

**C&I WORKS OF
Unit#1 & Unit#2**

TECHNICAL CONDITIONS OF CONTRACT (TCC) VOL-IA

**ERECTION, TESTING & COMMISSIONING OF C&I
Package FOR Unit#1 and Unit # 2 at 2X660 MW
NTPC Talcher Thermal Power Project, Stage-III,
Angul, Odisha**

BHARAT HEAVY ELECTRICALS LIMITED



TECHNICAL CONDITIONS OF CONTRACT (TCC)

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CHAPTER-I: PROJECT INFORMATION

1.	PROJECT INFORMATION	
1.1.	Project Name	2x660 MW NTPC Talcher TPS
	Talcher Thermal Power Project is situated near Talcher town in Angul district of Odisha. Talcher TPS was taken over by NTPC on 03.06.1995. The present proposal is for expansion of TTPS by adding 2 units of 660 MW.  LOCATION MAP:2X660MW Talcher Thermal Power Project	
1.2.	Plant Site Location	The proposed site is at a distance of about 4 km from Talcher town and about 25 km from district headquarters Angul in Odisha state, India.
1.3.	Nearest Town/ City	The proposed site is at a distance of about 4 km from Talcher town and about 25 km from district headquarters Angul in Odisha state, India.
1.4.	Nearest Railway Station	Talcher is on Talcher-Cuttack section of North Eastern Railway (renamed East Coast Railway) at about 2 Km. However, a small railway station named 'Talcher Thermal' is located near project boundary.
1.5.	Nearest Airport	Bhubaneshwar
1.6.	Nearest Seaport	Kolkata-424km
1.7.	Daily Ambient Temperature	Mean of daily minimum temperature = 15.1°C Mean of daily maximum temperature = 39.8°C
1.8.	Wind Speed	Design wind speed is 50 m/sec as per IS: 875 Part III

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1.9.	Seismic Zone	The project site lies in zone III as defined in IS: 1893.
Note: The Bidder shall acquaint himself by a visit to the site, with the conditions prevailing at site before submission of the bid. The information given here in under is for general guidance and shall not be contractually binding on the Owner. All relevant site data / information as may be necessary shall have to be obtained / collected by the Bidder.		

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2.	SCOPE OF WORK
2.1.	Name of the Package- A: ERECTION, TESTING & COMMISSIONING OF C&I PKG OF MAIN PLANT AREA-U#1 & COMMON SYSTEMS (Except AHP, CHP, LHP & GHP) Erection, Testing & Commissioning of C&I Package including providing labour, supervision, T&Ps, consumables, etc. for receipt of material from store/ storage yard, watch & ward, transportation to site {from inside or outside plant boundary}, pre-assembly, erection, testing, commissioning, trial run, handing over, etc., receipt & storage of self-supplied materials, for total scope defined in tender and terms & conditions of tender, taking into account of all clarifications, confirmations, agreements till date for complete work of Broad Scope of Work, etc for Main Plant Area - Unit #1 & Common Systems (Except AHP, CHP, LHP & GHP) of 2X660MW Talcher Thermal Power Project, Angul, Odisha. The work under these specifications broadly covers the complete work of handling at storage yard/ stores, transportation to work site {from inside or outside plant boundary (Approx 3 km away)}, calibration, pre-assembly, Minor Civil job (as per requirement), erection, testing, pre-commissioning, and handing over of Main Plant C&I System of Unit#1 i.e. SG & its Auxiliaries, TG and its Auxiliaries, Electrical Equipment with Transformer Yard, ESP, FGD, SCR including BOP / Common Systems like Water Systems, Common Areas / Buildings / Pump Houses etc. and other related areas also required for readiness of Unit-1&2 which are not specifically mentioned in this TCC. Name of the Package- B: ERECTION, TESTING & COMMISSIONING OF C&I PKG OF MAIN PLANT AREA-U#2 including AHP, CHP, LHP & GHP Erection, Testing & Commissioning of C&I Package including providing labour, supervision, T&Ps, consumables, etc for receipt of material from store/ storage yard, watch & ward, transportation to site {from inside or outside plant boundary}, pre-assembly, erection, testing, commissioning, trial run, handing over, etc., receipt & storage of self-supplied materials, supply of consumables as per BOQ for total scope defined in tender and terms & conditions of tender, taking into account of all clarifications, confirmations, agreements till date for complete work of Broad Scope of Work, etc for Main Plant Area – Unit #2 and AHP, CHP, LHP & GHP of 2X660MW Talcher Thermal Power Project, Angul, Odisha. The work under these specifications broadly covers the complete work of handling at storage yard/ stores, transportation to work site {from inside or outside plant boundary (Approx 3 km away)}, calibration, pre-assembly, Minor Civil job (as per requirement), erection, testing, pre-commissioning, and handing over of Main Plant C&I Systems Unit#2 i.e. of SG & its Auxiliaries, TG and its Auxiliaries, Electrical Equipment with Transformer Yard, ESP, FGD, SCR including AHP, CHP, LHP & GHP and other related areas also required for readiness of Unit-1&2 which are not specifically mentioned in this TCC. Supply of consumable like cable lugs and glands and termination and jointing kits as per BOQ given in Chapter-XII shall be in the scope of bidder. Separate payment shall be made on account of this. (applicable only for Pkg-B only). E&C of scope shall be completed as per approved drawings & instructions received from BHEL Engineers. The broad scope of ETC work includes: I. Cable Trays, Cable Ducts and Accessories

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	II. Cable Laying including Earthing Wires III. Junction Box/ Push Button Station IV. Conduits/ Impulse Pipe/ Tubes V. Miscellaneous Structural Steel including frames for panels/ racks/ instruments, supports for Cable Tray/ Pipes/ Tubes, Canopies etc. VI. Panels/ Cubicles/ Racks/ Enclosures/ Monitors/ Computer/ Computer Peripheral/ PLCs / UPS/ Batteries VII. Instruments/ devices including sensors/ cells/ probes etc VIII. Commissioning and testing activities for equipment erected by other agencies, like Control Valves, On/ Off Valves, Electrical/ Pneumatic Valves, Actuators, Solenoid Valves, Limit Switches, ERV Controllers, Power Cylinders, Pressure & Temperature Gauges / Transmitters, etc. IX. Power Cylinders X. Miscellaneous items (items not covered under above heads) like Coal Bunker Level Monitoring System, Master and Slave Clock System etc. XI. Fire Detection and Alarm Systems XII. Supply of Consumables for AHP, CHP, LHP & GHP (Applicable only for Pkg-B) E&C of scope shall be completed as per approved drawings & instructions received from BHEL Engineers.
2.2.	CONTROL & INSTRUMENTATION The contractor's scope of work is further described covering handling at storage yard/ stores, transportation to work site, calibration, pre-assembly, erection, testing, pre-commissioning, and handing over of Control & Instrumentation of the following packages:
2.2.1.	Control & Instrumentation of Boiler and its Auxiliaries Digital Distributed microprocessor based DCS system panels for FSSS, SADC, HP Bypass, auxiliary PRDS, soot blowers, coal milling system, gravimetric feeder remote/ local control panels, Electronic water level indicator, air heaters, electrical panels for DC control supply, electrical heat tracing system, STLD, Tray and instrument cabling, controlled circulation pumps, starter panel for mill lube oil/ fans and field devices/ instrumentation work for above system, piping, cabling etc.
2.2.2.	Turbine Generator Control & Instrumentation and its auxiliaries Digital distributed microprocessor based DCS system panels consist of TSC, EHTC, LPBP, TSI, ATT, LSR/ AS, ATRS, Turbine protection and monitoring, field instrumentation work/ cabling, boiler feed pumps/ condensate extraction pump, and misc. systems like lube oil, vacuum pumps etc.
2.2.3.	Station C&I/ Balance of Plant/ FGD/ SCR Digital Distributed microprocessor based DCS 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, Steam and water analyzers, instrumentations, cabling, etc. It may be noted that the work involves instrumentation work, cable laying & termination in all the Off-site areas like DM Plant, Chlorination Plant, Effluent Treatment Plan, Fire Detection & Protection System, AC System, Instrument Air Compressor System, etc.
2.3.	OVERVIEW
2.3.1.	The intent of specification is to procure 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.

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2.3.2.	The work covered under this specification is of highly sophisticated in 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, measuring instruments, calibrating equipment, modern/ latest construction aids etc. He must also deploy adequate numbers of trained, qualified and experienced engineers, supervisory staff and skilled personnel. The manpower deployment identified by contractor should match requirement of sophistication involved with the items mentioned in the BOQ.
2.3.3.	The work shall be executed under the usual conditions affecting major power plant construction and in conjunction with numerous other operations at site. The contractor and his personnel shall cooperate with personnel of BHEL, BHEL's customer, customer's consultants and other contractors, coordinating his work with others and proceed in a manner that shall not delay or hinder the progress of work or the project as a whole.
2.3.4.	Contractor shall erect, align and commission all the equipment 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.
2.3.5.	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.
2.3.6.	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/water/steam flushing, pre-commissioning tests, commissioning of systems, trial run of various auxiliaries, achieving various activities till handing over of the unit to BHEL's customer, providing maintenance team to cater to guarantee responsibilities and maintenance thereafter.
2.3.7.	Plant materials should not be used for any temporary supports/ scaffolding/ preparing pre-assembly bed etc.
2.3.8.	The contractor shall have total responsibility for all equipment and materials in his custody at contractor's stores, or any 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 or pilferage and shall also cover the finished parts immediately on completion of work as per BHEL Engineer's instructions. The machined surfaces/ finished surfaces should be greased and covered.
2.3.9.	At all stages of work, equipment/ materials in the custody of contractor, including those erected, will have to be preserved as per the instructions of BHEL.
2.3.10.	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.
2.3.11.	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 done departmentally or by engaging other agencies and recoveries will be affected from contractor's bills towards expenditure incurred.
2.3.12.	The terminal points decided by BHEL shall be final and binding on the contractor for deciding the scope of work and effecting payment for the work done.

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2.3.13.	During the course of erection, testing and commissioning of Control and Instrumentation works, certain rework/ modification/ rectification/ repairs/ fabrication etc., will be necessary on account of feedback 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. This will also include modifications/ re-works suggested by BHEL/ customer/ other inspection group. Contractor shall carryout such rework/ modification/ rectification/ fabrication repairs 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 works. Claims of contractor, if any, for such works will be dealt as per clauses 2.15 of GCC.
2.3.14.	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 clause no. 2.15 of GCC.
2.3.15.	Daily log sheets indicating the details of work carried out, man-hours, consumables used etc., shall be maintained by the contractor and counter-signed by BHEL Engineer every day.
2.3.16.	Contractor shall prepare Marked-Up drawings incorporating modifications and deviations from original drawings or prepare fresh sketch for actual installation/ connection details if required, that can be converted to "As-built" drawings by BHEL.
2.3.17.	All transport equipment, handling equipment, tools, tackles, fixtures, equipment, materials, manpower, supervisors/ engineers, consumables, electrodes including oxygen, acetylene argon etc. gases, primers, paints 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 clause. The contractor's quoted rates should be inclusive of all such contingencies.
2.3.18.	Electrodes (as per applicability) shall be baked/ dried in the electrode drying oven (range 375 – 425 °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.
2.3.19.	Equipment/ 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 as per the General Condition of the contract.
2.3.20.	Overhauling, cleaning, revisioning, servicing of equipment/ 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 equipment shall be preserved and protected before and after erection as per the advice of BHEL's Engineer.
2.3.21.	The glands & lugs shall be supplied either loose or fitted with the equipment. 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 the equipment 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.
2.3.22.	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 the 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 and settle it from the RA bill of contractor, if there is any failure on the part of contractor in this respect. 1% value of each RA bill will be earmarked against compliance of the above,

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	to be released only on satisfactory collection and deposit of scrap as stated above. In case of failure of contractor to comply with this requirement, BHEL will make suitable arrangement and settle it from the RA bill of contractor. In such case, any expenditure over and above the withheld 1% amount will also be recovered suitably from the RA bills of vendor.
2.3.23.	All works such as cleaning, leveling, aligning, trial assembly, dismantling of certain equipment/ 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 of cut outs/ openings for mounting of console inserts, modules, indicators, recorders, chipping, drilling of holes, reaming, scrapping, cable laying, dressing, lapping, 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 within the quoted rates.
2.3.24.	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 equipment without the specific written permission of the BHEL 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.
2.3.25.	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.
2.3.26.	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. forming an integral part of equipment or system are 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.
2.3.27.	Housekeeping 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 preassembly, boiler area and switch yard, etc. 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.
2.3.28.	The contractor shall ensure that all the packing materials and protection devices used for the various equipment during transit and storage are removed before the equipment are erected in position.
2.3.29.	All pipes and tubes, equipment, 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.
2.3.30.	Contractor shall calibrate, erect, commission all the equipment, cabinets/ panels 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.
2.3.31.	Descriptions of certain packages appearing in the rate schedule are available in this section and also in Chapter-XII, to give general idea to bidder about the type of equipment to be erected, calibrated, tested and commissioned.
2.3.32.	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.

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2.3.33.	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 (1no.) and printer (1no.) at his site office, along with suitable operator(s), consumables, etc. Such computer and & printer should not be more than 1 year old. Non-establishment of above equipment may attract penalty @Rs 10,000/- (Rs Ten thousand only) maximum per month under discretion of Project Director of Site. These computers/ printers & accessories shall remain contractor's property/ ownership for all legal/ technical purposes. The contractor will be allowed to take out the same after completion of the site works as per instruction of BHEL Engineer. All Engineers and Supervisors in the Planning, Quality, and MM groups shall be provided with a dedicated desktop or laptop for documentation and record maintenance.
2.3.34.	The weight & dimension as mentioned against the individual items in Price Bid Part –II Rate Schedules or elsewhere in the tender specification are indicative and approximate and there may be variation in dimension & weight in actual supply of equipment. No rate variation shall be considered on this account. 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 requirements; contractor shall note this point and assess the volume of work prior to submit the offer.
2.3.35.	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.
2.3.36.	The contractor shall prepare all erection/ commissioning log sheets and protocols/ test certificates as per field quality plan, and signed by the concerned BHEL/ BHEL's Customer engineer and submit the same to BHEL engineer as per his instruction.
2.3.37.	Contractor shall maintain the charged and commissioned equipment till the same is taken over by customer.
2.3.38.	The contractor shall work in co-ordination with civil, air-conditioning, ventilation, illumination fire protection & switchgear vendors. Where holes or openings in walls and floors are required for routing the conduits, the contractor shall provide the same. Cut-outs in false ceiling shall be provided by false ceiling contractor.
2.3.39.	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-2.15 of the GCC. The parts to be replaced shall however be provided by BHEL free of cost.
2.3.40.	It is the responsibility of contractor to provide skilled manpower for periodic maintenance after the initial commissioning till handing over the system.
2.3.41.	The terminal points as decided by BHEL shall be final and binding on the contractor.
2.3.42.	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.
2.3.43.	Calculation of Rates due variation in length of Panels
A)	Accepted unit rates for each panel shall remain firm regardless of any change in width, height, type, weight or other parameter (except length), as furnished in tender. For variation in length, adjustment to accepted rate of panel shall be based on following modality. Decision of BHEL shall be final & binding on bidder.
B)	For variation in length within +/- 15% of panel, accepted unit rates shall remain firm.
C)	For variation in length of panel beyond +/- 15% of specified length, wherever indicated in the tender, rate of unit length of variation shall be arrived by dividing the item rate by length as indicated in tender and rate/ price adjustment for payment during execution for length excess/ shortage over & above the +/- 15 % variation of indicated length shall be done accordingly on the following basis.

