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

No. BHE/PW/PUR/RGIT -CLE/444

FOR

HANDLING AT SITE STORES/STORAGE YARD, TRANSPORTATION TO SITE OF WORK, ERECTION, CHECKING OF CALIBRATION, TESTING, ASSISTANCE FOR COMMISSIONING AND HANDING OVER OF ELECTRICAL, CONTROL & INSTRUMENTATION WORKS FOR BOILER AND ITS AUXILIARIES, STEAM TURBINE, TURBOGENERATOR AND THEIR AUXILIARIES, STATION C&I, FOR 2x250 MW UNIT # 3 & 4

AT

O. P. JINDAL SUPER THERMAL POWER PLANT

RAIGARH

CHHATTISGARH

PART-I

(TECHNICAL BID SPECIFICATION, NOTICE INVITING TENDER and GCC)

Bharat Heavy Electricals Limited

Power Sector - Western Region, Nagpur

345-Kingsway, Nagpur-440 001

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CONTENTS

LEGEND:

$: PLACED BEFORE 'GENERAL CONDITIONS OF CONTRACT' IN BOTH HARD AND SOFT COPY DOCUMENTS.

#: ATTACHED AT THE END OF HARD COPY OF TENDER SPECS. PART-I (TECHNICAL BID) AND AS A SEPARATE FILE TITLED '**WEB_NIT_GCC**' AS SOFT COPY HOSTED IN WEB PAGE.

@: ISSUED AS SEPARATE BOOKLET IN HARD COPY AS **PRICE BID (PART-II)** AND AS SEPARATE FILE TITLED 'PRICE_BID' AS SOFT COPY HOSTED IN WEB PAGE.

BHARAT HEAVY ELECTRICALS LIMITED

(A GOVERNMENT OF INDIA UNDERTAKING)
POWER SECTOR - WESTERN REGION
SHREEMOHINI COMPLEX
345-KINGSWAY, NAGPUR-440 001

FOR

HANDLING AT SITE STORES/STORAGE YARD, TRANSPORTATION TO SITE OF WORK, ERECTION, CHECKING OF CALIBRATION, TESTING, ASSISTANCE FOR COMMISSIONING AND HANDING OVER OF ELECTRICAL, CONTROL & INSTRUMENTATION WORKS FOR BOILER AND ITS AUXILIARIES, STEAM TURBINE, TURBOGENERATOR AND THEIR AUXILIARIES, STATION C&I, FOR 2x250 MW UNIT # 3 & 4

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O. P. JINDAL SUPER THERMAL POWER PLANT

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EARNEST MONEY DEPOSIT: Please see Special Conditions of Contract.

LAST DATE FOR TENDER SUBMISSION: Please obtain updated information from web page **www.bhel.com** ® **Tender Notifications** ® **View Corrigendums.**

THESE TENDER SPECIFICATION DOCUMENTS CONTAINING **PART-I** TECHNICAL BID SPECIFICATION AND **PART- II** PRICE BID, ARE ISSUED TO:

M/s. ……

……

PLEASE NOTE:

1) **THESE TENDER SPECS DOCUMENTS ARE NOT TRANSFERABLE.**
2) **BIDDER SHALL NOTE THAT THEIR OFFER WILL BE CONSIDERED SUBJECT TO THE APPROVAL OF BHEL'S CUSTOMER.**

For Bharat Heavy Electricals Limited

DGM (Purchase)
Place: Nagpur
Date:

BHARAT HEAVY ELECTRICALS LIMITED

(A GOVERNMENT OF INDIA UNDERTAKING)
POWER SECTOR - WESTERN REGION
SHREEMOHINI COMPLEX
345-KINGSWAY, NAGPUR-440 001

PROCEDURE FOR SUBMISSION OF SEALED TENDERS

THE TENDERER MUST SUBMIT THEIR TENDERS AS REQUIRED IN TWO PARTS IN SEPARATE SEALED COVERS PROMINENTLY SUPERSCRIBED AS PART-I TECHNICAL BID AND PART-II PRICE BID AND ALSO INDICATING ON EACH OF THE COVERS THE TENDER SPECIFICATION NUMBER AND DUE DATE AND TIME AS MENTIONED IN THE TENDER NOTICE.

PART-I (TECHNICAL BID) COVER-I

EXCEPTING RATE SCHEDULE, ALL OTHER SCHEDULES, DATA SHEETS AND DETAILS CALLED FOR IN THE SPECIFICATION SHALL BE ENCLOSED IN PART-I "TECHNICAL BID" ONLY.

PART-II (PRICE BID) COVER-II

ALL INDICATIONS OF PRICE SHALL BE GIVEN IN THIS PART-II "PRICE BID". **EMD SHALL NOT BE INCLUDED IN THIS COVER.**

THESE TWO SEPARATE COVERS-I AND II (PART-I AND PART-II) SHALL TOGETHER BE ENCLOSED IN A THIRD ENVELOPE (**COVER-III**) ALONGWITH REQUISITE EMD AS INDICATED EARLIER AND THIS SEALED COVER SHALL BE SUPERSCRIBED AND SUBMITTED TO ADDL. GEN MANAGER (PURCHASE) AT THE ABOVE MENTIONED ADDRESS ON OR BEFORE THE DUE DATE AS INDICATED.

THE QUALIFIED TENDERER WILL BE INTIMATED SEPARATELY ABOUT THE STATUS OF THEIR OFFER.

TENDERER ARE REQUESTED TO MAKE SPECIFIC NOTE OF THE FOLLOWING CONDITIONS:

1. CONTRACTOR SHOULD HAVE ADEQUATE RESOURCES INCLUDING MAJOR T&PS AT HIS DISPOSAL FOR THIS JOB.

2. CONTRACTOR SHOULD HAVE SOUND FINANCIAL STABILITY.

3. TENDERER SHOULD MEET QUALITY REQUIREMENT REGARDING WORKMANSHIP, DEPLOYMENT OF PERSONNEL, ERECTION TOOLS AND NECESSARY INSPECTION, MEASUREMENT & TESTING INSTRUMENTS.

4. ALL INFORMATION AS CALLED FOR IN VARIOUS APPENDICES AND CLAUSES OF TENDER SPECIFICATION SHOULD BE FURNISHED IN COMPLETENESS. PLEASE REFER THE CHECKLIST.

5. CLARIFICATION ON TENDER IF ANY, SHALL BE OBTAINED BY THE TENDERER BEFORE SUBMITTING THEIR OFFER.

6. OFFERS MUST BE SUBMITTED WITHOUT ANY DEVIATION.

7. OFFERS RECEIVED WITH ANY DEVIATION OR WITHOUT RELEVANT INFORMATION AS DESCRIBED ABOVE ARE LIABLE TO BE REJECTED. PRICE BIDS RECEIVED IN THE FORM OTHER THAN SPECIFIED IN PART-II (PRICE BID) ARE LIABLE TO BE REJECTED.

PROJECT INFORMATION

JINDAL POWER LIMITED (JPL), A SUBSIDIARY OF JINDAL STEEL AND POWER LTD, IS SETTING UP A THERMAL POWER PLANT AT RAIGARH IN THE STATE OF CHATTISGARH. THE PLANT NAMED O. P. JINDAL SUPER THERMAL POWER PLANT, TAMNAR OF JINDAL POWER LIMITED, WILL HAVE AN ULTIMATE CAPACITY OF 1000MW (4x250 MW).

APPROACH TO SITE:

SITE IS LOCATED NEAR VILLAGE TAMNAR IN RAIGARH DISTRICT OF CHATTISGARH STATE. THE SITE IS APPROACHABLE FROM RAIGARH BY THE STATE HIGHWAY WHICH BRANCHES OFF AT PUNJIPATHRA ABOUT 12 KM FROM THE SITE AND 34 KM FROM RAIGARH TOWN. THE NEAREST BROAD GAUGE RAIL LINK IS AT RAIGARH WHICH IS ABOUT 35 KM (RAIGARH IS ON RAILWAY LINE OF HOWRAH–MUMBAI SECTION OF SOUTH EASTERN CENTRAL RAILWAYS)

METROLOGICAL DATA

A) MEAN OF DAILY MAX TEMP: 33.5 DEG.C

B) MEAN OF DAILY MIN TEMP: 21.5 GEG.C

C) HIGHEST TEMP. RECORDED: 47.2 DEG.C (19 JUNE 1960)

D) LOWEST TEMP. RECORDED: 6.4 DEG.C (24 DEC 1959)

E) RELATIVE HUMIDITY: VARIES FROM 19% TO 88%

F) ANNUAL AVERAGE RAINFALL: BETWEEN 1000-2000MM

G) WIND LOAD: 7.3KM/HR (ISN THE MONTH OF JUNE)

H) SEISMIC ZONE: ZONE III IN ACCORDANCE TO IS

Check List (Vide Para 1.3 Of Section-I of General Conditions Of Contract)				
1	Name of the Bidder with Postal Address for Correspondence			
2	Name of Contact Person with Telephone & Fax No.	Mr./Ms Tel No. Fax No.		
3	Nature of the firm	PROPRIETARY / PARTNERSHIP / LIMITED CO.		
4	Details of EMD Please Indicate whether 1) One Time EMD or, 2) Only for this Tender	DD No. …… DD Date…… Name of Bank……... Amount: Rs……		
5	Validity of Offer (BHEL's Requirement: 180 days from Due Date)	Validity _____ days		
6	Mobilization Time (Please refer Section-11 of SCC)	Mobilization Time _____		
7	Whether any conditions stipulated?	**Yes** (vide Document reference:	**No**	
		Bidder to note that tender with conditions unacceptable to BHEL shall be rejected.		
8	Bidder has visited the project site and acquainted with the site conditions		Yes	No
9	Details of concurrent jobs are furnished (**Appendix-VII)**		Yes	No
10	Headquarters organization is furnished		Yes	No
11	Proposed site organization is furnished		Yes	No
12	Names and particulars of directors/partners are furnished		Yes	No
13	Financial status of the firm (**Annexure 'A' of GCC**) is furnished		Yes	No

Check List (Vide Para 1.3 Of Section-I of General Conditions Of Contract)			
14	Profit & Loss Account for preceding three years is furnished	Yes	No
15	**Latest Certificate by Bidder's Banker for Overdraft & BG Limits** is Furnished (Certificate shall not be older than six months from the Last Date for offer submission)	Yes	No
16	Latest c**opy of IT Return along with copy of PAN Card** are Furnished	Yes	No
17	Month-wise Manpower Deployment Plan (**Appendix – IV A**) is furnished	Yes	No
18	Analysis of unit rates quoted (**Appendix-V**) is furnished	Yes	No
19	Month wise deployment plan for major T&P (**Appendix-IV B**) is furnished	Yes	No
20	Whether all the pages of the Tender Specification documents are read, understood and signed	Yes	No
21	Power of Attorney Enclosed in favour of Person Making Offer	Yes	No
22	Bidder has familiarized himself with all Relevant Local Laws & Local Conditions	Yes	No
23	Safety Requirement of this work in a Running plant Premises has been understood.	Yes	No
24	Erection and Commissioning programme furnished	Yes	No
	List of Jobs completed in last seven years is furnished (**Appendix-VI**)	Yes	No
25	Whether copies of detailed Work Orders (with BOQ) and Completion Certificates in support of above furnished	Yes	No
26	Whether contractor has left any job unfinished? If so, give reasons.	Yes	No
27	Whether any client has terminated the contractor's work before completion? If so, furnish reasons for the same	Yes	No

Note: strike off yes or no, as applicable

Date: Signature of Bidder

DECLARATION BY BIDDER'S AUTHORIZED SIGNATORY

I, …… HEREBY CERTIFY THAT ALL THE INFORMATION AND DATA FURNISHED BY ME WITH REGARD TO THE TENDER SPECIFICATION No. **BHE/PW/PUR/RGIT-CLE/468** ARE TRUE AND COMPLETE TO THE BEST OF MY KNOWLEDGE. I HAVE GONE THROUGH THE SPECIFICATIONS, CONDITIONS AND STIPULATIONS IN DETAIL AND AGREE TO COMPLY WITH THE REQUIREMENTS AND INTENT OF THE SPECIFICATION. I FURTHER CERTIFY THAT I AM DULY AUTHORIZED REPRESENTATIVE OF THE UNDER-MENTIONED TENDERER AND A VALID POWER OF ATTORNEY TO THIS EFFECT IS ALSO ENCLOSED.

AUTHORISED REPRESENTATIVE'S SIGNATURE WITH
NAME AND ADDRESS

DATE:

BIDDER'S NAME AND ADDRESS

CERTIFICATE OF NO-DEVIATION

TENDER SPECIFICATION No. BHE/PW/PUR/RGIT-CLE/ 468

I/WE, M/s .....

HEREBY CERTIFY THAT IN OUR OFFER I/WE HAVE NEITHER SET ANY TERMS AND CONDITIONS NOR THERE IS ANY DEVIATION TAKEN FROM THE CONDITIONS OF BHEL'S TENDER SPECIFICATIONS, EITHER TECHNICAL OR COMMERCIAL, AND I/WE AGREE TO ALL THE TERMS AND CONDITIONS MENTIONED IN BHEL'S TENDER SPECIFICATION WITH ASSOCIATED AMENDMENTS & CLARIFICATIONS.

SIGNATURE OF THE BIDDER

DATE:

SECTION-3

OFFER OF THE BIDDER

To
The DGM (Purchase)
BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR - WESTERN REGION
SHREEMOHINI COMPLEX
345, KINGSWAY
NAGPUR 440 001

DEAR SIR,

I/WE HEREBY OFFER TO CARRY OUT THE WORK DETAILED IN TENDER SPECIFICATION NO. **BHE/PW/PUR/PARST-INS/443** ISSUED BY BHARAT HEAVY ELECTRICALS LIMITED, POWER SECTOR-WESTERN REGION, NAGPUR, IN ACCORDANCE WITH THE TERMS AND CONDITIONS THEREOF.

I/WE HAVE CAREFULLY PERUSED THE FOLLOWING DOCUMENTS CONNECTED WITH THE ABOVE WORK AND AGREE TO ABIDE BY THE SAME.

1. INSTRUCTIONS TO TENDERERS
2. GENERAL CONDITIONS OF CONTRACT
3. SPECIAL CONDITIONS OF CONTRACT
4. OTHER SECTIONS, APPENDICES, SCHEDULES AND DRAWINGS.

I/WE HAVE DEPOSITED / FORWARDED HEREWITH THE EARNEST MONEY DEPOSIT FOR A SUM OF RS.2,00,000/- (RUPEES TWO LAKHS ONLY) DETAILS OF EMD PAYMENT ARE FURNISHED IN THE CHECK LIST.

EMD SHALL BE REFUNDED SHOULD OUR OFFER NOT BE ACCEPTED /EMD **NEED NOT BE REFUNDED AND THE AMOUNT MAY BE TREATED AS "ONE TIME EMD" FOR ERECTION AND COMMISSIONING TENDERS OF BHEL –PSWR NAGPUR** SHOULD OUR OFFER BE ACCEPTED, I/WE FURNTHER AGREE TO DEPOSIT SECURITY DEPOSIT FOR THE WORK AS PROVIDED FOR IN THE TENDER SPECIFICATION WITHIN THE STIPULATED TIME AS MAY BE INDICATED BY BHEL, POWER SECTOR –WESTERN REGION, NAGPUR.

I/WE FURTHER AGREE TO EXECUTE ALL THE WORKS REFERRED TO IN THE SAID DOCUMENTS UPON THE TERMS AND CONDITIONS CONTAINED OR REFERRED TO THEREIN AND AS DETAILED IN THE APPENDICES ANNEXED THERETO.

PLACE: SIGNATURE OF TENDERER:
DATE: ADDRESS:

WITNESSES WITH THEIR ADDRESS

	SIGNATURE	NAME	ADDRESS
1.			
2.			

SECTION-4

SPECIAL CONDITIONS OF CONTRACT

The scope of works under this contract includes handling at site stores/storage yard, transportation to site of work, complete erection, checking of calibration, testing, assistance for commissioning and handing over of Control and Instrumentation (Panels, Field instruments / transmitters / gauges, Monitoring systems, Analysers, LVS, Computers / workstations / servers, Impulse piping, cabling etc) and Electrical systems (Bus Duct, MCC, Power supply panels, UPS, Generator / transformer protections, Integrated testing, ESP, cabling, earthing etc).

Contractor may tie up with separate suitable agency/agencies for carrying out Bus Duct, Relay Testing and Integrated Testing of Generator System work. However before deploying such agencies on job, the Contractor shall obtain approval of BHEL Construction Manager in writing.

Items have been separated as "C&I ITEMS" and "ELECTRICAL ITEMS" in the rate schedule. This segregation is only indicative in nature. Certain items (viz., structural steel, earthing strips/wires, cable trays, certain instruments etc) which are common to both the areas have been placed either in C&I or Electrical item lists.

A. CONTROL AND INSTRUMENTATION

4.0.0 Scope of work involving Erection, Testing, Assistance for Commissioning and Calibration

4.1.1

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

4.1.2

The work shall be executed under the usual conditions affecting major power plant construction and in conjunction with numerous other operations at site. The contractor and his personnel shall co-operate with the personnel of other agencies, co-ordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.

4.1.3

All the work shall be carried out as per the instructions of BHEL engineer. *BHEL engineer's decision regarding the correctness of the work and method of working shall be final and binding on the contractor.*

4.1.4

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

4.1.5

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

4.1.6

The work to be carried out under the scope of this specification covers the complete work of loading, handling, transporting, unloading, preassembly, erection, calibration, testing, air flushing, pre-commissioning tests, assistance for commissioning of systems, trial run of various auxiliaries, achieving various activities till handing over of the unit to BHEL's customer after completion of all facilities. The work shall conform to dimensions and tolerances specified in various drawings that will be provided during the erection. If any portion of the work is found to be defective in workmanship or not conforming to drawings or other specifications, the contractor shall dismantle and re-do the work duly replacing the defective materials at his cost, failing which the work will be got done departmentally or by engaging other agencies and recoveries will be effected from contractor's bills towards expenditure incurred including 30% departmental charges.

4.1.7

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

4.1.8

Descriptions of certain packages appearing in the rate schedule are available in this section and also in Appendix-I, to give general idea to tenderer about the type of equipment to be erected, calibrated, tested and commissioned.

4.1.9

During the course of erection, testing and commissioning C&I work, certain rework/ modification/rectification/ repairs/ fabrication etc., will be necessary on account of feed back from various thermal power stations or units already commissioned and/or units under erection and commissioning and also on account of design discrepancies and manufacturing defects and site operation/maintenance requirements. Contractor shall carryout such rework / modification / rectification / fabrication repairs etc. promptly and expeditiously. Daily log sheets indicating the details of work carried out, man-hours; consumables used etc., shall be maintained by the contractor and got signed by BHEL engineer every day. Claims of contractor, if any, for such works will be dealt as per Section-13.

4.1.10

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

4.1.11

Electrodes shall be baked / dried in the electrode drying oven (range 375 – 425 deg C) to the temperature and period specified by BHEL Engineer before their use. Necessary drying oven / portable oven shall be provided by the contractor at his cost.

4.1.12

The scope of work under this tender specification covers transportation, calibration, erection, testing and commissioning, etc. of control / instrumentation and electrical equipments of the following packages.

A. Boiler Control & Instrumentation and its Auxiliaries

Digital Distributed microprocessor based system panels for FSSS, SADC, HP Bypass, auxiliary PRDS, soot blowers, coal milling system, gravimetric feeder remote /local, Electronic water level indicator, air heaters, electrical panels for DC control supply, controlled circulation pumps, starter panel for mill lube oil /fans and field devices/ instrumentation work for above system, piping, cabling etc.

B. Turbo generator Control & Instrumentation and its auxiliaries

Digital distributed microprocessor based system panels consist of TSC, EHTC, LPBP, TSI, ATT, LSR/AS, ATRS, turbine protection and monitoring, GAMP and field instrumentation work / cabling, boiler feed pumps /condensate extraction pump, and misc. System like lube oil, seal oil, hydrogen gas system, vacuum pumps etc.

C. Station C&I / Balance of Plant

Digital Distributed microprocessor based system panels for Balance of Plant controls, consisting of Open Loop and Closed Loop controls, interlock and protection systems for various HT, LT, pneumatic, hydraulic drives, remote multiplexed signal acquisition, alarm processing, MMI including computers and accessories, computer furniture, control desk, Large Video Screen, Steam and water analysers, Opacity monitors, Flue gas analysers, instrumentations, cabling, etc.

4.1.13

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

A. Based on rate of identical/similar items in the rate schedule
B. Based on the rate arrived from nearby items in the rate schedule
C. Wherever any item rate for similar type of work or nearby item rate does not exist in the rate schedule, rate will be worked out on the basis of work element or from fundamentals of estimation or existing rates in other job.

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

4.2.0 Collection of Materials

4.2.1.1

The contractor shall take delivery of equipment, materials from the storage yard/stores/sheds of BHEL/customer. He shall also make arrangements for verification of equipment, safe custody, watch and ward of equipment after it has been handed over to him till these are fully erected, tested and commissioned and taken over by the customer. The contractor should note that the transport of equipments to erection site, assembly yards etc should be done by the prescribed route in the most professional

manner without disturbing other ongoing works of various contractors. Special equipments such as laboratory equipments, measuring and control equipments, gauges, panels, console inserts, switches, transmitters, controllers, power cylinders, cables, conduits etc. shall be stored when taken over by the contractor in appropriate manner as per BHEL's instructions. The contractor should also note that while taking delivery of materials from BHEL stores (open/closed), it may be necessary to handle other items which could be blocking the exit route of the materials. *This aspect shall be taken care of in the quoted rates and no extra payment shall be done in this regard*. It shall be the contractor's responsibility to arrange necessary cranes/tractors, trailer, trucks, slings, labour, etc., etc., for transport of equipment.

4.2.1.2

The contractor shall take delivery of the components, equipments and special consumables 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.

4.2.1.3

The contractor shall handover all parts/materials remaining extra over the normal requirement with proper identification tags in a packed condition to BHEL stores. In case of any misuse or use over actual design requirements, BHEL reserves the right to 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.

4.2.2

Void

4.2.3

All works such as cleaning, levelling, aligning, trial assembly, dismantling of certain equipments/components for checking and cleaning, fabrication of tubes and pipes as per general engineering practice and as per BHEL engineer's instructions at site, cutting, weld depositing, grinding, straightening, chamfering, filing of cut outs/ openings for mounting of console inserts, modules, indicators, recorders, drilling of holes for gland entries, reaming, scrapping, cable laying, dressing, fitting up etc. as may be applicable in such erection works are treated as incidentals to erection work and are necessary to complete the work satisfactorily shall be carried out by the contractor as part of the work.

4.2.4

Overhauling, cleaning, revisioning, servicing of equipments / instruments, valves etc. during erection and commissioning stages will be arranged by the contractor. However, gaskets /packing for replacement will be provided by BHEL free of cost. All equipments shall be preserved and protected before and after erection as per the advice of BHEL engineer.

4.2.5

The contractor should take all reasonable care to protect equipment and materials under his custody either in his stores or at site. Copper tubing, brass fittings, brass valves etc. that are forming an integral part of equipment or system are susceptible to damage/pilferage/theft/loss. It will be responsibility of contractor to arrange for adequate security round the clock for protection from such damage/pilferage/theft/ loss.

4.2.6

All equipment shall be handled very carefully to prevent any damage or loss. No bare wire ropes, slings etc. shall be used for unloading and/or handling of the equipments without the specific written permission of the engineer. 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.

4.2.7

The contractor shall collect all scrap materials periodically from various levels of powerhouse, working area of the power station, auxiliary and piping around power station and collect he same at one place earmarked for the same. Loads of scraps are to be shifted to a place earmarked by BHEL. Failure to collect the scrap is likely to lead to accidents and as such BHEL reserves the right to collect and remove the scrap at contractor's risk and cost if there is any failure on the part of contractor in this respect.

4.2.8

All the surplus, damaged, unused materials, package materials, containers, special transporting frames, gunny bags etc. shall be returned to the BHEL stores/ customer's stores by the contractor.

4.2.9

All pipes and tubes, equipments, instruments issued to contractor and kept at site for erection shall be covered with plastic caps/steel caps or shall be closed with suitable plugs by the contractor.

4.2.10

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.

4.2.11

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. Materials 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 power plant is limited and accumulation of material may lead to the necessity of shifting and restacking 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 bills.

4.2.12

House keeping in the erection and preassembly area is as important as the well-planned and orderly work. The access to site for inspection approaches by BHEL and customer engineers and leading of the material shall be made available by the contractor at all times. The shifting and re-shifting of erection materials, tools and plants and clearance of restrictions, filling of ditches, undulation near the preassembly and boiler area is the responsibility of the contractor. Contractor should visit the site and acquaint himself with all restrictions and difficulties that he may encounter during erection/commissioning stages.

4.3.0 Brief description of work

4.3.1 Installation of panels

Electrical control panels, electronic control panels, etc., are normally supplied in suit of either one/two/three or loose shipping sections with integral base frame or loose supplied.

These panels may have to be installed as stand alone or in groups consisting of number of panels in each row, depending upon the plant layout and foundation arrangement.

4.3.2

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

4.3.3

Panels have to be shifted to their locations through floor openings, temporary openings like floor grills, door etc. which shall be part of work and no claim whatsoever will be entertained with regard to non-availability of opening as per shortest route etc. Panel have to be erected at different locations and elevation in boiler, TG, GTG hall, LT & HT switchgear room, unit control room, ESP control room etc.

4.3.4

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

4.3.5

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

4.3.6

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

4.3.7

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

4.3.8

For the panels erected by other agencies, commissioning/calibration work and trouble shooting has to be carried out by the contractor as part of testing and assistance for commissioning work as per the quoted rates.

4.3.9

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

4.4.0 Structural steel fabrication and installation

4.4.1

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

4.4.2

This shall include cutting into size, conduiting of end connections, if required, welding, grinding of excess weld deposits, drilling of holes for mounting of device/instrument, installation at location, levelling, alignment, providing bracings, painting etc. No gas-cut holes will be permitted. Contractor to follow the BHEL supplied welding schedule and welding procedures.

4.4.3

All the fabricated supports/frames shall be applied with one coat of primer red oxide paint before installation and two coat of synthetic enamel of prescribed shade of final paint,. If required, BHEL shall prescribe time gap between first and second coat of final paint. Paint, primer etc supply is in contractor's scope.

4.4.4

Frame installation/cable tray accessories' installation at site may involve mounting either on concrete floor by grouting/using anchor fasteners or on steel structure by welding etc.

4.4.5

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

4.4.6

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

4.5.0 Laying of pipes and tubes (impulse pipe & instrument air pipe)

4.5.1

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

4.5.2

Installation of impulse pipe of CS/AS/SS material shall include cleaning, air flushing, cutting to length from running meter, edge preparation, cold bending, welding of sockets / reducers / tee / cross / isolating valves / union, nut and tail pieces / nipples, condensing and other pots, etc., mounting of SS/CS valve manifolds and compression fittings, providing supports, clamping, conducting leak test / hydraulic pressure test, painting as per colour code (primer and two coats) and erection and commissioning of other standard accessories as per instrument hook-up diagram. Piping works shall involve either arc or TIG welding. Paint, primer etc supply is in the scope of the contractor. Colour codes for impulse piping, etc will be as per standard codes. Contractor to follow the BHEL supplied welding schedule and welding procedures. The decision of BHEL engineer will be final in this regard.

4.5.3

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

4.5.4

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

4.5.5

Threaded joints of air line shall be made leak proof by using Teflon tapes or sealing compound.

4.5.6

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

4.5.7

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

4.5.8

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

4.6.0 Installation of Cable trays/cable ducts

4.6.1

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

4.6.2

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

4.6.3

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

4.6.4

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

4.6.5

Installation of Copper tubes/SS tubes/copper pipes shall include cutting into required length, laying, bending, cleaning, brazing wherever required, fixing of brass fittings like compression fittings/tees/end connectors/straight connectors/bulk heads/valves etc, supporting clamping including supply of clamps and hardware, flushing and conducting leak test.

4.7.0 Cable laying (power / control / instrumentation shielded / unshielded cables / plug-in cables / coaxial / UTP / STP / data highway, armoured / un-armoured, single / multi-core, PVC/HR PVC/FRLS/TEFLON/XLP insulation)

4.7.1

Cable laying includes cutting to the required length, laying in overhead/underground cable trench/through pipes/flexible conduits, dressing/clamping in tray, drilling of holes in gland plates in panels and junction box, glanding, splicing, dressing of spliced wire inside the panel and JB, providing PVC numerical/alphabetical / printed ferrules, termination by using crimp type copper tinned/aluminium lugs, insulated/un-insulated, termination (crimp, soldering, etc.), plug-in connections with insert type crimping, providing identification PVC/aluminium cable tags (at both the ends and at 15 m intervals throughout the route length and also at each bend), continuity checking, insulation resistance checking, high voltage test on HT cables.

