence. If the coating is intact, direct coating of alkyd based red oxide paints over the coating is permitted. In case, the coating has peeled off over a large area, then the coating is to 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).
9. All currently active PGMAs are covered. Requirements for Missing / new PGMA s will be included under the relevant section, following the appropriate paint logic.
10. Ground shade/colour finish paints & identification tag/ band for equipments, piping, pipe service, boiler supporting structures and other boiler components shall be followed as per tender.
11. In components, wherever plates/sheets of thickness less than or equal to 5 mm, tubes/ rods<25mm/drain pipe are used, power tool /hand tool cleaning to SSPC-SP3/ SSPC-SP-2 shall be followed and the painting shall be done as described in Sl no: 5.1.
12. Touch-up painting of damaged areas shall be carried out as per clause applicable painting scheme.
13. Only weldable primer shall be applied on surfaces, which require to be welded subsequently at site. At those locations no other paint shall be applied.
14. DUs coming under Constant Load Hangers (CLH) shall be painted as per the system - PS 15 indicated in Sl. No. 4 of the table. However, for DUs coming under Variable Load Hangers (VLH), the painting shall be as per Painting Scheme PS 1A indicated in Sl. No. 5.1 of the table. (i.e., one coat of Red Oxide Zinc Phosphate Primer followed by two coats of Synthetic Enamel Paint –shade smoke grey, total DFT – 70 microns)
15. For internal protection of Pipes, tubes, headers and other pressure parts, Volatile Corrosion Inhibitor (VCI) pellets shall be put (after sponge testing/ draining/ or drying) and subsequently end capped. The dosage of VCI pellets shall be approximately 100 gm/ Cu..m. For tubes typically 4 – 5 tablets per end are to be put. For C & I items the dosage of self indicating Silica Gel (colourless) shall be 250 gm/ cu.m. (About 2 to 3 bags weighing approximately 100 grams each) . VCI pellets shall not be used for stainless steel components and its composite associates.
16. All threaded components of spring assemblies and turnbuckles shall be galvanized and achromatized to 15 microns minimum thickness.
17. Painting scheme for all temporary structures shall be PS 1AE i.e. 1 coat of Red oxide Zinc Phosphate primer (Alkyd Bse) to IS 12744-DFT-30 μ and 2 coats of Synthetic Enamel paint (Long Oil Alkyd) to IS 2932-DFT-2X20μ Shade Yellow –Shade No. 356 of IS 5- Total DFT 70μ.

Painting Scheme – Details for procurement & application purposes

Sl. No.	Material Code of Paint	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	120016131800	Heat Resistant Aluminium paint to IS 13183 Grade I/2	10	1	-	-	Aluminium	--	Brush / Spray	24
2	120011111900	Red oxide Zinc Phosphate primer paint to IS 12744	10	1	--	--	Red Oxide	--	Brush / Spray	12
3	120011121900	Red oxide Zinc Phosphate Dip coat primer paint to PR: CHEM: 09-03	10	1	--	--	Red Oxide	---	Dip	12
4	120011311200	Long oil alkyd synthetic enamel finish paint to IS2932	10	1	--	--	Reqd. shade	Corrpdg. Shade no.	Brush / Spray	12
5	120011140000	Temporary Rust preventive fluid to PR: CHE: 09 – 04	10	1	--	--	Amber	--	Brush / Spray	12
6	120012141700	Epoxy Zinc rich primer to IS14589 Gr. II	8	2	35	40	Grey	--	Spray	24
7	120013310200	Aliphatic acrylic polyurethane paint to IS13213	10	2	40	30	Phirozi – Blue./French Blue	176/166	Spray	24
8	120017101800	De Oxy Aluminate Weldable Primer- Colour Aluminium	10	1	--	--	Aluminium	--	Brush / Spray	24
9	120014111700	HB CR Based Zinc Phosphate Primer	10	1	40	50	Grey	--	Brush / Spray	12
10	120014300100	CR Based Finish Paint	10	1	30	30	French Blue	166	Brush / Spray	12
11	120012111700	Epoxy based Zinc Phosphate Primer to IS 13238	10	2	40	50	Grey	----	Spray	12
12	120012311700	Epoxy Polyamide cured Finish Paint to IS 14209	10	2	40	35	Smoke grey	692 ---	Brush / Spray	12
13	120012232000	Epoxy based Poly amide cured MIO pigmented intermediate coat	6	2	60	100	Brown	--	Spray	24

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.