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D)	Based on above, if actual length exceeds variation limit, accepted unit rates will undergo change for the portion beyond 1.15/ 0.85 times of indicated length, additional payment/ recovery will be effected by BHEL in the following manner.
E)	Length of SWGR/ panel as indicated in tender = A.
F)	Accepted unit rate for SWGR/ panel = Rs B.
G)	Rate per unit length (L) to be considered for the purpose of additional payment/ recovery for variation in length = Rs B/A = Rs C.
H)	Actual length of the panel = D.
I)	Additional payment/ recovery in unit rate for variation of length beyond length $(1.15A/ 0.85A) = (D - 1.15A)/ (0.85A - D) \times C$.
J)	Applicability of new size of cable tray, cable, etc for a project of such magnitude may be inevitable. To derive rates of such new items of installation of cable tray, laying of cable, cable termination, etc, which are not covered in BOQ of Volume-III, following guidelines shall be applicable for this tender. Decision of BHEL shall be final & binding on bidder.
K)	For new size cable tray, width of cable tray will be taken into reference and rate of installation of cable tray of nearest width will be pro-rated to derive the rate for installation of new cable tray.
L)	To derive the rate for laying of new size cable, OD of cable will be taken into reference and rate of laying of cable of nearest lower OD will be pro-rated to derive the rate for laying for new cable.
M)	Rate for termination of new size cable and other items will be derived based on mutually agreed modality and on approval of BHEL.
2.4.	STATUTORY LICENCES AND OTHER RELATED REQUIREMENTS
2.4.1.	All the necessary certificates and licenses required to carry out this scope of work are to be arranged by the contractor then and there at no extra cost.
2.4.2.	Contractor shall arrange inspection of concerned Statutory Authority for the installation, testing & commissioning of applicable equipment covered under this tender specification and obtain their approval in appropriate format prior to charging of the equipment as per applicability.
2.4.3.	Contractor shall be responsible for all necessary liaisoning work with Statutory Authority towards the certification of installation/ works. BHEL shall reimburse Statutory Fees as per actual on submission of original receipt, however all incidental expenses shall be borne by Contractor. BHEL/ BHEL's Customer shall be providing technical assistance, drawings & document for submission to Statutory Authority. Contractor shall provide all logistical services in this regard.
2.4.4.	Contractor should have obtained valid C&I Contractor-ship License (as per applicability) to carry out the Erection, Testing & Commissioning work on applicable Voltage electrical equipment from the appropriate statutory authority of concerned state or Central Electricity Authority, as the case may be. All fees and expenses in this regard shall be to the contractor's account.
2.4.5.	Supervisory Competency Certificate of Applicable Voltage for equipment erection, testing & commissioning classes as defined in this tender specification, issued by applicable appropriate State or Central Statutory Authority. During the execution of work minimum two persons should be posted at site who have valid Supervisory Competency Certificate.
2.4.6.	The installation of all electrical equipment shall be carried out only by persons holding valid certificates of Competency for the voltage classes as defined in this tender specification, issued by appropriate state or central Statutory Authority. Contractor shall submit the particulars of Licenses held by him.
2.4.7.	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 in time to ensure smooth progress of work.
2.4.8.	If the contractor does not have these licenses and statutory requirements, then the contractor has to arrange them to work in the concerned state where the project is being executed within 6 weeks of mobilization at site for carrying out the works covered under this contract without any additional cost to BHEL.

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2.5.	COLLECTION OF MATERIALS
2.5.1.	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 equipment 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 equipment such as laboratory equipment, measuring and control equipment, electronic items, gauges, panels, console inserts, switches, transmitters, controllers, 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, labor, etc., for transport of equipment.
2.5.2.	Damaged cable drums or any damaged items also to be shifted within the quoted rates. No extra compensation for difficulty in shifting due to damaged drums shall be done in this regard.
2.5.3.	The distance between storage area and erection site is approx. 3 km away. However, this location may change at the discretion of the BHEL's customer. Contractor shall plan and transport equipment, components from storage to erection site and erect them in such a manner and sequence that material accumulation at site does not lead to congestion at site of work. Materials shall be stacked neatly, preserved and stored in the Contractor's shed and at work areas in an orderly manner. In case it is necessary to shift and re-stack the materials kept at work areas/ site to enable other agencies to carry out their work or for any other reason, same shall be done by Contractor most expeditiously as incidental to work. No claim for extra payment for such work will be entertained.
2.5.4.	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.
2.5.5.	Contractor shall plan and transport equipment/ 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 may be 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 (no claim for extra payment for such work will be entertained) failing which the same will be arranged by BHEL and all charges together with departmental charges will be recovered from his bills.
2.5.6.	The contractor shall take delivery of the components, equipment, chemicals, lubricants etc. from the storage area/ sheds of BHEL/ customer after getting the approval of BHEL/ customer on standard indent forms to be specified by BHEL/ customer. Complete and detailed account of the materials and equipment after usage shall be submitted to the BHEL and reconciled periodically.
2.5.7.	The contractor shall handover all the damaged, unused materials, package materials, containers, special transporting frames, gunny bags, 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.
2.5.8.	Equipment/ instruments etc., under the scope of erection and commissioning are generally dispatched from BHEL's Manufacturing Units/ vendor's works to erection site well before the start of erection.

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	Sometimes, such dispatched 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 within the quoted rates.
2.6.	GUIDELINES FOR HANDLING AND STORAGE
2.6.1.	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.
2.6.2.	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.
2.6.3.	After opening the case, all supports provided for transport are to be removed with due care.
2.6.4.	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 equipment may get damaged due to vibration and shock.
2.6.5.	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.
2.6.6.	The equipment should preferably be stored 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.
2.6.7.	The wooden pallet provided for packing itself can be retained on raised platform to protect equipment from ground damp, sinking into and to circulate air under the stored equipment. This will also help in lifting the package with fork-lifter.
2.6.8.	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.
2.6.9.	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.
2.6.10.	All the equipment, 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.
2.6.11.	The packing material shall be retained if the cubicle is to be repacked after inspection.
2.6.12.	All subassemblies should be kept in a separate place where they are easily accessible.
2.6.13.	Subassemblies should have a protective cover in case they are stored without wooden packing/ case to prevent accumulation of dust. Silica gel packets should also be kept along with it.
2.6.14.	Subassemblies should not be stacked one above the other.
2.6.15.	The loose items supplied for the main equipment falls into various categories like tools, cables, prefabricated cables, console inserts, recorders, VDU/ CRT, other display units, printers, sensors and transducers, cable glands, cable ducts, frames, racks, etc. These are to be categorized and stored separately.
2.6.16.	All the electronic modules shall be handled by qualified personnel only.
2.6.17.	Electronic modules should only be touched when it is absolutely essential to do so.
2.6.18.	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.

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2.6.19.	The operator should not wear clothing made entirely from synthetic fibres, but a mixture containing at least 65% cotton.
2.6.20.	The PCB should always be held by front panel or by module frame and electronic components/ connectors should never be touched.
2.6.21.	The electronic modules should not be placed close to television sets or CRT units.
2.6.22.	Soldering irons and any other tools used must be grounded.
2.6.23.	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.
2.7.	MEASUREMENTS, WASTAGE & CUTTING ALLOWANCE
2.7.1.	The contractor shall not waste any materials issued to him. In case it is observed at any stage that the wastage/ excess utilization of materials is not within the permissible limits, recovery for the excess quantity used or wasted will be effected with departmental charges from the contractor. Decision of BHEL on this will be final and binding on the contractor.
2.7.2.	The entire surplus, damaged, unused materials, packaging materials/ containers, special transporting frames, gunny bags, etc., shall be returned to BHEL stores by the contractor.
2.7.3.	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's engineer in this regard will be final and binding on the contractor.
2.7.4.	For all payment purposes, measurement shall be made on the basis of the execution of drawings/ physical measurements. Physical measurements shall be made by the contractor in the presence of the BHEL Engineer.
2.7.5.	The measurement for cable, impulse pipes/ tubes, GI pipe, conduits, flexible conduits, trays etc., shall be made on the basis of length actually laid.
2.7.6.	All the surplus, damaged, unused materials, package material, containers, special transporting frames, gunny bags, etc. 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 BHEL Engineer.
2.7.7.	All materials returned to stores should carry aluminium tag indicating the size and type. Power cables more than 15 meters' length and C&I cable more than 5 meters' length is termed as serviceable material 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.
2.7.8.	While carrying out material reconciliation 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 will be taken as the net quantity issued to the contractor. Material reconciliation 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.
2.7.9.	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.
2.7.10.	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.

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2.7.11.	The erection contractor shall make every effort to minimize wastage during erection work. Cutting and wastage allowance shall be computed on length, weight of material actually used, measured and accepted. In any case, the wastage shall not exceed the following limits:																	
	<table><tr><th>S. No.</th><th>Item</th><th>%age Wastage on Erected Qty</th></tr><tr><td>a)</td><td>Each iron/ steel fabricated section</td><td>2</td></tr><tr><td>b)</td><td>Each size of power cables</td><td>1</td></tr><tr><td>c)</td><td>Each size of control/ instrumentation cable</td><td>2</td></tr><tr><td>d)</td><td>Impulse pipes/ tubes/ GI pipes/ copper tubes</td><td>1</td></tr></table>	S. No.	Item	%age Wastage on Erected Qty	a)	Each iron/ steel fabricated section	2	b)	Each size of power cables	1	c)	Each size of control/ instrumentation cable	2	d)	Impulse pipes/ tubes/ GI pipes/ copper tubes	1		
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2.7.12.	If the actual wastage is more than the specified figure, then equivalent price of the excess portion will be deducted from the contractor's bill.																	
2.7.13.	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 and the type of cable required for various destinations, the cable drums shall be suitably selected for cable laying. Any jointing shall have to be approved by BHEL Engineer. All the cut pieces/ bits of cables, which are not used, 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.																	
2.7.14.	Salvageable scrap shall mean lengths of pipes, multi-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, multicore cables, cables etc.																	
2.7.15.	Non - Salvageable scrap means the lengths of tubes, pipes, multicore cables, cables etc., and they are from cut-pieces of tubes, pipes, multicore cables, cables etc., that cannot be used at all one time or other.																	
2.7.16.	As per the contract material like cable tray and accessories, cables, tray supports shall be supplied by BHEL and customer. Reconciliation shall be done and duly submitted every month with joint signature to BHEL and Customer.																	
2.7.17.	The rate of laying for LT power, control and signal cable is inclusive of glanding, trefoil clamps and termination at both ends. Glands & Lugs above 4 sq. mm shall be supplied by BHEL & lugs up to 4 sq. mm shall be in vendor's scope. The rate for erection will be part of laying rates. No separate rate is applicable on this account.																	
2.7.18.	For any items or classes of work not specified herein but required for total completion of work, the same shall be carried out as per BHEL requirement. However, payment for these items/ class of work shall be regulated on the basis of rate arrived as per GCC.																	
2.8.	CABLE TRAYS/ CABLE DUCTS AND ACCESSORIES																	
2.8.1.	Cables shall run in cable trays mounted horizontally or vertically on cable tray support system which in turn shall be supported from floor, ceiling, overhead structures, trestles, pipe racks, trenches or other building structures.																	
2.8.2.	Horizontally running cable trays shall be clamped by bolting to cantilever arms and vertically running cable trays shall be bolted to main support channel by suitable bracket/ clamps on both top and bottom side rails at an interval of 2000mm in general. For vertical cable risers/ shafts cable trays shall be supported at an interval of 1000mm in general. Fixing of cable trays to cantilever arms or main support channel by welding shall not be accepted. Cable tray installation shall generally be carried out as per the approved guidelines/ drawings.																	

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2.8.3.	The cantilever arms shall be positioned on the main support channel with a minimum vertical spacing of 300mm unless otherwise indicated.
2.8.4.	Spacing between cable trays shall normally be kept 300mm for cable laying convenience and effective heat dissipation. Where direct heat radiation exists, heat isolating barriers shall be adopted.
2.8.5.	The contractor shall fix the brackets/ clamps/ insert plates using anchor fasteners. Minimum size of anchor fasteners shall be M8x50 and material shall be stainless steel grade 316 or better. Anchor fastener shall be fixed as recommended by manufacturer and as approved by site engineer. For brick wall suitable anchor fasteners shall be used as per the recommendations of manufacturer.
2.8.6.	All cable way sections shall have identification, designations as per cable way layout drawings and painted/ stenciled at each end of cable way and where there is a branch connection to another cable way. Minimum height of letter shall be not less than 75mm. For long lengths of trays, the identification shall be painted at every 10meter and at each end of cable tray & branch connection floor/ wall opening. Risers shall additionally be painted/ stenciled with identification numbers at every floor.
2.8.7.	In certain cases, it may be necessary to site fabricate portions of trays, supports and other non-standard bends where the normal prefabricated trays, supports and accessories may not be suitable. Fabricated sections of trays, supports and accessories to make the installation complete at site shall be neat in appearance and shall match with the prefabricated sections in the dimensions. They shall be applied with one coat of red lead primer, one coat of oil primer followed by two finishing coats of aluminium paint.
2.8.8.	Various types of sheet metal, galvanized 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, trefoil clamps and tray clamps etc.
2.8.9.	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 paint (refer clause no. 2.35 for details) on weld joints. Installation of tray/ duct covers, wherever provided, will be done as a part of tray erection and no extra rates will be payable.
2.8.10.	Fabrication of bends/ tee/ reducers from straight length of tray is within the scope of work and rate quoted shall be inclusive in unit rate (in running meter).
2.8.11.	Cable trays/ ducts have to be routed underground in cable trench, over head on structure, valves, floors etc. for various applications such as cable laying, copper tubes, conduits, thermocouple, temperature gauge capillary etc.
2.8.12.	As per the BOQ Main Cable tray and support shall be installed in Cable cellar, Boiler floors, All floors in B-C, C-D, and Mill, ID-Fan, PA-Fan, ID-Fan, ESP, Soot Blower area, and other associated systems. Looping Trays shall be laid from JB to Field which is also under the scope of the contract.
2.8.13.	Cable trays where ever is required by the other BHEL vendor (from BHEL Equipment to BHEL Equipment) are included in this contract as sizes mentioned in BOQ. Cable tray routing shall be done by the agency as per the drawing provided by PEM or Concerned agency.
2.8.14.	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:
2.8.15.	Ladder type cable trays shall be used in cable trenches and vertical risers.
2.8.16.	Perforated cable trays shall be used in higher elevations in Boiler and TG area.
2.8.17.	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.
2.8.18.	Cable trays in boiler & ESP area shall be supported from the boiler and ESP structures. The same shall be coordinated with Boiler/ ESP contractor.

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2.8.19.	Cable trays in these areas shall be in vertical formation to avoid dust accumulation. No cable trenches shall be provided in Boiler/ ESP area.
2.8.20.	Cable tray philosophy shall be as per enclosed cable erection philosophy as per Annexure-1 (Chapter-XI).
2.9.	METAL CHANNEL FLEXIBLE BOLTABLE CABLE SUPPORT SYSTEM (ESP/ BOILER / As per the drawing provided by BHEL for main route to AHP/ CHP etc.)
2.9.1.	Flexible GI cable support system, consisting of single/ double channels, base plates, and cantilever arms are as per BOQ. Wherever necessary, the base plate beam clamps will be supplied for bolting. Otherwise, the base plates are to be welded to the racks or beams if necessary, at 90°.
2.9.2.	Wherever supplied, GI cable trays shall be of bolted construction only with fixing screws and coupler plates.
2.9.3.	Angle fittings, flat plate fittings, clamps for single & double channels, fasteners etc. will be supplied for fixing trays and cantilever arms and for this no separate erection charges will be paid. Quoted Rate Rates shall be accommodated in support channel and cantilever arm erection.
2.9.4.	Metal channel bolt able GI cable support shall be supplied. Each cable rack assembly comprises of sub components such as single or double channel, base plate for single/ double channel, angle fitting, clamps, cantilever arm, anchor fastener, associated hardware (spring loaded nuts, bolts and washers) etc.
2.9.5.	Channel shall be supplied in standard length of six meter. Contractor shall cut the channel and assembly the rack as per site requirement. Cantilever arm is to be fixed on channel support with spring loaded nuts/ bolts as per installation drawing.
2.9.6.	Base plate/ angle fitting shall be continuously welded all around to steel members/ plate insert if provided. Brackets/ clamps shall be welded to steel surface with channel as applicable in position to ensure alignment of clamps/ channels. Weld thickness shall be 6 mm minimum. In case steel surface in not available for welding, anchor bolts is to be used for fixing the base/ angle fitting.
2.9.7.	Main support for longitudinal cable tray run in the cable vaults shall be fixed at both ends at top as well at bottom as out lined above.
2.9.8.	Galvanization damaged due to welding/ cutting shall be re-painted with cold galvanizing paint (refer Clause no. 2.35 for details).
2.9.9.	Flexible GI cable support system, consisting of single/ double channels, base plates, cantilever arms as per BOQ given. Wherever necessary, the base plate and beam clamps will be supplied for bolting. Otherwise, the base plates are to be welded to the racks or beams. Necessary 90° angle fittings, flat plate fittings, clamps for single & double channels, fasteners etc. will be supplied for fixing trays and cantilever arms and for this no separate erection charges will be paid. Rates shall be accommodated in support channel and cantilever arm erection. Support channels will be supplied in standard running lengths, and shall be cut at site depending on requirement, and exposed metal portion shall be painted as per specification given in the relevant sections (refer clause no. 2.35). Payment for erection will be made on per meter basis. No separate rate will be paid for cutting & painting.
2.9.10.	Unit rate for "Single/ Double Channel" shall include cutting channel in required lengths, fixing of angle fittings/ base plate/ clamps/ brackets/ fasteners/ cantilever arms/ welding etc. as required as per type of installation.
2.9.11.	The Nuts & bolts should be galvanized type.
2.10.	CABLE LAYING (POWER/ CONTROL/ INSTRUMENTATION SHIELDED/ UNSHIELDED CABLES/ PLUG-IN CABLES/ COAXIAL/ UTP/ STP/ DATA HIGHWAY, ARMoured/ UN-ARMoured, SINGLE-CORE/ MULTI-CORE, PVC/ HR PVC/ FRLS/ TEFLON/ PTFE/ XLPE INSULATION, OPTICAL FIBER)
2.10.1.	Cable installation shall be carried out as per IS:1255 and other applicable standards.