4.7.2

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

4.7.3

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

4.7.4

Copper tinned lugs of various types (pin, ring, fork, snap-on) up to 4 sq. mm, PVC cable ties, PVC ferrules, PVC button and tapes, cable identification tag of PVC/metallic, clamping and dressing material with hardware, PVC sleeves etc. shall be supplied by the contractor within the quoted rates for cable laying. The quality of material shall be got approved from BHEL engineer prior to their use on job.

4.7.5

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

4.7.6

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

4.7.7

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

4.7.8

Many of the cable trays and cables have to be laid in cable trenches. For this purpose, the cover of the trenches have to be opened for working in site and whenever the cables are to be laid in existing cable tray, all safety precautions have to be observed.

After completing the work, the trenches have to be cleaned and covers put back into position. Contractor shall also carry out de-watering from the trenches if required and arrange pumps etc., at his cost.

4.7.9

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

4.7.10

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

4.7.10.1

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

SN	Item	% Wastage on net issued Qty
1.	Fabrication steel	2
2.	Each size of power cables	1
3.	Each size of control/Inst cables	2
4.	Impulse pipe/tubes/GI pipes/copper tube	1

In case the actual wastages exceed the specified limits as above, the cost of excess wastage with BHEL overhead cost (presently 30%) will be recovered from the Contractor.

'Net Issued Quantity' = 'Total Issued Quantity' minus 'Useable Quantity returned and so accepted by BHEL'.

4.7.11 Terminal Connections:

The types of cable terminations are generally as detailed below:
SG package, TG package, Station C&I and Auxiliaries

1) All field cables in SG package are crimp type of different sizes.
2) All JB are both side screw type.
3) All console tiles wiring: screwed or plug-in type to be fabricated at site.

4.8.0 Field Instrumentation

4.8.1

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

4.8.2

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

4.8.3

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

4.8.4

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

4.8.5

Wherever thermowells are supplied along with temperature gauges, thermocouples, temperature switches, thermostats, etc., the fixing of thermowells on pipeline and seal welding shall be part of temperature measuring instrument/device installation.

4.8.6

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

4.8.7

Some devices line solenoid valves, feedback position transmitters, limit switches, air filter regulators, airlock relays, positioners etc., are supplied assembled along with mechanical equipments like pneumatic control valves, power cylinders, trip valves, dampers, motorised actuators, etc. These will need removal, calibration/testing, refixing, adjustment, etc., and commissioning. Separate payment shall not be made for this. The rates quoted for the assistance for commissioning of these equipments (viz., pneumatic control valves, power cylinders, trip valves, dampers, etc.) should take care of the above. Also, the contractor shall remove such devices prior to

erection either at site or at store to avoid damages/pilferages and keeping in safe custody and the same shall be installed prior to commissioning of such equipment.

4.8.7.1
Transmitter enclosure / open racks for various packages which are to be erected and commissioned at various locations of the Boiler, turbine and outdoors, shall be supplied with internal tubing, air filter regulators, rotameters, provision of continuous or intermittent purging arrangements wherever required, etc. The quoted rates for these racks / enclosures shall include the erection and assistance for commissioning of all such items inside these racks / enclosures.

4.8.8
It shall be the responsibility of the contractor to ensure that the calibrated instruments show correct reading while installed in the system.
However, recalibration may become necessary due to reasons not attributable to the contractor, e.g. Lapse of Time after first calibration, Need for change in range/parameter, etc. If re-calibration is required due to no fault of the contractor, the rates payable for re-calibration shall be as under:

Recalibration Charges = 60% of the Percentage Stage Payment for Calibration as per split-up defined in Terms of Payment (Section-12)
The contractor shall keep record of such instrument with the reason for re-calibration and certified by the BHEL Engineer.

Note: For recalibration of skid mounted items or other systems where lumpsum rates are quoted, the recalibration charges, if admissible, will be calculated from the relevant unit rates quoted for same / similar items elsewhere in the rate schedule. The decision of BHEL Engineer shall be final and binding on the contractor.

4.8.9
For the cases where required, the contractor shall carry out re-orientation of bottom/top entry arrangement for process connection if needed due to site condition in existing instrument rack/enclosure/JB and re-location of existing instrument including removing of the existing tubing and re-installation of the same at appropriate location due to any change in grouping of the instrument and no extra payment shall be applicable.

4.8.10
In certain cases instruments / devices are supplied on equipment or drawn by other agencies as part of mechanical package. The same are to be received or to be collected from other agencies for keeping in safe custody to avoid damages. The same are to be erected back after calibration for which unit rate shall be applicable for erection and calibration. Contractor shall maintain record of such instrument duly certified by BHEL engineer. However for removal of such instrument, no separate rate/payment shall be applicable.

4.9 Consoles

4.9.1

Wherever control desk / panel is not supplied by BHEL or is in customer scope of supply and installation, loose items supplied by BHEL if any, shall have to be mounted by the contractor.

4.9.2

Console/console tiles shall have plug-in/screwed/soldering/crimp snap-on, connection. Interconnecting cable between console and process control panel shall be either of pre-fabricated plug-in cable or plugs are required to be made at site with crimp insertion type of pins. BHEL shall provide plugs and any special lugs at free of cost. However, other ordinary lugs required for the work shall be arranged by contractor.

4.9.3

Generally, 0.5 sq. mm multi pair shielded cables are envisaged for console cabling. Cable may have to be terminated at different console tiles, spliced wire of individual cable need to be routed through PVC sleeves up to the plug end of the tiles.

4.10.0 Battery/battery charger/UPS

4.10.1

HDP Tubular 550/600AH or Ni-Cd (or similar type) or Lead acid Batteries will be supplied loose along with battery interconnection in the series/parallel links/bus bar, lugs, steel/wooden battery stand either assembled or knocked down condition, cables and associated charger and UPS system.

4.10.2

In case of Lead acid battery, the electrolyte shall be supplied in plastic cans. After installation, the electrolyte has to be filled in batteries and charging/discharging shall be carried out to achieve specific gravity of electrolyte and stability of battery/battery bank. If required, discharging of the charging cycle shall be repeated to achieve the desired results. However, BHEL engineer's decision shall be final. Any preparatory arrangement required to be done for charging and discharging of battery, the contractor shall arrange consumables, safety equipments etc., at his own cost.

4.10.3

In case of Ni-Cd (or similar type) batteries are normally supplied in charged condition, due care shall be exercised while handling/installation of the same. If the battery charge is found to be less than the required level, the charging/discharging cycle shall be carried out as per instruction of BHEL engineer.

4.10.4

Battery charging/discharging is a continuous process and skilled manpower shall be deployed by the contractor round-the-clock.

4.10.5

Contractor shall arrange suitable load, cables, safety equipments and consumables for discharging the battery during charging and discharging cycle at his cost.

4.10.6

Contractor shall provide skilled manpower for periodic maintenance after the battery are fully charged for the activities such as checking of electrolyte level, specific gravity, topping up with distilled water and cleaning till the set is handed over to customer.

4.11.0 Vibration monitoring system for boiler auxiliaries

System comprises of transducers with integral cables, weldable pads, wall mounted cabinet including monitors. The pads required to be welded on SS block on HT motors end shield and fan bearing housing. In case of pad sizes more than the SS block provided on motor, contractor shall get the pads machined as per the required size and blue matching to be carried out before welding on bearing housing. No extra charges will be applicable.

4.12.0 Control panels

SG, TG, Station C&I system panels are based on Max DNA distributed digital control philosophy. Max DNA system is having communication through UTP cables amongst themselves. The system consists of computer network with servers and workstations and various peripherals like printers, etc. Optical fibre cables are also used for communication, especially for larger distances. The various components/devices are generally located in control room/computer room/diagnostic and shift in charge room. Some panels (viz. network panels) are also located in outdoor plants and other units.

The entire work of erection, testing, assistance for commissioning of the connected devices/equipments as listed in rate schedule is to be carried out including laying of peripherals cables (either plug-in or plugs to be fabricated at site), placement of computer furniture in computer room as per lay out. The computer furniture shall be supplied either assembled or in knocked down condition, which have to be assembled at site. The quoted rate shall be inclusive of cable laying, termination and placement of furniture against each device as given in the rate schedule.

4.12.1 Steam and water analyser system

The system consists of the following in general:

Wet system panel consisting of Primary sample coolers, Secondary coolers, tubing and fittings for individual stream of steam and water lines and associated devices assembled together and housed in sheet metal enclosure. Process sample line of SS material to be terminated at panel end with bulk head connection. Sample lines will be socket welded type. Ph, conductivity, etc sensors will be supplied loose with integral / prefab cables, to be mounted and wired up in relevant panels.

Recorder panel may be supplied separately where the recorders (supplied as loose items) will have to be mounted and wired up.

In wet analyser panel, Phosphate, chlorine, silica, hydrazine, chloride, etc analysers along with accessories will be supplied loose for mounting, wiring and tubing at site.

Chilling Unit, auxiliary cooling water, etc would be supplied as package with accessories like SS/CS pipes, chilled water circulating pump, chilled water storage tanks, valves and fittings.

Commissioning support will be provided by vendor.

4.12.2 Flue gas analysers

4.12.2.1 Oxygen Analysers

The system consists of Zirconia probes, electronic units Panel for mounting electronic unit, purging and calibration gas arrangements, etc. The probes are meant for direct mounting on duct / chimney, etc., at suitable elevation.

4.12.2.2 NOX, SOX, CO analysers

NOX, SOX, CO analysers system consists of extraction type sampling probes and shall be mounted on the chimney at a considerable height. This will also consist of other accessories like gas extraction sampling pumps, sampling tubing, electrical heat tracer, insulation, test gas cylinders, purge air compressors, etc, etc.

4.12.2.3 Opacity Monitor

This consists of transmitters, receivers, Local electronic units and housing, air blower and associated hoses / pipes, JBs and cables.

4.13 Final painting

4.13.1

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

4.13.2

Other equipments like JB, Panels, transmitter racks, Local gauge boards etc., shall be painted with two coats of synthetic enamel paint. The quoted rates should be inclusive of application of two final coats of synthetic enamel paint. All the consumables such as wire brush, other cleaning materials, painting implements, etc., is to be arranged by the contractor at his own cost. All equipment painting will be done by spray painting. The quoted rates should be inclusive of all these including supply of paints and consumables.

4.13.3

All the weld joints of GI cable trays and GI structural members shall be applied with a coat of cold galvanising zinc paint.

4.14.0 Misc. Other instrument/equipment erection, calibration and commissioning.

4.14.1

Wherever panels, pneumatic power cylinders and control valves have been erected by other agencies, calibration/ assistance for commissioning has to be carried out by the contractor.

4.14.2

SADC power cylinders are to be erected by contractor in coordination with other agencies as per instructions of BHEL. For SADC power cylinders, copper tubing and

accessories will be supplied by BHEL. The copper tubing work from the instrument line header to the power cylinder and the internal connection to be carried out by the contractor as per site requirement. *Necessary security against pilferage is to be arranged by contractor.*

4.14.3
In the case of electronic water level indicator (EWLI), electrodes may be supplied loose and the same need to be fixed in the pressure vessel as per the drawings. No extra charges will be payable.

4.14.4
The calibration of NRVs in the turbine extraction system has to be carried out by the contractor. Position transmitters are to be erected by contractor within quoted rates of position transmitter calibration, if supplied loose.

4.14.5
The solenoids in the corner valves / HEA will be received in mounted condition and will be erected by the mechanical contractor. The contractor has to provide the services required for dismantling the solenoids and reinstalling the same after servicing/adjustment. Payments will be made as per testing/commissioning portion of the rate quoted for these items and no extra charges will be payable for removal and re-fixing.

4.14.6
Dimension and weight as mentioned against control panels, MCCs, etc. in rate schedule are only approximate and there may be changes in dimension and weight in actual supply of the equipment and no rate variation shall be applicable on this account.

4.14.7
Wherever brief description of the system is given under various sub-heads, it is only for the understanding system requirements. It does not indicate the total specification of work. For such system, other clauses are also applicable wherein work details are specified.

4.14.8
Supervision services for certain sub-vendor supplied packages (viz. TSC, Fuel oil flow meters, battery systems, etc) will be in supplier's scope for installation and commissioning. However, contractor shall carry out the work as per the instruction of their engineers and also provide necessary assistance during the execution of the work.

4.14.9
Normally, cable glands on junction boxes side are received in mounted condition. While terminating the cables as per drawings, the cable glands are to be removed and fixed. Wherever cable glands are not received along with junction boxes, the cable glands as per the requirement will be provided by BHEL and the contractor has to make necessary holes/adjust the available holes in the JB for fixing these. No separate payment will be made for drilling of holes and fixing the cable glands to the junction boxes. Nameplates for JBs will be supplied separately. These are to be suitably written and fixed onto the JBs. Separate payment will not be made for this.

4.14.10

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

4.15.0 Pre-commissioning / Commissioning and Post-commissioning Activities

4.15.1

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

4.15.2

In case any malfunctioning and/or defects are found during tests, trial runs such as loose components, undue noise or vibration, strain on connected equipments etc., the contractor shall immediately attend to these defects/ malfunctions and take necessary corrective measures. If any readjustment and realignment is necessary, the same shall be done as per BHEL engineer's instructions.

4.15.3

During each stage of commissioning, if any part of the instrument needs repair/rectification/rework/replacement, the same shall be done expeditiously and promptly by the contractor. Contractor's claim, if any, for such repair/rectification/ rework/replacement etc. for reasons not attributable to contractor will be governed by Section-13 of the special conditions of contract. The parts to be replaced shall however be provided by BHEL free of cost.

4.15.4

The pre-commissioning activities will start prior to light up of boiler and various trials, commissioning operations shall continue till the unit is handed over to customer. Simultaneous commissioning activities will be in progress in various areas, checking of equipments erected, making ready for trial runs, alkali flushing, chemical cleaning, mass flushing etc. All these works need specialised gangs including electricians/ instrument mechanics in each area. Contractor shall earmark separate manpower for various assistance for commissioning activities. This manpower shall not be disturbed or diverted.

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

4.15.5
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.

4.15.6
In case any rework / repair / rectification / modification / fabrication etc. is required because of contractor's faulty erection which is noticed during commissioning or at any stage; the same has to be rectified by the contractor at his cost. If any improvement /repair /rework/rectification/ fabrication/ modification due to design improvement/ requirement is involved, the same shall be carried out by the contractor promptly and expeditiously. Claims if any, for such works from the contractor shall be governed by section-13 of Special Conditions of Contract.

4.15.7
It is the responsibility of contractor to provide for necessary labour, tools and tackles and consumables till the completion of work under these specifications even in case erection, testing and commissioning of this work is delayed due to reasons not attributable to the contractor.

4.15.8
During commissioning activities and carrying out various tests, minor items like gauges, manometers, etc., have to be temporarily erected and put in service to suit the commissioning activities. BHEL will provide the necessary gauges and equipment. Contractor has to carry out the erection, calibration, dismantling of the same. After completion of activities the temporary systems have to be removed and returned to stores. No extra charges will be payable towards these.

4.15.9 Assistance for Commissioning
During pre-commissioning, commissioning, post commissioning and trial operation stages of various systems, certain category of manpower with T&P and consumables will have to be provided to BHEL commissioning engineers exclusively at their disposal. It shall be the responsibility of the contractor to provide Engineers, Electricians, technicians, Helpers, Fitters etc along with necessary consumables, hand tools, calibration equipment etc, for the various commissioning activities in progress. During peak months there could be requirements of separate assistance for commissioning gangs simultaneously in even upto 12 to 15 areas. Contractor has to augment the manpower as and when required as per work demand and necessity at site. The quoted rates shall include this.

4.15.10
It shall be specifically noted that contractor manpower may have to be engaged round the clock simultaneously at different areas and hence considerable number of personnel and their overtime payment and also deployment of multiple sets of tools etc., may be involved. *This aspect must be considered by the contractor while quoting their rates.* No additional compensation by for the same shall be payable, irrespective of number of persons engaged or number of working hours per day.

4.15.11
For electrical works, 415 volts and above, the contractor has to bring qualified electricians.

4.15.12

Certain systems may be supplied with portable programming units, which are to be connected at various locations during pre-commissioning to handing over. Necessary cabling interconnecting the programming units and other connected panels has to be carried out by the contractor and are to be dismantled after work. For the purpose of testing, monitoring, commissioning, etc., these programming units will have to be repeatedly connected and disconnected at various locations. These will be considered as part of assistance for commissioning activities and no separate payment will be entertained for the above.

4.15.13 Calibration, Testing & Assistance for Commissioning

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

A Calibration

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

-Codification of instruments as per system tag numbers

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

-Providing head correction in case of pressure measurement as per calculated values or actual measured value for the instrument, which are used for interlock protections / monitoring. This is generally applicable for turbine / generator, lube oil systems, lube oil system of fans etc.

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

-Checking and ensuring the proper function of instrument.

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

B Erection

-Drawal of material from store, verification, inspection as per shipping list, drawings and documents.

-Preservation, upkeeping, safe custody of the erected equipments till handing over to the customer.

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

-Continuity check and IR value check of cables.

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

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

-Energizing the functional group control panels and field devices.

-Flushing of impulse pipe before making the instruments process connections through.

-Any leakages, damages to impulse pipe, field device connections, air connections etc. shall be fully attended by contractor.

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

C Testing, Assistance for commissioning & Trial Operation

-Checking/verification of binary/analogue input and output signal from field and panel and upto recording/indicating instrument/MMI monitors.

-Adjustment, testing, calibration of pneumatic drive (control valve, trip valve, power cylinder for gate/dampers), electrical actuator operated valve/gate/dampers of other functional elements.

-Checking the operating electrical/pneumatic drive through functional group panel, remote control desk, MMI, CRT operation and repeatability and smooth operation to be checked.

-Checking the interlock, protection and alarm for various processes by simulation of field devices/process changes.

-Functional check of sub-loop control, sub group control and auto loop and fine tuning.

-Adjustments of limit switches/feed back position transmitter checking the actuator for correct Limit switch operation for correct position indication and repeatability shall be ensured.

-Motor IR value measurement, bearing/winding RTD checking, drying out of motor, providing assistance for trial run of motor which includes monitoring temperature rise winding/bearing during trial run.

-Contractor shall prepare calibration/testing report/protocols.

-During trial run of various systems, if the performance of any instrument is found erratic, un-satisfactory and requires re-adjustment, re-calibration etc., the defect shall be attended by contractor.

-Observing and checking the performance of the various devices on load/process variation. Any deficiencies/defect noticed during the variable load conditions, the same should be attended properly.

-Observe the proper functioning of sub-group/sub-loop control.

-Check the operation of various controls in manual/auto mode for smooth functioning.

-Clearing of all bad / invalid signals noticed during commissioning.

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

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

D Post-commissioning

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

-Contractor shall prepare and submit required number of copies of As- Built drawing as per guidelines and instruction of BHEL engineer.

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

E PG Test Assistance

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

4.16.0 Guidelines for erection

4.16.1 Impulse Pipelines

4.16.1.1

All impulse lines, air lines shall be thoroughly cleaned by removing the dust, burrs etc., and any foreign matter inside the pipe/air line is to be cleaned by compressed air or any other suitable means before installation.

4.16.1.2

The routing of pipe lines shall include sufficient flexibility near tap off points to allow for thermal expansion of process equipment.

4.16.1.3

The pipes shall be cold bent using hydraulic bending machines only .

4.16.1.4

The horizontal impulse lines shall be laid with proper slopes towards the tapping point.

4.16.1.5

Supports for piping and tubing shall be adequate and in no case exceed limits shown below:-

A) 1/4" OD / 3/8" OD copper	continuous
B) 1/2" NB pipe/tube	5 ft.
C) 3/4" NB pipe/tube	5 ft.
D) 1" NB pipe/tube	8 ft.

4.16.1.6

All CS impulse line welding shall be done through welding generator/rectifier and only structural welding may be done with welding transformer.

4.16.1.7

Impulse pipes of alloy steel/SS/carbon steel etc. shall be TIG welded. Contractor shall arrange for necessary TIG welding sets, electrodes etc.
Alloy Steel impulse pipes are to be preheated as per requirement before welding.

4.16.1.8

Minimum number of fittings shall be used on all lines wherever possible, to keep threaded joints to a minimum wherever threaded connections are to be made.

4.16.1.9 Testing

On completion of pipeline installation, the pipelines shall be hydraulically tested. Contractor shall arrange for water filling pump, hydraulic test pump and standard gauges and conduct the test satisfactorily.

4.16.1.10

The impulse lines shall be isolated from instruments and tested at 2 times the maximum working pressure. The fall in pressure shall not be more than 1 kg/cm^2 or 1% of the working pressures whichever is less, in 30 minutes and there shall be no leaks at any of joints/welds when isolated from source of pressure.

4.16.1.11 Air Piping

All instrument air pipelines shall be isolated from the instruments and pressurised pneumatically to maximum work pressure. They shall then be isolated from the source of pressure and fall shall be less than 1 PSI in 20 minutes.

4.16.1.12 Pneumatic Signal Lines

All pneumatic signal lines shall be disconnected and blown through with instrument air. The line shall be blanked off and pressurised pneumatically 20 psi and checked with soap solution for leaks and attended accordingly.

4.6.1.13

Items like connectors, tees, bends, cross, condensate pots, manifolds, small root valves etc shall be erected within the quoted rates of Impulse pipes.

4.17.1 Electrical cabling /wiring

All the cables will be properly laid in cable trays, dressed and clamped with aluminium flats. The cable will be terminated at both ends with suitable lugs and *printed ferrules* and will be glanded properly. Contractor shall arrange suitable material (if required) for making entry points of cables to field equipments waterproof. All care to be taken by contractor to prevent water entry into any instrument, JB, Panel etc. Suitable equipment and consumables for ferrule printing has to be arranged by the contractor at his own cost. For cable identification, the contractor shall provide at his cost aluminium tags at regular intervals (15 m) through each run of cable.

4.17.1.1

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

4.17.1.2

Insulation test of the various circuits shall be done.

4.17.1.3

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

4.17.1.4

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

4.17.1.5

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

4.17.1.6

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

4.17.1.7
Installation of cable racks and supports structure shall be carried out in all the required areas. Steel embedment shall be provided in the cable trenches, ceiling slabs and concrete blocks for installing the cable racks and support structures.

A) Ladder perforated type cable trays shall be used in cable trenches and vertical risers.
B) Perforated cable trays shall be used in higher elevations in boiler and TG area.

4.17.1.8
Cable racks in the trenches and control room are to be shared with other contractors installing cables in different areas wherever required. Contractor shall cooperate with the other contractors in sharing the cable trays and proper dressing and clamping the cables.

4.17.1.9
Where power and control cables are to be laid in the same route, suitable barriers to segregate them physically shall be employed.

4.17.1.10
Space equal to the diameter of cable shall be provided between power cables of six over 50 mm in diameter.

4.17.1.11
When cables pass through floors, walls etc., it shall be passed through a pipe for mechanical protection and the pipe ends sealed suitably.

4.17.1.12
Care shall be taken to avoid short bending and kinking of conductor damaging insulation and stressing the cable beyond pulling force recommended by the manufacturer. Cable shall be protected at all times from mechanical damage.

4.17.1.13
The minimum radius of formed bend of an insulated cable shall be 12d for un-armoured cables and 15d for armoured cables where ‘d’ is the overall diameter of the cables.

4.17.1.14
No cable shall be laid in ducts or trenches where other services such as oil pipes, steam or water pipes are laid.

4.17.1.15
Where cabling passes through brickwork or concrete work, the contractor shall provide suitable local protection against mechanical damage wherever necessary.

4.17.1.16
The layout of all cables shall be arranged to give adequate clearance from other services and cables shall be routed to avoid hot zones.

4.17.1.17
Jointing of cables shall be avoided as far as practicable. However, jointing if at all necessary shall be done by crimping type cable joints after getting approval of BHEL engineer.

4.17.1.18
The cable schedules indicating cable sizes, tentative cables routing information will be furnished by BHEL at site to the contractor. Required steel inserts on cable trenches, ceilings of the platforms in TG hall for erecting the cables will be provided by BHEL. The contractor shall design number of cable/racks to accommodate the cables on racks/trays properly.

4.17.2.0 Earthing installations
4.17.2.1
All equipments shall be earthed by two separate and distinct connections. Earthing terminals will be available in all equipment supplied by BHEL.

4.17.2.2
The earthing conductors shall be of mild steel/GI strip/ wires. All connections from equipment to main earthing conductors shall be made as illustrated in earthing drawing / as per instruction of BHEL engineer.

4.17.2.3
A continuous earthing conductor shall be installed in all cable trays and securely clamped to each tray section by suitable connectors to form a continuous earthing system. When two or more trays supporting power cables run in parallel, a continuous earthing conductor shall be provided on trays only with tap offs to the control cable trays. All valve and damper motors and rapping motors will be earthed to this conductor.

4.17.2.4
All joints in the earthing system shall be welded type. Earthing connections to all equipments including motors shall be bolted type.

4.17.2.5
Earthing connections shall be free from tinning scale paint, enamel, grease, rust or dirt at the time of making joint.

4.17.2.6
Metallic sheaths, screens/shields and armour of all multicore cables shall be bonded and earthed.

4.17.2.7
Earthing conductors along their run on columns, beams, walls etc. shall be supported by suitable cleats at intervals of 750 mm.

4.17.2.8
Welded joints on GI earthing conductors shall be coated with one coat of bituminous paint in case of buried earth grid or earth flats to be laid in cable trench. For site welded GI strips/wires which are exposed these are required to be painted with one coat of cold galvanising zinc paint.

4.18.0 Instruments and Equipments

4.18.1

All field mounted instruments are to be located in such a way as not to obstruct walk-ways or plant equipment access but shall be easily accessible for maintenance. Hand rails shall not be used for mounting or supporting instruments.

4.18.2

Racks/stands and supports for instruments and transmitters shall be fixed on RCC column/floor by chipping and grouting or by welding to steel structure. In no case these shall be welded to floor grills.

4.18.3

The power cylinders support/base erection will be welded to steel structure or by grouting. The power cylinder will be properly aligned and linkage mechanism wherever required shall be connected to the driven equipment. All accessories for power cylinders line air sets, solenoid valves, air lock, limit switches, if supplied loose, shall be fixed, aligned and connected up.

4.18.4

When installing flow and pressure transmitters/switches for Liquid /steam/ condensate vapour services, the instrument is to be mounted below its primary element or tapping point. For gas service applications, the instrument is to be mounted above Primary element tapping point.

4.18.5

During erection and commissioning stage, the site mounted instrument shall be protected suitably. Contractor shall provide suitable security arrangement in main control room, and other areas where equipments are positioned, at no extra cost.

4.18.6

All brackets/racks and support steel work for tubing impulse lines/instruments shall be painted with two coats of primer and two coats of final colour prior to installation. Paints, etc supply in the scope of contractor.

4.19.0 Guidelines for handling and storage of electronic cubicles/ subassemblies / loose items.

4.19.1

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

4.19.2

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

4.19.3
Cases should be opened/unpacked using correct nail pullers. While opening the planks, care should be taken to see that equipment inside is not damaged. Cases should not be unpacked in areas where they are exposed to rain, water/liquid splashing, dust or other harmful materials like chlorine gas, sulphur dioxide etc.

4.19.4
After opening the case, all supports provided for transport are to be removed with due care.

4.19.5
Hinged frames should not be opened when equipment is not secured to floor as this is likely to cause it to topple over. The hinged frame can be opened only if the equipment is still fixed on to bottom wooden pallet.

4.20.0 Storage
4.20.1
The equipment should be preferably in its original package and should not be unpacked until it is absolutely necessary for its installation or advised by BHEL engineer. The equipment should be best protected in its cases. It should be arranged away from walls.

4.20.2
The wooden pallet provided for packing itself can be retained for raised platform to protect equipment from ground damps, sinking into around and to circulate air under the stored equipment. This will also help in lifting packing with fork-lifter.

4.20.3
Periodic inspection if silica gel placed inside the equipment is necessary. It has to be replaced or regenerated when decolourisation takes place.

4.20.4
Due care should be taken to ensure that the equipment is not exposed to fumes, gases etc., which can affect electrical contacts of relays and terminal boards.

4.20.5
The storage room and the equipment should be checked at regular interval to ensure protection from termites, mould growth, condensation of water etc., which can damage the equipment.

4.20.6
All the equipments, materials and goods kept in the store room should be identified and registered in a book. Inspection report should be recorded. Any discrepancy observed should be communicated to site engineer.

4.20.7
The packing material shall be retained if the cubicle is to be repacked after inspection.

4.21.0 Sub-assemblies

4.21.1

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

4.21.2

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

4.21.3

Subassemblies should not be stacked one above the other.

4.22.0 Loose items

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

4.23.0 Guidelines for handling of electronic modules

4.23.1

All the modules shall be handled by qualified persons only.

4.23.2

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

4.23.3

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

4.23.4

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

4.23.5

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

4.23.6

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

4.23.7

Soldering irons and any other tools used must be grounded.