ANNEXURE-B REV-01

LIST OF T&P TO BE PROVIDED BY CONTRACTOR FOR PACKAGE-A (U#1&3)

Contractors may please note that this list is not exhaustive & given for guidance purpose. The contractor may be required to deploy additional T&Ps not mentioned in this list at their own cost for proper execution of the job.		
01	-100T Crawler Crane -75/80T Crawler Crane	02(Two) nos 100T Crawler Crane crane to be deployed within 30 days from start of work of U#1 75/80T Crawler Crane to be deployed within 30 days from start of work of U#3
02	Truck/Tyre mounted cranes with telescopic boom -40T	02 (Two) nos 1st no crane to be deployed within 30 days from start of work of Unit#1 2nd no. crane to be deployed within 30 days from start of work of Unit#3
03	Tyre Mounted Cranes-18T/25T	02(Two) nos 1st no crane to be deployed within 30 days from start of work of Unit#1 2nd no. crane to be deployed within 30 days from start of work of Unit#3
04	Crane 12 T Hydra	3 no
05	Passenger cum goods elevator (within 4 months of LOI)	2 no
06	Tractor-trailor 30T (with long bed)	2 no
07	Tractor-trailor 12T/15T (with long bed)	4 no
08	Truck 10T	2 no
09	Wheel barrows	2 no
10	Electrical winch 8T	4 no
11	Electrical winch 5T	6 no
12	Electrical winch 2T	10 no
13	Electrical winch 1T	10 no
14	3 Phase distribution board with complete set up for drawl of construction power-600Amp	As per reqmt.
15	Furnace maintenance platform	2(Two)

16	Air compressor (electric) – 7 kg/cm2 /100 psi/ 80 cfm	As Reqd.
17	Chain pulley block 10T	As per requirement
18	Chain pulley block 5T, 3T, 2T	
19	Pull lift 6T, 5T, 3T, 1.5T	
20	Multipurpose pulling and lifting m/c 5T, 3T, 1.6T	
21	Hydraulic jack 100T, 50T, 20T, 10T, 5T	
22	Single sheave snatch pulley 10T, 5T	
23	Double sheave snatch pulley 10T, 5T	
24	D shackles 10T, 20T, 50T	
25	Turn buckles 3T, 5T, 8T, 10T, 15T, 20T	
26	Welding generator K320	
27	Oil cooled welding transformer 300 amp, 450 amp	
28	Air cooled welding transformer 300 amp	
29	Stress relieving transformer 600 amp	
30	TIG welding torch air cooled	As required
31	Tig welding torch water cooled	
32	High frequency unit	
33	Oxygen regulator	
34	Acetylene regulator	
35	Cutogen 5	
36	Oxygen hose 10 mm	
37	Acetylene hose 10 mm	
38	Electrode drying oven	
39	Portable electrode drying cabinet	
40	Copper welding cable 600 amp, 400 amp	
41	Aluminium cable 600 amp, 400 amp	
42	Temperature recorder	
43	Thermochalk 100 deg C to 800 deg C	
44	Air compressor 250 cfm, 80 cfm	
45	Stationery compressor 350 cfm	
46	Filling pump 80 M head, 15 ltr/sec (at least one month prior to Hydraulic test)	
47	Electrode baking oven	
48	Vernier theodolite – 1 sec accuracy	
49	Dumpy level	
50	Spirit level 12 inch, 0.1 mm accuracy	
51	Combination squares	
52	Micrometers of different sizes	
53	Vernier 2alipers of different size	
54	Dial guage	
55	Flood light with bulb	
56	Step down transformer	
57	Drilling m/c of different sizes	
58	Megger	
59	Tong tester	
60	Grinding m/c of different sizes	
61	Chamfering m/c of different sizes	
62	Trip torque wrench	
63	Aluminium telescopic ladder	

64	Manila ropes of different sizes	
65	Steel wire ropes of different sizes	

66	Drawing board	
67	Radiography equipment	
68	Moving platform	
69	Magnetic particle test equipment	
70	Ultrasonic flaw detector	
71	Dye Penetrant test kit	
72	Sheet grooving m/c for outer sheet casing	
73	Sheet bending m/c for outer sheet casing	
74	Recordable ultrasonic test equipment (UFD Krauft Kammer make USN-50 or higher version to meet the requirements)	2 Sets.
75	Radiography arrangement including source- IR 192	2 Sets.
76	Mechanized hydraulic pipe bending machine with die of various sizes	2 Sets.
77	Gas burner arrangement	2 Sets.
78	Hardness tester	2 Sets.
79	Spot welding machine	2 Sets.
80	Special slings for unloading drum and lifting ceiling Girder	As Reqd.
81	DG Set -250MVA or of Required Capacity	As Reqd.
82	Grid Blasting set	As reqd