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2.10.2.	Cable laying includes cutting to the required length, laying in overhead cable racks/ underground cable trenches/ 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's, providing printed ferrules (ferrule printing machines to be provided by contractor for printing necessary cross ferruling details)/ providing PVC numerical/ alphabetical/ printed ferrules (contractor to arrange adequate numbers of his own ferrule printing machine), termination by using crimp type copper tinned/ aluminium lugs, insulated/ un-insulated, termination (crimp, soldering, etc.), plug-in connections with insert type crimping, continuity checking, providing identification PVC/ aluminium cable tags (at both the ends and at appropriate intervals (approximately 30meter) throughout the route length and also at each bend), continuity checking, insulation resistance checking. Laying of Optical fiber cables on cable trays/ cable trench shall necessarily be done using flexible conduit. In case of Underground cable, contractor to execute the excavation work, brick work, laying of cables and finishing.
2.10.3.	Entry to the panels and JB's may be at top, sides or bottom. All cables are required to be properly supported and clamped near to the JB/ panel. Spare Holes of JB/ Panels are to be sealed as per the requirement.
2.10.4.	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.
2.10.5.	Copper tinned lugs of various types (pin, ring, fork, snap-on) up to 4 sq. mm conforming to IS: 694 for cables, PVC cable ties, PVC ferrules, PVC button and tapes, cable identification tag of PVC/ metal as per site requirement, clamping and dressing material such as suitable cable ties/ clamps etc. with hardware, PVC sleeves etc. shall be supplied by the contractor within the quoted rates for cable laying. However, trefoil clamps with hardware for single core power cable shall be supplied by BHEL. No separate payment for erection of this trefoil clamp will be entertained and is included in the cable laying. The quality of material shall be got approved from BHEL Engineer prior to their use on job.
2.10.6.	All care should be taken to avoid abrasion, tension, twisting, kinking, and stretching of cables during installation. Rollers are to be used during pulling of cable for long length.
2.10.7.	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's and grounded at panel end only. While terminating the shield wire either in either panel or JB's, PVC sleeves are to be used to avoid two-point earthing.
2.10.8.	Spare holes in the panels/ Instruments/ Actuators/ Motors/ JB's etc. shall be sealed by suitable method by contractor. (The cost of work and Materials such as aluminium sheet or Adhesive tape/ Plugs etc. shall be within the quoted rates for laying of cables).
2.10.9.	Insulation test of the various circuits shall be done.
2.10.10.	Wherever cables run through ducts, conduits, valves, etc., they shall be sealed using fire/ weather proof compound. In addition to this, cable entry in panels, MCCs, instruments, electrical actuators etc., are also required to be sealed. The Contractor has to ensure the laying of cables along with presence of necessary Fire Sealant.
2.10.11.	All the cables will be properly laid in cable trays, dressed and clamped with aluminum flats. The cable will be terminated at both ends with suitable lugs and printed ferrules and will be glanded properly. Suitable equipment and consumables for ferrule printing has to be arranged by the contractor at his own cost. For cable identification, the contractor shall provide at his cost aluminium tags at regular intervals (20 m) through each run of cable.
2.10.12.	All electrical connections shall be tested for polarity and proper connections.
2.10.13.	The checking of operation of individual equipment and instruments to which the cabling/ wiring connected shall also be done by the contractor.

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2.10.14.	Wherever supplied, GI cable trays shall be of bolted construction only with fixing screws and coupler plates.
2.10.15.	To the extent possible, all the trays shall be fixed in vertical orientation
2.10.16.	Where power and control cables are to be laid in the same route, suitable barriers to segregate them physically shall be employed.
2.10.17.	Space equal to the diameter of cable shall be provided between power cables of six over 50 mm in diameter.
2.10.18.	When cables pass through floors, walls etc., it shall be passed through a pipe for mechanical protection and the pipe ends sealed suitably.
2.10.19.	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.
2.10.20.	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 or as per the datasheet, whichever is higher.
2.10.21.	No cable shall be laid in ducts or trenches where other services such as oil pipes, steam or water pipes are laid.
2.10.22.	Where cabling passes through brickwork or concrete work, the contractor shall provide suitable local protection against mechanical damage wherever necessary.
2.10.23.	The layout of all cables shall be arranged to give adequate clearance from other services and cables shall be routed to avoid hot zones. No extra cost shall be considered for rework.
2.10.24.	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.
2.10.25.	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.
2.10.26.	Many of the cable trays and cables have to be laid in cable trenches. For this purpose, the cover of the trenches has 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.
2.10.27.	Cables to be laid for exhaust fan and its starter box shall be laid on the wall/ beam/ ceiling for that spacer, cleat and clamp material shall be supplied by the bidder. Cable laying rate shall be inclusive of hardware items.
2.10.28.	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. Re termination of control cable in panel or equipment side due to any reason will not be paid extra. Agency shall provide the electrician during commissioning of equipment after cable termination work if necessary.
2.10.29.	Sharp bends of cable trays shall be avoided in all type of cable trays.
2.10.30.	Contractor shall carefully plan the cutting schedule of each cable drum in consultation with BHEL site engineer such that wastage is minimized. Recovery will be made in case the wastages are exceeding the wastage allowances fixed in this contract.
2.10.31.	The erection contractor shall make every effort to minimize wastage during erection work.
2.10.32.	Terminal Connections: The types of cable terminations are generally with following conditions: i) All field cables in above areas are crimp type of different sizes. ii) All JB's are both side screw type.

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	iii) All console tiles wiring: screwed or plug-in type to be fabricated at site.
2.10.33.	Complete termination and splicing of Optical Fiber Cable is in the scope of the vendor including supply of required items. Only the Optical Fiber Cable will be supplied by BHEL.
2.10.34.	For Cable unloading, pulling etc. following guidelines shall be followed in general:
2.10.35.	Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall be drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication, the drums may be rolled in the same direction as it was rolled during taking up the cables. For unreeling the cable, the drum shall be mounted on suitable jacks or on cable wheels and shall be rolled slowly so that cable comes out over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends. Cable ends shall be provided with sealed plastic caps to prevent damage and ingress of moisture.
2.10.36.	While laying cable, ground rollers shall be used at every 2-meter interval to avoid cable touching ground. The cables shall be pushed over the rollers by a gang of people positioned in between the rollers. Cables shall not be pulled from the end without having intermediate pushing arrangements. Pulling tension shall not exceed the values recommended by cable manufacturer. Selection of cable drums for each run shall be so planned so as to avoid using straight through joints. Care should be taken while laying the cables so as to avoid damage to cables. If any particular cable is damaged, the same shall be repaired or changed to the satisfaction of Engineer in Charge.
2.10.37.	Cables shall be laid on cable trays strictly in line with cable schedule. Where specific cable layouts are not shown on drawings, Contractor shall route these as directed by the Engineer in Charge
2.10.38.	Power and control cables shall be laid on separate tiers in line with the approved guidelines/ drawings. The laying of different voltage grade cables shall be on different tiers according to the voltage grade of the cables. In horizontal tray stacks, H.T. cables shall be laid on top most tier and cables of subsequent lower voltage grades on lower tiers of trays. Single core cable in trefoil formation shall be laid with a distance of four times the diameter of cable between trefoil center lines and clamped at every two meter. All multicore cables shall be laid in touching formation. Power and control cables shall be secured fixed to trays/ support with cable clamps/ ties with self-locking arrangement. For horizontal trays arrangements, multicore power cables and control cables shall be secured at every five-meter interval. For vertical tray arrangement, individual multicore power cables and control cables shall be secured at every one meter. After completion of cable laying work in the particular vertical tray, all the control cables shall be bound to trays/ supports by cable clamps/ ties with self-locking arrangement at every five-meter interval and at every bend. Fiber Optical cable shall be laid in trenches/ trays or as decided by BHEL.
2.10.39.	Bending radii for cables shall be as per manufacturer's recommendations and IS:1255.
2.10.40.	Where cables cross roads/ rail tracks, the cables shall be laid in hume pipe/ HDPE pipe.
2.10.41.	No joints shall be allowed in trip circuits, protection circuits and CT/ PT circuits. Also joints in critical equipment in main plant area shall not be permitted. Vendor shall identify and accordingly issue the cable drum length.
2.10.42.	In each cable run some extra length shall be kept at suitable point to enable one LT joints to be made. Control cable termination inside equipment enclosure shall have sufficient lengths so that shifting of termination in terminal blocks can be done without requiring any splicing.
2.10.43.	Wherever few cables are branching out from main trunk route troughs shall be used.
2.10.44.	Where there is a considerable risk of steam, hot oil or mechanical damage cable routes shall be protected by barriers or enclosures.
2.10.45.	The installation work shall be carried out in a neat workman like manner & areas of work shall be cleaned of all scraps, water, etc. after the completion of work in each area every day. Contractor shall

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	replace RCC/ Steel trench covers after the Installation work in that particular area is completed or when further work is not likely to be taken up for some time.
2.10.46.	Separation: At least 300mm clearance shall be provided between: HT power & LT power cables, LT power & LT control/ instrumentation cables.
2.10.47.	Segregation
2.10.48.	Segregation means physical isolation to prevent fire jumping.
2.10.49.	All cables associated with the unit shall be segregated from cables of other units.
2.10.50.	Interplant cables of station auxiliaries and unit critical drives shall be segregated in such a way that not more than half of the drives are lost in case of single incident of fire. Power and control cables for AC drives and corresponding emergency AC or DC drives shall be laid in segregated routes. Cable routes for one set of auxiliaries of same unit shall be segregated from the other set.
2.10.51.	In switchyard, control cables of each bay shall be laid on separate racks/ trays.
2.10.52.	Cable tags shall be provided on all cables at each end (just before entering the equipment enclosure), on both sides of a wall or floor crossing, on each duct/ conduit entry, and at every 20 meters in cable tray/ trench runs. Cable tags shall also be provided inside the switchgear, motor control centers, control and relay panels etc. where a number of cables enter together through a gland plate. Cable tag shall be of rectangular shape for power cables and control cables. Cable tag shall be of 2 mm thick aluminum with number punched on it and securely attached to the cable by not less than two turns of 20 SWG GI wire conforming to IS:280. Alternatively, the Contractor may also provide cable tags made of nylon, cable marking ties with cable number heat stamped on the cable tags. The cable tag requirements mentioned above shall prevail over Tag requirements mentioned elsewhere in this document for LT power & control cables.
2.10.53.	While crossing the floors, un-armoured cables shall be protected in conduits up to a height of 500 mm from floor level if not laid in tray.
2.10.54.	The termination and connection of cables shall be done strictly in accordance with cable termination kit manufacturer" instructions, drawings and/ or as directed by Engineer in Charge.
2.10.55.	Cable jointer shall be qualified to carryout satisfactory cable jointing/ termination. Contractor shall furnish for review documentary evidence/ experience reports of the jointers to be deployed at site.
2.10.56.	Work shall include all clamps, fittings etc. and clamping, fitting, fixing, plumbing, soldering, drilling, cutting, taping, preparation of cable end, crimping of lug, putting insulated sleeves over control cable lugs, heat shrinking (where applicable), connecting to cable terminal, shorting and grounding as required to complete the job to the satisfaction of the Engineer in Charge.
2.10.57.	The equipment will be generally provided with undrilled gland plates for cables/ conduit entry. The Contractor shall be responsible for punching of gland plates, painting and touching up. Holes shall not be made by gas cutting. The holes shall be true in shape. All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively sealed by 2 mm thick aluminium sheets.
2.10.58.	Control cable cores entering control panel/ switchgear/ MCC/ miscellaneous panels shall be neatly bunched, clamped and tied with self-locking type nylon cable ties/steel ties with de interlocking facility to keep them in position.
2.10.59.	All the cores of the control cable to be terminated shall have identification by providing ferrules at either end of the core, each ferrule shall be indelible, printed single tube ferrule and shall include the complete wire number and TB number as per the drawings. The ferrule shall fit tightly on the core. Spare cores shall have similar ferrules with suffix sp1, sp2, ---etc. along with cable numbers and coiled up after end sealing.
2.10.60.	All cable terminations shall be appropriately tightened to ensure secure and reliable connections.
2.10.61.	The erection contractor shall supply consumables like aluminum tags, lugs and ferrules.
2.10.62.	Buried cable routes shall have marker projecting 150mm above ground and shall be spaced at an interval of 30m along the route and at every bend.

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2.10.63.	No single core cable shall pass through a GI conduit/ pipe or duct singly except DC single core cables. AC single core cables shall pass through GI conduit/ pipe in trefoil formation only, or through PVC pipes conforming to IS: 4985.
2.10.64.	LT Power cables of cross-sectional area less than 95 sq. mm. and all control and Instrumentation cables shall be clamped in bunches by means of cable nylon ties/ steel ties.
2.10.65.	Trefoil clamps for single core cables to be supplied shall be pressure die cast aluminum or fiber glass or nylon and shall include necessary fixing accessories like G.I. nuts, bolts, washers, etc. Trefoil clamps shall have adequate mechanical strength to withstand the forces generated by the peak value of maximum system short circuit current.
2.10.66.	Cable lugs/ ferrules for power cables shall be tinned copper solderless crimping type suitable for aluminium compacted conductor cables. Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipment. Cable lugs and ferrule shall conform to DIN standards.
2.10.67.	Testing and electrical measurement of cable installations shall conform to the requirement of IS: 1255.
2.10.68.	The rate of laying for LT power, control and signal cable is inclusive of glanding, trefoil clamps and termination at both ends. Glands & Lugs above 4 sq. mm shall be supplied by BHEL & lugs up to 4 sq. mm shall be in vendor's scope. The LT Power Cable straight through Jointing Kit (if required) shall be in vendor's scope of supply. The rate for erection for all these items will be part of laying rates. No separate rate is applicable on this account.
2.10.69.	Cable laying shall include drilling of gland holes, fixing of cables, glanding, tagging, ferruling, termination & continuity checking.
2.10.70.	Metallic sheaths, screens/ shields and armour of all multicore cables shall be bonded and earthed.
2.10.71.	Apart from above, Cable Erection Philosophy (Doc no. PE-DC-424-507-E004) should be strictly followed.
2.11.	JUNCTION BOXES AND PUSH BUTTONS
2.11.1.	Different types of junction boxes are to be erected by the contractor as per attached BOQ. The junction boxes are to be located at the locations jointly decided at site during erection. The junction boxes are to be erected on the frames fabricated at site. The installation of Junction Boxes/ Push Buttons (JB/ PB) should be checked for correctness and their functions.
2.11.2.	Junction boxes shall be mounted at a height of 1200mm above floor level or as specified in the drawings and shall be adequately supported/ mounted on masonry wall by means of anchor fasteners/ expandable bolts or shall be mounted on an angle, plate or other structural supports fixed to floor, wall, ceiling or equipment foundations.
2.11.3.	Necessary holes for conduit/ cable entry shall be done during installation depending on the requirement. The holes shall be drilled/ punched neatly and shall be dust/ vermin proof after installation of the conduit.
2.11.4.	All welds, bolts holes, conduit entry holes etc., made during installation as mentioned above shall be wire brushed and touched up with metal primer (lead oxide and zinc chromate in synthetic medium).
2.11.5.	The junction boxes/ push buttons need to be checked of correct installation.
2.11.6.	There shall be functional checking/ adjustment of JB/ PB for their system.
2.12.	LAYING OF PIPES AND TUBES (Impulse Pipe & Instrument Air Pipe)
2.12.1.	Root valves are generally provided on process pipe line by other agencies. Prior to starting impulse pipe, contractor to identify the process point with respect to PIDs.
2.12.2.	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

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	pressure test, conducting RT/ UT, painting (refer clause no. 2.35 for details) and erection and commissioning of other standard accessories as per instrument hook-up diagram.
2.12.3.	Piping works shall involve either arc or TIG welding. Contractor to follow the BHEL supplied welding schedule and welding procedures. The decision of BHEL engineer will be final in this regard.
2.12.4.	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.
2.12.5.	Laying of GI pipe for instrument airline shall include air blowing, cutting from the running meter length, threading, installation of elbows/ tee/ reducer/ moisture traps/ auto drains pot/ check valves/ isolating valves, supporting clamping, conducting leak test and also seal welding of threaded joints, if required.
2.12.6.	Threaded joints of airline shall be made leak proof by using Teflon tapes or sealing compound. All consumables shall be in the scope of contractor.
2.12.7.	All fittings and accessories for impulse pipe and airline shall be provided by BHEL. Quoted rate for piping shall include cost of installation of such fittings and no separate rates are envisaged.
2.12.8.	Contractor shall provide GI "U" clamps for impulse pipe and GI pipes within the quoted rates for installation of the same.
2.12.9.	Impulse pipes shall be painted. Refer clause no. 2.35 for details.
2.12.10.	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.
2.13.	IMPULSE PIPELINE ERECTION
2.13.1.	All impulse lines, air lines shall be thoroughly cleaned by removing the dust, burrs etc., and any foreign matter inside the pipe/ airline is to be cleaned by compressed air or any other suitable means before installation.
2.13.2.	Different types of impulse pipes, like alloy steel, carbon steel, stainless steel of different sizes and thickness shall be supplied with suitable fittings like coupling, sockets, root valves, drain valves, manifold, condensing pots, syphons, tees, bends, nut and tail piece.
2.13.3.	Unit rate quoted for impulse piping shall include site routing using reducers (at root valve) unions, connector Nuts and tail pieces, sockets, nipples, equal tees, couplings, condensing pots, siphons, root valves, isolation valves cold bending, tig / arc welding. etc., fixing of manifolds and supporting with suitable fixtures and 'U' clamps and painting as per BHEL specification and site engineer's instructions. No separate rate shall be paid for the Impulse pipe fittings. The unit rate also includes supply of U clamps, fasteners, paints, etc. For impulse pipe support materials viz. Angles/ Channels, the rate shall be paid on tonnage basis. The above support materials shall be supplied by BHEL. For scope of painting, please refer Scope of Painting clause. Welding of impulse pipe for High Pressure Lines shall be carried out by High Pressure welder. Suitable root valves will be provided by BHEL on the tapping point wherever required.
2.13.4.	The routing of pipe lines shall include sufficient flexibility near tap off points to allow for thermal expansion of process equipment. For longer route lengths of impulse pipes, the contractor shall provide Tag numbers at appropriate locations as directed by BHEL site engineer.
2.13.5.	The pipes shall be cold bent using hydraulic bending machines only.
2.13.6.	The horizontal impulse lines shall be laid with proper slopes towards the tapping point.