4.23.8

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

B. ELECTRICALS

4.24 SCOPE OF WORK

The work under these specifications broadly covers the complete work of handling at storage yard/stores, transportation to work site, calibration, pre-assembly, erection, testing, pre-commissioning tests and checks and handing over of Electrical Equipment & Associated Auxiliaries of various systems as listed under.

1. ISOLATED PHASE BUS DUCT AND NON-SEGREGATED PHASE BUS DUCT.
2. ANY OTHER ASSOCIATED SYSTEMS REQUIRED FOR COMPLETION OF THE BUSDUCT BETWEEN GENERATOR, GENERATOR TRANSFORMER, UAT PACKAGE
3. SOOT BLOWER SYSTEM
4. EXCITATION SYSTEM
5. ELECTROSTATIC PRECIPITATOR
6. ELECTRICAL HOISTS AND ELEVATORS
7. CONTROL & RELAY PANELS
8. HT/LT MOTORS TESTING AND COMMISSIONING
9. ANY OTHER ASSOCIATED ELECTRICAL WORKS / SYSTEMS REQUIRED FOR COMPLETION OF THE BOILER-TURBINE-GENERATOR (BTG) PACKAGE.

Scope of work is further detailed in various clauses hereafter.

4.24.1

GENERAL REQUIREMENTS

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.

4.24.2

The work to be carried out under the scope of this specification covers the complete work of loading, handling, transporting, unloading, preassembly, erection, calibration, testing, air flushing, pre-commissioning tests, commissioning of systems, trial run of various auxiliaries and equipments, achieving various milestones till handing over of the unit to BHEL's customer. The work shall conform to dimensions and tolerances specified in various drawings that will be provided during the erection. If any portion of the work is found to be defective in workmanship or not conforming to drawings or other specifications, the contractor shall dismantle and re-do the work duly replacing the defective materials at his cost, failing which the work will be got done by engaging other agencies or departmentally and recoveries will be effected from contractor's bills towards expenditure incurred including 30% departmental charges.

4.24.3

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.

4.24.4

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.

4.24.5
The work covered under this specification is of highly sophisticated nature, requiring the best quality workmanship, supervision, engineering and construction management. The contractor should ensure proper planning and successful & timely completion of the work to meet the overall project schedule. The contractor must deploy adequate quantity of tools & plants, modern/latest construction aids etc. He must also deploy adequate trained, qualified and experienced supervisory staff and skilled personnel.

4.24.6
Contractor shall erect, align 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 / sequences adopted in erection of similar sets elsewhere.

4.24.7
All necessary certificates and licenses, permits & clearances required to carry out this work from the respective statutory authorities are to be arranged by the contractor expeditiously at his cost and in time to ensure smooth progress of work.

4.24.8
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 30% departmental overheads of BHEL.

4.24.9
The contractor shall execute the work in the most substantial and professional manner. The stores shall be handled with care and diligence.

4.24.10
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.

4.24.11
All transport equipment, handling equipment, tools, tackles, fixtures, equipment, materials, 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.

4.24.12
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 works will be governed by Section-13 of SCC.

4.24.13
All works such as cleaning, levelling, aligning, trial assembly, dismantling of certain equipments / components for checking and cleaning, surface preparation, fabrication of sheets, tubes and pipes as per general engineering practice and as per BHEL engineer's instructions at site, cutting, gouging, weld depositing, grinding, straightening, chamfering, filing, chipping, drilling, reaming, scrapping, lapping, fitting up etc., as may be applicable in such erection works and which are treated incidental to the erection works and necessary to complete the work satisfactorily, shall be carried out by the contractor as part of the work within the quoted rates.

4.24.14
The contractor shall make all fixtures, temporary supports, steel structures required for jigs & fixtures, anchors for load and guide pulleys required for the work (excepting those specifically included in BHEL scope). However, necessary steel will be provided from the scrap / surplus materials available at site.

4.24.15
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. While taking delivery of items from store it may be necessary to handle (shift / relocate) other items (not necessarily those in the scope of the contractor). Separate payment will NOT be made if such situations arise.

4.24.16
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, contractor shall do it most expeditiously. No claim for extra payment for such work will be entertained.

4.24.17
Plant materials should not be used for any temporary supports / scaffolding / preparing pre-assembly bed etc.

4.24.18
The services, tests and support to be provided by the agency for the work mentioned in various sections of this tender are indicative and not exhaustive, and not limited to these for completion of the work in all respects.

4.24.19
All the work shall be carried out as per the instructions of BHEL engineer. BHEL engineer's decision regarding the correctness of the work and method of working shall be final and binding on the contractor.

4.24.20
The weights & dimensions as mentioned against the individual items in Price Bid Part –II is indicative approximate and there may be variation in dimension & weight in actual supply of equipment. No rate variation shall be considered on this account.

4.24.21
The scope of work & description of system / equipment as given in the various clause of this tender specification and rate schedule are only for understanding the system requirement, contractor shall note this point and assess the volume of work prior to submitting the offer. No compensation shall be considered later on.

4.24.22
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.

4.24.23
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.

4.24.24
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.

4.24.25
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.

4.24.26
The entire surplus, damaged, unused materials, packaging materials / containers, special transporting frames, gunny bags, etc., shall be returned to BHEL stores by the contractor.

4.24.27
The contractor shall not waste any materials issued to him. In case it is observed at any stage that the wastage/excess utilisation of materials is not within the permissible limits, recovery for the excess quantity used or wasted will be effected with departmental charges from the contractor. Decision of BHEL on this will be final and binding on the contractor.

4.24.28
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 engineer.

4.24.29
House keeping in the erection and preassembly area is as important as well-planned and orderly work. The access to site for inspection, approaches by BHEL and customer engineers and leading of the material shall be made available by the contractor at all times. The shifting and re-shifting of erection materials, tools and plants and clearance of restrictions, filling of ditches, undulation near the pre-assembly and boiler area is the responsibility of the contractor. Contractor should visit the site and acquaint himself with all restrictions and difficulties that he may encounter during erection/commissioning stages.

4.24.30
The contractor shall take delivery of equipment, materials from the storage yard/ stores/sheds of BHEL/customer. He shall also make arrangements for verification of equipment, transportation up to site of work, safe custody, watch and ward of equipment after it has been handed over to him till these are fully erected, tested and commissioned and taken over by the customer. The contractor should 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 measuring and control equipments, panels, console inserts, switches, cables, conduits etc. shall be stored when taken over by the contractor in appropriate manner as per BHEL's instructions.

4.24.31
The contractor shall handover all parts/materials remaining extra over the normal requirement with proper identification tags in a packed condition to BHEL stores. In case of any misuse or use over actual design requirements, BHEL reserves the right to 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.

4.24.32
The contractor should take all reasonable care to protect equipment and materials under his custody either in his stores or at site. Copper tubing, copper bus bars, brass fittings, brass valves, contactors, etc., forming an integral part of equipment or system is liable to greater damages / pilferages /theft / losses. It will be responsibility of

contractor to arrange for adequate security round the clock for protection from such damages/pilferages/theft/losses.

4.24.33
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.

4.24.34
Overhauling, cleaning, revisioning, servicing of equipments during erection and commissioning stages will be arranged by the contractor. All equipments shall be preserved and protected before and after erection as per the advice of BHEL engineer.

4.24.35
Substantial portion of Cable laying & termination shall be done by other agencies for those equipment covered under this tender specification. The glands & lugs shall be supplied either loose or fitted with the equipments. Contractor shall take care of this aspect at the time of receipt of the equipment from BHEL stores. Contractor shall account for the quantities received with equipments and shall hand over the same to cabling agency under intimation to BHEL Engineer. Contractor shall extend all necessary help & co-ordinate with the cabling agency during the course of work.

4.24.36
Contractor shall prepare Marked-Up drawings incorporating modifications and deviations from original drawings or prepare fresh sketch for actual installation / connection details if need be, that can be converted to "As-built" drawing.

4.25 WELDING, NON-DESTRUCTIVE TESTING ETC.

a. Installation of equipment involves good quality welding, NDE checks etc.

b. Welder deployed for aluminium welding shall have experienced and approved by BHEL and MSEB after due qualification process/testing.

c. Welding of all structural steel & aluminium shall be done only by the qualified and approved welders.

d. All the welders shall be tested and approved by BHEL engineer / customer's quality deptt before they are actually engaged on work though they may possess IBR/other certificate. BHEL reserves the right to reject any welder without assigning any reason.

e. The welded surface shall be cleaned of slag and painted with primer paint to prevent corrosion. For this paint will be supplied by the contractor.

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

g. Certain types of coated 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 coated welding electrodes have to be carried in portable ovens.

4.26 TESTING, PRE-COMMISSIONING AND POST COMMISSIONING:

4.26.1
The contractor shall perform various activities during pre-commissioning, Integrated Testing, post-commissioning stages of equipment covered under this tender specification. It is responsibility of contractor to arranged tools & plants, test equipments, experienced engineers and technicians. Contractor shall earmark separate manpower for respective area of as specified in relevant clause and shall not be disturbed /diverted for other work. The contractor's assistance for commissioning group shall work as per the instruction of BHEL Engineer and they shall coordinate day-to-day activity with other agency and BHEL/ Customer. The testing activity may have to be repeated till satisfactory results are obtained and also to satisfy the requirement of Customer / statutory Authority.

4.26.2
The contractor shall simultaneously start testing & assistance for commissioning activities for equipments to match the mile stone activities of the project.

4.26.3
The mobilization of these assistance for commissioning groups shall be such that planned activities are taken up in time and also completed as per schedule and work undertaken round the clock if required. **It is responsibility of contractor to discuss on day to day/weekly/monthly basis the requirement of manpower, consumables, tools & tackles / testing equipments with BHEL Engineers and arrange for the same.** If at any time the requisite manpower, consumables etc are not arranged then BHEL shall make alternative arrangements and necessary recoveries with overhead cost will be made from the running bills.

4.26.4
Contractor shall cut/open work, if needed, as per BHEL engineer's instructions during commissioning for inspection, checking and make good the works after inspection is over.

4.26.5
It shall be specifically noted that the contractor may have to work round the clock and in shifts during the pre-commissioning and commissioning period along with or without BHEL engineers and hence considerable overtime payment is involved. The contractor's quoted rates shall be inclusive of all these factors.

4.26.6
In case any rework/ repair / rectification/ modification / fabrication etc is required because of contractor's faulty workmanship which are noticed during the commissioning of, at any stages, the same shall be rectified by the contractor at his cost. If during the commissioning any improvement / repair / rework / rectification / fabrication / modification due to design improvement is required, the same shall be carried out by the contractor promptly and expeditiously. Claim if any, for such work from the contractor shall be governed by Section-13 of SCC.

4.26.7
During the commissioning activities and carrying out various tests, if any of temporarily work such mounting of test equipments / cabling etc are required, the contractor shall carry out such work without on any extra cost. The same shall be removed after completion of the activity.

4.26.8
During this period, though BHEL/ client's staff will also be associated in the work, the contractor's responsibility will be to arrange for complete requirement of men and required Tools & Plants, Consumables, Scaffolding and approaches etc., till such time the commissioned unit is taken over for trial operations.

4.26.9
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.

4.27 INTEGRATED ELECTRICAL TESTING / COMMISSIONING

The brief scope of work under is defined as below, but not limited to the following. Contractor shall discuss & finalize testing procedure with BHEL Engineer In-Charge for the test to be conducted on Generator Control & Relay Panel testing. Drawing & documents shall be provided by BHEL at the time of testing. BHEL decision in this regard shall be final and biding on the contractor.

The contractor shall prepare all erection / commissioning log sheets and protocols / test certificates as per field quality plan, get is signed by the concerned BHEL/Customer engineer and submit the same to BHEL engineer as per his instruction.

Contractor shall maintain the charged and commissioned equipment till the same is taken over by BHEL's end customer.

Contractor's quoted rates for all concerned items shall include Integrated Testing as defined hereinafter.

4.27.1
GENERATOR CONTROLS AND PROTECTIONS RELAY PANELS & ASSOCIATED EQUIPMENTS SUCH AS BUS DUCTS, GT, UNIT & STATION TRANSFORMER, GENERATOR BREAKER etc.

1. Integrated Electrical testing/commissioning of Generator Control and Protection Relay Panels & associated equipment, etc. shall involve various activities like relay testing/setting, simulation checks, testing of energy meters, on/off line functional checks on integrated system.

2. Relay Testing in static condition for Generator, Transformers, and associated system by secondary current injection at different current and recording the time duration.

3. Testing and checking of control and protection interlock scheme in static condition and simulation of protection device contact from internal and external devices of all electrical panels.

4. Measurement of Insulations, Winding Resistance, Polarization Index of winding of Generator & associated equipment/ system.

5. Relay setting and checking the stability of protection relays in static and dynamic condition during the OCC (Open Circuit Characteristic) & SCC (Short Circuit Characteristic).

6. Functional checks / testing of synchronizing schemes, other electrical panels during the static and dynamic by simulation / back charging of generator transformer conditions.

7. Monitoring & recording the various parameters during open circuit and short circuit conditions test on generator & associated field equipment like generator transformer, unit auxiliary transformer. Recording and monitoring measurement.

8. Testing of protection current transformer for ratio test by primary injection, magnetization characteristic, polarity test, and IR measurement. Functional checks of relays of protection system by primary injection testing of potential transformer for ratio test by voltage ratio, polarity test, insulation resistance measurement etc, testing of surge capacitors, PT isolator in PTPS cubicle etc.

9. Measurement of Insulation resistance of individual equipment and connected together.

10. Tan delta test on generator & other equipments as required.

11. Calibration of energy meters, tri-vector meters, voltmeters, ammeters, current & power transducers etc.

12. Providing temporary shorting link on bus duct or any other location while testing & normalisation after the test.

4.27.2 415 VOLT LT SWITCHGEAR / MCC, DC DISTRIBUTION BOARD ETC

1. Checking of installation for correctness.
2. Mechanical functional checking/ adjustment of individual breaker.
3. Measurement of Insulation resistance of individual breaker, complete switchgear board and combined insulation resistance of individual breaker with cable connected to drives.
4. Testing of Protection Relay, Thermal over relay, Power transducers Energy/ Ammeters, Voltmeters, Power factor, frequency, tri-vector meters & metering etc. in static & dynamic condition relay
5. Conducting test such as Insulation Resistance measurement, Ratio, polarity, magnetisation characteristic, winding resistance on CT and PT.
6. Checking of electrical control & protection interlock of individual breaker and integration with other system.

7. Calibration of energy meters, tri-vector meters, voltmeters, ammeters, power current & voltage transducers etc.
8. Provide assistance for checking the electrical operation of individual breaker from remote panels / MMI package.

4.27.3 The following major works also shall be in the scope of the contractor

1. Generator stator winding resistance and PI value measurement / check
2. Generator rotor winding resistance, impedance, IR value measurement / check
3. Generator Bushing HV test
4. Main exciter winding resistance, IR value measurement / check
5. PMG winding resistance, IR value measurement / check
6. Testing and assistance for commissioning of generator and exciter accessories viz., heaters, blowers, stroboscope, diodes, enclosure lighting etc

Other than the above, minor testing / checks will also be involved in the generator area, which are also in the scope of the contractor. *Any instruments / tools etc required for carrying out the above shall be arranged by the contractor within the quoted rates*.

4.27.4
The scope of testing & assistance for commissioning of electrically operated actuators for valves, dampers, gates, soot blowers etc., will include meggering, providing loop wire on actuator terminal block, adjustments of mechanical/ electrical or electronic position transmitters, setting of limit/torque switches, cable checking, internal wiring checking, local/remote operation from MCC & MMI package, replacement of limit/torque switches if required.

4.28 MEASUREMENTS & WASTAGE & CUTTING ALLOWANCES:

4.28.1
For all payment purposes, measurement shall be made on the basis of actual execution in line with drawings/documents/site requirements.

4.28.2
The measurement for cable, impulse pipes/tubes, GI pipe, conduits, flexible conduits, trays etc. shall be made on the basis of length actually laid.

4.28.3
All the surplus, scrap and serviceable materials, out of the quantity issued to the contractor shall be returned to BHEL in good condition and as directed by the engineer.

4.28.4
All materials returned to stores should carry an Aluminium tag indicating the size and type. More than 5 metres length shall be termed as serviceable and shall be returned size wise and category wise to the owner's stores/yard. Cable of serviceable length being returned to the stores in drums shall have their free ends sealed and the balance lengths on the drum(s) shall be noted and certified by the Engineer-in-charge.

This shall be applicable only for the purpose of accounting the cables issued for installation.

4.28.5
While carrying out material appropriation with contractor, all the above points will be taken into account. All serviceable material returned by the contractor shall be deducted from the quantities issued for the respective sizes and categories and the balance quantity(ies) will be taken as the net quantity(ies) issued to the contractor. Material appropriation shall be done and allowable scrap quantity calculated as per wastage allowance percentage specified above. Any scrap/wastage generated by the contractor in excess of the allowable percentage shall be charged at the rates decided by the Engineer whose decision shall be final and binding on the contractor.

4.28.6
For all site-fabricated steel items such as supports, racks , frame , Canopy etc. physical measurement shall be made and then converted to tonnage . For steel material supplied to the contractor, all scrap shall be returned to BHEL stores with due accounting.

4.28.7
Every month the contractor shall submit an account for all the materials issued to him by BHEL in the standard Performa prescribed for this purpose by the site in charge.

4.28.8
The erection contractor shall make every effort to minimize wastage during erection work. Wastage limits and associated conditions specified earlier in this section shall be applicable.

4.28.9
The cable take off from drums shall be planned strategically such that jointing in the run of cables and wastage are avoided. For this purpose the exact route length between various equipment/panels as per the cable schedule shall be measured and the route length recorded before laying of the cables. Depending upon the route length the type of cable required for various destinations, the cable drums should be suitably selected for cable laying. Any jointing shall be approved by the BHEL engineer. All the cut pieces/bits of cables, which are not used/unused, shall be returned to the purchaser for accounting towards wastage. The cables damaged by the contractor shall have to be replaced by the contractor at his own cost.

NOTES:
Salvageable scrap shall mean lengths of pipes, multi core cables, other cables etc., that can be used one time or other at a later date and normally they are recovered from the cut-pieces of pipes, multi core cables, other cables, etc.

Non - Salvageable scrap means the lengths of tubes, pipes, multi core cables, other cables etc., and they are from cut-pieces of tubes, pipes, multi core cables, other cables etc., that cannot be used at all one time or other.

4.28.10
For any items or class of work not specified herein but required for total completion of work, the same shall be carried out as per BHEL requirement. However, payment of

these items/class of work shall be regulated on the basis of rate arrived at by either of the following methods:

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

B) Based on the rate arrived from nearby items in the rate schedule.

C) Wherever any item rate for similar type of work or nearby item rate does not exist in the rate schedule, rate will be worked out on the basis of work element or from fundamentals of estimation.

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

4.29 The contractor's scope of work is further described in the clauses hereafter:

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

4.29.1 INSTALLATION OF PANELS

1. Electrical control panels, electronic control panels, 415 volt LTMCC (if applicable), Analyser panels, transmitter racks/enclosure etc., are normally supplied in suit of either one/two/three or loose shipping sections with integral base frame or loose base frame. These panels may have to be installed as stand alone or in groups consisting of number of panels in each row, depending upon the plant layout and foundation arrangement.

2. The panels shall be transported from stores to the place of installation in vertical position. Care shall be taken such that the switches, lamps, instruments etc. mounted on the panel do not get damaged during transit.

3. Installation of panel shall include fixing of base frame, levelling, alignment, fixing of anti-vibration pads, removal of side covers, fixing of cubicle interconnection hardware, interconnection of bus bar /bus bar jointing, wiring interconnection, welding and grouting of panels and base frames, mounting of panel canopy wherever supplied as part of panel, drilling of gland plates, sealing of panels/ cable entries. Where the base frame is not supplied as part of panel supply, the contractor shall fabricate the base frame from structural items at site. Payment for such fabrication will be effected on measured quantity at the rate applicable for structural steel fabrication and installation. Proper sealing of all the holes and cable entries (even if the cable has been laid by others) in the panel is in the contractor's scope.

4. Panels have to be shifted to their locations through floor openings, temporary openings like floor grills, door etc. which shall be a part of work and no claim whatsoever will be entertained with regard to non-availability of opening as per shortest route etc. Panels have to be erected at different locations and elevation in powerhouse building, switchgear room, unit control room etc.

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

5. Whenever the panels are to be mounted on cable trenches, channel supports have to be provided across the cable trench over which the base frame of panel shall be mounted. For such work, structural steel fabrication & installation rate shall be applicable.

6. Normally the panels shall be supplied with meters, relays, electronic modules, contactors, pushbuttons, etc., mounted and pre-wired. However, if such devices are supplied loose/separately for safety in transit, contractor shall mount the same, as part of panel installation work and no extra payment shall be made for this.

7. Supplier's instruction manuals, packing slips, door keys etc. received along with the panels will be handed over to BHEL's engineer on opening of the panels.

8. Regular cleaning of the panels as per the instruction of BHEL engineer till handing over of the set to customer is to be carried out by the contractor free of cost.

9. 24 / 48 Volt DC Interposing Relay along with mounting base shall be supplied separately for mounting in the various feeders of 6.6 KV HT switchgear boards and 415 Volt MCC Board / Switchgear Panel Boards for uni-directional / bi-directional drives, solenoid valves. 2 Nos. interposing relay may be required to be mounted in each feeder. Internal wiring for these relay shall be pre-wired in the feeders, wires to be terminated on relay terminals. Approximately quantity is 1500 Nos. Contractor shall mount the same and terminate the wire as part of panel installation work and no extra payment shall be made for this work.

4.30 STRUCTURAL STEEL FABRICATION AND INSTALLATION

4.30.1 INSTRUMENT/JUNCTION BOX FRAME/CABLE TRAY & MISC STRUCTURES FABRICATION

1. Structural steel material like MS angles, channels, beams, flats, plates etc. shall be supplied in running meter and the same shall be used for fabrication of panel base frame, canopies for instruments/panels/ drives/JB/push buttons etc., instrument/junction box frames, impulse pipe/instrument air pipe supports and instruments etc.

2. This shall include cutting to size, contouring of ends for connections if required, welding, grinding of excess weld deposits/burrs, drilling of holes for mounting of device/instrument, installation at location, levelling, alignment, providing bracings and painting etc. No gas cut holes will be permitted. All paints, primers, etc are in the scope of the contractor.

3. All the fabricated supports/frames shall be painted as per painting specifications. Supply of all paints, primers etc s hall be in contractor's scope.

4. Frame installation at site may involve mounting either on concrete floor by grouting/using anchor fasteners or on steel structure by welding etc. All consumables including anchor fasteners shall be arranged by the contractor. Where required, as part of work, concrete floors may have to be chipped out to reinforcement depth for anchoring the frames. Wherever grouting is required, contractor shall arrange all the required material including cement/grout mix, shuttering etc., necessary labour and meet all other requirements as part of work.

5. In case, structural cable trays, bends, tees, reducers etc., are required to be fabricated from structural steel and installed, unit rate applicable for fabrication and installation of structural steel shall be applicable in such instances.

6. In certain packages, members of frames/rack for mounting of junction boxes/ instruments may be supplied readymade. These have to be assembled prior to installation. The installation rate as quoted shall include assembly of the frames.

7. Gas cutting of tray/impulse pipe support and holes in frame is not permitted. Only hacksaw cutting/ drilled hole shall be permitted

4.30.2 CABLE TRAY SUPPORT

1. GI Structural material shall be supplied in standard length. The support member required for typical installation to be cut suit to site / lay out requirement from the straight length. Tray supporting members to be installed for typical installation as indicated in sectional arrangement of cable tray route plan. BHEL's customer shall provide projected dowels embedded in cable trenches for welding of supports. The support shall be either bolted or welded type as per drawing. **No cutting by gas shall be permitted**.

2. Wherever supports needs to fixed on concrete slabs or ceiling with anchor fastener, and anchor fastener shall be arranged by contractor as part of work.

3. All galvanization damaged due to cutting / welding operation required to be carried out for the installation of cable support system shall be made good with application of cold galvanization paint (to be arranged by the contractor at his cost) immediately after completion of welding.

4.31 CABLE LAYING (POWER/CONTROL/INSTRUMENTATION SHIELDED CABLES/ PLUG-IN CABLES/INTRA-PLANT BUS/DATA HIGHWAY, ARMOURED/UN-ARMOURED, SINGLE/MULTI-CORE, PVC/HR PVC/FRLS/TEFLON/XLP INSULATION)

1. Cable laying includes cutting to the required length, laying in overhead / underground cable trench / through pipes / flexible conduits, dressing / clamping in tray (**all consumables for cable dressing, tagging, clamping etc., including aluminium trefoil and other clamps are in the scope of the contractor**), drilling of holes in gland plates in panels and junction box, glanding, splicing, dressing of spliced wire inside the panel and JBs, providing printed ferrules **(contractor to arrange ferrule printing machine(s) as required)**, termination by using crimp type copper tinned/aluminium lugs, insulated/un-insulated, crimp and soldering termination, plug-in connections

with insert type crimping, providing identification cable tags, PVC/aluminium at both the ends and at appropriate interval throughout the route length, continuity checking, insulation resistance checking, high voltage test on HT cables.

2. Entry to the panels, JB's may be at top, side or bottom. All cables are required to be supported and clamped near to the panel.

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

4. Supply of copper tinned lugs conforming to IS: 694 of various types (pin, ring, fork, snap-on) upto 4 sq.mm, PVC cable ties, printable ferrules, PVC button and tapes, cable identification tag of PVC/metal, clamping and dressing material with hardware, PVC sleeves etc. shall be supplied by contractor within the quoted rate for cable laying. The quality and make of cable lugs shall be got approved from BHEL engineer prior to their use on job.

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

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

7. Wherever cable runs through the duct, conduit, valves and the entry and exit points shall be sealed using fire/weather proof compound. In addition to this, cable entry in panels, MCC/LT breakers, instruments, electrical actuators etc. are also required to be similarly sealed. **The required material for doing so shall be included by contractor in the cable laying.**

8. Many of the cable trays and cables have to be laid in cable trenches. For this purpose, the cover of the trenches have to be opened for working in site and whenever the cables are to be laid in existing cable tray, all safety precautions have to be observed.

9. After completing the work, the trenches have to be cleaned and covers put back into position. Contractor shall also carry out de-watering from the trenches if required and arrange pumps etc. at his cost.

10. Looping wire at terminal block of panels and electrical actuator as shown in the inter-connection diagram is to be done by contractor at no extra cost.

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

Recovery will be made in case the wastages are exceeding the wastage allowances fixed in this contract.

4.32 ELECTROSTATIC PRECIPITATOR

1. ESP shall have four flue gas passes and each pass comprises of rectifier transformer (silicon oil filled), Auxiliary Control Panels, electronic controller, LT Main switch board and its bus duct, Drives for Rapping/Collecting/ Gas damper screen, heating element for hopers/shaft and supporting insulator housing, ash level indicator and EP management system (software based) including computer interface and associated interlock and protection.

2. Transformer shall be erected by other agencies engaged by BHEL. Scope of work covered under this contract is oil filtration of transformers and erection and testing of various devices as enlisted in rate schedule. **Contractor shall arrange silicon oil filter machine as a part of scope**. Contractor has also to provide operator round-the-clock for oil filtration and other necessary testing equipments. Contractor shall utilise power supply for filter machine from the source, which is given for the construction purpose, and contractor shall arrange required cables.

3. Erection of necessary materials for complete earthing scheme is in the scope of the contractor.

4.33 ISOLATED PHASE BUS DUCT 16.5 KV, 12KA CONTINUOUS AIR-COOLED.

Items under the scope (per unit)

SN	Item Description	Quantity Per Unit	Max. Size of item (L X W X H) mm	Max. Wt./ Qty (KG)
1	Isolated Phase Bus duct (Main)	38 nos.	6000X1500X 1500	1000
2	Isolated Phase Bus duct(Tap-off)	18 nos.	4000 x 1000 X 1000	350
4	LAVT Cubicle(1 Phase)	3 Nos.	1200 X 3000 X 3000	1000
5	N.G. Cubicle	1 No.	2400 X 1800 X 2000	1500
6	Steel Structure	1 LOT	Max. length 6 Mtr.	16000
7	Air Pressurisation Equipment	1 No.	3500 x 2000 x 3500	2500
8	Top Chamber	1 No.	5000 x 3000 x 4500	2500
9	Hot Air Blowing Equipment	1 No.	2800 x 1800 x 3300	1500
10	Miscellaneous Items/ Packages	25 Nos.	1000 x 1000 x 1000	1000

GENERAL DESCRIPTION

1. Generator isolated bus duct is connected to low voltage side of Generator transformers 315 MVA and main bus duct shall have tee off connection for unit transformer, LAVT cubicles, excitation transformer and air pressurisation equipment. Bus duct consist of round / octagonal/ box hollow aluminium alloy

conductor and supported inside aluminium enclosure with post insulator. Flexible connections and expansion joints are provided at terminals and intermediate point to alleviate stresses. Ring type protection current transformer will be mounted inside the bus duct.