LIST OF T&P TO BE PROVIDED BY CONTRACTOR FOR PACKAGE-B(U#2)

Contractors may please note that this list is not exhaustive & given for guidance purpose. The contractor may be required to deploy additional T&Ps not mentioned in this list at their own cost for proper execution of the job.		
01	100 T Crawler Crane	01(One) 1 no crane to be deployed within 30 days from start of work of U#2
02	Tyre mounted/ crawler cranes with telescopic boom/ lattice boom-40T	01 (One) no 1 no crane to be deployed within 30 days from start of work of U#2
03	Pick & Carry Cranes-18T/25T	01(One) no 1 no crane to be deployed within 30 days from start of work of U#2
04	Crane 12 T Hydra	2 no
05	Passenger cum goods elevator (within 4 months of LOI)	1 no
06	Tractor-trailor 30T (with long bed)	1 no
07	Tractor-trailor 12T/15T (with long bed)	2 no
08	Truck 10T	1 no
09	Wheel barrows	1 no
10	Electrical winch 8T	2 no
11	Electrical winch 5T	3 no
12	Electrical winch 2T	5 no
13	Electrical winch 1T	5 no
14	3 Phase distribution board with complete set up for drawl of construction power-600Amp	As per reqmt.
15	Furnace maintenance platform	1(One)
16	Air compressor (electric) – 7 kg/cm2 /100 psi/ 80 cfm	As Reqd.
17	Chain pulley block 10T	As per requirement
18	Chain pulley block 5T, 3T, 2T	
19	Pull lift 6T, 5T, 3T, 1.5T	
20	Multipurpose pulling and lifting m/c 5T, 3T, 1.6T	
21	Hydraulic jack 100T, 50T, 20T, 10T, 5T	
22	Single sheave snatch pulley 10T, 5T	
23	Double sheave snatch pulley 10T, 5T	
24	D shackles 10T, 20T, 50T	
25	Turn buckles 3T, 5T, 8T, 10T, 15T, 20T	
26	Welding generator K320	
27	Oil cooled welding transformer 300 amp, 450 amp	
28	Air cooled welding transformer 300 amp	
29	Stress relieving transformer 600 amp	
30	TIG welding torch air cooled	
31	Tig welding torch water cooled	

32	High frequency unit	As required
33	Oxygen regulator	
34	Acetylene regulator	
35	Cutogen 5	
36	Oxygen hose 10 mm	
37	Acetylene hose 10 mm	
38	Electrode drying oven	
39	Portable electrode drying cabinet	
40	Copper welding cable 600 amp, 400 amp	
41	Aluminium cable 600 amp, 400 amp	
42	Temperature recorder	
43	Thermochalk 100 deg C to 800 deg C	
44	Air compressor 250 cfm, 80 cfm	
45	Stationery compressor 350 cfm	
46	Filling pump 80 M head, 15 ltr/sec (at least one month prior to Hydraulic test)	
47	Electrode baking oven	
48	Vernier theodolite – 1 sec accuracy	
49	Dumpy level	
50	Spirit level 12 inch, 0.1 mm accuracy	
51	Combination squares	
52	Micrometers of different sizes	
53	Vernier 5alipers of different size	
54	Dial guage	
55	Flood light with bulb	
56	Step down transformer	
57	Drilling m/c of different sizes	
58	Megger	
59	Tong tester	
60	Grinding m/c of different sizes	
61	Chamfering m/c of different sizes	
62	Trip torque wrench	
63	Aluminium telescopic ladder	
64	Manila ropes of different sizes	
65	Steel wire ropes of different sizes	
66	Drawing board	
67	Radiography equipment	
68	Moving platform	
69	Magnetic particle test equipment	
70	Ultrasonic flaw detector	
71	Dye Penetrant test kit	
72	Sheet grooving m/c for outer sheet casing	
73	Sheet bending m/c for outer sheet casing	
74	Recordable ultrasonic test equipment (UFD Krauft Kammer make USN-50 or higher version to meet the requirements)	1 Set.
75	Radiography arrangement including source- IR 192	1 Set.

76	Mechanized hydraulic pipe bending machine with die of various sizes	1 Set.
77	Gas burner arrangement	1 Set.
78	Hardness tester	1 Set.
79	Spot welding machine	1 Set.
80	Special slings for unloading drum and lifting ceiling Girder	As Reqd.
81	DG Set -250MVA or of Required Capacity	As Reqd.
82	Grid Blasting set	As reqd

NOTE (APPLICABLE FOR BOTH PACKAGEA&B):-

1. In case the bidder fails to mobilize the above T&P as per requirement and the work progress/safety is affected for non-mobilization of any required T&P, gadgets, equipment, system; BHEL shall inform the bidder writing that BHEL shall provide the required items and recover the actual cost of providing such item / system plus BHEL's overhead as per rule.