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2.13.7.	Supports for piping and tubing shall be adequate and in no case exceed the limits mentioned below: <table><tr><td>a)</td><td>1/4" OD or 3/ 8" OD copper</td><td>Continuous</td></tr><tr><td>b)</td><td>1/2" NB pipe/ tube</td><td>5 ft</td></tr><tr><td>c)</td><td>3/4" NB pipe/ tube</td><td>5 ft</td></tr><tr><td>d)</td><td>1" NB pipe/ tube</td><td>8 ft</td></tr></table>	a)	1/4" OD or 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								
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d)	1" NB pipe/ tube	8 ft																			
2.13.8.	OR as below: - <table><tr><th>Tube OD (mm)</th><th>Tube Material</th><th>Wall Thickness (mm)</th><th>Max. Unsupported span (mm)</th></tr><tr><td>6</td><td>SS</td><td>1.65</td><td>900</td></tr><tr><td>10</td><td>SS</td><td>1.65</td><td>1200</td></tr><tr><td>12</td><td>SS</td><td>1.65</td><td>1500</td></tr><tr><td>20</td><td>SS</td><td>1.65</td><td>1800</td></tr></table>	Tube OD (mm)	Tube Material	Wall Thickness (mm)	Max. Unsupported span (mm)	6	SS	1.65	900	10	SS	1.65	1200	12	SS	1.65	1500	20	SS	1.65	1800
Tube OD (mm)	Tube Material	Wall Thickness (mm)	Max. Unsupported span (mm)																		
6	SS	1.65	900																		
10	SS	1.65	1200																		
12	SS	1.65	1500																		
20	SS	1.65	1800																		
2.13.9.	All CS impulse line welding shall be done through welding generator/ rectifier and only structural welding may be done with welding transformer.																				
2.13.10.	Impulse pipes of alloy steel/ SS/ carbon steel etc. shall be TIG welded. Contractor shall arrange for necessary TIG welding sets, electrodes etc. TIG-welding sets, welding transformer/generator rectifier, Hydraulic bending machines, DPT kits, Hydraulic testing pumps required for pressure testing of impulse pipes shall be arranged by the contractor. Similarly, consumables such as welding electrodes, gas, Tungsten rods, filler wire etc., shall be arranged by the contractor within the quoted rate.																				
2.13.11.	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.																				
2.13.12.	Testing																				
A)	On completion of pipeline installation, the pipelines shall be tested as per BHEL approved Field Quality Plan and/ or other relevant documents. Contractor shall arrange for water/ oil filling pump, hydraulic test pump and standard gauges and conduct the test satisfactorily. For DPT/ LPI, contractor shall arrange penetrant, developer etc. and conduct the test satisfactorily.																				
B)	Hydraulic test shall be conducted for all impulse pipes after completion of erection as per site engineer's directive, as part of the work. 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/ cm2 or 1% of the working pressures whichever less, in 30 minutes is and there shall be no leaks at any of joints/ welds when isolated from source of pressure.																				
C)	Air Piping All instrument air pipelines shall be isolated from the instruments and pressurized 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.																				
D)	Pneumatic Signal Lines All pneumatic signal lines shall be disconnected and blown through with instrument air. The line shall be blanked off and pressurized pneumatically 20 psi and checked with soap solution for leaks and attended accordingly.																				
2.14.	PRE-FABRICATED/ SEMI-FABRICATED LIR/ LIE/GAUGE BOARDS																				
2.14.1.	If the frame or rack is supplied as a pre-fabricated item like LIR, same shall be erected, grouted and painted as per site requirement.																				
2.14.2.	If any frame or support or rack supplied as semi-fabricated item, same shall be assembled at site either by welding or bolting and erected, grouted and painted as per site requirement.																				
2.14.3.	Unit rate quoted for such pre-fabricated /semi-fabricated items like LIE/LIR and enclosure shall be on Number basis. Unit rate shall cover installation, grouting, painting and supply of nuts, bolts, anchor																				

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	fasteners, grouting materials such as cement, sand etc as required. Unit rate shall also include full painting of impulse line fitted and supplied along with LIR/LIE/LGB.
2.14.4.	Wherever LIR/LGB/LIE are supplied with instruments mounted on them, the rate quoted for LIR/LGB/LIE shall include calibration of all the instruments mounted on them as detailed in the BOQ. However, if the instruments supplied as loose items, the instruments shall be calibrated and mounted on the LIR/LGB/LIE and separate calibration/erection /commissioning charges shall be applicable in line with other instruments erection.
2.15.	COPPER / STAINLESS STEEL TUBES
2.15.1.	Different sizes of copper tubes of different thickness with or without PVC coating shall be supplied in standard lengths of 15-meter Coils and Stainless-Steel tube shall be supplied in standard length of 6 meter. The connectors and tees will be of brass / Stainless Steel of different sizes as per site requirement.
2.15.2.	The unit rate quoted on meter basis shall cover site routing, bending, providing supports, fixing of connectors, unions, valves, tees, etc. and connecting to the instrument airline instruments. The unit rate shall also include providing tag plates on instruments / power cylinders.
2.15.3.	If copper / Stainless Steel tube length is more than half meter, suitable support shall be provided either by angle or trays. Protective angles to be used for copper tube routing. The support materials shall be supplied by BHEL. For fabrication and installation of steel supports and frames, the rate shall be as quoted in BOQ for fabrication and installation of steel Tonnage basis.
2.15.4.	Copper / Stainless Steel tubes shall be clamped with suitable clamping materials. Supply of suitable Aluminium clamps and tag plates are under contractor's scope. The unit rate quoted for laying of copper tube shall cover the supply of clamping materials also. For SADC system copper tube, tag plates shall be provided near instruments, Tees and Power cylinders. Leak test shall be carried out after completion of tubing works as per guidelines.
2.16.	INSTRUMENT AIR LINES (GI PIPES)
2.16.1.	Different type of GI pipes of different thickness class shall be supplied along with GI fitting accessories like union, coupling, tee, reducers, elbow, valves, etc.
2.16.2.	Unit rates on length basis for erection of instrument air lines includes site routing, providing supports, fixing "U" clamps, fixing of loose supplied GI accessories mentioned as above as per the drawings, providing fresh threading as required for jointing with unions, valves and all type of other fittings as required in the system. Unit rate also shall include supply of U clamps, Teflon tapes and bolts, etc.
2.16.3.	Teflon tapes shall be used for tightening all the joints. No bending, welding etc. is allowed. No separate rate shall be paid for erection of GI fittings / accessories and U clamps.
2.16.4.	After installation of instrument airlines, the line shall be blown and leak test shall be conducted for all the joints as per the guidelines given elsewhere in this tender.
2.17.	STRUCTURAL STEEL FABRICATION AND INSTALLATION (INSTRUMENT/ JUNCTION BOX FRAME/ CABLE TRAY & MISC STRUCTURES FABRICATION)
2.17.1.	Structural steel material like MS angles, channels, beams, flats, plates etc. shall be supplied in running meter and the same shall be used for misc. fabrication if required. and the same shall be used for fabrication of panel base frame, cable tray supports, canopies for instruments/ panels/ drives/ JB's/ Push Buttons etc., Instrument/ Junction box frames, Impulse Pipe/ Instrument Air Pipe supports and instruments etc.
2.17.2.	This shall include cutting into size, conduiting of end connections, if required, welding, grinding of excess weld deposits, drilling of holes for mounting of device/ instrument, installation at location, leveling, alignment, providing bracings, painting etc. No gas cut holes will be permitted. Contractor to follow the BHEL supplied welding schedule and welding procedures.
2.17.3.	The steel structures supplied by BHEL and fabricated by the contractor shall be made from standard quality steel sections/ flats/ plates. The steel fabricated structures shall be free from defects, cleaned of rust, grease, oil etc., and sharp edges shall be removed.

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2.17.4.	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 instance. Fabricated tray bends, TEE, cover supplied by the customer shall be paid in running meter of that cable route. Alteration in readymade bends, tees, reducers etc. shall not be paid extra.
2.17.5.	Frame installation/ cable tray accessories 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. All consumables including anchor fasteners shall be arranged by the contractor.
2.17.6.	In certain packages, galvanized members of junction box frames and instrument racks shall be supplied in cut to sizes and frame assemblies are required to be done as per drawing by bolting/ welding. The installation rate as quoted shall include the assembling of the frames.
2.17.7.	Gas cutting of tray/ impulse pipe support and holes in frame is not permitted. Only hacksaw cutting/ drilled hole shall be permitted.
2.17.8.	The welds shall be wire brushed or cleaned otherwise. The holes shall be touched up with metal primer.
2.17.9.	All the fabricated supports/ frames for instruments, trays, pipes, electrical equipment, etc., shall be painted after sand blasting and surface preparation as per painting specifications (refer clause no. 2.35 for details). Paints and other associated items are in the scope of the contractor.
2.17.10.	All steel fabrications shall be painted with two coats of metal primer (lead oxide and zinc chromate in synthetic medium) followed by two coats of aluminium paint. The welds to galvanized steel shall be touched up with galvanized weld rod applied in accordance with manufacturer's instruction.
2.17.11.	Fabrication & painting charges of structural steel shall be part of erection charges of that equipment for which the same is being used.
2.18.	PANELS
2.18.1.	Control panels are normally supplied in suit of either one/ two/ three etc. or loose shipping sections with integral base frame or loose base frame. These panels may have to be installed as stand-alone or in-group consisting of number of panels in each row, depending upon the plant layout and foundation arrangement.
2.18.2.	Installation of panel shall include fixing of base frame, fabrication of base frame if required, leveling, alignment, fixing of anti-vibration pads, removal of side covers, fixing of cubicle interconnection hardware, interconnection of bus bars/ 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 panels/ cable entries. Where the base frame/ panel canopy 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.
2.18.3.	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. These panels have to be regularly cleaned and surroundings tidy 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.
2.18.4.	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 has to be erected at different locations and

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	elevations in, TG Hall CCR, LT & HT switchgear room, Unit Control Room, Other Areas Control Room etc. No extra payment for the change in elevation shall be entertained.
2.18.5.	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.
2.18.6.	Normally the panels shall be supplied with instruments, relays, meters, electronic modules etc. mounted and pre-wired. However, if these are supplied loose/ separately for safety in transit, contractor shall mount/ wire such devices as part of the panel installation work and no separate rates shall be applicable unless otherwise specially listed in the rate schedule.
2.18.7.	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.
2.18.8.	For the panels erected by other agencies, commissioning/ calibration work and troubleshooting has to be carried out by the contractor as part of testing and commissioning work as per the quoted rates.
2.18.9.	Minor civil works like drilling, chipping, punching holes and opening in concrete floors, slabs and brick walls, grouting, related to Rack, support installation, minor civil works required for installation of control panels, Junction boxes etc., shall be included in the erection cost of such items. Also all miscellaneous civil works like chipping away and making good as necessary in floor slab/ wall for cabling/ earthing etc., as required are included in the scope for which no separate payment is applicable. The scope also includes supply of grouting material, if any.
2.18.10.	Supplier's instruction manuals, packing slips, door keys etc. received along with the panels should be promptly handed over to BHEL Engineer on opening of the panels.
2.18.11.	Interposing Relays (24/ 48 V DC) along with mounting base shall be supplied separately for mounting in the various feeders of 11 kV/ 6.6 kV/ 3.3 kV HT switchgear boards and 415 Volt MCC Board/ Switchgear Panel Boards for unidirectional/ bi-directional drives, solenoid valves. 2 Nos. interposing relay are 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 1000 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.
2.19.	CONTROL PANELS
2.19.1.	All system panels are based on METSO DNA distributed digital control philosophy. METSO 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 fiber 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.
2.19.2.	The entire work of erection, testing, commissioning of the connected devices/ equipment 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.
2.20.	BATTERY/ BATTERY CHARGER/ UPS
2.20.1.	HDP Tubular 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.
2.20.2.	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

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	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 equipment etc., at his own cost.
2.20.3.	In case of Ni-Cd (or similar type) batteries are 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.
2.20.4.	Battery charging/ discharging is a continuous process and skilled manpower shall be deployed by the contractor round-the-clock.
2.20.5.	Contractor shall arrange suitable load, cables, safety equipment and consumables for discharging the battery during charging and discharging cycle at his cost.
2.20.6.	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 and record of the same shall be maintained and submitted before handing over of the system.
2.21.	ACTUATORS
2.21.1.	The scope of Testing and Commissioning of electrically/ pneumatically 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 (METSO DNA system), replacement of limit/ torque switches if required.
2.21.2.	Different types of pneumatic actuators like regulating type, on-off type, of different stroke length shall be supplied. Some of them may be fitted and supplied with main equipment.
2.21.3.	The unit rate quoted for erection & commissioning scope of electrical and pneumatic actuators includes fabrication and installation of base frame, modification of linkage mechanism wherever required and connecting the same with driven equipment, fixing of all accessories like air sets, Solenoid valves, air lock off valves, limit switches, if supplied loose item as part of power cylinders, replacing the damaged copper tubes or any other accessories like gauges, solenoid valves, limit switches, etc. connecting to airline, and adjusting the stroke length. No separate rate shall be paid for the above works. For all pneumatic and electrical actuators, the necessary Linkage Mechanism shall be supplied by BHEL as part of actuators. No separate rate shall be paid for erection of linkage mechanism. For fabrication and erection of steel supports and frames, the rate shall be paid on Tonnage basis.
2.21.4.	The link rods have to be adjusted to suit the opening and closing position. This adjustment has to be repeated number of times till proper operation is obtained. If BHEL site engineer desires to remove the accessories like position transmitters, air locks, positioners, limit switches, solenoids etc. prior to erection either at BHEL stores or at site to avoid damages/pilferage, keep in safe custody and remount the same prior to commissioning, this shall be part of scope of work for power cylinders.
2.21.5.	For calibration of any Pneumatic Actuator at field, temporary air supply if required shall be arranged by the contractor.
2.21.6.	In case the power cylinder is supplied in assembled condition along with main equipment and the BOQ calls for Erection & Commissioning of the same, payment shall be made only for commissioning, in line with rate quoted for commissioning of pneumatic power cylinder of similar type.
2.21.7.	In case the power cylinder is supplied as loose item, and the BOQ calls only for commissioning, the contractor shall carry out erection and commissioning of the same. Payment shall be made in line with rate quoted for Erection and Commissioning of power cylinder of similar type.
2.21.8.	Erection and Commissioning of MCCs and laying of power cables to bi-directional electrical actuators shall be done by other agency. The C&I Contractor shall provide necessary support for checking the remote operation of Electric actuators and loop checking of command and feedback signals from DCS

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	to the actuator. The Contractor shall co-ordinate with the other agencies to ensure that all feedback and command signals and settings are made available for bi-directional.
2.22.	RIGID & FLEXIBLE CONDUITS
2.22.1.	Cables shall normally be laid on cable trays. However, in case of shorter routes where trays are not possible, suitable GI pipe/flexible conduits supplied by BHEL shall be used. Unit rate shall be paid on running meter basis.
2.22.2.	Unit quoted on meter basis for flexible conduit includes drilling of the holes on the plates, fixing of the end connectors, providing suitable supports and fixing tag marks wherever specified as required by BHEL. No separate payment will be made for fixing of end connectors.
2.22.3.	Unit quoted on meter basis for GI rigid conduit includes supply of suitable clamps / fasteners / tag plates etc.
2.22.4.	The scope of work includes drilling of holes on the plates, fixing of end connectors, providing suitable supports and fixing tag plates as required by BHEL. Supply of suitable clamps, fasteners and tag plates are covered in the unit rate.
2.23.	SOOT BLOWER SYSTEM
2.23.1.	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, commissioning covers the items/ devices as per rate schedule and the testing, 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: • Cable loop checking from DCS to field. • Remote commissioning of soot blower system from DCS.
2.24.	VIBRATION MONITORING SYSTEM & FLUE GAS ANALYZER FOR BOILER
2.24.1.	Vibration Monitoring System System comprises of transducers with integral cables, weld-able 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. Fabrication of all support, Frame for JB or Probe shall be in the scope of contractor.
2.24.2.	Oxygen Analyzers 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. NOTE: Erection, Testing & Commissioning shall be done by vendor.
2.24.3.	NOX, SOX, CO Analyzers NOX, SOX, CO analyzers 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. NOTE: Erection, Testing & Commissioning shall be done by vendor.
2.24.4.	Opacity Monitor This consists of transmitters, receivers, Local electronic units and housing, air blower and associated hoses/ pipes, JBs and cables. NOTE: Erection, Testing & Commissioning shall be done by vendor.
2.25.	UNIT CONTROL DESK AND COMPONENTS