2. Isolated phase bus duct shall have tap connection for potential transformer, surge protector etc. housed in a metal clad cubicle, UAT and NG cubicle/ resistor cubicle. Various electrical tests have to be performed before and after erection.

3. Bus duct enclosure /conductor is a continuous welded type. Conductor, enclosure, makeup pieces, shunts pieces etc have to be welded at site.

4. The scope of for Isolated Phase Bus Duct shall include Transportation of material from stores/ storage yard, preparatory work such as erection of supporting structure, placement of sub assemblies / equipments, alignment, edge preparation of conductor / enclosure, welding of conductor / enclosure, welding of shunt pieces & make up pieces, installation of seal of bushing & wall frame assemblies, shorting links, earthing, LAVT cubicle, copper flexibles, copper rubber bellows, weldable/ bolted flexibles, installation of air pressurising unit and its associated piping work and cable etc, testing and commissioning.

5. Pre-fabricated G.I. supporting members shall be supplied loose and to be erected as per lay out drawing. Foundation pockets and embedded plate inserts shall be provided as per lay out drawing (on floor for bottom support and on bottom of concrete slabs). Contractor shall weld the supports on insert plate and shall carry out grouting including supply of grout materials after complete alignment/bolting of structural members. If any modifications are required in supporting structure due to site conditions, the same shall be carried out without any extra cost. All welded joints shall be applied cold galvanizing zinc paint (paint in the scope of the contractor).

6. Required aluminium welding of conductor, enclosures, shunt, make up pieces, aluminium flexible etc as detailed in drawings has to be carried out by contractor. MIG welding shall be applicable. Contractor shall arrange necessary welding equipment/ accessory in sufficient number, filler wire, argon gas and other required consumables at his cost.

7. During erection of bus duct/enclosure, makeup pieces and shunts, if any modifications are needed to match the alignment, they shall be part of work and no extra payment shall be made.

8. All bolted joints and flanges shall be tightened with torque wrench to the approved torque. Wherever bolted joints, the same shall be cleaned and a layer of anti-oxidation paint shall be applied. Such paints etc will be arranged by the contractor within the quoted rates.
9. Top chamber/adapter box for line and neutral side, hood assembly at UT, hood assembly at excitation transformer and at LAVT cubicle end shall have drilled hole in flange. If there is any mismatch of the hole in above with respect to the counter flange / welded studs provided on UAT, LAVT and excitation cubicle, the contractor shall drill new holes if required within the quoted rates.

10. Proper sequence shall be followed during erection to avoid any mismatch and alignment problem.

11. Prior to installation of bus duct assemblies in position, the various component like conductor, insulator shall be inspected and cleaned and insulation resistance to be measured and recorded. If any insulator found damaged, the same shall be replaced.

12. Electrical test on current transformers and potential transformers shall have to be carried out prior to installation & during pre-commissioning. The tests are insulation resistance measurement, winding resistance, magnetisation characteristic, ratio test, water ingress and air leak test on assembled bus- ducts.

13. Minor civil work such as chipping, levelling of foundation, providing pockets, drilling/enlargement of holes in structure, bus bar etc. which are incidental to the erection of bus duct shall not be treated as extra.

14. All miscellaneous items such as disconnecting links, flexibles, shorting bars, hardwares, conduit for wiring, marshalling box, CTs and PTs wiring through conduit, earthing materials, bus bar fish plates etc. are part of bus duct installation. Hence separate break-up quantity is not given in BOQ.

15. Round makeup pieces for main and tee off duct shall be supplied in two halves and it involves both circumferential and horizontal welding at parting plain.

16. Air tightness and water tightness test have to be carried out on completion of bus duct installation. In case of any leakages, contractor has to rectify and bring to the required level of air tightness/water tightness without any extra cost.

17. High voltage test of bus duct is to be carried out as per the instruction of BHEL engineer. Contractor shall arrange necessary test equipment/ instrument for conducting various electrical tests at his own cost.

18. Contractor has to carry out final painting as per standard colour coat recommended by BHEL. Paints and consumables shall be in contractor's scope.

19. Shunt pieces shall be supplied in two halves and to be welded between two-phase bus duct at transformer end. The shunt pieces to be welded on both the side on matching plain and bus duct circumference and horizontal plain.

20. Contractor shall conduct 20 % radiography and 100% NDT test on welded joints.

21. Any enclosed drawings are for estimation and tendering purpose only. Contractor has to ascertain quantum of work involved. The BOQ as furnished in this tender specification for Isolated Phase Bus Duct & Segregated Phase Bus Duct are tentative / approximate. **Contractor has to ascertain the quantum of work involved and quote the lump sum value, as called in the rate schedule, without any additional compensation for any variation in length or numbers of joints.**

22. One end of the enclosure to be earthed to the station earth at shunt location where all three-phase enclosure are shorted. Wherever shunts are not provided, each phase should be earthed separately.

23. In case of bolted bus-ducts, phase split covers, rubber bellows, clamping earth straps to be connected to maintain the electrical continuity and in turn enclosure gets earthed at one point.

24. All other equipment such as LAVT, NG transformer/ resistor cubicle, air pressurization, CT chambers, junction boxes, etc to be earthed at two points to the earth grid.

4.34 SOOT BLOWER SYSTEM

1. Soot blower system comprises of motor control centre having various feeders of motor starters, micro-processor based PLC panel with mimic diagram and control station, push button boxes, junction boxes, wall blowers/LRSB with drive mechanism, integral control box with limit switch and internal wiring, inter connecting cables between field blowers and MCC, PLC panel etc. The scope of work for testing, assistance for commissioning covers the items/devices as per rate schedule and the testing, assistance for commissioning of blowers shall be carried out in close co-ordination with mechanical agencies who shall be erecting these blowers and contractor shall obtain clearance from BHEL engineer prior to start of work. The contractor shall carry out the following works under testing & commissioning.

2. Pre-commissioning checks and tests on MCC, blowers, PLC panels, energizing the MCC and its feeders, wiring checks, insulation resistance measurements, testing of thermal over load relays etc.

3. Adjustment of limit switches, torque switches, internal wiring checks, minor wiring modification to suit to system requirements for wall/LRSB blowers.

4. Electric operation of each blower from local, MCC and PLC panels and from Unit control board.

5. Providing loop on terminal block of MCC individual feeders & blowers.

6. During pre-commissioning/post-commissioning of soot blower system, the component like TB's, limit switch, torque switch, over load relay, contactors etc. if found defective, contractor shall replace such components without any extra payment.

4.35 DIGITAL STATIC EXCITATION SYSTEM.

System comprises of regulation, field flushing, thyristor, field breaker panels; transformer trunking cubicle alongwith copper bus bar/flexible connectors/air duct and blowers/blower control box including internal wiring, and associated inter connecting cables.

4.36 ELECTRICAL HOIST

1. Electrically operated hoist of capacity varying from 3 MT to 35 MT are provided for maintenance purpose for ID/FD/PA fans, Mill area, Air Heater, ESP and other area in boiler**.** Mechanical erections of hoist components such as runway beams, hoist carriage, drive unit, etc. shall be done by other agency. The scope of work covered in this tender specification for erection & assistance for commissioning is installation of DSL system and associated accessories. The scope of work for the contract in this package is as under:

2. **TEE IRON TYPE DSL SYSTEM:-** It consists of tee iron guide for cable trolley and associated supporting structural members, trailing cable, cable guide trolley, dog chain, switch fuse unit, limit switch etc.

3. **TAUT WIRE TYPE DSL SYSTEM:-** It consists of end bracket, Galvanised wire rope, turn buckle/ straining bolt, real insulator,/cable guide trolley ,cable, switch fuse unit, rope clamps, leather bands, dog chain, limit switch etc.

4. DSL system shall have to be erected at higher elevation. Contractor shall take all safety measures while carrying out the work.

5. Installation of tee iron &other structural steel member, unit rate for fabrication & installation shall be applicable and other items unit rate shall be paid, however cable dressing, fixing of leather bands, rope clamps and any incidental work such making approaches for executing the work, scaffolding etc. shall be part of work.

6. Assistance for commissioning & testing of electrical hoists shall includes panel wiring check, IR measurement, functional check, over load relay testing, trial run, providing assistance during load test, replacement of component if required etc. However, preparatory work for load test and arrangement of load etc. shall be done by other agency.

4.37 415V MOTOR CONTROL CENTERS (MCC) & DC/AC DISTRIBUTION BOARDS

1. Motor control centres are double front draw –out/non-draw type consisting of circuit breakers units, contractor/starter, switch fuse units, MCC, Protection & metering relays/ instruments etc. arranged in multi tier construction. These PCC and MCC are mainly supplied to cater to the requirements of drives, valve actuators etc.

2. DC distribution Boards is single front non-draw out type consisting of circuit breakers, contactors, starters, fuse units, MCB etc arranged in multi-tier construction. Shall be located in LT switchgear room to cater the dc supply requirement.

3. The scope of work for the LT switch board and DCDB covers receipt of materials from stores, transportation to the respective location, erection, testing, assistance for commissioning and handing over.

4. Rubber mats shall be supplied by BHEL for HT/LT switchgear and the same shall be laid wherever required as part of work.

4.38 PAINTING

4.38.1 BUS DUCTS

Exposed metal surfaces of Transformers and Bus Ducts erected by the contractor shall be painted with two coats of Finish Paint after thoroughly cleaning the surface from dust, rust, greases, oils, scales, etc, by wire brush, scrapping, machine buffing, water washing and any other appropriate method as specified in relevant erection documents. Bus Ducts shall first be coated with two coats of Primer before application of Finish Paint. Touch-up primer coat shall also be applied on Transformers as and where necessary. Supply of paints, etc for the above is in the scope of the contractor.

Colour Banding, Legend and Identification Marking, Direction Marking etc. shall be in scope of the contractor for all items (Erection or Commissioning) in the scope of the contractor.

4.38.2 STRUCTURALS

Structural components may be supplied without any primer/paint coat from shop. The surface of such items shall be cleaned as per specifications and then coated with two coats of ROZC (IS:2074) Primer. Supply of Primer, etc is included in the scope of the contractor. Cold Galvanised Paint to be applied wherever modification of GI coated Structure is required. The supply and application of Cold Galvanised Paint shall be in Contractor's scope.

4.38.3 PANELS, JUNCTION BOXES

Panels and Junction Boxes shall be Touch-up painted as and where original shop paint is peeled off. Necessary surface cleaning and preparation shall be done by the contractor as per relevant painting codes followed by two coats of Primer and two coats of Finish Paint. All necessary paints, primers, etc are to be arranged by the contractor within the quoted rates.

4.39

The work under this scope being quite sophisticated and also quite extensive, for proper planning, monitoring, reporting, etc of ongoing works, the contractor shall establish his own computer(s) and printer(s) at his site office, along with suitable operator(s), consumables, etc*. Non-establishment of above equipment will attract penalty @ Rs 10000 (Rs Ten thousand only) per month.*

BHEL uses its own software SOMS (Site Operation and Management System) for total project execution and billing. The contractor shall also provide adequate and suitable manpower for updating / entries into SOMS in BHEL computers at site.

4.40 Troubleshooting during plant operation

During pre-commissioning / commissioning stages when the plant will be under various stages of operation, it will be necessary to have continuous (day and night) presence of suitable manpower along with required tools to attend to any defects etc that may arise during such operation. The contractor will be required to put such personnel in shifts in both electrical and C&I area. The bidder must also take this aspect into consideration.

4.41

Equipments/instruments etc., under the above scope of erection and commissioning are generally despatched from BHEL's manufacturing units / vendor's works at site well before start of erection. Sometimes, such despatched materials may get stuck up with transporters/railways. The contractor shall provide support / manpower for necessary chase up for removal of such bottlenecks in transportation. Also, for smaller items, it could be necessary to depute his person to personally carry certain items from works to site. Requirement of such activities which will be decided by BHEL engineer and chase up activities, if required, shall be performed under authorization by BHEL. The above services shall be provided without any additional price to BHEL.

4.42 INSTALLATION (ERECTION, TESTING AND COMMISSIONING) SUPERVISION SERVICES

The contractor shall extend various installation supervision services to BHEL site establishment as specified and explained in the following clauses. These installation supervision services ***are in addition*** to the scope of work specified in the clauses herein above in section-4 of special conditions of contract.

Separate item rate for these services are not envisaged. Bidder shall include the price of these services in rates being quoted for various items of work as per price bid.

4.42.1 DETAILS OF MAJOR PRODUCT AREAS REQUIRING INSTALLATION SUPERVISION SERVICES

The contractor shall provide to BHEL installation supervision services for the installation of various equipments/components/assemblies/sub-assemblies/parts etc. **This service shall be available to BHEL irrespective of terminal points of erection testing and commissioning work covered under this tender**. BHEL may use these services at its discretion. The service categories are:

1. Cabling area: One service point
2. SG C&I erection area: One service point
3. SG C&I commissioning area: One service point
4. TG C&I erection area: One service point
5. TG C&I commissioning area: One service point
6. Station C&I erection area: One service point
7. Station C&I commissioning area: One service point
8. Control valves / dampers: One service point
9. Soot Blowers: One service point
10. Bus ducts : One service point
11. ESP: One service point
12. Motorised control valves commissioning area: One service point

4.42.2 SCOPE OF INSTALLATION SUPERVISION SERVICES

4.42.2.A

The contractor under this contract shall provide services towards installation (erection, testing and commissioning) supervision as per instructions of BHEL engineer for the relevant product system assigned as above for the time being and shall broadly include the following responsibilities:

- Studying the relevant drawings, documents etc. of concerned product/ system
- Draw out periodical plans with the engineers/supervisors of the contractor deployed for direct on the job supervision.
- Check with the stores the receipt of required materials for the current plan and for the period ahead as may be directed.
- Check the materials for correctness and soundness and ensure proper stacking, storage, preservation of materials brought to site for erection, refer and implement concerned documents in this regard.
- Ensure proper handling of materials during all site activities.
- Assist contractor in tracing of materials wherever required and as instructed
- Study, understand and implement the erection, testing & commissioning procedures/manuals requirements as applicable. Seek guidance of BHEL engineer wherever required.
- Study the relevant field quality plans and understand requirements of quality checks especially with regard to customer check points.
- Carry out all erection, testing and commissioning activities as planned/ instructed.
- Carry out all field checks along with contractor.
- Ensure implementation of safety instructions.
- Verify daily/ periodical reports and maintain progress registers
- Ensure filling of all protocols/ log sheets/ check lists etc
- Ensure material re-conciliation with contractor regularly.

4.42.2.B EXPECTED MINIMUM QUALITY OF SERVICE

Contractor shall render the installation (erection, testing and commissioning) supervisory services by ensuring deployment of requisite personnel with adequate educational qualification in engineering and possessing valid and current certificates wherever applicable, having thorough field experience to enable understanding the intricacies of and special requirements involved in erection, testing and commissioning of projects, taking care of inconsistencies and uncertainties associated with flow of project activities. These personnel would be required to work beyond normal working hours, on holidays and irregular working hours. Contractor shall ensure prompt and timely availability of such services as and when required by BHEL. ***The CV of such personnel shall be submitted to concerned BHEL engineer for approval at site before them being deployed***.

4.42.3 PARAMETERS AND QUANTIFICATION OF INSTALLATION (ERECTION, TESTING AND COMMISSIONING) SUPERVISION SERVICES, PERIODIC MONITORING

For the purpose of delivery of the aforesaid installation (erection, testing and commissioning) supervision services & progressive monthly billing by the contractor and release of payment thereof by BHEL, there shall be an action plan jointly agreed by BHEL and contractor. This action plan shall be drawn at the beginning of each quarter/each month/any convenient number of months as per actual project need. The plan shall detail the following aspects.

- Plan period (number of months planned).

- List of activities/targets to be carried out/achieved by the contractor under the scope of these installation (erection, testing and commissioning) supervision services in the defined plan period.

- Identification of necessary resources to be deployed by the contractor for delivery of the planned activities/targets in the defined plan period.

- Deciding on the break up of the assigned amount towards installation (erection, testing and commissioning) supervision services in the plan period for the purpose of monthly billing by contractor and payment by bhel.

4.42.4 PRICE AND STAGE PAYMENT

Contractor shall include the price for rendering complete installation (erection, testing and commissioning) supervision services in the various item rates as appearing in the rate schedule of price bid. Contractor shall not quote any separate item rate/price for installation (erection, testing and commissioning) supervision services in the rate schedule.

4.42.5 DEFICIENT/UNSATISFACTORY INSTALLATION SUPERVISION SERVICES & NOT RENDERING INSTALLATION SUPERVISION SERVICES

4.42.5.1

Contractor shall render the installation (erection, testing and commissioning) supervision services as per the jointly agreed plan and parameters thereof as described in “parameters and quantification of installation (erection, testing and commissioning) supervision services”. In case the contractor fails in delivering/ rendering these services partly or totally, either qualitatively or quantitatively in the concerned plan period, BHEL will take the following recourse.

- Deficient/unsatisfactory services:

In case the level/quality of installation supervision services is found not in compliance with the plan (either in terms of deficiency in quality or quantity or both, with regard to the mutually agreed/identified resources), BHEL will communicate the same to the contractor on record. Contractor shall immediately take corrective action to eradicate the complaint. BHEL will not make any payments for such period / number of days when services are found deficient/ unsatisfactory. Payment will be made for the period /number of days of satisfactory services on pro-rata basis as per the following formula.

$P = P_a \times D_s / D_m$, where

P = amount payable for rendering the installation supervision service satisfactorily in a billing month.

P_a = amount assigned towards the installation supervision service for the concerned month as per agreed plan.

D_s = number of equivalent days including Sundays and BHEL holidays of satisfactory services rendered in the particular billing month.

D_m = total number of days including Sundays and BHEL holidays in the particular billing month.

In addition to no payment for the unsatisfactory/deficient services period, a penalty @ 5% applied on the pro-rata amount of the deficient period i.e. 5% of (P_a – P) will be levied on the contractor. This penalty will be recovered from the running account bill of the same month.

4.42.5.2 **NOT RENDERING THE SERVICES AT ALL**

In the event, the contractor fails to render a particular service during the month (either part of the month or full) BHEL will not make any payment towards that service for such period. Additionally, a penalty @ 15% will be levied as under.

For no service in the entire month: 15% of the total monthly assigned amount.

For no services during part of the month: 15% of the pro-rata amount for the defaulting period as per formula given earlier here.

4.42.6 IRREVOCABLE **PENALTY AND DISALLOWED AMOUNT**

It shall be specifically noted that the payment disallowed for deficient or nil service in a particular month and/or penalties levied on similar ground, shall not be considered for release in any subsequent month even if the contractor takes corrective action in the later stage.

4.43 Exclusions

The following are specific exclusions from this work.

1. Attachment welding of thermocouple pads for boiler tube metal temperature measurement, flow nozzles and control valves.
2. Erection of valves, actuators along with valves, damper actuators along with dampers, burner tilt power cylinder, seal air dampers and scanner air emergency dampers. (However, SADC power cylinder erection is in the scope of the contractor)
4. Erection of electro hydraulic actuators, control valves.
5. Erection of control valves.

Note:

The aforesaid exclusions should not be construed as exhaustive. They are meant for general guideline. BHEL reserves the right to include or exclude any item which is required for completing the job as per rates indicated in rate schedule. Contractor should carry out all such jobs as per the instructions of BHEL engineer.

Special Conditions of Contract

Section-5

5.0 Obligations of the contractor

5.1.1

The list of tools and tackles, standard calibrating equipments proposed to be deployed for this work shall be submitted along with the tender (please refer Appendix-IIIA). It may be noted that the contractor is required to provide all necessary tools and plants, measuring/testing instruments, calibrating equipments and handling equipments for handling, erection, calibration, testing and commissioning of equipments covered in this scope in addition to those listed in Appendix-IIA. The contractor shall submit major T&P and instrument deployment plan as per Appendix-IVB.

5.1.2

All the tools and tackles, calibrating instruments etc to be deployed for this work shall have range and accuracy level prescribed by BHEL and shall have valid calibration from approved agencies to be specified by BHEL.

5.1.3

The contractor shall provide all the necessary steel scaffolding materials, temporary structures and necessary safety devices etc. during preassembly, calibration, erection, testing and commissioning of the equipment.

5.1.4

Contractor shall maintain and operate his tools, plants, calibrating instruments etc. in such a way that major breakdowns are avoided. In the event of major breakdown, the contractor shall make alternate arrangements expeditiously so that the progress of the work is not hampered.

5.1.5

In the event of contractor failing to arrange the required tools, plants, machineries, calibrating and testing equipments and non availability of the same owing to breakdown, or otherwise, BHEL will resort to hiring out the same from outside agencies or may provide their own equipment, if available or may resort to buying of equipment at the cost of the contractor. Full cost of equipment/hire charges/rental charges along with departmental overheads @ 30% will be charged to the contractor.

5.1.6

The T&P calibrating and testing equipments to be arranged by the contractor shall be in proper working condition. Their operation shall not lead to unsafe conditions.

5.1.7

The tenderers are requested to note that the tools and tackles and equipments and instruments which will be made available by BHEL free of hire charges on returnable basis are detailed in Appendix - IIA and it is the responsibility of the contractor to keep these equipments always in working condition and ensure their safe return in working condition to BHEL stores after completion of the job, subject to normal wear and tear. The material to be returned shall be supported by BHEL's prescribed form in triplicate which will contain details of the T&P returned. This form shall be got signed by BHEL's engineer who shall record the damage and deficiency if any, and the amount recoverable from the contractor on that account. The three copies of the filled up form

together with the equipment should be handed over to the stores in charge who will return one copy in token of having received the material/ equipment. Further since there will be more than one agency who will be working at site requiring the same T&P, the BHEL site engineer shall regulate the use of these BHEL equipments amongst the agencies and his decision in this regard will be final. All other tools and tackles as required for the completion of the work shall be arranged by the contractor.

5.1.8

Timely deployment and required quantity is the responsibility of contractor. Also he should be able to augment the erection equipments at short notice to match the planned programme every month and to achieve the milestone events.

5.1.9

Air compressor, blowers, etc., required for erection purpose like cleaning of panels, impulse pipes, equipments, and for any other incidental work wherein compressed air is required, shall be arranged by contractor.

5.2 Consumables

5.2.1

The contractor shall provide all consumables required for carrying out the work covered under this scope of work except those which are specifically indicated as BHEL supply. The consumables and items to be provided by BHEL free of charges are indicated in Appendix-IIB.

5.2.2

All consumables to be procured and used for the work shall have prior approval of BHEL in regard to brand, quality and specification. The list indicated in appendix-IIIB (consumables to be provided by the contractor) is only tentative. Any other consumables required for the satisfactory completion of work are to be arranged by contractor at his cost.

5.3 Electrodes and gases

5.3.1

The contractor shall provide all electrodes required for erection, etc. These are to be procured as per BHEL approved brand and quality.

5.3.2

All the required gasses like argon, oxygen, acetylene, liquid petroleum gas etc. will be provided by the contractor for the work covered under this scope.

5.3.3

All small fixtures of required quantity like bolts, nuts, washers etc. for fixing the instruments, clamps for dressing and clamping cables, impulse lines etc., Teflon tapes etc. required to complete the job as per good engineering practice and in all respects, shall be supplied by the contractor at his cost.

5.3.4

If at any time during the execution of work, it is noticed that the work is suffering on account of non availability of consumables from the contractor's side like electrodes, gases and other materials, then BHEL will make alternate arrangements and the necessary costs with overheads as per prevailing rate at that time will be recovered from the running bills of the contractor.

5.3.5 Welding Electrodes, Filler Wires for MIG/TIG Welding and Gases

5.3.5.1

Contractor at his cost shall arrange all the required welding electrodes as approved by BHEL. It shall be the responsibility of the contractor to obtain prior approval of BHEL, regarding manufacturer, type and brand name of welding electrodes etc. On receipt of the electrodes at site, it shall be subject to inspection and approval by BHEL regarding type of electrodes, batch number, date of expiry etc. Batch test certificates shall be made available to BHEL for verification & records.

BHEL reserves the right to reject the use of any electrodes, if found non-acceptable because of bad quality, deterioration in quality due to improper storage, shelf-life expiry, unapproved type/brand etc

5.3.5.2

All the required gases for welding and gas cutting like Oxygen, Acetylene, Argon (welding quality), Nitrogen etc. shall be arranged by the contractor at his cost.

5.3.5.3

If at any time during the execution of work, it is noticed that the work is suffering on account of non-availability of consumables from the contractor's side BHEL will make alternate arrangements at the risk and cost of contractor. The expenditure incurred with overheads will be recovered from the contractor.

5.3.5.4 TEST PIECES FOR WELDERS QUALIFICATION TEST.

Materials for Test Pieces for qualification of structural welders shall be supplied by the Contractor. Contractor shall also prepare the test coupons from such materials. All expenses in respect of welders' qualification test shall be to the contractors account.

5.3.5.5 WELDING PQR :

The Test weld Piece may be required to send to Govt / Customer approved Lab for Process Qualification for RT, NDT, Guide Bend Test, Tensile Test etc required for Welding Process Qualification. This is to be arranged by contractor within the quoted rates.

5.3.5.6

Field Quality Plan approved by BHEL and Customer, Erection / O&M Manual as well as drawings supplied by BHEL's Manufacturing unit shall be guidelines for executing the job.

5.4 Field office and stores

5.4.1
No office accommodation will be provided by BHEL. Only open space will be provided by BHEL free of cost for constructing contractor's office on a temporary basis.

5.4.2
The contractor shall make his own arrangements for field office with necessary equipments, tool room, clerical staff, storekeeper, watch and ward etc. for the execution of the work. After the completion of work, contractor shall dismantle the above structure and handover the vacant land to BHEL/customer.

5.4.3
Contractor shall establish instrument testing/calibration laboratory including test benches, instruments and adequate space for storage of instrument.

5.4.4
Contractor shall arrange for own fire fighting equipments for the materials stored under contractor's custody

5.5 Lighting

5.5.1
Permanent lighting inside the powerhouse is to be provided by BHEL/ the customer of BHEL. Till such time the permanent lighting arrangements are made, the contractor at his cost should arrange for temporary lighting. This arrangement is besides the local lighting that may be required for the execution of the work which shall also be arranged by the contractor.

5.5.2
Contractor shall arrange suitable flood lighting arrangements at various levels of power house for safety and proper working operations during night times and also in preassembly areas and his storage areas, during working hours.

5.5.3
All temporary wiring must comply with local regulations and will be subjected to engineer’s inspection and approval before connecting to supply point.

5.5.4
It shall be the responsibility of the contractor to provide, maintain the complete installation on the load side of the supply with due regard to the safety requirements at site. All cabling and installations shall comply in all respects with the appropriate statutory requirements.

5.6 Collection of materials

5.6.1
The contractor shall take delivery of equipments/instruments/ materials from the storage yard/stores/sheds of BHEL/customer. He shall also make arrangements for verification of equipment, safe custody, watch and ward of equipment after it has been handed over to him till these are fully erected, tested and commissioned and taken over by the customer. The contractor should 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.

5.6.2

The contractor shall handover all parts/materials remaining extra over the normal requirement with proper identification tags in a packed condition to BHEL stores. In case of any misuse or use over actual design requirement, BHEL reserves the right to 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.

5.7 Labour colony

5.7.1

BHEL/BHEL's client will be providing only the space for labour colony. Contractor shall make his own arrangements for accommodation with necessary facilities such as drinking water, sanitation and lighting etc for his workmen and the staff. The electricity for labour accommodation shall be on chargeable basis at the prevailing rats. Taxes, duties, levies over and above the rates etc shall also be born by the contractor. Also, the contractor has to make his own arrangement for transportation of his workmen and other employees. BHEL/client shall not provide any facility in this regard.

5.7.2

The contractor, in the event of his engaging 10 or more workmen must obtain independent licence under the contract labour (regulations and abolition) act 1970, from the concerned authorities based on the certificate (form-v) issued by the principal employer /customer.

5.7.3

Contractor will deduct the necessary amount from his employees towards provident fund and contribute equal amount as per government of India labour laws. This amount will be deposited by contractor regularly to the provident fund commissioner and get the account code. Contractor shall submit the account code duly certified by the PF commissioner to BHEL project incharge. Also all other employees' benefits to be borne by contractor as per the labour laws.

5.8 CONSTRUCTION POWER & WATER

5.8.1

Construction power (three phase, 415V/440V, 200 Amps, 4-wire) will be provided at one point near the site (approx 500 meters) free of charge. However all taxes, duties, levies, charges etc, as applicable, shall be borne by the contractor. Accordingly, required energy meter, all cables, fuses, distribution boards, switches, switchboards, bus bars, earthing arrangements, protection devices e.g. ELCB, if any, and any other installation as specified by Statutory Authority, Client in this regard, for drawl of construction power shall be arranged by the contractor. Obtaining approvals, payment of necessary fees, duties etc towards the clearance of such installations, if any, prior to these being put to use or as may be specified, shall be the responsibility of the contractor.