2. The Make of these items has to be approved either by BHEL and/or by IPCL. The same has to be tested/calibrated/certified by statutory authorities as the case may be.

3. The contractor shall provide one operator for each crane for Sl. No.-1.These operators shall be working exclusively at the direction of CM,BHEL.

ANNEXURE – C REV-01 **LIST OF T&P TO BE MADE AVAILABLE ON SHARING BASIS BY BHEL FREE OF ANY CHARGES (for each unit)**			
Sl no	**ITEM**	**Capacity**	**Quantity**
1	Crawler crane	Heavy lift Crawler Crane suitable for Ceiling Girder lifting	1 no
2	Crawler Crane	150T capacity	1 no
3	EOT crane in TG hall (if required in exceptional case)	As installed	As installed
4	Hydro test pump	0-450 kg/sqcm	As required
5	Chemical circulating pumps	As required	As required
6	Air Blower	As required	1 no.
7	Huck Bolting Machine	As required	As required
8	Induction Heating M/c	As required	As required
9	Drum lifting winch (10T) along with shieve pulley blocks and wire ropes and other accessories	As required	2sets
Note:-			
01	The above T&Ps will be made available for the project. Contractor may make use of the T&Ps as per the provision of tender document.		
02	All other T&Ps required for proper execution of the job shall be provided by the contractor.		
03	All the T&P listed above shall be issued and used as per relevant clause in the contract.		
04	The T&Ps under sl. Nos. 1 & 2 shall be provided with fuel & operator as per relevant clause of the tender. Operator for T&P under Sl No 3 shall be provided by BHEL for piping erection as per requirement.		

ANNEXURE - 2

FORMAT FOR NO DEVIATION CERTIFICATE
(To be submitted in the bidder's letter head)

BHARAT HEAVY ELECTRICALS LIMITED,
Power Sector - Eastern Region,
Plot no 9/1, DJ Block, Sector – II, Salt Lake City,
Kolkata – 700 091

Sub	No Deviation Certificate.	
Job	Package A:- Transportation of materials , storage as required , erection , grid blasting of pipes, insulation , commissioning , trial run , PG test , final painting and handing over etc of boiler , rotating machines , duct , ESP , Critical piping , misc piping etc. of unit # 1 & 3 for 3X150 MW Units at IPCL HALDIA TPP , WB. Package B:- Transportation of materials , storage as required , erection , grid blasting of pipes, insulation , commissioning , trial run , PG test , final painting and handing over etc of boiler , rotating machines , duct , ESP , Critical piping , misc piping etc. of of unit # 2 for 3X150 MW Units at IPCL HALDIA TPP , WB.	
Ref	1.0	Tender no PSER:SCT:HLD-B1259:11
	2.0	BHEL's NIT, vide ref no Ref: PSER:SCT:HLD-B1259:11 Dated 31/10/2011
	3.0	BHEL's TCN-01 vide ref. no. PSER:SCT:HLD-B1259:TCN-01 Dated 19/11/2011
	4.0	BHEL's TCN-02 vide ref. no. PSER:SCT:HLD-B1259:TCN-02 Dated 05/12/2011
	5.0	BHEL's TCN-03 vide ref. no. PSER:SCT:HLD-B1259:TCN-03 Dated 12/12/2011
	6.0	BHEL's TCN-04 vide ref. no. PSER:SCT:HLD-B1259:TCN-04 Dated 19/12/2011
	7.0	BHEL's TCN-05 vide ref. no. PSER:SCT:HLD-B1259:TCN-05 Dated 26/12/2011
	8.0	BHEL's TCN-06 vide ref. no. PSER:SCT:HLD-B1259:TCN-06 Dated 05/01/2012
	9.0	BHEL's TCN-07 vide ref. no. PSER:SCT:HLD-B1259:TCN-07 Dated 11/01/2012
	10.0	Other references (if any).

Dear Sirs,

With reference to above, this is to confirm that as per tender conditions, we have visited 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/ issued by you and in case of such 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. We hereby confirm our unqualified acceptance to all terms & conditions, unqualified compliance to technical specification and acceptance to reverse auctioning process.

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 in accordance with tender instructions and as per aforesaid references.

Thanking you,

Yours faithfully,

(Signature, date & seal of authorized

representative of the bidder)