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2.25.1.	Unit control desk will be supplied in a single shipping section for erection at site. Console Inserts shall be supplied either mounted on console grid or supplied loose. Also, the items (indicators, pushbuttons, etc.) of the console insert may be supplied mounted in the console insert or may be supplied loose. The lump sum rates quoted for console inserts should take the above into consideration. No separate payment will be done for the erection of individual components of console inserts. However, for the other items like recorders, indicators, etc., unit rate shall be applicable. Alarm facia on the control desk may be supplied mounted or loose. Mounting these, if required, will not attract any extra payments. The commissioning of these will constitute a part of the panel commissioning from where the alarm is driven.
2.25.2.	Wherever control desk/ panel is not supplied by BHEL or is in customer scope of supply and installation, loose item supplied by BHEL if any, shall have to be mounted by the contractor.
2.25.3.	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.
2.25.4.	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.
2.26.	FIRE DETECTION & ALARM SYSTEM (FDA)
2.26.1.	Fire Analogue addressable type Fire Alarm System consisting of Multi sensor type detectors, Linear Heat Sensing Cable (LHSC) detector, cabling, junction boxes, instrumentation, Fire Alarm cum control panels, repeater panels, etc.
2.26.2.	For erection of Digital LHS Cable, J-Hooks and Chains to be welded with conveyor structures and trays for necessary support.
2.26.3.	All MCC/ switch gear room/ Control room shall be provided with Multisensor type detectors.
2.26.4.	All Conveyors and Cable Galleries shall be provided with Linear Heat Sensing Cable detectors.
2.26.5.	All cable galleries shall be provided with Multisensor type detector.
2.26.6.	All Power and Signal Cable to be laid in different buildings and deluge valves shall have proper dressing with saddles, clamps etc.
2.26.7.	The complete Fire Detection and Protection Systems shall be as per the guidelines/ codes/ standards/ rules of TAC/ NFPA/ IS: 3034/ OISD etc. and all the systems, equipment's and installation shall be got approved from TAC accredited professional(s)-India. Customer will make arrangement of TAC approved agemaxncy for accreditation of work. The contractor has to facilitate TAC for getting approval. As per TAC any modification or re-erection of any item should be done and same should be carried by contractor with in quoted rates. There is no extra payment will be paid.
2.27.	FIRE INSURANCE REGULATIONS
2.27.1.	Rule no. 35, 48, 49, 50, 61 & 64 of Indian Electricity Rule with amendment-3 rules 1986
2.27.2.	Regulations laid down by the chief Electrical Inspector of the State/ CEA.
2.28.	AUXILIARY BOILER
2.28.1.	Auxiliary Boiler of will be erected by another agency. The C&I part of the auxiliary boiler is also in this scope.
2.29.	SELECTIVE CATALYTIC REDUCTION (SCR) SYSTEM:
2.29.1.	Erection, Testing, commissioning of all the C&I equipment related to Selective Catalytic Reduction (SCR) system shall be in contractor scope. All these items covered in BOQ & Price bid.
2.30.	FGD SYSTEM
2.30.1.	FGD system shall be based on Wet Limestone Forced Oxidation process. Each unit shall be provided with an independent absorber.

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2.30.2.	Gas from terminal point on ID fan discharge duct shall be taken directly to the absorber through Booster Fans. In the absorber, SO ₂ in flue gas shall be removed by a spray of recirculating slurry, pumped by slurry recirculation pumps.
2.30.3.	Compressed oxidation air shall be blown through the slurry in the oxidation tank, to oxidize the Calcium sulphite to gypsum.
2.30.4.	Clean gas from the absorber shall be taken to the Wet Chimney through three stage mist eliminators.
2.30.5.	Limestone to the absorbers of the units shall be supplied by a wet limestone grinding system, common for the units. Limestone shall be fed to the Limestone day silos which in turn will feed the Limestone to wet ball mill through a gravimetric feeder.
2.30.6.	The gypsum from the absorber(s) shall be pumped by dedicated gypsum bleed pumps to a common Gypsum Dewatering system consisting of two streams (2x100%) of primary and secondary hydro-cyclone and vacuum belt filters for gypsum dewatering. The water removed from the absorber shall be recycled to the absorbers. The waste water from the system shall be collected and neutralized using lime and neutralized effluent shall be pumped at required pressure to waste water terminal point.
2.30.7.	Erection, Testing, commissioning of all analyzers, CEMS, Opacity Monitoring Systems, instruments used in FGD, LHP, GHP Systems shall be done by the contractor. Overall C&I System commissioning of whole FGD, LHP & GHP Systems shall be in the scope of the C&I contractor.
2.31.	GUIDELINES FOR INSTRUMENTS AND EQUIPMENT
2.31.1.	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.
2.31.2.	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.
2.31.3.	The power cylinder 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 cylinder line air sets, solenoid valves, air lock, limit switches, if supplied loose, shall be fixed, aligned and connected up.
2.31.4.	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.
2.31.5.	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 equipment are positioned, at no extra cost.
2.31.6.	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. Refer clause no. 2.35 for details.
2.31.7.	Contractor shall arrange for own firefighting equipment for the materials stored under contractor's custody.
2.32.	MISC. OTHER INSTRUMENT/ EQUIPMENT ERECTION, CALIBRATION AND COMMISSIONING
2.32.1.	Wherever panels, pneumatic power cylinders and control valves have been erected by the mechanical contractor, calibration/ commissioning has to be carried out by the contractor.
2.32.2.	SADC power cylinders are to be erected by contractor in co-ordination 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.
2.32.3.	In the case of electronic water level indicator, 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.

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2.32.4.	The calibration of position transmitters of the NRVs in the turbine extraction system has to be carried out by the contractor. Position transmitters are to be erected by contractor if supplied loose.
2.32.5.	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. Small items like speed regulators, etc. will have to be fitted in the copper tubing route of corner stations. No separate rate will be applicable for such devices.
2.32.6.	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.
2.32.7.	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.
2.32.8.	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. Wherever nameplates for JBs are not supplied, the JB no. are to be written with paint on JBs for identification. Separate payment will not be made for this.
2.32.9.	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.
2.33.	FIELD INSTRUMENTATION
2.33.1.	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.
2.33.2.	Scope of work under erection/ calibration/ testing/ commissioning shall include calibration, setting, adjustment, writing instrument tag number with paint, report making, installation, servicing, minor repairs/ servicing, putting instrument into service, signal checking from field up to the functional group panels and remote indicating instrument, functional checks, interlock and protection/ alarm checks by simulating the field devices, troubleshooting during pre-commissioning/ post-commissioning till system is handed over to the customer.
2.33.3.	It is the responsibility of contractor to make erection, calibration/ testing protocols for various C&I equipment/ 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.
2.33.4.	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.
2.33.5.	Wherever thermowells are supplied along with temperature gauges, thermocouples, temperature switches, thermostats, etc., the contractor has to co-ordinate with the mechanical contractor for identification and fixing of thermowells on the pipeline. However actual fixing of thermowells on pipeline and seal welding shall be done by mechanical contractor and is not a part of instrument installation.
2.33.6.	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.

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2.33.7.	Some devices like solenoid valves, position feedback transmitters, limit switches, air filter regulators, airlock relays, positioners etc., are supplied assembled along with mechanical equipment like pneumatic control valves, trip valves, dampers, motorized actuators, etc. These will need removal, calibration/ testing, re-fixing, adjustment, etc., and commissioning. Separate payment shall not be made for this. The rates quoted for the commissioning of these equipment (viz., pneumatic control valves, 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.
2.33.8.	Transmitter enclosure/ open racks for various packages which are to be erected and commissioned at various locations of the 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 commissioning of all such items inside these racks/ enclosures.
2.33.9.	Sometimes recalibration of equipment 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 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 lump sum 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.
2.33.10.	For the very few cases where required, the contractor shall carry out re-orientation of bottom/ top entry arrangement for process connection if needed due to site condition in existing instrument rack/ enclosure/ JB and re-location of existing instrument including removing of the existing tubing and re-installation of the same at appropriate location due to any change in grouping of the instrument and no extra payment shall be applicable.
2.33.11.	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.
2.33.12.	Instruments in various systems i.e. DM, PT, ETP, STP, etc. are to be calibrated by the sub-contractor as per the site requirement. The contractor's payment shall be in accordance with the unit rate already available in the BOQ for the same item.
2.34.	WELDING, NON-DESTRUCTIVE TESTING ETC.
2.34.1.	Installation of equipment involves good quality welding, NDE checks etc.
2.34.2.	Welder deployed for aluminium welding shall have experienced and approved by BHEL and BHEL's Customer after due qualification process/ testing.
2.34.3.	Welding of all structural steel & aluminium shall be done only by the qualified and approved welders.

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2.34.4.	All the welders shall be tested and approved by BHEL Engineer/ BHEL's Customer before they are actually engaged on work even though they may possess IBR/ other certificates. BHEL reserves the right to reject any welder without assigning any reason.
2.34.5.	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.
2.34.6.	Welding electrodes have to be stored in enclosures having temperature and humidity control arrangement. This enclosure shall meet BHEL specifications.
2.34.7.	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.
2.35.	FINAL PAINTING
2.35.1.	The contractor shall provide all the primer, paint, and other consumables like brush, cleaning agents etc. All T&P, manpower, supervision is in contractor's scope. Painting shall be carried out as per colour scheme approved by BHEL/ BHEL's customer.
2.35.2.	The contractor shall provide the Primer (ROZC as per IS:2074) for the scope of painting work indicated in Section-4 as well as for protection of site weld joints and gas cut locations. Contractor shall also arrange to provide the required thinner and other consumables, T&P etc. required for application of ROZC Primer. All paints and thinners shall be sourced only from BHEL approved manufacturers. Some of them are as listed under: • M/ s Asian Paints • M/ s Berger paints • M/ s Jenson & Nicholson • M/ s Shalimar Paints • M/ s Akzo Nobel • M/ s Kansai Nerolac Paints
2.35.3.	In order to have consistency in painting system, it is preferable that all the supplies are sourced from one single manufacturer.
2.35.4.	Touch up paintings on damaged areas: Surface preparation by manual tools, wire brush/ emery paper etc. Minimum 6" peripheral area, adjoining to damaged area to be covered. If metal surface is exposed; it is to be painted with Zinc rich epoxy (70 micron) or suitable primer with existing paint scheme. If primer is intact, intermediate & top coat to be done with specified DFT in scheme.
2.35.5.	All the fabricated frames, instrument racks, Junction box frame, trays/ impulse pipes, supports, panel base frame, etc., wherever applicable shall be after thoroughly cleaning the surface from dust, rust, greases, oils, scales, etc, by wire brush, scrapping, sand blasting/ shot blasting (as applicable) as specified in relevant erection documents. The above parts shall then be painted with specified two coats of specified paint over the shop primer/ paint. Also, where the shop primer/ paint has peeled off, the affected area shall be cleaned thoroughly by the specified method and then primer coat applied. Similarly, certain components may be supplied without any primer/ paint coat from shop. The surface of such items shall be cleaned as per specifications, coated with suitable primer and then coated with final paint coats. The dry film thickness after final coat should be as per specification. The color, shade etc. shall be as per specification. Painting schedule will be furnished at site. The quoted rates should be inclusive of all these including supply of paints and consumables.
2.35.6.	All metal parts of the equipment including supports, structures, etc., as applicable shall be painted after thoroughly cleaning the surface from dust, rust, greases, oils, scales, etc., by wire brush, scrapping, sand blasting/ shot blasting (as applicable) as specified in relevant erection documents. The above parts shall then be painted with specified two coats of specified paint over the shop primer/ paint. Also, where the shop primer/ paint has peeled off, the affected area shall be cleaned thoroughly by the specified method and then primer coat applied. Similarly, certain components may be supplied without any primer/ paint coat from shop. The surface of such items shall be cleaned as per

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	specifications, coated with suitable primer and then coated with final paint coats. The dry film thickness after final coat should be as per specification. The color, shade etc. shall be as per specification. Painting schedule will be furnished at site.
2.35.7.	Other equipment like JB's, 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
2.35.8.	All the weld joints of GI cable trays and GI structural members shall be applied with red oxide and aluminium paint and then coated with bitumen.
2.35.9.	All damaged surfaces of galvanized or un-galvanized faces of steel structures etc. shall be brushed up and painted with red primer paint followed by two coats of aluminium paint/ enamel paint to the satisfaction of Engineer. The contractor has to arrange all the materials for painting at his cost.
2.35.10.	Welded joints on GI earthing conductors shall be coated with one coat of bituminous paint in case of buried earth grid or earth flats to be laid in cable trench. For site welded GI strips/ wires which are exposed these are required to be painted with one coat of cold galvanizing zinc paint. Contractor to arrange the required paints and other items at his cost.
2.35.11.	In case of GI Structure, the cold galvanizing paint to be applied as touch up where ever needed. This is to be done as per instruction of BHEL Engineer.
2.35.12.	The primer shall be compatible with the final coat paint schedule.
2.35.13.	Colour Banding, Legend and Identification Marking, Direction marking etc. shall be in scope of the contractor.
2.35.14.	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 as instructed by BHEL Engineer/ painting schedule. BHEL may prescribe a time gap between first coat and second coat of final paint. Paint, primer, brush, etc. supply is in the scope of the contractor. Colour codes for impulse piping, etc. will be as per standard codes/ mother pipe.
2.35.15.	The external & internal colour of the panels/ enclosures shall be RAL 7032 and brilliant white respectively. The panels shall have matt finish to prevent any glare surface due to illumination.
2.35.16.	Touch-up painting of Control Panels, DCS Panels or any other equipment/ devices wherever necessary. Treatment as per IS: 6005. Two coats of lead oxide primer followed by powder painting with final paint shade of RAL 9002.
2.35.17.	The primer shall be compatible with the final coat paint schedule.
2.35.18.	Supply of paint, primers, other consumables etc. for above and any other scope in these specifications shall be in Contractor's scope.
2.35.19.	Irrespective to scopes of painting & supply of paint mentioned elsewhere it is to be noted that supply of paint, primers, other consumables etc. for all primer/ painting works to be done by the contractor, shall be in Contractor's scope. No dispute shall be entertained on the above matter.
2.35.20.	STRUCTURAL 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 Primer.
2.35.21.	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.
2.36.	CALIBRATION, TESTING & COMMISSIONING
2.36.1.	Calibration, testing & commissioning activity as specified in this technical specification and rate schedule against various equipment, devices, systems etc. are broadly classified below. However, there may be some overlapping between the activities (erection, calibration and testing,

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	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.
2.36.2.	Calibration
a)	Verification after drawing of material of various types, range of the field devices with respect to instrument schedule, data sheet or system document.
b)	Codification of instruments as per system tag numbers
c)	Calibration/ adjustment of instrument as per system requirement/ set values.
d)	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 lube oil systems, lube oil system of fans etc.
e)	Verification of installation of instruments for range, type, tag number as per physical location of process point as per process, instrumentation diagram.
f)	Checking and ensuring the proper function of instrument.
g)	All the recorders shall be made functional with proper chart movement and ink marking.
h)	Preparation of computerized calibration certificates in the formats specified by BHEL Engineers and getting those signed by the customer is in the scope of the contractor.
2.36.3.	Erection
a)	Withdrawal of material from store, verification, inspection as per shipping list, drawings and documents.
b)	Preservation, up keeping, safe custody of the erected equipment till handing over to the customer.
c)	Verification of installation as per drawing and document for the correctness of cabling, JBs, impulse pipe, various field device, panels, instruments etc.
d)	Continuity check and IR value check of cables.
e)	Verification of correction of cable termination with respect to instrument, electrical hook-up diagram, panel interconnection diagram, JB schedule.
f)	Checking earthing of the equipment and cable shield wire continuity.
g)	Energizing the functional group control panels and field devices.
h)	Flushing of impulse pipe before making the instruments process connections through.
i)	Any leakages, damages to impulse pipe, field device connections, air connections etc. Shall be fully attended by contractor.
j)	All cable glands/ piping/ tubing to be fixed as per installation requirement before commissioning.
2.36.4.	Post-Commissioning
a)	Contractor shall rectify the defect observed/ informed by customer during the trial run.
b)	Contractor shall submit the as- built drawing as per guidelines and instruction of BHEL Engineer.
c)	After trial run/ handing over of the equipment, if due to unforeseen reasons, certain works crop up; the contractor shall provide all the assistance.
2.37.	TROUBLESHOOTING DURING PLANT OPERATION
2.37.1.	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 the designated areas. The bidder must also take this aspect into consideration.
2.38.	TESTING, PRE-COMMISSIONING, AND POST COMMISSIONING
2.38.1.	The work is also inclusive of various commissioning activities of BHEL scope. 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.