5.8.2
It shall be the responsibility of the contractor to provide, maintain the complete installation on the load side of the supply with due regard to the safety requirements at site. All cabling and installations shall comply in all respects with the appropriate statutory requirements. The installation and maintenance of this shall be done by licensed and experienced Electrician.

5.8.3
The Customer will provide water for Construction purpose at a single point free of charge. However, Taxes, Duties, Levies, charges if any shall be borne by the contractor. All arrangements for further distribution beyond this point have to be made by contractor.

5.8.4
In case of non-availability of customer supplied power, it is the responsibility of the contractor to make alternative arrangements. Contractor shall be adequately equipped to arrange standby diesel welding generators in the event of construction power failure. Essential welding jobs shall not be stopped on account of main construction power failure.

5.8.5
BHEL is not responsible for any loss or damage to the contractor's equipment as a result of variations in voltage or frequency or interruptions in power supply. Contractor shall take suitable insurance policy for such accidental loss/ damages.

5.8.6
Contractor shall be well equipped with Back-up Power Supply arrangement like Diesel Generating set and Diesel operated welding machine etc. to tackle situations arising due to failure of construction power, so as to ensure continuity and completion of critical processes that are underway at the time of power failure or important activities planned in immediate future.

5.9 RESPONSIBILITIES WITH REGARD TO LABOUR EMPLOYMENT ETC.

5.9.1
Refer clause 2.8 of General Conditions of Contract in this regard.

5.9.2
Contractor shall also comply with the requirements of local authorities/ project authorities calling for police verification of antecedents of the workmen, staff etc.

5.9.3
BHEL / customer may insist for witnessing the regular payment to the labour. They may also like to verify the relevant records for compliance with statutory requirements. Contractor shall enable such facilities to BHEL / customer.

5.9.4
It is the responsibility of the contractor to arrange gate pass for all his employees, T&P etc for entering the project premises. Necessary coordination with customer officials is the responsibility of the contractor. Contractor to follow all the procedures laid down by the customer for making gate passes. Where permitted, by customer / BHEL, to

work beyond normal working hours, the contractor shall arrange necessary work permits for working beyond normal working hours.

5.9.5

Contractor shall provide at different elevation suitable arrangement for urinal and drinking water facility with necessary plumbing & disposal arrangements including construction of septic tank. These installations shall be maintained in hygienic condition at all times.

5.9.6

If at any time during the execution of work, it is noticed that the work is suffering on account of non-availability/shortfall in provision of resources from the contractor's side BHEL will make suitable alternate arrangements at the risk and cost of contractor. The expenditure incurred with overheads thereby shall be recovered from the contractor.

5.10 Taxes, Duties, Levies

5.1

Refer to Clause 2.8.4 of General Conditions of Contract. Notwithstanding anything contained therein, the following provisions shall be applicable for this contract.

5.1.1

The contractor shall pay all (save the specific exclusions as enumerated in this contract) taxes, fees, license charges, deposits, duties, tools, royalty, commissions or other charges which may be levied on the input goods & services consumed and output services delivered in course of his operations in executing the contract. In case BHEL is forced to pay any of such taxes, BHEL shall have the right to recover the same from his bills or otherwise as deemed fit.

5.1.2 Service Tax & Cess on Service Tax

Service Tax and Cess on Service Tax as applicable on output Services are excluded from contractor's scope; therefore contractor's price/rates shall be **exclusive** of Service Tax and Cess on Output Services. In case, it becomes mandatory for the contractor under provisions of relevant act/law to collect the Service Tax & Cess from BHEL and deposit the same with the concerned tax authorities, such applicable amount will be paid by BHEL. Contractor shall submit to BHEL documentary evidence of Service Tax registration and remittance record of such tax immediately after depositing the tax with concerned authorities. Contractor shall obtain prior written consent from BHEL before billing the amount towards such taxes.

With introduction of Cenvat Credit Rules 2004, which came into force w.e.f. 10.09.2004, Excise Duty paid on Input Goods including Capital Goods and Service Tax paid on Input Services that are used for providing the output services can be taken credit of against the Service Tax payable on output services. However BHEL may opt for availing the abatement provision in which case cenvat credit may not be available on input duty.

5.1.3 VAT/WCT

As regards Sales Tax on transfer of property in goods involved in Works Contract applicable as per local laws, the price quoted by the contractor shall be **exclusive** of the same. Where such taxes are required to be paid by the contractor, this will be reimbursed on production of proof of payment made to the authorities by the Contractor. In any case the Contractor shall register himself with the respective Sales Tax authorities of the state and submit proof of such registration to BHEL along with the first RA bill. The contractor has to take all necessary steps to **minimize tax on input goods** by purchasing the materials from any registered dealer of the concerned state only. In case contractor opts for composition, it will be with the prior express consent of BHEL. Deduction of tax at source shall be made as per the provisions of law unless otherwise found exempted. In case tax is deducted at source as per the provisions of law, this is to be construed as an advance tax paid by the contractor and no reimbursement thereof will be made unless specifically agreed to.

5.1.4 Modalities of Tax Incidence on BHEL

Wherever the relevant tax laws permit more than one option or methodology for discharging the liability of tax/levy/duty, BHEL will have the right to adopt the appropriate one considering the amount of tax liability on BHEL/Client as well as procedural simplicity with regard to assessment of the liability. The option chosen by BHEL shall be binding on the Contractor for discharging the obligation of BHEL in respect of the tax liability to the Contractor.

5.1.5 New Taxes/Levies

In case the Government imposes any new levy/tax on the output service/ goods/work after award of the contract, the same shall be reimbursed by BHEL at actual.

In case any new tax/levy/duty etc. becomes applicable after the date of Bidder's offer, the Bidder/Contractor must convey its impact on his price duly substantiated by documentary evidence in support of the same **before opening of Price Bid**. Claim for any such impact after opening the Price Bid will not be considered by BHEL for reimbursement of tax or reassessment of offer.

No reimbursement/recovery on account of increase/reduction in the rate of taxes, levies, duties etc. on input goods/services/work shall be made. Such impact shall be taken care of by the Price Variation/Adjustment Clause (PVC) if any. In case PVC is not applicable for the contract, Bidder has to make his own assessment of the impact of future variation if any, in rates of taxes/duties/ levies etc. in his price bid.

5.11 Submission of Periodical Reports

- Contractor shall submit periodical reports in respect of following aspects of operation:
- Consumption of welding electrodes and gases
- Consumption of construction power
- Availability and utilization of BHEL's cranes
- Manpower reports
- Progress reports - periodically
- Field calibration reports

BHEL at site will suggest formats for these reports.

5.11.1
It is the responsibility of the contractor to arrange gate pass for all his employees, T&P etc. Necessary coordination with customer officials is the responsibility of the contractor. Contractor to follow all the procedures lay down by the customer for making gate passes. Where permitted, by customer/ BHEL, to work beyond normal working hours, the contractor shall arrange necessary work permit for working beyond normal working hours.

5.12 ELECTRICAL INSPECTORATE'S APPROVAL /STATUTORY INSPECTION

5.12.1
Contractor shall have/obtain valid Electrical Contractors License to carry out the Erection, Testing & Commissioning work on High/Low Voltage Electrical Equipments from the appropriate statutory authority of the concerned state or Central Electricity Authority, as the case may be. All fees and other related expenses in this regard shall be in the contractor's account.

5.12.2
Contractor shall arrange inspection of concerned Statutory Authority for the installation, testing & commissioning of High / Low voltage equipments covered under the scope of work in this tender specification and obtain their approval in appropriate format prior to charging of the equipments.

5.12.3
Contractor shall be responsible for all necessary liasioning work with Statutaory Authority towards the certification of installation / works. BHEL will pay Statutory Fees in respect of inspection of installations as per demand note/challan issued by the statutory authority. All other expenses shall be borne by the Contractor. BHEL/ BHEL's Customer shall be providing technical assistance, drawing & document for submission to Statutory Authority. Contractor shall provide all logistics services in this regard.

Special conditions of Contract

Section-6

6.0

Contractor's obligation in regard to employment of engineers, supervisory staff and workmen

6.1 Supervisory staff and labour

6.1.1

The contractor shall supply all the skilled labour and high pressure welders, carbon and alloy steel welders, gas cutters, riggers, sarangs, erectors, instrument fitters electricians, instrument technicians, instrument calibrators, etc. in addition to other skilled, semiskilled and unskilled labour required for all the work of handling and transporting from site, storage at erection site, calibration, erection, testing and commissioning and all other works envisaged in this tender. Only fully trained and competent men with previous experience on the job shall be employed. They shall hold valid certificates wherever necessary. BHEL reserves the right to decide on the suitability of the workers and other personnel who will be employed by the contractor. BHEL reserves the right to insist on removal of any employee of the contractor at any time if he is found to be unsuitable and the contractor shall forthwith remove him. Contractor should furnish the list of personnel proposed to be deployed for this job along with their qualification, experience
In similar type of job. The actual deployment will be so as to satisfy the erection and commissioning targets set by BHEL. The contractor shall give an organisation chart indicating the staffing pattern for the work. Each area shall be adequately supported by supervisors. This is only for guidance. During execution of work if any area needs extra attention, contractor shall post engineers/supervisors/ skilled/semiskilled/unskilled workers as per the advise of BHEL engineer. Contractor shall submit his manpower deployment plan as per appendix-IVA.

6.1.2

Any sort of subcontracting/subletting of the work awarded, by the contractor is strictly prohibited.

6.1.3

If at any time, it is found that the contractor is not in a position to deploy the required workmen due to any reason, BHEL shall have the option to deploy their workmen or make alternate arrangements at the contractor's risk and cost. The expenditure incurred with overhead on this account will be recovered from the contractor's bills.

6.1.4

It is the responsibility of the contractor to engage his workmen in shifts and or on overtime basis for achieving the target set by BHEL. This target may be set to suit BHEL's commitments to its customer or to advance date of completion of events or due to other reasons. The decision of BHEL in regard to setting the erection targets will be final and binding on the contractor.

6.1.5

Contractor shall employ only qualified and experienced engineers/supervisors for this job. They shall have professional approach in executing the work having adequate

knowledge and experience in the fields of erection, erection methodology, calibration, testing and commissioning, quality control and quality assurance procedures, planning, safety etc. required to undertake the type of work as per this tender.

6.2 Safety aspects at site

6.2.1

The safety engineer/supervisor of contractor shall coordinate all aspects connected with this work. He shall be aware of the safety procedures, use of safety equipment, safe rigging and also in a position to enforce strict safety at site. He shall coordinate with the various contractors' engineers, supervisors working gangs to enforce safe working procedures, he shall also coordinate the timely arrangement of work permits required for hot works and cold works. He should be trained and qualified to give proper guidance and direction to other supervisors and workers. He shall also submit weekly accident report in the format required by BHEL.

6.3 Industrial relations and labour laws

6.3.1

An industrial relations supervisor shall coordinate for the implementation of local labour laws, maintenance of records as required by contract labour (regulation and abolition) act and also coordinate with the local labour authorities.

6.3.2

In case at any time the contractor is not in a position to deploy the required engineer/supervisors due to any reason, BHEL shall have the option to deploy their engineers/supervisors. The expenditure incurred with overheads on this account will be recovered from the contractor's bills.

6.3.3

The contractor’s supervisory staff shall execute the work in the most substantial and workmanlike manner in the stipulated time. Accuracy of work and aesthetic finish are essential part of this contract. They shall be responsible to ensure that the assembly and workmanship conform to dimensions and tolerances given in the drawings/ instructions given by BHEL engineer from time to time.

6.3.4

The supervisory staff employed by the contractor shall ensure proper outturn of work and discipline on the part of the labour put on the job by the contractor and in general, see that the works are carried out in a safe and proper manner in coordination with other labour and staff employed directly by BHEL or other contractors of BHEL or BHEL's client.

6.4 Watch and ward

Contractor has to arrange and provide watch and ward round the clock. Any theft or damage of component due to negligence of the contractor will have to be replaced/repaired by the contractor. The areas are unit control room, field and any other place where equipments are kept (stored or installed) by the contractor.

6.5 Proposed site organisation chart for erection/commissioning.

Contractor to provide necessary engineers and supervisors for the work and they shall have adequate experience in similar type of work. Adequate staffing shall be provided by contractor in the following areas:-

- Overall co-ordination planning & execution
- Boiler & aux. C&I erection / commissioning
- Electrical equipments (other than bus ducts) erection / commissioning
- Bus ducts erection and commissioning
- Turbo-generator and aux. C&I erection / commissioning
- Station C&I
- Instrument calibration
- Quality control
- Safety
- Planning, review, monitoring & reporting
- Industrial relations
- Material management, material identification, transport, storage & supervision.

Contractor shall deploy separate in charge for erection & commissioning for the above mentioned areas. Contractor shall give an organization chart indicating the staffing pattern for the above purpose. The engineer in each area shall have adequately supported by supervisors.

The above areas are indicated for guidance. During erection of work if any area needs extra attention, contractor shall post engineers/supervisors accordingly.

6.5.1

Contractor shall provide alongwith the offer, names and details of the engineers/supervisors supposed to be deployed

6.5.2

Contractor should provide a team of engineers with proven experience in microprocessor based DDC systems with regards to the software as well as hardware. They should be in a position to undertake specific assignments during the start up / post start up situation of above system as per the instruction of BHEL engineer. Contractor has to provide names of the engineers with their bio data for the scrutiny of BHEL.

6.5.3

Planning - Contractor shall have his own planning cell headed by planning engineer. He shall work out the physical erection target area wise for his engineers and also plan the achievements for milestone events. He shall also monitor the input like T&P, materials, manpower, deployment position of the various working gangs. He shall furnish all the details required by BHEL as per the relevant contract clauses.

Special conditions of Contract

Section-7

7.0 Obligations of BHEL

7.1 Facilities provided by BHEL

7.1.1 Space

Please see Section 5

7.1.2 Water

Please see Section 5

7.1.3 Electricity

Please see Section 5

7.1.4

BHEL is not responsible for any loss or damage to the contractor's equipment as a result of variations in voltage or frequency or interruptions in power supply.

7.1.5

Sufficient quantity of test plates and pipe pieces as considered adequate for testing contractor's welders will be supplied by BHEL free of cost. All other expenses in conducting the test shall be borne by contractor.

7.2 Equipment and tools

7.2.1

BHEL will make available free of charges equipment indicated in appendix-IIA after assessing the requirement on day-to-day basis. The services of these equipment will have to be shared along with other contractors working at site.

7.2.2

In case of break down of equipments listed in appendix-IIA for any reason, the contractor should make his own alternative arrangements to meet the work requirements. No extra claim will be entertained on this account. However, if the equipments listed in appendix-IIA are not made available to the contractor for more than 30 days continuously, he will be compensated at mutually agreed rates provided breakdown has not been caused due to his fault and alternative arrangements have been made by him.

7.2.3

All other special tools which are supplied by BHEL as part of maintenance tools under regular DU/DESS numbers in various product groups will be spared free to contractor and contractor shall return them after the completion of the specific work for which the tools were spared, in good working order.

7.2.4

Operation, daily maintenance, breakdown maintenance, replacement in case of damage etc. due to negligence of the contractor for equipments listed under appendix-IIA, will have to be done by the contractor at his cost. Only major spare parts for

replacement shall be provided by BHEL free of cost if the cause for replacement is not attributable to contractor or if it is due to normal wear and tear.

7.2.5
The contractor must not use these equipments for purposes other than the scope of work given in this tender. Misuse, if any, will result in penalty.

7.2.6
All the above equipments issued to contractor will be inspected periodically by BHEL engineer. In case contractor fails to make good the damages caused, BHEL will do the same at contractor's cost.

7.2.7
If the above items issued to contractor are found not utilised/not maintained to the satisfaction of BHEL engineer or misused, these will be withdrawn and no replacement will be done for such items.

7.2.8
Non-availability of these equipments due to break-down maintenance or any other reason will not be the cause for claiming extension of time.

Special conditions of Contract

Section-8

8.0 Quality control and quality assurance

8.1.1

BHEL gives lot of importance for this function. Contractor's engineers and supervisors shall be adequately qualified and inclined to do a quality job. The quality assurance engineer shall coordinate all aspects of quality control, inspection, implementation of quality assurance procedures laid down by BHEL. He shall also fill up all the quality assurance log sheets and submit for BHEL/customer for joint inspection and acceptance. Total quality is the watch ward of the work and contractor shall strive to achieve the quality standards/procedures laid down by BHEL. He shall follow all the instructions as per BHEL drawings and quality standards.

8.1.2

All the electrical/mechanical, testing, calibrating and all other measuring equipments/instruments for checking, testing, calibrating the equipments under the scope of this work shall be provided by contractor (refer clause 5.1.1).

8.1.3

All these instruments/equipments/gauges/tools etc. provided by the contractor shall be of brand, quality and accuracy specified by BHEL engineer and should have necessary calibration and other certificates as per the requirement of BHEL engineer. Decision of BHEL engineer regarding acceptance or otherwise of the measuring instruments/gauges/tools for the work under this specification, is final and binding on the contractor.

8.1.4

It is the responsibility of the contractor to prove the accuracy of the testing/ measuring/calibrating equipments brought by him based on the periodicity of calibration as called for in the BHEL's quality assurance standards/BHEL engineer's instructions.

8.1.5

Apart from day-to-day inspection by BHEL engineers stationed at site and also by BHEL's customer engineers, stage inspection of equipments etc. under calibration, erection, testing and commissioning at various stages by teams of engineers from field engineering services of BHEL's manufacturing units and quality assurance teams from field quality assurance unit/factory quality assurance unit of BHEL will also be conducted. Contractor shall arrange all labour, tools and tackles etc. for such stage inspection.

8.1.6

Any re-laying or re-termination of cables/re-erection of instruments/ recalibration of instruments etc. required due to contractor's mistake or design requirement and found at any stage inspection, shall be carried out by the contractor at no extra cost.

8.1.7
Total quality is the watch word of the work and contractor shall strive to achieve the quality standards, procedures laid down by BHEL. He shall follow all the instructions as per BHEL drawings and quality standards. Contractor shall provide for the services of quality assurance engineer as per the relevant clauses.

8.1.8
The welders' performance will be reviewed from time to time as per BHEL/IBR standards and welders not performing to the standards of BHEL/IBR will be removed from working. Contractor shall arrange for alternative welders immediately.

8.1.9
All the welders including HP welders shall carry identity cards as per the proforma prescribed by BHEL. Only welders duly authorised by BHEL shall be engaged on the work.

8.1.10
Stage inspection by QA engineers : Apart from day-today inspection by BHEL engineers stationed at site and also by customer engineers, stage inspection of the equipments under erection & commissioning at various stages of erection and commissioning by teams of engineers from field quality assurance will also be conducted. All necessary inputs required for such stage inspection shall be arranged by contractor free of cost.

Any modifications suggested by QA engineers shall be carried out.

Any minor modification/repairs of defective work found during stage inspection shall be rectified free of cost by contractor.

Any major rectification or in case of repairs/re-work of defective work found during stage inspection, but not attributable to the contractor shall also be carried out. Claims of contractor if any, shall be governed as per the clauses in section 13.

8.2 Statutory inspection

8.2.1
The scope includes getting the approvals from the statutory authorities. This includes arranging for inspection visits of electrical inspector periodically as per BHEL engineer's instructions, submitting documents etc. and following up the matter with them as and when necessary for the work involved in this scope.

8.2.2
All fees connected with the contractors for testing his welders/ men/workers and testing, inspection, calibration of his instruments and equipments, shall be paid by the contractor. It shall be contractor's responsibility to obtain approval of statutory authorities wherever applicable, for conducting of any work which comes under the purview of these authorities.

SECTION-9

SPECIAL CONDITIONS OF CONTRACT

Safety, Occupational Health and Environmental Management

BHEL PSWR has been certified for Environmental Management under ISO 14001:1996 standard and Occupational Health & Safety under OHSAS 18001 by DNV. In order to comply with the above standards, it shall be the endeavour of BHEL and all its subcontractors to meet and implement the requirements by following the guidelines issued under Environmental, Occupational Health and Safety Management (EHS) manual a copy of which will be available with the BHEL Site-in-charge.

Contractor shall also enter into a "Memorandum of Understanding" as given in clause 9.9 in case of award of contract.

9.0 Responsibility of the Contractor in Respect of Safety of Men, Equipment, Material and Environment.

9.1 The Contractor Shall

9.1.1

Abide by the Safety Regulations applicable for the Site/Project and in particular as mentioned in the booklet "Safe Work Practices" issued by BHEL. Contractors are also to ensure that their employees and workmen use safety equipments as stipulated in the Factories Act (Latest Revision) during the execution of the work. Failure to use safety equipment as required by BHEL Engineer will be a sufficient reason for issuance of memo, which shall become part of Safety evaluation of the contractor at the end of the Project. Also all site work may be suspended if it is found that the workmen are employing unsafe working practice and all the costs/losses incurred due to suspension of work shall be borne by contractor. A comprehensive list of National Standards from which the contractor can draw references for complying with various requirements under this section is given under 9.10

9.1.2

Hold BHEL harmless and indemnified from and against all claims, cost and charges under Workmen's Compensation Act 1923 and 1933 and any amendment thereof and the contractor shall be solely responsible for the same.

9.1.3

Abide by the Procedure governing entry/exit of the contractor's personnel within the Customer/Client premises. All the contractors employees shall be permitted to enter only on displaying of authorized Photo passes or any other documents as authorised by the Customer/Client

9.1.4

Be fully responsible for the identity, conduct and integrity of the personnel/workers engaged by them for carrying out the contract work and ensure that none of them are ever engaged in any anti national activity

9.1.5

Prepare a signboard giving the following information and display it near work site:

I Name of Contractor
II Name of Contractor Site-in-charge & Telephone number
III Job Description in short
IV Date of start of job
V Date of expected completion
VI Name of BHEL Site-in-charge.

9.1.6
Abide by the rules and regulations existing during the contract period as applicable for the contractors at the Project premises.

9.1.7
Observe the timings of work as advised by BHEL Engineer-in-charge for carrying out the contract work.

9.2 SPECIAL CONDITIONS

9.2.1 Safety

9.2.1.1 Safety Plan

Before commencing the work, contractor shall submit a "safety plan" to the authorized BHEL official. The safety plan shall indicate in detail the measures that would be taken by the contractor to ensure safety to men, equipment, material and environment during execution of the work. The plan shall take care to satisfy all requirements specified hereunder.

The contractor shall submit "safety plan" before start of work. During negotiations, before placing of work order and during execution of the contract, BHEL shall have right to review and suggest modifications in the safety plan. Contractor shall abide by BHEL's decision in this respect.

9.2.1.2
The contractor shall take all necessary safety precautions and arrange for appropriate appliances and/or as per direction of BHEL or it's authorized person to prevent loss of human lives, injuries to men engaged and damage to property and environment.

9.2.1.3
The contractor shall provide to his work force and also ensure the use of Personnel Protection Equipment (PPE) as found necessary and/or as directed and advised by BHEL officials without which permission is liable to be denied.

- Safety helmets conforming to IS 2925/1984 (1990)
- Safety belts conforming to IS 3521/1989
- Safety shoes conforming to IS 1989 part-II /1986(1992)
- Eye and face protection devices conforming to IS 2573/1986(1991), IS 6994 (1973), part-I (1991), IS 8807/1978 (1991), IS 8519/1977(1991).
- Other job specific PPE of standard ISI make as may be prescribed

9.2.1.4
All tools, tackles, lifting appliances, material handling equipment, scaffolds, cradles, cages, safety nets, ladders, equipment, etc used by the contractor shall be of safe design and construction. These shall be tested and certificate of fitness obtained

before putting them to use and from time to time as instructed by authorised BHEL official who shall have the right to ban the use of any item found to be unsafe.

9.2.1.5
All electrical equipment, connections and wiring for construction power, its distribution and use shall conform to the requirements of Indian Electricity Act and Rules. Only electricians licensed by the appropriate statutory authority shall be employed by the contractor to carryout all types of electrical works. All electrical appliances including portable electric tools used by the contractor shall have safe plugging system to source of power and be appropriately earthed.

9.2.1.6
The contractor shall not use any hand lamp energised by electric power with supply voltage of more than 24 volts. For work in confined spaces, lighting shall be arranged with power source of not more than 24 volts.

9.2.1.7
The contractor shall adopt all fire safety measures as per relevant Indian Standards

9.2.1.8
Where it becomes necessary to provide and/or store petroleum products, explosives, chemicals and liquid or gaseous fuel or any other substance that may cause fire or explosion, the contractor shall be responsible for carrying out such provisions and/or storage in accordance with the rules and regulations laid down by the relevant government acts, such as petroleum act, explosives act, petroleum and carbides of calcium manual of the chief controller of explosives, Government of India etc. The contractor in all such matters shall also take prior approval of the authorised BHEL official at the site.

9.2.1.9
Proper means of access must be used e.g. ladders, scaffolds, platforms etc. No makeshift access such as oil drums or pallets shall be used. Design of these will be in accordance with relevant standards and certified by competent persons before use.

9.2.1.10
Temporary arrangements made at Site for lifting, platforms, Approach access etc should be
properly designed and approved before being put to use.

9.2.1.11
All excavations and openings must be securely and adequately fenced/ barricaded and warning signs erected when considered necessary as per relevant code of practice.

9.2.1.12
No persons shall remove guard rails, covers or protective devices unless authorised by a responsible supervisor and alternative precautions have been taken

9.2.1.13
Access ways, means of escape and fire exits shall be clearly marked, kept clear and unobstructed at all times

9.2.1.14
Only authorised persons holding relevant license will drive and operate site plant and equipments e.g. cranes, dumpers, excavators, transport vehicles etc

9.2.1.15
Only authorised personnel are allowed to repair, commission electrical equipments.

9.2.1.16
Gas cylinders shall be handled and stored as per Gas Cylinder Rules and relevant safe working practices

9.2.1.17
All wastes generated at Site shall be segregated and collected in a designated place so as to prevent spillage/contamination/scattering at Site, until the waste is lifted for disposal to designated disposal area as advised by BHEL official.

9.2.1.18
The contractor shall arrange at his cost (wherever not specified) appropriate illumination at all work spots for safe working when natural day light is not adequate for clear visibility.

9.2.1.19
The contractor shall train adequate number of workers/supervisors for administering "FIRST AID". List of competent first aid administers should be prominently displayed.

9.2.1.20
The contractor shall display at strategic places and in adequate numbers the following in fluorescent markings

- Emergency telephone numbers
- Exit, Walkways
- Safe working load charts for wire ropes, slings, D shackles etc
- Warning signs

9.2.1.21
The contractor shall be held responsible for any violation of statutory regulations (local, state or central) and BHEL instructions that may endanger safety of men, equipment, material and environment in his scope of work or other contractors or agencies. Cost of damage, if any, to life and property arising out of such violation of statutory regulations and BHEL instructions shall be borne by the contractor.

9.2.1.22
In case of a fatal or disabling injury/accident to any person at construction sites due to lapses by the contractor, the victim and/or his/her dependents shall be compensated by the contractor as per statutory requirements. However, if considered necessary, BHEL shall have the right to impose appropriate financial penalty on the contractor and recover the same from payments due to the contractor for suitably compensating the victim and/or his/her dependents. Before imposing any such penalty, appropriate enquiry shall be held by BHEL giving opportunity to the contractor to present his case.

9.2.1.23
In case of any damage to property due to lapses by the contractor, BHEL shall have the right to recover cost of such damages from payments due to the contractor after holding an appropriate enquiry.

9.2.1.24
In case of any delay in the completion of a job due to mishaps attributable to lapses by the contractor, BHEL shall have the right to recover cost of such delay from payments due to the contractor after notifying the contractor suitably and giving him opportunity to present his case.

9.2.1.25
If the contractor fails to improve the standards of safety in its operation to the satisfaction of BHEL after being given a reasonable opportunity to do so, and/or if the contractor fails to take appropriate safety precautions or to provide necessary safety devices and equipment or to carry out instructions regarding safety issued by the authorised BHEL official, BHEL shall have the right to take corrective steps at the risk and cost of the contractor after giving a notice of not less than seven days indicating the steps that would be taken by BHEL.

Emergency Response

BHEL will have an Emergency Response Plan for each Project Site in consultation with the Owner as the case may be, detailing the procedure for mobilisation of personnel and equipment, and defining the responsibilities of the personnel indicated, in order to prepare for any emergency that may arise in order to ensure the priorities of

- Safeguard of life
- Protect assets under construction or neighboring
- Protect environment
- Resumption of normal operations as soon as the emergency condition is called off

All Contractors shall also be part of the Emergency response Plan and the personnel so nominated shall be aware of their duties and responsibilities in an emergency response situation.

9.2.1.27
At least 5% Contractors supervisors and workmen shall undergo training in administering 'First Aid'. The trained persons should represent for all categories of work and for all areas of work. Adequate number of trained persons should be available for each shift. These first-aiders shall be included in the emergency response team. Contractor employees and workmen are encouraged to participate in first aid training programmes whenever organised by BHEL.

9.2.2 OCCUPATIONAL HEALTH

9.2.2.1
Specific occupational health hazards will be identified through the hazard evaluation processes in consultation with BHEL engineers and the necessary prevention/ reduction/elimination methods implemented.

9.2.2.2
All personnel working in an activity with a potential risk to health shall be made aware of all those risks and the actions they must take to reduce/control/eliminate the risk.

9.2.2.3
Safety coordinator shall conduct periodic checks to ensure that every group of workers engaged in similar activities are aware of potential risks to health and the actions required to be taken to mitigate the risk

9.2.2.4
In order to protect personnel from associated health hazards, the following main areas will be focused

- Issue of approved Personnel Protective Equipment
- Verification that the PPE are adequate/maintained and worn by all staff involved in operations that are potentially hazardous to their health
- Ensure that the personnel deployed are physically fit for the operation/work concerned
- Provide hygienic and sanitary working conditions

9.2.2.5
Contractor workers employees engaged in noise risk areas shall be issued with hearing protection aids and the use of the same will be enforced. Further, these workers will be educated on the hazards of noise

9.2.2.6
Contractor workers engaged in dust environment shall be issued with necessary dust protection aids and the use of the same shall be enforced

9.2.2.7
Workers engaged in exposure to bright light/rays as in welding or radiation shall be issued with eye protection devices and the use of the same shall be enforced

9.2.2.8
Adequate arrangements shall be made to provide safe drinking water

9.2.2.9
Health monitoring records on at least sample basis for contractor employees & workmen shall be maintained for persons engaged in specified categories of work. These shall include

- Noise induced hearing loss
- Lung Function test
- Ergonomic Test
- Eye Test for Welders, Grinders, Drivers etc

9.2.3 **HYGIENE and HOUSEKEEPING**

9.2.3.0
Good house keeping and proper hygiene is one of the key requirements of Occupational Health Safety and Environment management. Towards this the

contractor shall encourage his workers and supervisors to maintain cleanliness in their area of work.

9.2.3.1
The Contractor shall arrange to place waste bins/chutes at convenient locations for the collection of scrap and other wastes. The bins shall be clearly marked and segregated for metal, non-metal, hazardous and non hazardous wastes.

9.2.3.2
BHEL may take up appropriate remedial measures at the cost of the contractors if the contractors fail good house keeping and if there is an imminent risk of pollution

9.2.4 ENVIRONMENT MANAGEMENT

9.2.4.1
BHEL has a sound environmental management system, which is to be maintained and implemented by all the contractors. The system allows for project specific objectives to be set and developed sensitive to client requirements, applicable environmental legislation and BHEL's own objectives and policy. BHEL engineers will assess and monitor the environmental impact of their work and lay out objectives for their minimization. The contractors shall implement the objectives for continual improvement of environmental performance. BHEL shall regularly audit environmental impacts and their improvements.

9.2.4.2 WASTE MANAGEMENT

9.2.4.2.1
The objective of waste management is to ensure the safe and responsible disposal of waste, ensuring that it is correctly disposed of and being able to audit the process to ensure compliance.

9.2.4.2.2
Chemical wastes if any shall be collected separately and disposed of to BHEL designated refuse yard as per BHEL advice

9.2.4.2.3
No dangerous chemicals, noxious waste products or materials will be disposed off on or off site without approval obtained through BHEL.

9.2.4.2.4
All disposal of wastes generated during construction shall be in accordance with all relevant legislation.

9.2.4.3.1
Acid and alkali cleaning wastes shall be neutralized to acceptable norms before disposal to the designated area.

9.2.4.3.2
All necessary measures shall be taken to ensure safe collection and disposal of waste oils. In particular to ensure the prevention of their discharge into surface waters, ground waters, coastal waters or drainages

9.3 SUPERVISION
9.3.1

Contractor must provide at least one full time on site safety coordinator when the manpower engaged is in excess of 50 for the contract activities in the premises. If the manpower is less than 50, the on site safety coordination responsibilities shall be assumed by any one of the contractor's other supervisory staff; however in both the cases, the contractor must specify in writing the name of such persons to the BHEL Engineer in Charge.

9.3.2

Contractor's safety coordinator or his supervisor responsible for safety as the case may be shall conduct at his work site, and document formal safety inspection and audits at least once in a week. Such documents are to be submitted to BHEL Engineer in Charge for his review and record

Contractor, supervisor must attend all schedule safety meetings as would be intimated to him by the BHEL Engineer in Charge.

9.3.3

Before starting work under any contract, the contractor must ensure that a job specific safety procedures/field practices as required over and above the safety permit conditions are prepared and followed .He should also ensure that all supervisors and workers involved understand and follow this procedures /field practices.

9.3.4
Contractor must ensure that in his work site appropriate display boards are put displaying signs for site safety, potential hazards and precautions required.

9.4.0 **TRAINING & AWARENESS**

9.4.1
Contractor shall deploy experienced supervisors and other manpower who are well conversant with the safety and environment regulations of the Project. The electricians to be deployed on the job should have wireman license.

9.4.2
All Supervisors & Workmen of the Contractor shall undergo Fire safety training/ demonstration whenever arranged by BHEL with the help of either Customer's Fire and Safety department or outside faculty so as to acquire knowledge of fire prevention and also to be able to make use of appropriate fire extinguishers.

9.4.3
Contractor must familiarize himself from BHEL Engineer in Charge about all known potential fire, explosion or toxic release hazards related to the contract. He in turn will ensure that same information has been passed to the supervisors and workmen

9.4.4
Contractor must ensure that all his supervisors are properly trained and each employee has received and understood from his supervisor necessary training and briefing about the safety requirement. Necessary document as a means to verify that employees have understood the training is to be maintained.

9.4.5
The contractor supervisors shall also give a small safety briefing to all the workmen under his charge before undertaking any new work and specially understand the safety requirements that are mandatory

9.5.0 **REPORTING**

9.5.1
The contractor shall submit report of all accidents, fires and property damage, dangerous occurrences to the authorised BHEL official immediately after such occurrence but in any case not later than twelve hours of the occurrence. Such report shall be furnished in the manner prescribed by BHEL and also to meet statutory requirement.

9.5.2
Any injury sustained by any of the contractor's employees within the Project premises must be reported to BHEL supervisor and FIRST AID should be immediately administered. The Contractor shall be responsible for keeping and maintaining proper records of Accidents to his personnel.

9.5.3
Contractor must arrange to immediately investigate, properly document and report any injury, accident or near miss involving any of his employees and take appropriate follow up action. He must furnish within 12 hours of the incident a written report to BHEL Engineer in charge and the Safety Section.

9.5.4
According to the Factory Act and the Employees state Insurance Act & regulation, any person sustaining any injury within the project premises and absenting himself from work for more than 46 hours, his accident report has to be sent to the respective Government Authorities. Therefore contractor shall inform the owner's representative such matter immediately for their needful action.

9.5.5
In addition, contractor shall submit periodic reports on safety to the authorized BHEL official from time to time as prescribed.

9.5.6
Before commencing the work, the contractor shall appoint/nominate a responsible officer to supervise implementation of all safety measures and liaison with his counterpart of BHEL.

9.6 **AUDIT REVIEW AND INSPECTION**

9.6.1
BHEL shall conduct audit on the contractor performance and compliance with the project specific requirements of the Environment and Occupational Health & Safety Management systems. The programme of audit shall cover all activities under the contract but will focus particularly on high-risk activities. The Construction Manager shall decide the schedule of audit. The audit findings shall be communicated to the contractors and necessary remedial action as advised by BHEL Engineers shall be under taken within the stipulated time.

9.6.2
Inspections shall be carried out regularly by the contractors and by BHEL Engineers on activities, facilities, equipment, and documentation, to cover the following aspects.

- Compliance with procedures and systems
- Availability, condition and use of PPEs
- Condition of maintenance tools, equipments, facilities
- Availability of fire fighting equipments and its condition
- Use of fire fighting equipments and first aid kit
- Awareness of occupational health hazard
- Awareness of safe working practices
- Presence of quality supervision
- Housekeeping

The Safety Co-coordinator shall visit and inspect work sites daily. All unsafe acts, unsafe conditions that have imminent potential for causing harm/injury/damage will be immediately corrected. He shall maintain a daily logbook giving details of unsafe acts or conditions observed and the corrective action taken and recommendations for preventing recurrence. Adequacy of corrective actions will be verified

The contractor shall take remedial measures as per the findings of each inspection

Besides the above, the contractor shall be required to carry out the following inspections

SN	Equipment	Scope of inspection	Inspection by	Schedule
1	Hand tools	To identify unsafe/defective tool	User	Daily
2	Power tools	To identify unsafe/defective tool	User	Daily
3	Fire Extinguishers	To check pressure and any defect	User / Safety Coordinator	Daily Every month
4	Lifting equipment/tackles	To check for defects and efficacy of brakes	User Third party	Daily Every Year
5	PPE	To check for defects	User	Daily

9.7 **NON COMPLIANCE**:-

9.7.1 NONCONFORMITY OF SAFETY RULES AND SAFETY APPLIANCES WILL BE VIEWED SERIOUSLY AND THE BHEL HAS RIGHT TO IMPOSE FINES ON THE CONTRACTOR AS UNDER **for every instance of violation noticed**:

SN	Violation of Safety Norm	Fine (Rs)
01	Not Wearing Safety Helmet	50/-
02.	Not wearing Safety Belt	100/-
03.	Grinding Without Goggles	50/-
04.	Not using 24 V Supply For Internal Work	500/-
05.	Electrical Plugs Not used for hand Machine	100/-
06.	Not Slinging property	200/-
07.	Using Damaged Sling	200/-
08.	Lifting Cylinders Without Cage	500/-
09.	Not Using Proper Welding Cable With Lot of Joints And Not Insulated Property.	200/-
10.	Not Removing Small Scrap From Platforms	200/-
11.	Gas Cutting Without Taking Proper Precaution or Not Using Sheet Below Gas Cutting	200/-
12.	Not Maintaining Electric Winches Which are Operated Dangerously	500/-
13.	Improper Earthing Of Electrical T&P	500/-
14.	Accident Resulting in Partial Loss in Earning Capacity	25,000/- per victim
15.	Fatal Accident/Accidents Resulting in total loss in Earning Capacity	1,00,000/- per victim

Any other non-conformity noticed not listed above will also be fined as deemed fit by BHEL. The decision of BHEL engineer is final on the above. The amount will be deducted from running bills of the contractor. The amount collected above will be utilised for giving award to the employees who could avoid accident by following safety rules. Also the amount will be spent for purchasing the safety appliances and supporting the safety activity at site.

9.8

CITATION:- If safety record of the contractor in execution of the awarded job is to the satisfaction of safety department of BHEL, issue of an appropriate certificate to recognise the safety performance of the contractor may be considered by BHEL after completion of the job

9.9 Memorandum of Understanding

After Award Of Work, Contractors Are Required To Enter Into A Memorandum Of Understanding As Given Below:

Memorandum of Understanding

BHEL, PSWR is committed to Health, Safety and Environment Policy (EHS Policy) as given in the booklet titled "Safe Working Practices" issued to all contractors.

M/s _____ do hereby also commit to the same EHS Policy while executing the Contract Number _____

M/s _____ shall ensure that safe work practices not limited to the above booklet are followed by all construction workers and supervisors. Spirit and content therein shall be reached to all workers and supervisors for compliance.

BHEL will be carrying out EHS audits twice a year and M/s _____ shall ensure to close any non-conformity observed/reported within fifteen days.

Signed by authorised representative of M/s----------

Name :

Place & Date:

9.10 Comprehensive list of National Standards for reference and use wherever applicable in the execution of Civil, Erection and Commissioning Contracts.

IS No	YEAR	Amd upto	DESCRIPTION
IS 10204	1982		PORTABLE FIRE EXTINGUISHERS MECHANICAL FOAM TYPE
IS 10245	1994		SPECIFICATION FOR BREATHING APPARATUS
IS 10291	1982		SAFETY CODE FOR DRESS DRIVERS IN CIVIL ENGINEERING WORKS
IS 10658	1983		HIGHER CAPACITY DRY POWDER FIRE EXTINGUISHERS (TROLLEY MOUNTED)
IS 10662	1992		COLOUR TELEVISION
IS 10667	1983		GUIDE FOR SELECTION OF INDUSTRIAL SAFETY EQUIPMENT FOR PROTECTION OF FOOT AND LEG
IS 11037	1984		ELECTRONIC FAN REGULATORS
IS 11057	1984		INDUSTRIAL SAFETY NETS
IS 11451	1998		RECOMMENDATION FOR SAFETY AND HEALTH REQUIREMENT RELATING TO OCCUPATION EXPOSURE TO ASBESTOS
IS 1169	1967		PEDESTAL FANS
IS 1179	1967		SPECIFICATION FOR EQUIPMENT FOR EYE AND FACE PROTECTION DURING WELDING

IS No	YEAR	Amd upto	DESCRIPTION
IS 11833	1986		DRY POWDER FIRE EXTINGUISHERS FOR METAL FIRES
IS 11972	1987		CODE OF PRACTICE FOR SAFETY PRECAUTION TO BE TAKEN WHEN ENTERING A SEWARAGE SYSTEM
IS 1287	1986		ELECTRIC TOASTER
IS 13063	1991		STRUCTURAL SAFETY OF BUILDINGS ON SHALLOW FOUNDATIONS ON ROCKS
IS 13385	1992		SPECIFICATIONS FOR FIRE EXTINGUISHERS 50 LITRE WHEEL MOUNTED WATER TYPE (GAS CARTRIDGES)
IS 13386	1992		SPECIFICATIONS FOR FIRE EXTINGUISHERS 50 LITRE MECHANICAL FOAM TYPE
IS 13415	1992		CODE OF SAFETY FOR PROTECTIVE BARRIERS IN AND AROUND BUILDINGS
IS 13416	1992		RECOMMENDATIONS FOR PREVENTIVE MEASURES AGAINST HAZARDS AT WORKING PLACE PART 1 TO PART 5
IS 13430	1992		CODE OF PRACTICE FOR SAFETY DURING ADDITIONAL CONSTRUCTION AND ALTERATION TO EXISTING BUILDINGS
IS 13849	1993		PORTABLE FIRE EX TINGUISHERS DRY POWDER TYPE (CONSTANT PRESSURE)
IS 1446	1985		CLASSIFICATION OF DANGEROUS GOODS (FIRST REVISION)
IS 1476	1979		REFRIGERATORS
IS 1641	1988		CODE OF PRACTICE FOR FIRE SAFETY OF BUILDINGS (GENERAL): GENERAL PRINCIPLES OF FIRE GRADING AND CLASSIFICATION
IS 1642	1989		CODE OF PRACTICE FOR FIRE SAFETY OF BUILDINGS- DETAILS OF CONSTRUCTION
IS 1643	1988		CODE OF PRACTICE FOR FIRE SAFETY OF BUILDINGS (GENERAL): EXPOSURE HAZARD
IS 1646	1997		CODE OF PRACTICE FOR FIRE SAFETY OF BUILDINGS (GENERA L): ELECTRICAL INSTALLATIONS
IS 1904	1986		CODE OF PRACTICE FOR DESIGN AND CONSTRUCTION OF FOUNDATIONS IN SOIL
IS 1905	1987		STRUCTURAL SAFETY OF BUILDINGS MASONARY WALLS
IS 2082	1985		ELECTRICAL GEYSERS
IS 2171	1985		PORTABLE FIRE EXTINGUISHERS DRY POWDER TYPE (CARTRIDGE)
IS 2309	1989		PRACTICE FOR THE PROTECTION OF BUILDINGS AND ALLIED BUILDINGS AGAINST LIGHTENING
IS 2312	1967		EXHAUST FANS
IS 2361	1994		SPECIFICATION FOR BUILDING GRIPS - FIRST REVISION
IS 2418	1977		TUBULAR FLUORSCENT LAMPS IS 2418 (FT-1)
IS 2750	1964		STEEL SCAFFOLDINGS
IS 2762	1964		SAFE WORKING LOADS IN KGS FOR WIRE ROPE SLINGS
IS 2878	1986		FIRE EXTINGUISHERS CARBON DIOXIDE TYPE (PORTABLE AND TROLLEY MOUNTED)
IS 2925	1984		SPECIFICATION FOR INDUSTRIAL SAFETY HELMETS
IS 3016	1982		CODE OF PRACTICE FOR FIRE PRECAUTIONS IN WELDING AND CUTTING OPERATIONS-FIRST REVISION
IS 3315	1974		DESERT COOLERS
IS 3521	1989		INDUSTRIAL SAFETY BELTS AND HARNESS
IS 368	1983		IMMERSION WATER HEATERS
IS 3696	1991		SAFETY CODE OF SCAFFOLDS AND LADDERS PART 1 TO 2
IS 3737	1996		LEATHER SAFETY BOOTS FOR WORKERS IN HEAVY METAL INDUSTRIES
IS 374	1979		CEILING FANS INCLUDING REGULATORS

IS No	YEAR	Amd upto	DESCRIPTION
IS 3764	1992		EXCAVATION WORK - CODE OF SAFETY
IS 3786	1983		METHOD FOR COMPUTATION OF FREQUENCY AND SEVERITY RATES FOR INDUSTRIAL INJURIES AND CLASSIFICATION OF INDUSTRIAL ACCIDENTS
IS 3935	1966		CODE OF PRACTICE FOR COMPOSITE CONSTRUCTION
IS 4014	1967		CODE OF PRACTICE FOR STEEL TUBULAR SCAFFOLDING
IS 4081	1986		SAFETY CODE FOR BLASTING AND RELATED DRILLING OPERATIONS
IS 4082	1977	1996	STACKING AND STORAGE OF CONSTRUCTION MATERIALS AND COMPONENTS AT SITE
IS 4130	1991		DEMOLITION OF BUILDINGS - CODE OF SAFETY PART 1 TO 2
IS 4138	1977		SAFETY CODE FOR WORKING IN COMPRESSED AIR (FIRST REVISION)
IS 4155	1966		GLOSSARY OF TERMS RELATING TO CHEMICAL AND RADIATION HAZARDS AND HAZARDOUS CHEMICALS
IS 4209	1967		CODE OF SAFETY FOR CHEMICAL LABORATORY
IS 4250	1980		FOOD MIXERS
IS 4262	1967		CODE OF SAFETY FOR SULFURIC ACID
IS 4756	1978		SAFETY CODE FOR TUNNELING WORK
IS 4912	1978		SAFETY REQUIREMENTS FOR FLOOR AND WALL OPENINGS, RAILINGS AND TOE BOARDS
IS 5121	1969		SAFETY CODE FOR PILING AND OTHER DEEP FOUNDATIONS
IS 5182	1969	1982	METHODS FOR MEASUREMENT OF AIR POLLUTION
IS 5184	1969		CODE OF SAFETY FOR HYDROFLUORIC ACID
IS 5216	1982	2000	RECOMMENDATIONS ON SAFETY PROCEDURES AND PRACTICE IN ELECTRICAL WORK PART I AND II
IS 555	1979		TABLE FANS
IS 5557	1995		INDUSTRIAL AND SAFETY LINED RUBBER BOOTS (SECOND REVISION)
IS 5916	1970		SAFETY CODE FOR CONSTRUCTION INVOLVING USE OF HOR BITUMINOUS MATERIALS
IS 5983	1980		SPECIFICATION FOR EYE PROTECTORS - FIRST REVISION
IS 6234	1986		PORTABLE FIRE EXTINGUISHERS WATER TYPE (STORED PRESSURE)
IS 692	1994		CRITERIA FOR SAFETY AND DESIGN OF STRUCTURES SUBJECTED TO UNDERGROUND BLASTS
IS 6994	1973		SPECIFICATION FOR SAFETY GLOVES
IS 7155	1986		CODE OF RECOMMENDED PRACTICE FOR CONVEYOR SAFETY (PART 1 TO 8)
IS 7205	1974		SAFETY CODE FOR ERECTION OF STRUCTURAL STEEL WORK
IS 7293	1974		SAFETY CODE FOR WORKING WITH CONSTRUCTION MACHINERY
IS 7323	1994		GUIDELINES FOR OPERATIONS OF RESERVOIRS
IS 7812	1975		CODE OF SAFETY FOR MERCURY
IS 7969	1975		SAFETY CODE FOR HANDLING AND STORAGE OF BUILDING MATERIALS
IS 8089	1976		CODE OF SAFE PRACTICE FOR LAYOUT OF OUTSIDE FACILITIES IN AN INDUSTRIAL PLANT
IS 8091	1976		CODE OF PRACTICE FOR INDUSTRIAL PLANT LAYOUT
IS 8095	1976		ACCIDENTS PREVENTION TAGS
IS 818	1968	1997	CODE OF PRACTICE FOR SAFETY AND HEALTH REQUIREMENTS IN ELECTRIC AND GAS WELDING, AND CUTTING OPERATIONS
IS 8448	1989		AUTOMATIC LINE VOLTAGE CORRECTOR (STABILISER)

IS No	YEAR	Amd upto	DESCRIPTION
IS 8519	1977		GUIDE FOR SELECTION OF INDUSTRIAL SAFETY EQUIPMENT FOR BODY PROTECTION
IS 8520	1977		GUIDE FOR SELECTION OF INDUSTRIAL SAFETY EQUIPMENT FOR EYE, FACE AND EAR PROTECTION
IS 875	1987		STRUCTURAL SAFETY OF BUILDING: LOADING STANDARD PART 1 TO 5
IS 8807	1978		GUIDE FOR SELECTION OF INDUSTRIAL SAFETY EQUIPMENT FOR PROTECTION OF ARMS AND HANDS
IS 8978	1985		INSTANTANEOUS WATER HEATERS
IS 8989	1978		SAFETY CODE FOR ERECTION OF CONCRETE FRAMED STRUCTURES
IS 940	1989		PORTABLE FIRE EXTINGUISHERS WATER TYPE (GAS CARTRIDGE)
IS 9457	1980		SAFETY COLOURS AND SIGNS
IS 9679	1980		CODE OF SAFETY FOR WORK ENVIRONMENTAL MONITORING
IS 9706	1997		CODE OF PRACTICE FOR THE CONSTRUCTION OF AERIAL RPEWAYS FOR THE TRANSPORTATION OF MATERIAL
IS 9759	1981		GUIDELINES FOR DEWATERING DURING CONSTRUCTION
IS 9815	1989		SERVO MOTOR OPERATED LINE VOLTAGE CORRECTOR (SERVO STABILISER)
IS 9944	1992		RECOMMENDATIONS ON SAFE WORKING LOAD FOR NATURAL AND MAN-MADE FIBRE ROPE SLINGS
IS 996	1979		SINGLE PHASE ELECTRIC MOTORS
ISO 3873	1977		SAFETY HELMET

SECTION-10

SPECIAL CONDITIONS OF CONTRACT

10.0 DRAWINGS AND DOCUMENTS

10.1
THE DETAILED DRAWINGS, SPECIFICATIONS 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.

10.2
ONE SET OF NECESSARY DRAWINGS/DOCUMENTS TO CARRY OUT THE ERECTION WORK WILL BE FURNISHED TO THE CONTRACTOR BY BHEL ON LOAN THAT SHALL BE RETURNED TO BHEL AFTER COMPLETION OF THE WORK. CONTRACTOR'S PERSONNEL SHALL TAKE CARE OF THESE DOCUMENTS GIVEN TO THEM.

10.3
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 EXPECTED TO OCCUR AS IS USUAL IN ANY SUCH LARGE SCALE OF WORKS.

10.4
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 SUBMISSION OF OFFER.

10.5
IN CASE AN AMBIGUITY IS DETECTED AFTER AWARD OF WORK, THE SAME MUST BE BROUGHT TO THE NOTICE OF BHEL BEFORE COMMENCEMENT OF THE WORK/ACTIVITY. BHEL'S INTERPRETATION IN SUCH CASES WILL BE FINAL AND BINDING ON THE CONTRACTOR.

10.6
IN CASE OF ANY CONFLICT BETWEEN GENERAL INSTRUCTIONS TO TENDERERS, GENERAL CONDITIONS OF CONTRACT CONTAINED IN SECTIONS 1 & 2 RESPECTIVELY AND SPECIAL CONDITIONS OF CONTRACT CONTAINED IN SECTIONS 4 TO 15 AND APPENDICES, PROVISIONS CONTAINED IN SPECIAL CONDITIONS OF CONTRACT IN SECTIONS 4 TO 15 AND APPENDICES SHALL PREVAIL.

10.7
IN CASE OF DISCREPANCY BETWEEN QUOTED ITEM RATE AND CORRESPONDING AMOUNT IN THE RATE SCHEDULE, THE **QUOTED ITEM RATES SHALL BE RECKONED AS CORRECT AND AMOUNT RECALCULATED**. QUOTED ITEM RATES SHALL ALSO PREVAIL FOR ARRIVING AT THE TOTAL PRICE QUOTED FOR OFFER EVALUATION. OFFER WILL BE EVALUATED ON THE BASIS OF TOTAL PRICE OF PRICE BID.

10.8
BANK GUARANTEES TO BE FURNISHED BY THE CONTRACTOR TOWARDS SECURITY DEPOSIT AND PERFORMANCE GUARANTEE (LAST 5% PAYMENT AGAINST WORKMANSHIP WARRANTY/DEFECT LIABILITY) SHALL HAVE A CLAIM PERIOD OF SIX MONTHS OVER AND ABOVE THE VALIDITY PERIOD REQUIRED FOR THE RESPECTIVE CASES.

Special Conditions of Contract

Section-11

11.0 Time schedule - Contract Variation - Progress etc.

11.1 TIME SCHEDULE & MOBILIZATION

11.1.1 INITIAL MOBILIZATION AND TENTATIVE SCHEDULE

Contractor shall reach site, make his site establishment and be ready to commence the work **within two weeks** from the date of fax Letter of Intent (LOI) or as per directions of construction manager of BHEL.

The contractor has to subsequently augment his resources in such a manner that the entire work is completed to achieve the following tentative schedule:

SN	Activity	Tentative Date
01	Start of Erection	Dec 2006
02	Boiler light up and ABO :Unit 3	May 2007
03	Boiler light up and ABO :Unit 4	Aug 2007
04	Turbine box-up : Unit 3	April 2007
05	Turbine box-up : Unit 4	Jul 2007
06	Steam blowing of completion: Unit 3	Jun 2007
07	Steam blowing of completion: Unit 4	Sept 2007
08	Turbine Oil flushing completion: Unit 3	May 2007
09	Turbine Oil flushing completion: Unit 4	Aug 2007
10	Synchronisation and coal firing: Unit 3	July 2007
11	Synchronisation and coal firing: Unit 4	Oct 2007
12	Trial Operation: Unit 3	Sept 2007
13	Trial Operation: Unit 4	Dec 2007
14	PG test : Unit 3	Oct 2007
15	PG test : Unit 4	Dec 2007
16	Completion of works	June 2008

11.1.1 Contract Period

The contract period shall be 16 months from the start of work. Erection, testing, calibration and commissioning of permanent equipments required for completion of system shall be completed within the time schedule given above. Permanent erection of the first major sub-assembly/main assembly of any other equipment on its designated foundation/location following due process of pre-assembly and quality

checks as per approved field quality plan (FQP) shall be considered as the start of contract period for this contract. Placement of packer plates etc shall not be considered as start of erection.

BHEL, owing to its commitment to their customer, may ask contractor to compress the schedule to the possible extent for advancement of various milestones. Contractor shall plan his activities and mobilise additional resources accordingly to the satisfaction of BHEL engineer within the quoted rates.

11.1.2 Grace period

Grace Period of **3 months** will be allowed at BHEL's discretion.

11.2

The contractor should reach site and establish his site office and mobilise to commence the work as per directions of BHEL engineer. The date of starting the work at site shall be fixed in consultation with BHEL's engineer and the same will be recorded in measurement book while entering the first RA bill.

11.3

Subject to availability of materials and other inputs, it is the responsibility of the contractor to carry out work to achieve the monthly progress and keep up the schedules.

11.4

Contractor shall draw the monthly erection programme along with BHEL engineer indicating the work to be achieved and event to be completed as per clause 11.1. Once the programme is drawn, he shall adhere to the same. Contractor shall plan and erect the materials as it is received at site. The monthly planned percentage shall take into consideration the material available at site before the start of the month and also any material received during the month. Contractor shall mobilise his resources required to achieve the monthly programmes.

11.5 Progress and monitoring of work

11.5.1

It is the responsibility of the contractor to provide all the relevant information on a regular basis regarding erection progress, welding progress, labour availability, equipment deployment, consumption of electrodes, gases, down time of measuring test equipment etc.

11.5.2

The contractor shall submit daily, weekly and monthly progress reports, manpower reports, material reports, equipment reports etc. as per formats specified by BHEL. The progress reports shall indicate the progress achieved against planned with reasons indicating the delays, if any. The report shall also give the remedial actions that 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.

11.5.3
Any other information required for decision-making, planning and action taking, the contractor shall furnish the same, other reports and daily/weekly/monthly erection progress shall be furnished in the format prescribed by BHEL.