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2.38.2.	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 arrange tools & plants, test equipment, experienced engineers and technicians. Contractor shall earmark separate manpower for respective commissioning areas and they shall not be disturbed/ diverted for other work. The contractor's 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.
2.38.3.	The contractor shall simultaneously start testing & commissioning activities for equipment to match the mile stone activities of the project.
2.38.4.	In case any malfunctioning and/ or defects are found during tests, trial runs such as loose components, undue noise or vibration, strain on connected equipment 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.
2.38.5.	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 equipment erected, making ready for trial runs, alkali flushing, chemical cleaning, mass flushing etc. All these works need specialized gangs including electrician/ instrument mechanics in each area. Contractor shall earmark separate manpower for various commissioning activities. This manpower shall not be disturbed or diverted. The mobilization of these commissioning gangs shall be 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.
2.38.6.	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 commissioning gangs simultaneously in even up to 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.
2.38.7.	The mobilization of these 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 equipment with BHEL Engineers and arrange for the same. If at any time the requisite manpower, consumables, testing equipment etc. are not arranged then BHEL shall make alternative arrangements and necessary recoveries with overhead cost will be made from the running bills.
2.38.8.	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.
2.38.9.	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 may be involved. This aspect must be considered by the contractor while quoting their rate. No additional compensation by for the same shall be payable, irrespective of number of persons engaged or number of working hours per day.

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2.38.10.	It is the responsibility of contractor to provide for necessary labor, 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.
2.38.11.	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.
2.38.12.	During the commissioning activities and carrying out various tests, if any of temporary work such mounting of test equipment/ cabling etc. are required; the contractor shall carry out such work without any extra cost. The same shall be removed after completion of the activity.
2.38.13.	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 T&Ps, consumables, scaffolding and approaches etc., till such time the commissioned unit is taken over for trial operations.
2.38.14.	The contractor shall carry out any other tests as desired by BHEL Engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning and commissioning, to demonstrate the completion of any part or whole of work performed by the contractor.
2.38.15.	The pre-commissioning activities will start in phased manner to meet the various milestones and shall continue till equipment are commissioned fully with all connected equipment/ devices or handed over to customer for regular operation. In this duration other erection activities such as cabling etc., shall be carried out by other agencies even though equipment are partially commissioned/ charged. In order to co-ordinate the work such as issue of safety permit, normalization and compliance of other requirement, contractor shall keep team of experienced engineer, supervisor, technician and helper in each shift as decided by BHEL Engineer. The team shall take instruction from BHEL Engineer for day-to-day work and shall not be diverted for other work. No extra payment shall be made for their services.
2.38.16.	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 commissioning activities and no separate payment will be entertained for the above.
2.38.17.	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.
2.38.18.	Contractor shall prepare calibration/ testing report/ protocols.
2.38.19.	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.
2.38.20.	Providing necessary assistance for Trial Operation of the unit is in scope of this specification. 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.
2.38.21.	If any small wiring correction or minor modification in control panel wiring is noticed during the commissioning, it shall be carried out as a part of commissioning activity.

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2.38.22.	The trial run of the complete facility as an integral unit shall be conducted for 720 continuous hours. During the period of trial run of 720 hours, the unit shall operate continuously at full rated load for a period of not less than 72 hours.
2.39.	PG TEST ASSISTANCE
2.39.1.	In case PG test is to be conducted, laying of impulse pipes, cables, etc. and installation of instrument tapping points shall be done by the contractor. 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 and returned to BHEL Stores, after the completion of PG Test for which no separate payment is admissible.
2.40.	CCTV System (if applicable):
2.40.1.	Erection of CCTV including cabling and commissioning, specialized work of pole erection, camera mounting, termination of various types of cable in JB's etc
2.40.2.	Location of CCTV shall be informed by BHEL.
2.40.3.	Contractor shall be responsible for total system commissioning.

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3. FACILITIES IN THE SCOPE OF CONTRACTOR/ BHEL (SCOPE MATRIX)				
S. No.	Description	Scope/ to be taken care by		Remarks
		BHEL	Bidder	
3.1.	ESTABLISHMENT			
3.1.1.	FOR CONSTRUCTION PURPOSE:			
a)	Open space for office (as per availability)	Yes		Location will be finalized after joint survey with owner
b)	Open space for storage (as per availability)	Yes		Location will be finalized after joint survey with owner
c)	Construction of bidder's office, canteen and storage building including supply of materials and other services		Yes	
d)	Bidder's all office equipment, office/ store/ canteen consumables		Yes	
e)	Canteen facilities for the bidder's staff, supervisors and engineers etc.		Yes	
f)	Firefighting equipment like buckets, extinguishers etc.		Yes	
g)	Fencing of storage area, office, canteen etc. of the bidder		Yes	
3.1.2.	FOR LIVING PURPOSES OF THE BIDDER			
a)	Open space for labour colony (as per availability)		Yes	Agency has to make his own arrangement at his own cost.
b)	Labour Colony with internal roads, sanitation, complying with statutory requirements		Yes	
3.2.	ELECTRICITY			
3.2.1.	Electricity for construction purposes only of Voltage 415/ 440V, 3phase, 50Hz	Yes		Free of cost at one point near the site at a distance of approx. 500 meter. Further distribution and Metering are in scope of bidder.
a)	Single point source	Yes		At a distance of 500 m from site (Distance is only tentative, it may vary up-to an extent depending on site condition)

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b)	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
c)	Duties and deposits including statutory clearances if applicable		Yes	
3.2.2.	Electricity for the office, stores, canteen etc. of the bidder			
a)	Single point source	Yes		Chargeable basis. Single point as above for construction purpose, no separate point shall be given. Metering is in scope of bidder.
b)	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
c)	Duties and deposits including statutory clearances if applicable		Yes	
3.2.3.	Electricity for living accommodation of the bidder's staff, engineers, supervisors etc.		Yes	Agency has to make his own arrangement at his own cost.
a)	Single point source		Yes	
b)	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
c)	Duties and deposits including statutory clearances if applicable		Yes	
3.3.	WATER SUPPLY			
3.3.1.	For construction purposes:			
a)	Making the water available from single point	Yes		Free of cost at one point near the plant boundary. Further distribution and metering are in scope of bidder.
b)	Further distribution as per the requirement of work including supply of materials and execution		Yes	
3.3.2.	Water supply for bidder's office, stores, canteen etc.			
a)	Making the water available at single point	Yes		Free. Contractor has to make his own arrangements for distribution. Single point as above for construction purpose, no separate point shall be given.

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b)	Further distribution as per the requirement of work including supply of materials and execution		Yes	Contractor has to make his own arrangements for distribution.
3.3.3.	Water supply for Living Purpose			
a)	Making the water available at single point		Yes	No separate point shall be given.
b)	Further distribution as per the requirement of work including supply of materials and execution		Yes	Contractor has to make his own arrangements for distribution.
3.4.	LIGHTING			
a)	For construction work (supply of all the necessary materials) 1. At office/ storage area 2. At the preassembly area 3. At the construction site/ area		Yes	
b)	For construction work (execution of the lighting work/ arrangements) 1. At office/ storage area 2. At the preassembly area 3. At the construction site/ area		Yes	
c)	Providing the necessary consumables like bulbs, switches, etc. during the course of project work		Yes	
d)	Lighting for the living purposes of the bidder at the colony/ quarters		Yes	
3.5.	COMMUNICATION FACILITIES FOR SITE OPERATIONS OF THE BIDDER			
a)	Telephone, fax, internet, intranet, e-mail etc.		Yes	
3.6.	COMPRESSED AIR (wherever required for the work)		Yes	
b)	Supply of Compressor and all other equipment required for compressor & compressed air system including pipes, valves, Storage System etc.		Yes	
c)	Installation of above system and operation & maintenance of the same		Yes	
d)	Supply of the all the consumables for the above system during the contract period		Yes	

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3.7.	Demobilization of all the above facilities		Yes	
3.8.	TRANSPORTATION			
a)	For site personnel of the bidder		Yes	
b)	For bidder's equipment and consumables (T&P, Consumables etc.)		Yes	
3.9.	ENGINEERING WORKS FOR CONSTRUCTION:	Yes		NOT APPLICABLE
a)	Providing the erection/ constructions drawings for all the equipment covered under this scope	Yes		
b)	Drawings for construction methods	Yes	Yes	In consultation with BHEL
c)	As-built drawings – where ever deviations observed and executed and also based on the decisions taken at site-example – routing of small bore pipes		Yes	Changes are to be marked in drawing & handover to BHEL on completion of work.
d)	Shipping lists etc. for reference and planning the activities	Yes		NOT APPLICABLE
e)	Preparation of site erection schedules and other input requirements		Yes	In consultation with BHEL
f)	Review of performance and revision of site erection schedules in order to achieve the end dates and other commitments	Yes	Yes	In consultation with BHEL
g)	Weekly erection schedules based on S. No. d		Yes	In consultation with BHEL
h)	Daily erection/ work plan based on S. No. e		Yes	In consultation with BHEL
i)	Periodic visit of the senior official of the bidder to site to review the progress so that work is completed as per schedule. It is suggested this review by the senior official of the bidder should be done once in every two months.		Yes	
j)	Preparation of preassembly bay		Yes	NOT APPLICABLE
k)	Laying of racks for gantry crane if provided by BHEL or brought by the contractor/ bidder himself		Yes	NOT APPLICABLE
l)	Arranging the materials required for preassembly		Yes	NOT APPLICABLE
m)	COVID-19 Preventive Measure		Yes	
3.10.	LAND			

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a)	Land will be provided free of cost by BHEL to the extent available/ considered necessary by BHEL to successful bidder for their temporary office & store. Contractor has to make his own arrangements for Land for Labour colony. Availability of land is very limited and successful bidder have to plan & use existing land considering use of land by other civil/ mechanical/ electrical successful bidders and storage of plant machineries & materials. The existing land shall be shared by all agencies deployed by BHEL at site.
b)	BHEL shall hand over such allotted land to the successful bidder on as is where is condition. Successful bidder shall arrange at his own cost cleaning and grading of area allotted, construction of their temporary office, stores, go-down, fabrication yards etc and also the watch & ward, etc as may be required.
c)	All temporary roads for crane movement shall be constructed and maintained by BHEL.
d)	Land, as available, shall be arranged by the successful bidder for labour colony outside plant boundary. BHEL shall reimburse lease rent of such land used for Labour Colony. Necessary vehicles from plant to labour colony to and fro, for transportation of laborer shall be arranged by the successful bidder. Successful bidder should visit the site to assess site condition regarding feasibility of use of land for the purpose. The successful bidder to construct temporary labour colony/ hutment, toilets as per attached technical specifications and drawings after obtaining approval of formalities from statutory body/NTPC Guidelines.
e)	Successful bidder shall provide adequate no of toilets in their labour colony and maintain minimum requirement hygiene as per safety regulations.
f)	On completion of work, all the temporary buildings, structures, pipelines, cables, etc, shall be dismantled & leveled and debris shall be removed as per instruction of BHEL by successful bidder at their cost. In the event of failure to do so, same will be removed and expenditure thereof will be recovered from successful bidder. Decision of BHEL in this regard shall be final & binding. However, the scope of dismantling & leveling the area is limited only to successful bidder's site office, yard and other spaces occupied by successful bidder.
3.11.	WATER
a)	BHEL will provide construction as well as potable water at one strategic point within plant premises, free of cost, to the successful bidder for their site office & store.
b)	Further network for construction & potable water system for construction work shall be arranged by successful bidder at their own cost.
c)	BHEL shall not be responsible for any inconvenience or delay caused due to any interruption of water supply and successful bidder shall claim no compensation for delay in work for such interruption. Successful bidder may make standby arrangement for water for which no separate payment shall be made by BHEL.
d)	Successful bidder will have to arrange for storage of water to meet day-to-day requirement.
e)	Availability of water (construction as well as potable) in project site is limited. Successful bidder shall ensure that no water is wasted and shall take all necessary measures for any wastage & preservation of water. In this context, for proper utilisation & to avoid scarcity, successful bidder shall mandatorily construct storage facility of construction & potable water at site (Near work places). Any deviation from this shall lead to forthwith withdrawal of the facility.

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f)	Construction water, as available, may be provided for labour colony within the project premises free of cost. Successful bidder should visit site before quoting to assess site condition regarding feasibility of use of water source for the purpose. Further network for drinking water system for construction work shall be arranged by successful bidder at their own cost. Successful bidder shall take care of all precautions to avoid any sort of misuse, wastage of water. Any deviation from this shall lead to forthwith withdrawal of this facility.
g)	Successful bidder shall make their own arrangement of potable water facility for labour colony, at their own cost.
h)	Bidder to note that use of construction/potable water from bore-well may be permitted if found suitable. Any statutory clearance required shall be obtained by the contractor.
3.12.	ELECTRICITY
a)	BHEL will provide construction power free of charges at 415 V level at one/ two strategic point(s) within plant premises. Successful bidder shall make their own distribution arrangement to draw electricity. However, provision of suitable temporary lights at different floors/ working areas for execution of the work & safety of workmen shall be provided by successful bidder, within accepted rate. Illumination should be such that minimum illumination requirement as specified by local statutory body / international standard for general illumination is maintained.
b)	Contractor shall be responsible for fulfilment of all requirements including statutory requirements in this regard. Contractor shall deploy and install required energy meter, cables, fuses, distribution boards, switchboards, bus bars, earthing arrangements, protection devices and any other installation as specified by statutory authority/act. Contractor shall also obtain approvals of appropriate authority and pay necessary fees, levies etc towards the clearance of such installations, prior to use. Sufficient power factor compensation equipment like capacitor shall be provided by contractor for reactive loads like welding machines etc. In case of any fine/penalty on account of low power factor, same shall be shared by contractor proportionately according to power consumption.
c)	Contractor shall make necessary arrangements for onward distribution of construction power taking due care of surrounding construction activities like movement of cranes & vehicles, civil work, fabrication/construction/assembly/ erection etc and safety of personnel. It may become necessary to relocate some of the installations to facilitate work of other agencies or himself.
d)	Contractor to note that till construction power is made available by BHEL, contractor shall make his own arrangement like DG set etc. The contractor shall also take the approval/ permission of statutory authorities for his DG set installation. The Contractor has to make his own arrangement for the same as required to carry out the job under the scope of work within the quoted rate. Nothing extra shall be paid on this account of DG set up and running for construction and office maintenance etc.
e)	Contractor is advised to maintain the calibrated energy measuring instruments and use their system as efficiently as possible to maintain the HT side input energy meter reading and LT side outgoing energy meter reading to sub-contractors as equal. Successful bidder shall arrange energy meter for their office.

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f)	If any other voltage level (other than normally available) is required, the same shall be arranged by successful bidder from power supply as above. Successful bidder will have to provide at their own cost necessary calibrated energy meters (tamper proof, suitably housed in a weather proof box with lock & key arrangement) at point of power supply along with calibration certificate from authorized/ accredited agency for working out the power consumption. In case of recalibration required for any reason, necessary charges including replacement by calibrated meters is to be borne by successful bidder. Supply of electricity shall be governed by applicable Rules & Regulation. In case of any major deviation from normally accepted norms is observed, BHEL will reserve the right to impose penalty as deemed fit for such cases.
g)	Successful bidder shall have to provide earth leakage circuit breaker at each point wherever human operated electrical drives/ T&Ps are deployed.
h)	The power supply will be from the available grid. BHEL shall not be responsible for any inconvenience or delay caused due to any interruption of power supply/ variation in voltage level and no compensation for delay in work can be claimed by the successful bidder due to such non-supply on the grounds of idle labour, machinery or any other grounds.
i)	Successful bidder shall arrange sufficient illumination at their own work areas and energy meter for office.
j)	Successful bidder should ensure that the work in critical areas is not held up in the event of power breakdown. In the event of breakdown in the electric supply, if the progress of work is hampered, it will be the responsibility of the successful bidder to step up the progress of work after restoration of electric supply so that overall progress of work is not affected.
k)	Successful bidder has to make arrangement at their own cost for illumination for their working area for execution of the work & safety of workmen. This system will include temporary pole lighting, portable lighting towers with DG back-up, within the quoted price. The illumination should be such that minimum illumination requirement as specified by Indian standards for general illumination is maintained.
3.13.	CONSTRUCTION MANAGEMENT
a)	Based on the approved program, successful bidder shall submit a program of construction/ erection/ commissioning for the implementation. These programs would be amplified showing start of erection and subsequent activities and shall form the basis for site execution and detail monitoring. The three-monthly rolling program with the first month's program being tentative based on the site condition would be prepared based on these programs. Successful bidder shall also be involved along with BHEL/ customer to tie up detailed resources mobilization plan over the period of the contract matching with the performance targets.
b)	The program would be jointly finalized by Site Incharge of successful bidder with BHEL/ customer as well as the site-planning representative. The erection program will also identify sequential events matching financial turnover.
c)	Successful bidder is liable to furnish all documentary evidences towards payment of Works Contract Tax as and when required by BHEL.
d)	The contractor shall maintain a site organization of adequate strength in respect of manpower, construction machinery and other implements at all times for smooth execution of the contract. This organization shall be reinforced from time to time, as required to make up for slippage from the schedule without any commercial implication to BHEL. The site organization shall be headed by a competent construction manager having sufficient authority to take decisions at site.
e)	The contractor should also submit to BHEL for approval a list of construction equipment, erection tools, tackle etc. prior to commencement of site activities. These tools & tackles shall not be removed from site without written permission of BHEL.
3.14.	OTHER FACILITIES

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a)	Adequate water less urinals shall be arranged by the contractor within quoted rates, at site of construction at different level and different areas like boiler structure, with proper disposal arrangement.
b)	Vendors have to comply requirements of HSE & Statutory requirement in line with BHEL HSE plan, NTPC Safety requirement, Odisha/ Central statutory requirement.
c)	Vendors have to arrange labour rest sheds, drinking water facility, toilets, canteen facility as per local labour act/ BOCW act. Maintaining hygiene and disposal of debris, scraps, canteen items and area cleaning is included in vendor's scope.
d)	Agency has to arrange trained scaffolding experts with accreditation from statutory agencies with proper experience and they will issue fitness certificates for safe use. Such kind of qualified scaffolding experts will vary as per job requirement. At the same time, training has to be given by these experts at regular intervals for their own workers for increasing no. of experts.
e)	Agencies HSE officers should have sufficient experience as per rule 209 of BOCW act central rule 1998. Agencies HSE officers will be part of BHEL HSE Team and they will be responsible for giving training on HSE issues in addition to normal field works and other normal site requirements.
f)	Preparation of method statement, HIRA, Job Safety analysis, permit to work, lifting plans, and all supporting documents as required for starting & continuation of work/ job is in vendor's scope.
g)	Hydras are not allowed for materials transport, only pick and carry cranes shall be deployed by the agency.
h)	First aid centre will be maintained by BHEL and cost will be proportionately recovered from vendors.
i)	Vendor has to arrange land within his quoted rate for making labour colony. Vendors labour colony has to be maintained with proper hygiene, drinking water, bathroom water, lighting arrangement, sewerage system. These facilities are to be regularly maintained including drains, surrounding, upkeep of labour colony. BHEL/ NTPC & local statutory authorities will visit labour colony from time to time and all healthy conditions are to be maintained by vendor.
j)	Scaffolding pipes, clamps, safety nets, floor grills for working platforms are to be made of good quality with proper certifications as per IS Codes.