11.5.4
Contractor shall work out tentative programmes of erection, commissioning to match the schedules indicated in clause 11.1 and should submit along with his offer the month-wise calibration, erection and testing and commissioning programme area-wise.

11.6.0 Quantity Variation
11.6.1
The quantities shown in rate schedule are only estimated and the payment will be made on the actual quantity executed on unit rate basis. Variation in quantities upto ± 40% in case of the cable quantities and about ± 25% for other items to be considered while quoting. Agreed rates shall remain firm for any upward and downward variation.

11.7.0 Price Variation
11.7.1
The rates quoted by the contractor shall remain firm throughout the contract period, grace period and extensions if any. Provisions of clause no. 2.16 of General Conditions of Contract shall not be applicable to this contract.

11.8.0 Extension of Contract Period

11.8.1
BHEL at its discretion may extend the contract beyond the end of grace period for further required period depending upon the quantum of work left out at the end of grace period. If the completion of work gets delayed for reasons other than attributable to the contractor or force-majeure condition, the contractor will be compensated by way of Overrun Charges.

11.8.2
Overrun period beyond the grace period shall be decided based on the performance of contractor during the normal completion period and shortfall if any shall be recorded under the following heads:-

A) Erection/commissioning programme not achieved owing to non-availability of fronts.

B) Erection/commissioning programme not achieved owing to non-availability of materials.

C) Erection/commissioning programme not achieved owing to non-availability of tools and plants, manpower and consumables by the contractor.

11.8.3
Total extension shall be apportioned between BHEL and contractor in the same proportion. Extension on account of delay attributable to contractor shall be exhaustive fist.

11.8.4
During the over-run period, contractor shall deploy necessary and adequate resources like engineers, supervisors, labours, T&P and consumable to complete the agreed programme in each month.

11.8.5
Over-run compensation will be paid proportionate to the progress made during the corresponding month evaluation of progress of the achievements vis-à-vis programme drawn for respective month, shortfall will be apportioned accordingly between BHEL and contractor.

11.8.6 Overrun Charges
If the contract is extended beyond the contract (including grace) period for any reason other than those attributable to the contractor or force majeure conditions, the contractor will be compensated by payment of overrun charges at the rate of Rs. 50,000/- per month (Rupees fifty thousand only). Overrun compensation will be paid for the extension attributable to bhel only. No overrun compensation will be payable for the extension on account of reasons attributable to contractor and/or force majeure conditions. Overrun compensation for eligible period shall be in proportion to the progress achieved against the plan for respective period.

11.9 Foreclosing of Contract
11.9.1
BHEL, at its discretion may foreclose the contract at any time after the completion of contract period from the date of starting the work at site.

11.9.2
In case it is decided to withdraw any portion of work or foreclose the contract, the percentage value of the work withdrawn / left over shall be determined mutually. BHEL engineer's decision in regard to status of an item shall be final and binding on the contractor.

11.9.3
The date of completion of work for the purpose of guarantee vide clause 2.13 of general conditions will be the date on which the contract is foreclosed.

11.10
Clause 2.12 of GCC regarding force majeure shall, inter-alia, include stoppage of work due to 'local bandhs' arising out of external factors.

11.11 INTEREST BEARING ADVANCE

Interest bearing (rate of interest @ 12% per annum on monthly rest reducing balance basis) limited to 5% of the award value may be paid by BHEL at its discretion depending on the merit of the case against receipt & acceptance of bank guarantee from the contractor for the amount sought. This bank guarantee shall be valid for

sufficient period till the entire advance amount including interest thereof is recovered. Recovery will be made at least @ 10% of the admitted running bill amount from the first applicable running bill onwards till entire due is recovered. Rate of recovery for a shorter available duration will accordingly be higher so that entire due is recovered within the remaining contract period.

11.12 DEFINITION OF WORK COMPLETION

The contractor's scope of work under these specifications will be deemed to have been completed in all respect, only when all the activities are completed satisfactorily and so certified by BHEL site in charge. The decision of BHEL in this regard shall be final and binding on the contractor.

Section-12
Special Conditions of Contract

12.0 Terms of Payment

12.1 Payment for the Work Completed

12.1.1
Contractor shall submit his on account bills with all the details of measurement required by BHEL on 26th of every month covering progress of work in all respects and areas up to 24th day of the same month.

12.1.2
Clause 2.6 of general conditions of contract shall be referred to as regards mode of payment, and measurement of the work completed.

12.1.3
Release of payment in each running bill will be restricted to 95% of the value of work admitted, as per the percentage break-up for the stage of work completion stipulated vide clauses hereinafter.

The 5% thus remaining shall be on account of workmanship guarantee of work executed. The same will be released after completion of the guarantee period of 12 months from the date of completion of entire work as certified by BHEL engineer. However, this amount may be released earlier on receipt and acceptance of bank guarantee of equal amount in prescribed format and the BG shall be kept valid till completion of such guarantee period and an additional six months claim period.

12.2 STAGES OF PROGRESSIVE PRO-RATA PAYMENTS

12.2.1 Transportation, Erection, Checking of Calibration, Testing, Assistance for Commissioning and Final Painting.

The agreed rates for each item shall be paid progressively as per the break up given hereunder (aggregating 90%), based on the progress of work in each month.

SN	Payment terms Type	Calibration / Testing	Erection	Final painting
1	A	40%	45%	5%
2	B	40%	50%	N.A.
3	C	90%	N.A	N.A.
4	D	NA	90%	N.A.
5	E	N.A.	85%	5%

F: ISOLATED PHASE BUS DUCT:		
SN	DESCRIPTION OF ACTIVITY	PERCENTAGE
01	COLLECTION OF MATERIAL, TRANSPORTATION FROM BHEL STORES TO SITE	10%
02	ERECTION AND ALIGNMENT OF SUPPORTING STRUCTURE	10%
03	PLACEMENT OF BUS DUCT, SUB-ASSEMBLIES, LAVT CUBICLE, NG TRANSFORMER AND RESISTANCE CUBICLE, AIR PRESSURIZATION UNIT AND ITS PIPING AND ACCESSORIES, EXCITATION TRANSFORMER AND ITS TRUNKING CUBICLE, WALL FRAME ASSEMBLY, SEAL AIR BUSHINGS	15%
04	ALIGNMENT OF BUS DUCT ASSEMBLIES, WELDING OF CONDUCTORS, MAKEUP PIECES, SHUNTS, FLEXIBLES, CURRENT TRANSFORMERS AND VOLTAGE TRANSFORMER, SURGE PROTECTOR ETC. INSTALLATION, LINE, NEUTRAL TEE OFF DUCT CTs, WIRING UPTO MARSHALLING BOX, DPD TEST ON CONDUCTOR WELD JOINTS ETC.	20%
05	PRE-COMMISSIONING TESTS, HIGH VOLTAGE TEST	10%
06	COMPLETION OF AIR LEAKAGE TEST	03%
07	FINAL BOX-UP AND END TERMINATION AND MAKING READY FOR ENERGIZATION	04%
08	COMPLETION OF SHORT CIRCUIT/OPEN CIRCUIT TEST WHICH INCLUDES FIXING AND REMOVING OF CERTAIN LINK AND NORMALISATION AND SYNCHRONIZATION OF THE UNIT, INTEGRATED ELECTRICAL TESTING/ COMMISSIONING WITH ASSOCIATED CONNECTED EQUIPMENT	10%
09	FINISH PAINTING	05%
10	TRIAL RUN AND FULL LOADING	02%
11	COMPLETION OF ALL FACILITIES AND HANDING OVER	01%

12.2.2 Month-wise Payment for Installation Supervision Services

For the purpose of payments to the contractor, remaining 10% of the contract value shall be assigned as the amount payable towards Installation (erection, testing & commissioning) supervision services as enumerated in Section - 4 earlier.

For the purpose of release of progressive payments, month-wise break up for each of the above services will be jointly worked out by BHEL and the contractor at site at the time of start of work. This will be ***dynamically and regularly*** reviewed every month/ quarter or mutually agreed periodicity and shall be re-calculated based on expected requirement of services keeping in view relevant aspects. On all the issues as above, BHEL engineer's decision shall be final & binding.

These services are to be rendered even during extended period (the contract extension may be due to any reason) without any additional payment/compensation. The periodical review of monthly billing/payment break up shall take this aspect in consideration. Progressive payment for the service rendered will be made on certification of BHEL accordingly.

For the items where the payment is to be made against unit of weight, the actual weight of items erected by contractor will be paid after assessing the weight on the basis of shipping list or standard engineering practice. BHEL engineer's decision will be final and binding on contractor in this regard.

12.3 Payment for the Work Completed

12.3.1
The tenderer shall quote separate unit rates for each item as detailed in Rate Schedule. Payment will be made by BHEL according to agreed item rates, break up of stage payments and actual executed quantities.

12.3.2 Measurement for Payment

12.3.3
In rate schedules, all inclusive unit rates have been called for entire scope of work for respective item including erection, calibration, testing and commissioning as applicable for various device and instrument and payment shall be made as per split up furnished in the table earlier in this section.

12.3.4
For all payment purpose, measurement shall be made on the basis of physical measurement. Physical measurement shall be made by contractor in presence of BHEL engineer. Contractor shall maintain records for utilization of material system-wise.

12.3.5
All the surplus, scrap and serviceable materials shall be returned by the contractor to BHEL's stores as per the instruction of engineer

12.3.6
All the cables returned to stores should carry aluminium tag(s) indicating the size and type of cables. Cable of more than five-meter length is termed as "serviceable material".

12.3.7
Any item returned to stores shall be clearly identified and tagged for its serviceability or any defects in the returned items.

12.3.8

Wherever additional instrumentation work has to be carried out for performance guarantee test, the same has to be executed by the contractor as per the applicable rates already provided in the rate schedule.

Special Conditions of Contract

Section-13

13.0 Extra charges for modification and rectification

13.1

If extra works for modification, rework, revamping, or in brief, any work done to change the state existing to a stage desired, and also fabrication, if any, are needed due to any change in or deviation from the drawings and design of equipment, operation/ maintenance requirements, mismatching, transit damages and other allied works which are not very specifically indicated in the drawings, but are found essential for satisfactory completion of the work, are done, no extra charges will be paid. The tenderers are requested to take this aspect into account and the quoted rate should include all such contingencies.

13.2

It may also be noted that if any such said extra works arise on account of the contractor's fault it will have to be carried out by the contractor free of cost. Under such circumstances, any material and consumable required for this purpose, will also have to be arranged by the contractor at his cost.

13.3

However, BHEL may consider for payment as extra, for such of those works detailed in clause 13.1 which require more than 40 man-hours and such payment will be regulated by the terms, conditions and stipulations contained in the clauses 13.4 and/or 14.2.1 to 14.2.11. It may be specifically noted that the decision of BHEL as to whether such payment is due shall be final and binding on the contractor.

13.4

BHEL may, at their absolute discretion, consider payment for extra work as found by them as justifiable for such of those works specified in clause 13.1 which require major modification, major repair, major reworks, major rectification etc., provided each work requires more than 40 manhours. It may also be noted that only those works which are identified as major and warrant extra payment and certified as such by the project manager and accepted by the designers and/or competent authority of BHEL, will be considered for extra payment.

13.5

Such extra works arising out of transit, storage and erection damages, payment, if found due, will be regulated by clauses 14.2.1 to 14.2.11.

13.6

All the extra work carried out should be done by a separate gang which could be identified for ascertaining the mandays. No diversion of regular gang for such extra works will be permissible and no delay or slow progress should be caused due to executing extra works. Hence, the question of granting extension of time for this reason should not arise. Daily log sheets in the proforma prescribed by BHEL should be maintained and shall be signed by the contractor's representative and BHEL engineer. No claim for extra work will be considered/entertained in the absence of the said supporting documents i.e., daily log sheets, etc. It may, however, be noted that signing of log sheets by BHEL engineer does not mean the acceptance of such

works as extra works eligible for payment of the acceptance of number of mandays needed for the work. Also contractor shall compile the extra work done regularly and submit the same within 30 days after completion of extra work.

13.7

BHEL retains the right to award or not to award any of the major repair/major rework/major modification / major rectification / major fabrication works under clauses 13.1 to 13.6 to the contractor, at their discretion without assigning any reason for the same.

13.8

Payment for works which are accepted as additional by BHEL will be regulated as per relevant clauses.

13.9 Extra charges

Single average man-day rate of 8 hours, including overtime if any, and other site expenses and incidentals, including consumables, tools and tackles, and supervision required will be **Rs 240/-** (Rupees Two hundred forty only). No payment will be made if an item of work lasts less than 40 man-hours.

SECTION-14
SPECIAL CONDITIONS OF CONTRACT

14.0 Insurance

14.1 Marine, Storage cum Erection (MCE) Insurance and Repairing Damages

14.1.1 BHEL/client has an MCE insurance cover, inter-alia, for all the permanent project equipments/components supplied by BHEL under scope of this work under a transit and storage cum erection policy covering liability against damages/ losses etc.

14.2 Reporting Damages and Carrying out Repairs

14.2.1 Checking all components/equipments at siding/site and reporting to transporter and /or insurance authorities of any damages/losses will be done by BHEL.

14.2.2 Contractor shall render all help to BHEL in inspection including handling, re-stacking etc, assessing and preparing estimates for repairs of components damaged during transit, storage and erection, commissioning and preparing estimates for fabrication of materials lost/damaged during transit, storage and erection. Contractor shall help BHEL to furnish all the data required by railways, insurance company or their surveyors.

14.2.3 Contractor shall report to BHEL in writing any damages to equipments/ components on receipt, storing, and during drawl of the materials from stores, in transit to site and unloading at place of work and during erection and commissioning. The above report shall be as prescribed by BHEL site management. Any consequential loss arising out of non-compliance of this stipulation will be borne by contractor.

14.2.4 Contractor shall carry out fabrication of any material lost/damaged as per instructions from BHEL engineer.

14.2.5 BHEL, however, retains the right to award or not to award to the contractor any of the rectification/rework/repairs of damages and also fabrication of components.

14.2.6 All the repairs/rectification/rework of damages and fabrication of materials lost, if any, shall be carried out by a separately identifiable gang for certification of man-hours. Daily log sheets should be maintained for each work separately and should be signed by contractor's representative and BHEL engineer. Signing of log sheets does not necessarily mean the acceptance of these as extra works.

14.2.7 All rectification, repairs, rework and fabrication of components lost, which are minor and incidental to erection work (consuming not more than 100 man-hours on each occasion) shall be treated as part of work without any extra cost.

14.2.8 Insurance cover under this policy will generally be as per clauses 2.10.1 to 2.10.4 of General Conditions of Contract unless and otherwise specified differently in the Special Conditions.

14.2.9 in case the loss/damage is not attributable to the contractor, Payments of all extra works on account of repair / rectification / reworks of damages and fabrication of materials lost will be as per provisions of Section-13.

14.2.10 In case the repairs/rectification/rework and fabrication of materials lost, the work has been done by more than one agency including the contractor, the payment towards extra charges will be on pro-rata basis and the decision of BHEL in this regard is final and binding on the contractor.

14.2.11 In case of theft / damage / loss of materials due to **repeated and continued instances of negligence/failure** attributable to the contractor, the expenses incurred on account of repair/ replacement of such components including BHEL's overhead expenses as applicable (presently @ 30%) in excess of the amount realized from the underwriters, if any, shall be recovered from the contractor. Recovery will be limited to Normal Deductible Franchise (DF)/Excess as per applicable Insurance (TAC) tariff guidelines. However, in case the underwriters citing reasons of wilful negligence/ damage/loss on the part of the contractor summarily reject such insurance claim, the total cost of repair/ replacement with BHEL overhead expenses shall be recovered from the contractor.

14.3 Insurance by the Contractor and indemnification of BHEL

BHEL have taken a third party liability insurance, indicating in the proposal for such insurance that sub-contractors will be taking part in the erection work detailed in this tender. However, the tenderer has to bear any expenses /consequences over and above the amount that may be reimbursed to BHEL by such coverage of third party liability insurance taken by BHEL.

Such additional liability will be to cover and indemnify BHEL and its customer of all liabilities which may come up and cause harm/damage to other contractors/customer/BHEL properties/personnel or all or anybody rendering service to BHEL/customer or is connected with BHEL/ customer's work in any manner whatsoever. The tenderer's specific attention is also invited to clause 2.10 of General conditions of contract.

SECTION-15

SPECIAL CONDITION OF CONTRACT

15.0 EARNEST MONEY DEPOSIT & SECURITY DEPOSIT

15.1 EARNEST MONEY DEPOSIT:

EARNEST MONEY DEPOSIT FOR THIS TENDER WILL BE Rs. 2,00000/- (RUPEES TWO LACS ONLY).

ONE TIME EMD WILL ALSO BE Rs. 2 LACS.

EMD SHALL BE DEPOSITED IN EITHER CASH (AS PERMISSIBLE UNDER INCOME TAX ACT), PAY ORDER OR DEMAND DRAFT (PAYABLE AT NAGPUR IN FAVOUR OF 'BHARAT HEAVY ELECTRICALS LIMITED') OR BY BANK GUARANTEE FROM A SCHEDULED BANK (EXCEPTING CO-OPERATIVE BANK) ONLY. **NO OTHER FORM OF EMD REMITTENCE SHALL BE ACCEPTABLE TO BHEL.**

15.1.1 EMD BY THE TENDERER WILL BE FORFEITED AS PER TENDER DOCUMENTS IF

I) AFTER OPENING THE TENDER, THE TENDERER REVOKES HIS TENDER WITHIN THE VALIDITY PERIOD OR INCREASES HIS EARLIER QUOTED RATES.

II) THE TENDERER DOES NOT COMMENCE THE WORK WITHIN THE PERIOD AS PER LOI / CONTRACT. IN CASE THE LOI / CONTRACT IS SILENT IN THIS REGARD THEN WITHIN 15 DAYS AFTER AWARD OF CONTRACT.

15.1.2 EMD SHALL NOT CARRY ANY INTEREST.

15.2 SECURITY DEPOSIT

15.2.1 SECURITY DEPOSIT SHOULD BE COLLECTED FROM THE SUCCESSFUL TENDERER. THE RATE OF SECURITY DEPOSIT WILL BE AS BELOW:

SN	Contract Value	Security Deposit Amount
1	Up to Rs. 10 lakhs	10% of Contract Value
2	Above Rs. 10 lakhs upto Rs.50 lakhs	1 lakh + 7.5% of the Contract Value exceeding Rs. 10 lakhs.
3	Above Rs. 50 lakhs	Rs 4 lakhs + 5% of the Contract Value exceeding Rs. 50 lakhs.

THE SECURITY DEPOSIT SHALL BE REMITTED BEFORE START OF THE WORK BY THE CONTRACTOR IN THE MANNER SPECIFIED AS FOLLOWS.

15.2.2 SECURITY DEPOSIT MAY BE FURNISHED IN ANY ONE OF THE FOLLOWING FORMS

I) CASH (AS PERMISSIBLE UNDER THE INCOME TAX ACT)

II) PAY ORDER, DEMAND DRAFT IN FAVOUR OF BHEL.

III) LOCAL CHEQUES OF SCHEDULED BANKS, SUBJECT TO REALIZATION.

IV) SECURITIES AVAILABLE FROM POST OFFICES SUCH AS NATIONAL SAVINGS CERTIFICATES, KISAN VIKAS PATRAS ETC.

(CERTIFICATES SHOULD BE HELD IN THE NAME OF CONTRACTOR FURNISHING THE SECURITY AND DULY PLEDGED IN FAVOUR OF BHEL AND DISCHARGED ON THE BACK).

V) BANK GUARANTEE FROM SCHEDULED BANKS / PUBLIC FINANCIAL INSTITUTIONS AS DEFINED IN THE COMPANIES ACT SUBJECT TO A **MAXIMUM OF 50%** OF THE TOTAL SECURITY DEPOSIT VALUE. THE BALANCE 50% HAS TO BE REMITTED EITHER BY CASH OR IN THE OTHER FORM OF SECURITY. THE BANK GUARANTEE FORMAT SHOULD HAVE THE APPROVAL OF BHEL.

VI) FIXED DEPOSIT RECEIPT ISSUED BY SCHEDULED BANKS / PUBLIC FINANCIAL INSTITUTIONS AS DEFINED IN THE COMPANIES ACT. TH E FDR SHOULD BE IN THE NAME OF THE CONTRACTOR, A/C BHEL, DULY DISCHARGED ON THE BACK.

VII) SECURITY DEPOSIT CAN ALSO BE RECOVERED AT THE RATE OF 10% FROM THE RUNNING BILLS. HOWEVER IN SUCH CASES AT LEAST 50% OF THE SECURITY DEPOSIT SHOULD BE REMITTED (EITHER BY CASH/DD OR **BG FOR MAXIMUM 50%** OF TOTAL SD) BEFORE START OF THE WORK AND THE BALANCE 50% MAY BE RECOVERED FROM THE RUNNING BILLS.

VIII) EMD OF THE SUCCESSFUL TENDERER, EXCEPTING THOSE WHO HAVE REMITTED ONE TIME EMD, SHALL BE CONVERTED AND ADJUSTED AGAINST THE SECURITY DEPOSIT OR SPECIFIC REQUEST BY THE CONTRACTOR.

IX) THE SECURITY DEPOSIT SHALL NOT CARRY ANY INTEREST.

NOTE: ACCEPTANCE OF SECURITY DEPOSIT AGAINST SL. NO. (IV) AND (VI) ABOVE WILL BE SUBJECT TO HYPOTHECATION OR ENDORSEMENT ON THE DOCUMENTS IN FAVOUR OF BHEL. HOWEVER, BHEL WILL NOT BE LIABLE OR RESPONSIBLE IN ANY MANNER FOR THE COLLECTION OF INTEREST OR RENEWAL OF THE DOCUMENTS OR IN ANY OTHER MATTER CONNECTED THEREWITH.

15.2.3 SECURITY DEPOSIT SHALL NOT BE REFUNDED TO THE CONTRACTOR EXCEPT IN ACCORDANCE WITH THE TERMS OF THE CONTRACT.

Appendix- I

Details (wherever required) of items listed in the rate schedule

Please Note:

1. All the items in general are to be erected and commissioned by the contractor, unless specifically mentioned otherwise.
2. In such cases where systems are described with component quantities (viz., Vibration monitoring systems, Lube Oil skids, etc., etc.) lump sum rates are to be quoted. No separate payment will be made for the component items of those systems, although these systems may have certain items for which separate unit rates are also available elsewhere.
3. The dimensions and weights mentioned are only approximate. No extra claims will be entertained due to change in dimensions/weight.
4. The numbers are generally given in per unit basis

- Sl No C-1 to C-4: Control panels
  - These are microprocessor based sophisticated electronic control panels in majority. Also includes 6 nos Gravimetric feeder panels per unit under C-2. Weights range from 400 to 1600 Kgs from C1 to C4 respectively.
- Sl No C-6: Air Heater Rotor stoppage box

  Rotor Stoppage Alarm Box- including sensors (magnetic switch), timer relays, interconnecting cables etc. Lumpsum rate per set is to be quoted.
- Sl No C-7: Burner tilt Shear pin failure indication box
  - One set consist of 4 Nos. shear pin alarm boxes with 4 Nos. Shear pin failure contact switches. These are to be erected and commissioned
- Sl No C-9 : DC motor starter box for scanner fan
  - DC starter box for scanner fan dimension approx 900 x 1120 x 375 weight approx 100 KG.
- Sl No C-10: Electrical Control panel
  - Dimension 3224 x 2354 x 1000 in two / three shipping sections.
  - This panel houses the electrical mimic diagram of the plant and consists of various switches, indicators, semaphore indicators, digital

indicators etc., in suitable tiles. The individual items may come mounted or loose. Other than what are envisaged in the rate schedule, no separate charges will be entertained. Lumpsum price to be quoted.

- Sl No C-12: HART Management system

  Consists of panel (1200 x 800 x 2415) approx weight 500 Kgs. Also consists of PC, printer, Hart communicators for field use, etc.

- Sl No C-13: LIRs and LIEs

  - Local instrument racks are open type housing for field instruments. These have to be located in suitable places, impulse piping and cabling to be done. Number of instruments in each LIR will vary.
  - Local instrument enclosures are closed type housing for field instruments. These have to be located in suitable places, impulse piping and cabling to be done. Number of instruments in each LIE will vary.

- Sl No C-14: Master and slave clock system (Common to both units)

  - This equipment consists of one control panel (900 x600 x 2415) housing power supplies, clock modules etc. GPS antenna is also to be suitably located and cabled up under this scope. About 10 nos slave clocks will have to be installed at various locations throughout the plant. Commissioning supervision will be provided by the supplier of Master clock system.

- Sl No C-15: Network panels

  - These panels are used basically for housing Ethernet switches which are to be wired up with various other max stations. System interface network panels also house computer CPUs, monitors, etc

- Sl No C-20 to C-27: SWAS system

  The scope of work includes all equipments including recorders etc, which may be fitted in any of the panels.

- Sl No C-35: Condenser Vacuum Pump (CVP) system

  Removal, calibration and commissioning of CVP skid mounted instruments including CVP PLC and motor mounted on the skid. The approximate quantity of skid mounted instruments shall be

  - Pressure Indicators – 2
  - Flow Switches – 2
  - Level Switches – 2
  - Pressure/DP – 3
  - Temp. Indicators – 2
  - Flow Indicators – 1

  Lumpsum rate per set is to be quoted.

- Sl No C-36: Console inserts

  Console inserts are to be mounted on the Backup desk. The console inserts consist of moving coil indicator modules, LED modules, pushbutton modules, blank plates, etc., which may or may not come assembled. No separate rates are payable for the individual components erection, testing and commissioning. However, cabling and termination will be paid as per rates for cables.

- Sl No C-38: Direct water level gauge

  Direct Water Level Gauge commissioning (consisting of illuminator assembly, fibre port system illuminator, transformer, lights, etc.). Lumpsum rate per set is to be quoted.

- Sl No C-41: Electronic water level indicator (EWLI)

  2 nos Electronic Water Level Indicator EWLI comprises of the following:

  - 1 No. 16 Port pressure vessel & 1 No. 8 port pressure vessel with loose supplied electrodes (24 nos)
  - 2 Nos. of Ascertor Units (Local) with Display, each of dimension: 600 x 350 x 600 mm; Weight: 25 kg each

- 2 Nos. of Remote Display Unit (100 x 90 x 234 mm) in control room and 2 nos display units in FAP panel
- Interconnecting cables between local panel and 24 electrodes (included in cabling BOM)

2 nos Electronic level detector in TG side consists of capacitance type probes, amplifier units etc.

Lumpsum rate per set is to be quoted.

❖ Sl No C-42: Flame Scanner head assembly

It includes erection of fibre optic cable of length 120", Lens Barrel Assembly, Miniature 6 way Junction Box etc. Lumpsum rate per set is to be quoted.