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CHAPTER-IV: T&PS AND MMEs TO BE DEPLOYED BY CONTRACTOR

4.	T&PS AND MMEs TO BE DEPLOYED BY CONTRACTOR	
4.1.	LIFTING MATERIALS	
SL NO.	ITEM	
4.1.1.	12 TON / 14 TON CAPACITY NEW GENERATION HYDRA - 01 NO,	
4.1.2.	TYRE MOUNTED MOBILE CRANE OF 40 TON CAPACITY – 01 No (To be deployed/arranged by the agency on as and when required basis for execution of their contractual scope of work, as per instruction of BHEL Site engineer)	
4.1.3.	STEEL WIRE ROPES- As required	
4.1.4.	SHACKLE-As required	
4.1.5.	JACK-As required	
4.1.6.	HAND PULLEY BLOCK / HOIST- As required	
4.1.7.	SLING-As required	
4.1.8.	TRANSIT PULLEY-As required	
4.1.9.	TRAILOR – 01 NO (To be deployed/arranged by the agency on as and when required basis for execution of their contractual scope of work, as per instruction of BHEL Site engineer)	
4.2.	MAJOR TESTING INSTRUMENTS / EQUIPMENT	
SL NO.	ITEM DESCRIPTION	QUANTITY
4.2.1.	Arc/ TIG welding machine and sets	As required
4.2.2.	Gas cutting set	- Do -
4.2.3.	Electric blower	- Do -
4.2.4.	Vacuum cleaner	- Do -
4.2.5.	Hand operated meggers, 500V & 1000V	- Do -
4.2.6.	Digital multimeters, 3.5 digit, 4.5 digit	- Do -
4.2.7.	Analog multimeters	- Do -
4.2.8.	Tong tester with selector switch, 0-1000V	- Do -
4.2.9.	Variac, 3 phase, 415V, 5A	- Do -
4.2.10.	Variac, 1 phase, 5A	- Do -
4.2.11.	Decade resistance box	- Do -
4.2.12.	DC calibrators 0-200 mV/0-20mA (portable / battery operated)	- Do -
4.2.13.	Dead weight tester	- Do -
4.2.14.	Comparison tester 0-400 kg/ sqcm	- Do -
4.2.15.	Master pr gauge, 0.2-1 kg/ sqcm, 0-4 kg/ sqcm, 0-16 kg/ sqcm, 0-40 kg/ sqcm, 0-300 kg/ sqcm, -1 to 0 kg/ sqcm	- Do -
4.2.16.	Oil bath with cooler for temp, 0-160 deg C	- Do -
4.2.17.	Salt bath for temp. up to 1200 deg C	- Do -
4.2.18.	Mercury in glass thermometer, 0-120 deg C, 0-200 deg C	- Do -
4.2.19.	U-tube manometer (mercury & water)	- Do -
4.2.20.	Regulated DC power supply, 0 to +/- 30 V, 5A to 15A.	- Do -
4.2.21.	Function generator.	- Do -
4.2.22.	Oscilloscope	- Do -
4.2.23.	Manual crimping tool suitable for all sizes	- Do -

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CHAPTER-IV: T&PS AND MMEs TO BE DEPLOYED BY CONTRACTOR

4.2.24.	Tarpaulin (big & small)	- Do -
4.2.25.	Watchmaker screw driver set	- Do -
4.2.26.	Terry spanner set	- Do -
4.2.27.	Box spanner set	- Do -
4.2.28.	D-spanner set	- Do -
4.2.29.	Vacuum puller for solder	- Do -
4.2.30.	Soldering iron (temperature controlled)	- Do -
4.2.31.	Bench vice	- Do -
4.2.32.	Pistol drilling machine	- Do -
4.2.33.	Watchmaker vice	- Do -
4.2.34.	Drill bit set	- Do -
4.2.35.	Sling & manila rope	- Do -
4.2.36.	Hand tools, spanners and torque wrench	- Do -
4.2.37.	Star point screw driver	- Do -
4.2.38.	Hand lamp with glass cover	- Do -
4.2.39.	Socket for socket wrench, M10, M12	- Do -
4.2.40.	Reversible ratchet handle	- Do -
4.2.41.	General tools for electrician	- Do -
4.2.42.	General tools for fitter	- Do -
4.2.43.	General tools for rigger	- Do -
4.2.44.	Hydraulic test pump	- Do -
4.2.45.	Copper tube bender	- Do -
4.2.46.	Pipe bender	- Do -
4.2.47.	Needle file set	- Do -
4.2.48.	Allen key set (both mm and inch size)	- Do -
4.2.49.	Slide wrench	- Do -
4.2.50.	Needle puller	- Do -
4.2.51.	Tray cutting machine.	- Do -
4.2.52.	Dial gauge, Vernier scale	- Do -
4.2.53.	Portable low pressure/ vacuum calibrator (-1 to 10 kg/ sqm) with digital display	- Do -
4.2.54.	Portable temperature calibrator (upto 600 deg C)	- Do -
4.2.55.	Rheostat 100 ohm, 5A	- Do -
4.2.56.	0.2 to 1.0 kg/ sqcm Pennwalt or equivalent pneumatic testing kit	- Do -
4.2.57.	Portable air compressor and vacuum pump for vacuum gages	- Do -
4.2.58.	Portable pressure calibrator up to 25 kg/ sqm with digital display (hand held field calibrator)	- Do -
NOTE		
A)	Any other T&P/ MMD required for smooth completion of the job shall be arranged by the contractor at their own cost.	
B)	The quantities of items were not mentioned with an intent that contractor shall bring adequate quantity of the above mentioned tools/ MMD so that parallel gangs can work and no work is held-up due to non-availability of tools/ MMD at any point of time. The bidders are also required to make provision for availability of tools/ MMD for work during emergency or odd hours, with test certificates wherever required	

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CHAPTER-IV: T&PS AND MMEs TO BE DEPLOYED BY CONTRACTOR

C)	The contractor may please note the periodical testing and calibration of the testing equipment are to be done at regional research laboratories and copy of test certificates to be submitted to BHEL as per 'ISO' norms.			
D)	The above instruments / equipment will be tested and calibrated wherever from time to time and maintained by contractor as required by BHEL.			
E)	All testing instruments shall have calibration certificate issued by recognized / accredited agencies.			
F)	Contractor shall maintain calibration records as per the BHEL format given in SI No.4.4 and produce them whenever called for by BHEL Engineers.			
G)	The Contractor shall provide two (2) Ferrule Printing Machines per package (Package A & B) prior to the commencement of cable laying works. These machines must remain available until the Unit's Commercial Operation Date (COD). Failure to provide the required equipment will result in a penalty of 10,000 per month for each missing machine.			
4.3.	ACCURACY REQUIREMENT OF TESTING INSTRUMENTS			
Sl.No.	Instrument / Tool	Range	Accuracy	Dial Size
4.3.1.	Digital Multimeter	Voltage 200 mV to 1000 V DC	± 1% + 1 digit	
		Philips Voltage 200 mV to 1000 V AC	± 1% + 1 digit	
		Philips Current 20 mA to 20 A AC	± 0.8% + 1 digit	
		Resistance (HCl) 2120 200* to 20 M*	± 0.5% + 1 digit	
		Resistance (Hcl) 2105 200* to 200M*	± 0.25% + 3 digits	
		Hcl Voltage 200 mV to 750 V	± 0.8% + 1 digit	
		Philips Current 20 mA to 20 A DC	±0.5% + digit	
		Hcl Current 200 mA to 010 A AC	± 1% + digit	
4.3.2.	Analog Multimeter	Voltage 2.5 to 2500V AC	± 1.0%	
		Current 100 mA to 10A AC	± 2.0%	
		Current 250 micro A to 1A DC	± 1.5%	
4.3.3.		Resistance upto 100 ohms	± 3.0%	
		Voltage 2.5 V to 2500 V	± 1 %	
4.3.4.	mA/mV Source	0 to 200 mA / 200mV	0.2%	
4.3.5.	Hand operated Megger 500V/1000 V	Upto 200 m Ohms	± 5% at Centre scale	10"
4.3.6.	Standard Pressure Gauges	0 to 1 kg/cm ²	±0.25% LC-0.02 kg/ cm ²	10"
		0 to 6 kg/cm ²	±0.25% LC-0.1 kg/ cm ²	10"

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		0 to 10 kg/ cm ²	±0.25% LC– 0.02kg/ cm ²	10"
		0 to 25 kg/ cm ²	±0.25% LC– 0.25kg/ cm ²	10"
		0 to 60 kg/ cm ²	±0.25% LC– 0.1kg/ cm ²	10"
		0 to 250 kg/ cm ²	±0.25% LC– 2.5kg/ cm ²	10"
		0 to 400 kg/ cm ²	±0.25% LC–2.5 kg/ cm ²	10"
		0 to 600 kg/ cm ²	±0.25% LC– 2.5 kg/ cm ²	10"
		0 to 1000 kg/ cm ²	±0.25% LC–1.0 kg/ cm ²	10"
4.3.7.	Dead Weight Tester	0 to 400	LC – 5 kg/cm2	
		0 to 600	LC – 5 kg/cm2	
4.3.8.	Standard Hg in glass Thermometer	0 to 100 ⁰ C	LC - 1 ⁰ C	
		0 to 110 ⁰ C	LC - 1 ⁰ C	
		0 to 250 ⁰ C	LC - 1 ⁰ C	
		0 to 150 ⁰ C	LC - 1 ⁰ C	
		0 to 360 ⁰ C	LC - 1 ⁰ C	
		0 to 420 ⁰ C	LC - 1 ⁰ C	
4.3.9.	Single Phase Variac	15 A Capacity	N/A	
4.3.10.	Power Pack	0 to 50 V DC, 3A	± 2%	
4.3.11.	Vibration Measuring Equipments	Velocity up to 50 mm/sec	± 0.5% mm/sec	
		Displacement upto 300 microns	± 2 microns	
4.3.12.	Tongue tester	0/300/600 A AC	± 5%	
		0 to 300 A DC	± 5%	
4.3.13.	Tacho Meter (Hand held)	0 to 4000 rpm	± 5%	
4.3.14.	Phase Sequence Meter		N/A	
4.3.15.	Earth Megger (Tester)	0 to 1, 10, 100 Ohms	± 5% at Centre Scale range	
4.3.16.	DC Ammeter	0 to 300 A	± 10%	
4.3.17.	DC Voltmeter	0 to 500 V	± 10%	

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CHAPTER-IV: T&PS AND MMEs TO BE DEPLOYED BY
CONTRACTOR

4.4.	CALIBRATION RECORD OF SUB-CONTRACTOR'S INSTRUMENTS					
4.4.1.	Format No. CP: PEX: FOX Name of Site: Name of Sub-Contractor:					
	Sl.No.	Name of the Instrument	Instrument REGN.No.	Date of Entry / Exit	Periodicity of Calibration	Calibration Details
						Date of Cal: Cal. Agency: Next Due Date:
						Date of Cal: Cal. Agency: Next Due Date:
						Date of Cal: Cal. Agency: Next Due Date:

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CHAPTER-V: T&PS AND MMEs TO BE DEPLOYED BY BHEL ON
SHARING BASIS

5.	T&PS AND MMEs TO BE DEPLOYED BY BHEL ON SHARING BASIS		
5.1.	DESCRIPTION & CAPACITY OF T&P	QTY	PURPOSE
A)	EOT crane in TG Hall without Operator.	2 Nos.	For handling and erection within TG hall on sharing basis as available and subject to their accessibility and approachability.
5.2.	Above T&P will be provided on sharing basis only. Contractor has to plan his activities well in advance and inform BHEL Engineer in charge/ Construction Manager the date of actual use. The decision of BHEL Engineer in-charge/ Project Director on this will be final in this regard.		

TECHNICAL CONDITIONS OF CONTRACT (TCC)

CHAPTER-VI: TIME SCHEDULE

6.	TIME SCHEDULE			
6.1.	Initial Mobilization After issue of LOA (through Fax/courier/email) the contractor shall report to the Construction Manager/Site In-Charge of BHEL at site within Two weeks (14 days) from date of LOA for Kick-off meeting regarding mobilization of manpower, T&Ps and date of start of work and detailed completion program etc. The contractor has to subsequently augment his resources in such a manner that the project milestones are completed on specified schedules and entire work completed within the entire contract period, as specified in the following clause from the date of start of work, in a manner required by BHEL to match with the project schedule.			
6.2.	Commencement of Contract Period: BHEL Engineer will certify the actual date of start of work after adequate mobilization of manpower, major equipment and required T&P by the contractor. In case of discrepancy, the decision of BHEL shall be considered to be final and binding to contractor. Based on the availability of civil foundations, drawings and material from BHEL, contractor may have to advance the erection activity after getting clearance from Construction Manager, or the erection activity may get delayed due to site conditions. The contractor shall complete all the works in the scope of this contract within the contract period. Pending points identified by the customer/BHEL during the execution of the contract are to be liquidated during the contract period itself.			
6.3.	Schedule of Completion: The contract period for completion of entire work under scope shall be as mentioned hereunder, from the "START OF CONTRACT PERIOD" as specified earlier for completion of the entire work in respective Packages.			
	Package		Contractual Schedule (Month)	
	ERECTION, TESTING & COMMISSIONING OF C&I PKG OF MAIN PLANT AREA-U#1 & COMMON SYSTEMS (Except AHP, CHP, LHP & GHP)		13 Months	
	ERECTION, TESTING & COMMISSIONING OF C&I PKG OF MAIN PLANT AREA-U#2 including AHP, CHP, LHP & GHP		13 Months	
6.4.	The contractor has to subsequently augment his resources in such a manner that C&I readiness for following major milestones are achieved on specified schedules:			
	S. No.	C&I READINESS FOR MAJOR MILESTONE	Tentative Schedule from start of work of Package - A	Tentative Schedule from start of work of Package - B
			Unit-1	Unit-2
	1	ND HYDRO TEST	3 rd Month	3 rd Month
	2	BOILER LIGHT UP	5 th Month	5 th Month
	3	SYNCHRONIZATION	9 th Month	9 th Month
	4	COMPLETION OF FACILITIES	13 th Month	13 th Month

TECHNICAL CONDITIONS OF CONTRACT (TCC)

CHAPTER-VI: TIME SCHEDULE

	Agency for C&I Package has to expedite their work in order to meet the milestones as indicated above. NOTE: Above time schedule is only tentative and in order to meet C&I readiness for above schedule in general, and any other intermediate targets set, to meet customer/ project schedule, contractor shall arrange & augment all necessary resources from time to time as per the instructions of BHEL Engineer w.r.t. monthly plan and review format (F-14). The C&I readiness for above schedule may get advanced, if there are requirements to advance the project to meet the project requirement. No extra payment whatsoever shall be paid on this account.														
6.5.	Intermediate milestones: Two Major Intermediate Milestones are identified as M1 and M2. <table border="1"> <thead> <tr> <th></th><th>Milestone Names</th><th>Tentative Schedule from start of work of Package - A</th><th>Tentative Schedule from start of work of Package - B</th></tr> </thead> <tbody> <tr> <td>M1</td><td>C&I readiness for Boiler Light Up</td><td>5th Month</td><td>5th Month</td></tr> <tr> <td>M2</td><td>C&I readiness for Synchronization</td><td>9th Month</td><td>9th Month</td></tr> </tbody> </table> Successful bidder shall plan their work in such a manner so as to meet the above construction schedule & project schedule, in consultation with BHEL/ customer. M1 & M2 are the intermediate LD milestone. Successful bidder shall submit detailed L1/L2 schedule separately for the package after getting LOA from BHEL and prior to issuance of detailed work order.				Milestone Names	Tentative Schedule from start of work of Package - A	Tentative Schedule from start of work of Package - B	M1	C&I readiness for Boiler Light Up	5 th Month	5 th Month	M2	C&I readiness for Synchronization	9 th Month	9 th Month
	Milestone Names	Tentative Schedule from start of work of Package - A	Tentative Schedule from start of work of Package - B												
M1	C&I readiness for Boiler Light Up	5 th Month	5 th Month												
M2	C&I readiness for Synchronization	9 th Month	9 th Month												
6.6.	Provision of Penalty in case of slippage of Intermediate Milestones: - In case of slippage of Two Major Intermediate Milestones, mentioned as M1 & M2 above, delay Analysis shall be carried out on achievement of each of these two Intermediate Milestones in reference to F-14. - In case delay in achieving M1 Milestone is solely attributable to the contractor, 0.5% per week of executable contract value*, limited to maximum 2% of executable contract value, will be withheld. - In case delay in achieving M2 Milestone is solely attributable to the contractor, 0.5% per week of executable contract value*, limited to maximum 3% of executable contract value, will be withheld. - Amount already withheld, if any against slippage of M1 milestone, shall be released only if there is no delay attributable to contractor in achievement of M2 Milestone. - Amount required to be withheld on account of slippage of identified intermediate milestone(s) shall be withheld out of respective milestone payment (if any) and balance amount (if any) shall be withheld @10% of RA Bill amount from subsequent RA bills. - Final deduction towards LD (if applicable), on account of delay attributable to contractor shall be based on final delay analysis on completion / closure of contract. Withheld amount, if any due to slippage of identified intermediate milestone(s) shall be adjusted against LD or released as the case may be. - In case of termination of contract due to any reason attributable to contractor before completion of work, the amount already withheld against slippage of intermediate milestones shall not be released and be converted into recovery. - Contractor shall make all possible efforts to expedite the activities, in case of delay of any intermediate milestone, to maintain overall project completion schedule. *Executable Contract Value - Value of work for which inputs/ fronts were made available to contractor and were scheduled for execution till the date of achievement of that milestone.														