❖ Sl No C-48: Lab Equipments

- Package consists of various standard laboratory instruments, which are to be installed in Customer's lab. Tentative list is as follows:

1	140.PE1.58.01.16	Electronic Test Bench	No	1
2	140.PE1.58.01.17	Table Mounted Thermocouple / RTD Calibrator	No	3
3	140.PE1.58.01.18	Test RTD	No	1
4	140.PE1.58.01.19	Portable Infrared Radiation Thermomerer	No	1
5	140.PE1.58.01.20	Vibration / Shock Pulse analyser	No	1
6	140.PE1.58.01.21	DIGITAL srotage Oscilloscope	No	1
7	140.PE1.58.01.22	Frequency Counter	No	1
8	140.PE1.58.01.23	Insulation Tester	No	1
9	140.PE1.58.01.24	Multimeter 3 1/2 dgt hand held	No	2
10	140.PE1.58.01.25	Multimeter 4 1/2 dg Hand held	No	2
11	140.PE1.58.01.26	Multimeter 4 1/2 dg Desk Top	No	1
12	140.PE1.58.01.27	Multimeter 5 1/2 dg Desk Top	No	1
13	140.PE1.58.01.28	Multimeter 6 1/2 dg Desk Top	No	1
14	140.PE1.58.01.29	Multifunction Instrument Calibrator	No	1
15	140.PE1.58.01.30	Portable millivolt Calibrator	No	1
16	140.PE1.58.01.31	Table mounted millivolt Calibrator	No	4
17	140.PE1.58.01.32	Portable mA Calibrator	No	1
18	140.PE1.58.01.33	Table mounted mA Calibrator	No	1
19	140.PE1.58.01.34	Soldering Iron 18 Watt	No	1
20	140.PE1.58.01.35	Soldering Iron 10 Watt	No	1
21	140.PE1.58.01.36	Soldering Iron 40 Watt	No	1
22	140.PE1.58.01.37	Solder Sucker	No	1
23	140.PE1.58.01.38	Soldering & Desoldering station	No	1
24	140.PE1.58.01.39	Decade resisrance box	No	1
25	140.PE1.58.01.40	Tachometer	No	1

26	140.PE1.58.01.41	Stop watch	No	1
27	140.PE1.58.01.42	Torximitor	No	1
28	140.PE1.58.01.43	Rheostat / Potentiometer	Set	1
29	140.PE1.58.01.44	AC Power Meter	No	1
30	140.PE1.58.01.45	Logic Probe	No	1
31	140.PE1.58.01.46	Sound level Monitor	No	1
32	140.PE1.58.01.47	Auto Transformer	No	1
33	140.PM1.58.01.40	Wet and Dry bulb Hygrometer	No	1
34	140.PM1.58.01.41	Pneumatic Test Bench	No	1
35	140.PM1.58.01.42	Pressure & Vacuum Air Pump	No	1
36	140.PM1.58.01.43	Portable Calibrator for pressure (Low&High)	No	2
37	140.PM1.58.01.44	Test Pressure guage (different ranges)	Set	1
38	140.PM1.58.01.45	Table mounted Pressure calibirater (Low&High)	No	5
39	140.PM1.58.01.46	Portable calibrator for Vacuum	No	1
40	140.PM1.58.01.47	Fortin Barometer	No	1
41	140.PM1.58.01.48	Table mounted Vacuum calibrator	No	1
42	140.PM1.58.01.49	U Tube Manometer	No	2
43	140.PM1.58.01.50	Test Manometer	No	2
44	140.PM1.58.01.51	Mercury Thermometer	No	13
45	140.PM1.58.01.52	Temperature Bath	No	1
46	140.PM1.58.01.53	Bench vise	No	1
47	140.PM1.58.01.54	Tool maker clamp jaw 50mm wide	No	1
48	140.PM1.58.01.55	Tool maker clamp jaw 100mm wide	No	1
49	140.PM1.58.01.56	Magnetic Screw Driver	No	1
50	140.PM1.58.01.57	SS & Copper Tube Cutter /Blender	No	1
51	140.PM1.58.01.58	Std Tool Box	No	4
52	140.PM1.58.01.59	Coil winding machine	No	1
53	140.PM1.58.01.60	Electrically operated Wire Wrap	No	1
54	140.PM1.58.01.61	Portable flue gas analyser	No	1
55	140.PM1.58.01.62	Portable H2 gas analyser	No	1
56	140.PM1.58.01.63	Dead weight Tes ter	No	1
57	140.PM1.58.01.64	Vacuum Tester	No	1
58	140.PM1.58.01.65	Aneroid Barometer	No	1
59	140.PM1.58.01.66	Jewellers Lathe	No	1
60	140.PM1.58.01.67	Radial Drilling M/C	No	1
61	140.PM1.58.01.68	Air Set	No	1
62	140.PM1.58.01.69	Thermocouple Test Furnace	No	4
63	140.PM1.58.01.70	Flow Meter Calibrator 0-1000 mm wcl	No	1
64	140.PM1.58.01.71	Flow Meter Calibrator 0-6000 mm wcl	No	1
65	140.PM1.58.01.72	Flow Meter Calibrator 0-30000 mm wcl	No	1
66	140.PM1.58.01.73	Portable Ultasonic Flowmeter	No	1

The above equipment to be set up in customer's laboratory

- Sl No C-52: LVS
  - Other than the 4 nos LVS (67" diagonal) per set mentioned in the rate schedule, accessories like video switches, associated cabling (prefab and otherwise) etc are also included.
  - There are also 5 nos PCs/workstations for LVS control. Payment for these will be as per rates for PCs/workstations quoted elsewhere in the rate schedule.

    LVS erection and commissioning supervision in scope of other agency (supplier)
- Sl No C-77: Vibration Monitoring system for BFP(2 nos), CEP(2 nos), ACWP(2 nos) consists of the following (Bently Nevada Series 3500 system):
  - 32 Nos. of Vibration probes (Piezo velocity sensor) & proximeter, JBs (16 nos) & control cable, conduits etc.
  - 6 Nos. Key Phasor Probes, probe fixtures, JBs & communication cable with conduit
  - 1 No. Panel along with 2 nos 19 inch racks, etc, (loose supplied or mounted).
  - Size of panel: 800 x 800 x 2415 mm; approximate weight 300 kg

  Lumpsum rate per set is to be quoted.
- Sl No C-78: Vibration monitoring system for Fans and Pulverisers:

  The scope covers installation of equipment, integration of system, commissioning etc. including drilling and tapping, welding of pads, etc. Vibration Monitoring System (VMS) for Fans (6 nos) & Pulverizers (6 nos), consists of the following (approximate quantities):
  - 3 Nos. of VMS Remote Cabinets, each of size 800 x 800 x 2415 mm and weight 500 kg.
  - 72 Nos. of horizontal/ vertical velocity type pick ups with proximeters, 10 Mtr long pigtail noise proof cable and conduit upto local JB
  - 16 Nos. of local junction boxes
  - Key phasor probes 9 nos
  - Mounting accessories etc.

  Lumpsum rate to be quoted
- Sl No C-79: Vibration Monitoring system for Main turbine

- Vibration analysis system for Main turbine: 1 panel (122x800x1000 1000kg), 1 PC, 35 probes, 25 proximeters, 10 JBs, 2000m triad cable approx, for measurement of bearing vibration, shaft vibration, axial shift, differential expansion, speed, etc.

Lumpsum rate per set is to be quoted.

❖ Sl No C-80: Vibration Monitoring system for TDBFP consists of the following-

- 1 No. Monitor rack with modules of approximate weight 40 kg (to be mounted on BHEL EDN cabinet).
- 16 Nos. of Vibration/ Axial displacement/Differential Expansion/Casing Expansion probes, 14 Nos. of probe extension cables, 14 nos. proximitors, 9 Nos. of proximitor housing, flexible conduit etc.

Lumpsum rate per set is to be quoted.

❖ Sl No C-81: Coal Feeder local instruments

- Involves only cabling and commissioning of local cabinet and peripherals like load cells, coal motion monitor, several switches, etc. Lumpsum rate per set is to be quoted.

❖ Sl No C-85: ERV Controller

The controller box to be erected near the ERV and impulse piping to be done. It has 220V DC rated pressure switches inside which are to be calibrated. Dimension: 350 x 290 x 180 mm; weight: 5 kg each. Remote console is to be mounted at control room backup desk. Lumpsum rate per set is to be quoted.

❖ Sl No C-86: Fan Lube oil skid

The scope of work includes removal of instruments, calibration, refixing, checking cable connection from JB to instruments, motor connection, meggering and improving IR value of motor etc. and commissioning the skid

The approximate total quantity of instruments *for all the 6 Nos. skids put together* is given below:

- Pressure/DP Gauges - 44 Nos.
- Temperature Gauges – 18 Nos.
- DP Switches – 6 Nos.
- Pressure Switches - 28 Nos.
- Level Switches - 6 Nos.

Lumpsum rate per set is to be quoted.

- Sl No C-87: Furnace temperature probes
  - Consist of Type K thermocouple, advance/retract/park mechanism with limit switch tripping, pressure switch, solenoid valve, local pushbutton cum control box , remote control station at control room, etc. The temperature probes will be erected by mechanical agency. The local control box (800x800x400, 75 Kgs) shall be erected by the contractor.

  Lumpsum rate per set is to be quoted.

- Sl No C-88: HEA Exciter System

  H.E.A. Excitor box along with retractor assembly, flexible spark rod, spark tip, flexible HT cable assembly, S.S. Hose (1 Mtr long, 6.35 mm ID), *Air Filter Regulator*, HEA Exciter transformer, limit switches etc. Lumpsum rate per set is to be quoted.

- Sl No C-94: Rack mounted Instruments commissioning

  Involves removal, calibration and refixing of rack mounted instruments, checking solenoid valves, drives, including wiring on the rack etc.

  - TDBFP Governing Console – 2 sets consisting of:

  Pressure Gauges: 6 Nos, Pressure Switches: 13 Nos

  - LP Bypass rack –1 set consisting of
    - Pressure Gauges: 11 Nos, Pressure Switches: 1 Nos
  - EHG Rack –1 set consisting of
    - Pressure Gauges: 10 Nos, Pressure Switches: 4 Nos
  - Supply Unit Racks for HPV-1, HPV-2, IPV-1&2 - 1 set consisting of
    - Pressure Gauges: 17 Nos, Pressure/DP Switches: 15 Nos

  Lumpsum rate per set is to be quoted.

- Sl No C-159: Computer furniture
  - Computer table 5 nos, printer tables 5 nos, chairs 10 nos approx.
  - The furniture will be delivered in knocked down condition and will have to be assembled at site by contractor.

  Lumpsum rate to be quoted.

- Sl No C-160: Plant Control Desk

- To be erected in the PCR (Plant Control Room).
- This consists of seven computer tables (app dim 1200x1400x1000), integrated into a single curved Operator control desk. Relevant CPUs will be housed inside.

Lumpsum rate to be quoted.

❖ Sl No C-161 to C-164: Assembly of JB mounting frames:

Galvanised members will be supplied. These are to be assembled as per drawings. Some frames are suitable for one side JB mounting and others are suitable for JB mounting on both sides. Rate quoted should include assembly and installation.

❖ Sl No E-2: 220/240VAC UPS

- *Parallel Redundant* UPS Power supply system with isolation transformer, inverter and SCVS, 2X100 KVA rating consisting of UPS panels 5 nos (App dim 1200x800x2200), Oil cooled variac (app 250 Kg without oil), AC distribution boards 2 nos (app 800 Kg), Battery of 192 Nos HDP tubular 550/600AH cells and charger. Scope includes laying and termination of approx 220 sqmm 3C copper / aluminium cable (about 200 meters) between the panels, battery banks etc.

Lumpsum rate per set is to be quoted.

❖ Sl No E-22: Electrical operated Hoist DSL cable trailing system, consists of following items (approx quantities for 20 hoists of one 250MW unit).

- Trailer Cable 4 core upto 25 Sq. mm. copper 1500m
- Dog Chain 1000m
- Cable Guide Trolley with cable clamping arrangement 400nos
- Switch Fuse Units (ICTPN) 30nos
- Reel Insulator/ Cable guide trolley 300nos
- Limit Switches 50nos

Testing & Commissioning of hoists is in the scope

Appendix-IIA

List of **T&P** to be made available **by BHEL** free of hire charges (on sharing basis).

01	EOT crane in TG hall shall be made available on sharing basis for handling panels	1 no
02	Tyre-Mounted Crane 8 MT Capacity	1 no.

Note:

Above T&P will be provided for specific erection/commissioning activities wherein these equipment will be required. While taking delivery, contractor shall check for proper working of the equipment and the same shall be returned after the work is completed to BHEL stores in good working condition subject to normal wear and tear.

Tyre-mounted crane will be made available on sharing basis for loading/ unloading at stores and site for handling heavier components. Operator, fuel and lubricants shall be arranged by the contractor or contractor shall share the cost. BHEL will provide spare parts in case of breakdown not attributable to the contractor (accidental damage, regular wear & tear). Contractor shall carry out regular preventive maintenance. Filters for Fuel and Oil will be provided by BHEL.

While all effort will be made for amicable sharing of the above, non-availability of the above due to any reason shall not absolve the contractor of performing his responsibilities in time. The contractor shall undertake sufficient pre-planning and arrange his own handling/transport equipment as deemed necessary.

Appendix-IIB

Consumables to be provided by BHEL free of charge

01 Metallic Cable glands

02 Lugs above 4 sq. mm. size

Appendix-IIIA		
List of major T&P, testing & measuring instrument/ tools and tackles to be arranged by contractor.		
SN	Description	Minimum Quantity
For C&I works		
Tentative List of Instruments		
01	Dead weight tester rated 400 Kg/ cm^2 and with weights and test gauge facility. Make 'Budenberg or 'Ravika'	1 no.
02	Oil temperature bath suitable to calibrate the instruments range 0 – 200 deg. C with standard temperature gauges and thermostatic control	2 nos.
03	Muffle furnace – 800 deg. C with standard temperature gauges	1 no.
04	Standard gauges 12" dial size make "Budenberg" or "H Guru" or "Odin"	
	A) – 1-0 kg/ cm^2 pressure gauge(vacuum gauge) B) 0 – 5 or 6 kg/ cm^2 pressure gauge C) 0 – 10 kg/ cm^2 – do – D) 0 – 25 kg/ cm^2 – do – E) 0 – 60 kg/ cm^2 – do – F) 0 – 100 kg/ cm^2 –do – G) 0 – 250 kg/ cm^2 – do – H) 0 – 600 kg/ cm^2 – do – I) 0.2 to 1 kg – do --	1 no. 1 no. 1 no. 1 no. 1 no. 1 no. 1 no. 1 no. 1 no.
05	Manometers (+/-) 1000 mm water column With hand bulb for lab and small manometers for field purpose.	2 nos.
06	Manometer (+/-) 500mm mercury column with hand bulb for lab and small manometer for field purpose.	1 no.
07	Inclined manometer (+/-) 300 mm water column	1 no.
08	Portable air compressor with drier and regulator make "Toshniwal" / "Khosla" rated for 7 to 10 kg/cm^2	2 nos.
07	Soldering iron "Soldron" make 25 watt	3 nos.
09	Vacuum pump	1 no.

Appendix-IIIA		
List of major T&P, testing & measuring instrument/ tools and tackles to be arranged by contractor.		
SN	Description	Minimum Quantity
10	Multimeters	
A) B) C)	Digital, 3 1/2 digit Motwane/HIL/Fluke Analog: Motwane make Digital, 4 1/2 digit Motwane/HIL/Fluke	15 nos 2 nos. 4 nos.
11	Standard milliamps / millivolts source of reputed make. Range 0 to 50 ma and 0 to 100 mv	4 nos.
12	Insulation tester hand operated 250V / 500V / 1000V rated mains/battery operated	1 no. Each
13	DC power supply 0 -50 VDC, 5 A make "Aplab" or equivalent (variable source)	2 nos
14	Single phase variac 250 V, 8 amp	1 no
15	3 phase variac rating 5 amps	1 no.
16	Glass thermometer 0 -120 deg. C, 0-200 deg.c and 0-600 deg.c	1 no. Each
17 18	Tong tester AC 5/10 and 25/60/300 amp of reputed make Tong tester DC 30/60/300 amp	1 no. Each 1 no.
19 20	Secondary current injection kit upto 300 amp Tarpaulin fire proof	1 no. 10 nos.
21	DC shunt 400 amp 75 mv	1 no.
22	Tachometer non-contact type 0 to 4000 rpm	1 no.
23	Industrial type vacuum cleaner	1 no.
24	RTD/Pt 100 source	4 nos.
25	Decade resistance box	3 sets.
26 27	Teletalk 2 wire system Function generator	6 sets 1 no
Tentative List for Electrical works		
01	TRANSFORMER OIL PURIFICATION PLANT WITH VACUUM PUMP FOR EVACUATION TRANSFORMER ALONGWITH ACCESSORIES & HOSES. A) CAPACITY 750/1000 LTR. PER HOUR	2 NOS.
02	PRIMARY INJECTION KIT UPTO 10000 AMPS WITH PAIR OF LEADS & CLAMPS FOR TESTING CTS	1 SET
03	SECONDARY INJECTION KIT WITH INTEGRAL TIMER FOR RELAY TESTING WITH CABLES LEADS & BANNA PLUGS SELECTIVE RANGE 5 AMPS & 1 AMPS RANGE (FOR RELAY TESTING)	1 SET

Appendix-IIIA		
List of major T&P, testing & measuring instrument/ tools and tackles to be arranged by contractor.		
SN	Description	Minimum Quantity
04	CFB & ZFB KIT OR EQVIVALENT FOR TESTING OF RELAY & DISTANCE PROTECTION	1 No. EACH
05	PPM TESTER FOR TRANSFORMER OIL	1 No.
06	METERS FOR TIME MEASUREMENT OF BREAKER OPENING & CLOSING TIME	1 No.
07	3 PHASE VARIAC 15 Amps	2 NO.
08	SINGLE PHASE VARIAC 28 AMPS	2 NO.
09	TRANSFORMER TURNS RATIO TEST KIT	1 NO.
10	HV TEST KIT AC, 0–50 KV &DC, 0 - 100 KV PREFERSBLY WITH DRY TYPE TRANSFORMER	1 NO. EACH
11	TRANSFORMER OIL BDV TEST KIT 0-100 KV WITH 2.5MM AIR GAP.	1 NO.
12	PORTABLE AIR COMPRESSOR WITH DRIER AND REGULATOR MAKE "TOSHNIWAL"/"KHOSLA" RATED FOR 7/10 KG/CM2	2 NO.
13	SOLDERING IRON "SOLDRON" MAKE 25 WATT	3 NOS.
14	VACUUM PUMP	1 NO.
15	MULTIMETRES	
16	DIGITAL "MOTWANE" MAKE 3.1/2 DIGIT OR HIL MAKE ANALOG MOTWANE MAKE DIGITAL 4.1/2 DIGIT Accuracy +/- 1% (HIL/MOTWANE/ Fluke make)	4 NOS. 4 NOS. 2NOS.
17	STANDARD MILLI AMPS/MILLIVOLTS SOURCE MAKE RANGE 0 TO 60 mA AND 0 TO 100 mV	2 NO.
18	INSULATION TESTER MOTORISED OPERATED / ELECTRONIC WITH SELECTIVE RANGE 0F 1000 / 2500/ 5000 VOLT. Range 0.5 Mega ohms to 10000 Mega ohms	1 No.
19	INSULATION TESTER MAINS OPERATED/ ELECTRONIC 500 volt & 1000 Volts Range 0.5 Mega ohms to 1000 Mega ohms	3 NO.
20	VARIABLE DC POWER SUPPLY 0 TO 250 V DC, 10 A MAKE "APLAB" OR RQUIVALENT(VARIABLE SOURCE)	2NO
21	PHASE SEQUENCE INDICATOR	1 NO.
22	FREQUENCY SOURCE 45 TO 55 HZ WITH 110V	1 NO.
23	DIGITAL TONGUE TESTER A/C 5/10, 25/60/300 AMP RANGE AC KEW SNAP MAKE	1 NO. EACH
24	DIGITAL TONGUE TESTER D/C 30/60/300 AMS	1 NO.
25	DIGITAL TONGUE TESTER 0 -1 / 5 AMPS AC	1 NO.
26	STOP WATCH	1 NO.
27	CONTAINER FOR TRANSFORMER OIL SAMPLING	10 NOS.

Appendix-IIIA		
List of major T&P, testing & measuring instrument/ tools and tackles to be arranged by contractor.		
SN	Description	Minimum Quantity
28	TARPOLIN FIRE PROOF	As required
29	DC SHUNT 400 AMS 75 MV	1 NO.
30	3 PHASE SHIFTER	1 NO.
31	INDUSTRIAL TYPE VACUUM CLEANER	1 NO.
32	MICRO OHM METER/DUCTER (mV volt Drop Test Kit) 0-200 A DC , 0-2000 Micro ohms with suitable calibrated cable leas for current injection & mv drop	1 NO.
33	C APACITANCE METER HAVING RANGE 20 pf –100MFD +/- 1%	1 NO.
34	DECADE RESISTANCE BOX	2 NOS.
35	TELETALK 2 WIRE SYSTEM	6 SETS
36	PORTABLE BLOWER WITH HEATING ARRANGEMENT	1 NO.
37	TORQUE WRENCH (12-60Nm, 50-225 Nm)	1 NO EACH
38	WATTMETER AC/DC 0-125-250V, 0-5-10A	1 NO
39	OSCILLOSCOPE 100 MHZ	1 NO
40	TACHOMETER (NON CONTACT TYPE)	1 NO
41	CAPACITANCE & TAN DELTA TEST KIT 12 KV	1 SET
42	OIL SPECIFIC GRAVITY AND PPM MEASURING INSTRUMENT	1 NO
43	RHEOSTAT	3 NOS
44	POLARITY TEST KIT	1 NO
45	NON – CONTACT TYPE DIGITAL THERMOMETER	1 NO
46	RELAY TESTING KIT	1 NO
47	TWO WAY INTERCOM SET WITH 50 to 100 MTRS CABLES FOR CHECKING THE CABLES CONTINUTITY	2 Sets
48	PROTECTIVE EARTH ROD SUITABLE FOR 220 / 400 KV SYSTEM HAVING LEAKAGE CURRENT METER, 70 SQMM CABLE & CLAMPS ANY REPUTED MAKE	2 Nos.
49	OTHER PROTECTIVE DEVICES	AS REQUIRED
Tentative List of Handling Equipment		
1	Turn buckles	As per reqmt
2	D-shackles	
3	Steel wire ropes	
4	Manila ropes	
5	Chain pulley block/Pull Lift Block	

Appendix-IIIA		
List of major T&P, testing & measuring instrument/ tools and tackles to be arranged by contractor.		
SN	Description	Minimum Quantity
Tentative List of Major T&P		
1	Pipe bending machine – 2" size	4 nos
2	Grinding machine	6 nos
3	Drilling machines 1/4", 1/2", 3/4" & 1"	1 no. Each
4	Copper tube bender and cutter sizes 6mm, 8mm, 1/2", 1/4"	1 no. Each
5	Die sets for threading upto 2" pipe.	2 nos
6	Spirit level	2 nos.
7	Tap sets for both BSP and NPT threads upto 1" each	1 set each
8	Measuring instruments like micrometers and callipers	1 set each
9	Welding generators	4 nos.
10	Welding transformer	4 nos.
11	TIG welding set	2 no.
12	Mechanical tool kit for fitters	6 sets.
13	Electrician tool kit including spanners, allen keys, etc	10 sets.
14	Crimping tool Hydraulic upto 600 sqmm	2 nos.
15	Flood light fittings	8 nos.
16	Fire extinguishers as required	1 set.
17	Distribution boards with power cable complete as required	1 set
18	Painting brush	As per reqmt.
19	Fire proof tarpaulin	As per reqmt.
20	Safety belts and safety helmets	As per reqmt.
21	24V AC transformer & hand lamps	8 nos.
22	Ferrule printing machine	2 nos
23	Electrode drying ovens	As required
24	Personal computer and accessories, Printer	1 set
25	Cranes, trucks	As per reqmt
26	MIG welding machine with accessories air cooled type	2 nos.
27	Torque wrench set	2 sets

Appendix-IIIA

Note:

The list of instruments / equipments to be deployed by the contractor as shown above is only indicative. Any other instruments/equipments and additional quantities required for the execution of the work is to be necessarily arranged by the contractor without any additional cost/price to BHEL.

Dedicated sets of tools/equipments and instruments are to be deployed for assistance for commissioning.

Contractor shall submit calibration certificate from NABL accredited agency prior to deployment of same at site. Periodical calibration of the same shall be arranged by contractor as per procedure of BHEL/engineering practice.

If contractor fails to arrange the testing instruments as listed above, BHEL will arrange the required instruments at the cost of contractor.

Appendix-IIIB

The following materials/consumables are to be arranged by the Contractor.

SN	Description
01.	Welding electrodes for welding AS/CS/SS pipe and other welding from BHEL approved vendors only
02.	Filler wire for argon welding
03.	Argon, oxygen and acetylene gas
04.	Provision for temporary scaffoldings.
05.	GI "U" clamps with nuts and washers for impulse and GI pipe clamping.
06.	Round aluminium tags (30mm dia x 3mm thick)
07.	Teflon tape and insulation tape.
08.	'Holdtight', bitumen tape, shellac compound for GI pipe coupling.
09.	Required paints and primer from BHEL approved vendors only.
10.	Solder wire (60/40)
11.	Protocol/calibration report sheets as per BHEL format.
12.	Panel/JB sealing compound material (for cable entry from bottom/top of panel).
13.	PVC cable tie, aluminium strip and hardware for clamping of cables, copper tube and temperature gauge capillary.
14.	Copper lugs up to 4 sq. mm. PVC sleeve of different size, PVC button & tape
15.	Ferrules (PVC) and ferrules suitable for ferrule printing
16.	Cold Galvanizing Paint, Synthetic Enamel conforming IS:2932, ROZC Primer conforming IS:2074, Thinner and other consumables for the aforesaid.
17.	Anchor fasteners for fixing anchor plates and anchor frames in concrete.

Pl note: The above list is only indicative. The contractor to arrange consumables as required as per scope of contract.

Appendix-IVA (Page 1 of 2)

Month-wise Manpower Deployment Plan by the Bidder for Erection, Calibration, Testing, Assistance for Commissioning etc. EXCLUDING INSTALLATION SUPERVISION SERVICES (category-wise number to be indicated in each month).

Sl. No.	Category	Months																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
01.	Resident manager																			
02.	Engineers																			
03.	Supervisors																			
04.	J) Mechanical K) Electrical L) Instrumentation D) industrial relation/safety																			
05.	Riggers																			
06.	Fitters																			
07.	HP welders																			
08.	Struct. Welders																			
09.	Tig welders																			
10.	Electricians																			
11.	Instrument technicians																			
12.	Store keeper																			
13.	Semiskilled & unskilled workers																			
14.	Watchmen/security																			

Note:

01. Minimum number of persons to be indicated month-wise.
02. Above deployment plan will be discussed prior to award of work and necessary changes will have to be made by contractor as per discussion, if required. Any additional deployment required during execution of work will have to be made by contractor for meeting various schedules/targets set by BHEL without any additional compensation.

Signature of tenderer with seal

Appendix-IVB (Page 1 of 1)

Month-wise Manpower Deployment Plan by the Bidder for INSTALLATION SUPERVISION SERVICES

Sl No	Category	Months																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	Cabling area: One service point																			
2	SG C&I erection area: One service point																			
3	SG C&I commissioning area: One service point																			
4	TG C&I erection area: One service point																			
5	TG C&I commissioning area: One service point																			
6	Station C&I erection area: One service point																			
7	Station C&I commissioning area: One service point																			
8	Control valves / dampers: One service point																			
9	Soot Blowers: One service point																			
10	Bus ducts : One service point																			
11	ESP: One service point																			
12	Motorised control valves commissioning area: One service point																			

Appendix-V																				
Deployment plan for major tools and plants/instruments (month-wise quantity to be indicated for each category) by the contractor.																				
S N	Category	Months																		Present location
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
01	Welding generators																				
02	Welding transformer																				
03	TIG welding sets (air cooled)																				
04	MIG welding set																				
05	Standard milli-amps source /milli-volt source																				
06	Low pressure calibrator																				
07	Pipe bending machine																				
08	Grinding machines																				
09	Drilling machines 1/4”, 1/2”, 3/4”, 1”																				
10	Dead weight tester																				
11	Oil temperature bath																				

Appendix-V

Deployment plan for major tools and plants/instruments (month-wise quantity to be indicated for each category) by the contractor.

SN	Category	Months																		Present location
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
12	Furnace 600 deg.c																				
13	Standard gauges 12” dia size																				
14	Manometers																				
15	Portable air compressor																				
16	Portable vacuum cleaner																				

Signature of Bidder with seal

Note:

Also, the list of other tools and plants to be deployed for this project may be indicated by the tenderers separately.

Above deployment plan will be discussed prior to award of work and necessary changes will have to be made by contractor as per discussion, if required. Any additional deployment required during execution of work will have to be made by contractor for meeting various schedules/targets set by BHEL without any additional compensation.

Appendix-VI

Analysis of unit rate quoted

Sl. No.	Description	Percentage OF unit rate quoted	Remarks if any
01	Site facilities viz., electricity, water, workshop and other infrastructure.		
02	Salary & wages		
03	Consumables		
04	Depreciation & maintenance for t&p/instruments and other items		
05	Establishment & administration expenses of site		
06	Retrenchment benefit		
07	Extra work incidental to erection		
08	Overheads		
09	Profit		

Signature of the tenderer with seal

APPENDIX–VII

DETAILS OF SIMILAR WORK DONE DURING THE LAST SEVEN YEARS

SL. NO.	FULL POSTAL ADDRESS OF CLIENT & NAME OF OFFICER IN CHARGE	DESCRIP-TION OF WORK	VALUE OF CONTRACT	DATE OF AWARD OF WORK	DATE OF COMMENCEMENT OF WORK	ACTUAL COMPLETION TIME (MONTHS)	DATE OF ACTUAL COMPLETION OF WORK	REMARKS
1								
2								
3								
4								
5								
6								
7								
8								
9								

BIDDERS SHALL ENCLOSE COPIES OF DETAILED WORK ORDER (GIVING BILL OF QUANTITIES AND SCOPE OF WORK) AND COMPLETION CERTIFICATE IN SUPPORT OF THIS STATEMENT.

DATE

SIGNATURE OF TENDERER WITH SEAL

APPENDIX –VIII

CURRENT COMMITMENTS OF THE TENDERER

SL. NO.	FULL POSTAL ADDRESS OF CLINT & NAME OF OFFICER IN CHARGE	DESCRIP-TION OF WORK	VALUE OF CONTRACT	DATE OF COMMENC EMENT OF WORK	SCHEDULE OF COMPLE - TION	% OF WORK COMPLETED AS ON DATE	EXPECTED DATE OF COMPLETION	REMARKS

DATE

SIGNATURE OF TENDERER WITH SE AL