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6.7.	Completion of Work and Commencement of Guarantee Period
6.7.1.	The works shall be completed to the entire satisfaction of the Engineer and in accordance with the completion schedule as specified in the Contract, and all unused stores and materials, tools, plant, equipment, temporary buildings, site office, labour hutments and other things shall be removed and the site and work cleared of rubbish and all waste materials and delivered up clean and tidy to the satisfaction of the Engineer at the Contractor's expenses.
6.7.2.	BHEL shall have power to take over from the Contractor from time to time such sections of the work as have been completed to the satisfaction of the Engineer. Such work however shall not be treated as have been completed until the remaining / pending works are executed to the satisfaction of Engineer.
6.7.3.	Commencement of performance guarantee shall be as per clause no. 2.24 (Performance Guarantee for Workmanship) of General Conditions of Contract. The commencement of guarantee period for the quality of the workmanship shall start from the date of Trial operational acceptance of facilities OR Handing Over to the customer, whichever is earlier.
6.7.4.	The contractor shall submit a detailed area/structure wise L3 schedule within 25 days from date of LOA, in consultation with BHEL, based on the tentative schedule provided as above. The detailed L3 schedule shall be approved by BHEL and same shall be implemented. Bidder shall submit L3 schedule in MS Projects and excel to meet the agreed project schedule covering various mile stone activities and their split-up details such as mobilization, procurement of materials & erection activities. This schedule shall also clearly indicate the interface facilities / inputs applicable in each package. Bidders shall submit Resource deployment plan Area wise with detail program in line with above schedule in the form of Bar Chart/ MS project planner along with their offer.
6.8.	The under mentioned Records/ Log-books/ Registers applicable to be maintained. i) Hindrance Register. ii) Site Order Book. iii) Test Check of measurements. iv) Records of Test reports of Field tests. v) Records of manufacture's test certificates. vi) Records of disposal of scraps generated during and after the work completion
6.9.	CONTROL AND MONITORING OF PROGRESS OF WORK
6.9.1.	Refer forms F -14 to F-15 of volume I D (Forms & Procedure). Plan and review will be done as per the formats.
6.9.2.	The progress reports shall indicate the progress achieved against plan, indicating reasons for delays, if any. The report shall also give remedial actions which the contractor intends to make good the slippage or lost time so that further works can proceed as per the original plan the slippages do not accumulate and affect the overall programme.
6.9.3.	It is the responsibility of the contractor to provide all relevant information on a regular basis regarding progress of work, labour availability, equipment deployment, testing, etc.
6.9.4.	Contractor is required to draw mutually agreed monthly work programs in consultation with BHEL well in advance. Contractor shall ensure achievement of agreed program and shall also timely arrange additional resources considered necessary at no extra cost to BHEL.
6.9.5.	Progress review meetings will be held at site during which actual progress during the week vis-a-vis scheduled program shall be discussed for actions to be taken for achieving targets. Contractor shall also present the program for subsequent week. The contractor shall constantly update / revise his work program to meet the overall requirement. All quality problems shall also be discussed during above review meetings. Necessary preventive and corrective action shall

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	be discussed and decided upon in such review meetings and shall be implemented by the contractor in time bound manner so as to eliminate the cause of nonconformities.
6.9.6.	The contractor shall submit quarterly progress reports, manpower reports, materials reports, consumables (gases / electrodes) report, cranes availability report and other reports as per Performa considered necessary by the Engineer. The periodicity of the reports will be decided by BHEL Engineer at site.
6.9.7.	The contractor shall submit quarterly statement report regarding consumption of all consumables for cost analysis purposes.
6.9.8.	The contractor shall submit a report of any damage, shortage, discrepancy etc., every week detailing in this regard. Non-submission of report would be considered as no shortage of materials.
6.9.9.	The manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.
6.10.	The monthly report as a booklet shall be submitted at the end of every month and shall contain the following details: - 2.1 Progress photographs in colour. 2.2 Erection progress in terms of the respective work areas against planned 2.3 Site Organization chart of engineers & supervisors as on the last day of the month with further mobilization plan. 2.4 Safety implementation report in the format. Pending material and any other inputs required from BHEL for activities planned during the subsequent month.
6.11.	Site Data Digitalization: Daily Activity Log, M-Book and Subcontracting Billing Module: - 1. Refer Vendor Portal System with links: for ref. https://pshq.bhel.in/sddvp/ 2. Login ID and Password shall be provided by respective package manager. 3. Contractor by clicking 'Daily Work Photos', shall upload area wise photos on daily basis. 4. Contractor by clicking 'Daily Activity Log', shall update site activities on daily basis. 5. Contractor by clicking 'Measurement Book', shall enter Measurement Book in Format and BOQ. 6. Contractor shall raise their RA Bills along with supporting documents (such as Quality and HR Document – Vetted by Customer Etc.) and checklist through SDD portal only. 7. Contractor shall comply the system requirement. 8. Refer Vendor Manual for further details. Note: The contractor shall be required to provide all facilities including manpower for the aforementioned activities, without any cost implications to the BHEL.
6.12.	Agency shall extend all support towards inputs for Project Management to PMC team, IPMS system or any other system/tool for project monitoring and control.
6.13.	General Terms:
6.13.1.	Successful bidder shall submit daily work program based on above construction schedule. Deferment of schedule is not acceptable, unless specifically called for by BHEL. Successful bidder will adhere to schedule and resource planning to be augmented to ensure completion as per schedule. Slippage from adherence to this schedule will attract penalty/ LD as per tender provision.
6.13.2.	Periodic progress reviews on the entire activities of execution in respect of supply & works in scope of successful bidder will be held once in a month at Region Head-Quarter / site. These meetings will be attended by reasonably higher officials of successful bidder and will be used as a forum for discussing all areas where progress needs to be speeded up. Successful bidder shall be further responsible for ensuring that suitable steps are taken to meet various targets decided upon such meetings. Review shall be done in applicable BHEL format (F-14 etc) and shall have

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	to be signed jointly by BHEL engineer and site in-charge of vendor. This signed document shall form the basis for future delay analysis of the project.
6.13.3.	The contractor shall complete all the work in the scope of this contract within the contract period. 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.
6.13.4.	Contractor shall draw the monthly erection program along with BHEL Engineer indicating the work to be achieved and event to be completed. Once the program 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 mobilize his resources required to achieve the monthly programs.
6.13.5.	Contractor shall specifically note that there is likely to be some delay in supplies of materials/ release of work fronts/ other reasons. Contractor shall have to work round the clock on such critical activities as a part of catch up program to meet the project requirement to the extent possible and shall also provide required resources as part of scope of work.
6.13.6.	In order to meet above schedule in general, and any other intermediate targets set, to meet customer/ project schedule, contractor shall arrange & augment all necessary resources from time to time as per the instructions of BHEL.
6.13.7.	In case the activities in the schedule are to be advanced, the related structural activities in the scope of the contractor are to be advanced to meet the project requirement. No extra payment whatsoever shall be paid on this account.
6.13.8.	The contractor shall submit area-wise L3 schedule within 7 days in consultation with BHEL. The detailed L3 schedule shall be approved by BHEL and same shall be implemented. Bidder shall submit L3 schedule in MS Projects to meet the agreed project schedule covering various mile stone activities and their split-up details such as mobilization, procurement of materials, fabrication & erection activities. This schedule shall also clearly indicate the interface facilities/ inputs applicable in each package.
6.14.	DEFINITION OF WORK COMPLETION
6.14.1.	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.
6.15.	MATERIAL RE-CONCILIATION & SHORT CLOSURE OF CONTRACT
6.15.1.	The BOQ is for the Package (Unit#1 & Unit#2). The contractor shall do unit-wise material re-conciliation periodically. In extreme case if need arises, BHEL may short close the contract unit-wise.
6.16.	SCHEDULE COMPRESSION
6.16.1.	BHEL, owing to its commitment to their customer, may ask contractor to compress the total completion schedule by up to 15%. This will result in advancement of various milestones. For achieving the same, contractor shall plan his activities and mobilize additional resources accordingly to the satisfaction of BHEL engineer within the quoted rates.

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CHAPTER-VII: TERMS OF PAYMENT

7. TERMS OF PAYMENT		
The progressive payment for erection, testing and commissioning on accepted price of contract value for Electrical Package rates will be released as per the break up given hereinafter:		
S. No.	Activity/ Work Description	% of Unit Rate
7.1.	Main E&C Equipment/ Items	
I.	PRO RATA PAYMENTS (90%)	
7.1.1.	Cable Tray and Accessories	
A)	Fabrication and fixing/ welding/ bolting in position	85%
B)	Covering of trays where ever envisaged	5%
	Total =	90%
7.1.2.	Cable Laying	
A)	Laying of Cables/Wires	60%
B)	Glanding, Termination and Testing	20%
C)	Dressing & Clamping of cables	10%
	Total =	90%
7.1.3.	Junction Box/ Push Button Station (Local)	
A)	Erection including fixing of terminal blocks where ever applicable	80%
B)	Name plate fixing where ever applicable, Labelling (both inside and outside), Earthing and Commissioning of connected equipment	10%
	Total =	90%
7.1.4.	Conduits/ Impulse Pipe/ Tubes	
A)	Fabrication, Laying and Erection	65%
B)	Leak Test/ Hydraulic Test (where ever applicable, otherwise clubbed with next activity)	10%
C)	Dressing, clamping, tagging and painting where ever applicable	8%
D)	Testing & commissioning of associated equipment/ system	7%
	Total =	90%
7.1.5.	Miscellaneous Structural Steel including Frames for Panels/ Racks/ Instruments, Supports for Cable Tray/ Pipes/ Tubes, Canopies etc.	
A)	Fabrication/ Pre-assembly/ Erection, Alignment, welding/ bolting and if applicable chipping/grouting/painting	80%
B)	Painting	10%
	Total =	90%
7.1.6.	Panels/ Cubicles/ Desks/ Racks/ Enclosures/ Monitors/ Computers/ Computer Peripherals/ PLCs/ UPS/ Batteries	
A)	Erection and alignment	65%

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CHAPTER-VII: TERMS OF PAYMENT

B)	Fixing of loose items/ instruments where ever applicable	10%
C)	Pre commissioning checks, charging of panel and Loop testing etc.	10%
D)	System commissioning	5%
	Total =	90%
7.1.7.	Instruments/ Devices including Sensors/ Cells/ Probes etc.	
A)	Calibration/ Testing/ Pre erection checks	30%
B)	Erection/Placement and fixing of loose items/accessories/Pre commissioning checks/loop testing/Simulation testing as required	50%
C)	Remote/ local commissioning as required	10%
	Total =	90%
7.1.8.	Commissioning and Testing Activities for Equipment Erected by Other Agencies, Like Control Valves, On/ Off Valves, Electrical/ Pneumatic Valves, Actuators, Solenoid Valves, Valves, Limit Switches, ERV Controllers, Power Cylinders, Pressure & Temperature Gauges/ Transmitters, etc.	
A)	Removal & re-fixing/Fixing loose supplied components, including tubing/hose, regulators, etc. (where ever applicable, otherwise clubbed with next activity)	35%
B)	Calibration/ Local testing - commissioning readiness	30%
C)	Local Commissioning & Loop Testing as required	15%
D)	System Commissioning or Remote Commissioning as required	10%
	Total =	90%
7.1.9.	Miscellaneous Items (Items not covered under Above heads)	
A)	Erection	50%
B)	Alignment	15%
C)	Testing	15%
D)	Completion	10%
	Total =	90%
7.1.10.	FDA Items (Fire Detection and Alarm System)	
A)	Cable Laying, loop testing, charging, dressing, and clamping along with JB	25%
B)	Panel Erection and Commissioning	25%
C)	Instruments/Sensor/Detector/Indicators/Solenoid/Valves/ Call Points/ Modules/Hooter/Siren/Exit Sign E&C	25%
D)	Furniture/Work Station/Printer/UPS/Battery Charging Commissioning etc.	15%
	Total =	90%
7.1.11.	Supply of consumables mentioned in BOQ for Package-B in Vendor Scope (For AHP, CHP, GHP & LHP Area only)	
	Supply of consumables mentioned in BOQ for Package-B in Vendor Scope on receipt of MDCC (Material Dispatch Clearance Certificate) from BHEL (For AHP, CHP, GHP & LHP Area only)	54%
	Erection of consumables mentioned in BOQ for Package-B in Vendor Scope (On Physical verification at Site) (For AHP, CHP, GHP & LHP Area only)	36%
	Total =	90%

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CHAPTER-VII: TERMS OF PAYMENT

7.2.	STAGE/ MILESTONE PAYMENTS (10%)	
A)	Boiler Light Up	2%
B)	Rolling and Synchronization (STG)	1%
C)	Full Load	1%
D)	COD	1%
E)	Trial Operation	1%
F)	Punch List points/ pending points liquidation	1%
G)	Area cleaning, temporary structures cutting/ removal and return of scrap	1%
H)	Submission of 'As Built Drawings'	1%
I)	Material Reconciliation	1%
	Total for Stage/ Milestone Payments (10%)	10%
7.3.	Progressive Payment/ Final Payment: The payments for works under the scope of this contract for both the packages shall be as per clause no 2.6; 2.22; 2.23 of General Conditions of Contract and Volume-IB, Chapter-X of SCC.	
7.3.1.	Documents required for RA Bill:	
	GST Complied Invoice of the work done as per approved BBU.	
	WAM -6 for RA Bill.	
	Jointly signed Measurement sheet/ Protocols	
	Power of Attorney before submission of Bill.	
	Validity of Bank Guarantees as applicable under the contract.	
	Monthly HSE Compliance Certificate certified by BHEL- Safety	
	Material reconciliation statement along with RA Bill (Monthly basis).	
	HR/IR compliance documents:	
	i. Wages payment sheet as per applicable minimum wages.	
	ii. Proof of PF contribution submission.	
	iii. Proof of ESI/ WC contribution submission	
	iv. Proof of Bonus payment as per Bonus Act if applicable.	
	v. Proof of EL payment if applicable.	
	vi. Any other statutory document if applicable.	
7.3.2.	Documents required for Final Bill:	
	The final bill is drawn as soon as the entire work is completed. From the final amount due, all amounts already claimed up to the previous running account bill will be deducted. It should be ensured that in the final bill the following additional particulars have been provided:	
	- Final Bill in WAM-7 Format. 'No claim' certificate from the contractor. - Clearance certificates where ever applicable viz. Clearance Certificates from Customer, various Statutory Authorities like Labour department, PF Authorities, Commercial Tax Department etc. - Final Material re-conciliation statement duly approved by BHEL. - Indemnity Bond as per prescribed format. - Deviation statement showing the difference between the actuals and as per the contract. - Final Delay Analysis.	

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CHAPTER-VII: TERMS OF PAYMENT

7.3.3.	The payment for running bills will be released after submission of running bill complete in all respects with all documents. It is the responsibility of the contractor to make his own arrangements for making timely payments towards labour wages, statutory payments, outstanding dues etc. and other dues in the meanwhile. No interest shall be payable for the delayed payment (if any). Few points of consideration are as below: a) The measurements sheets of work done in a month shall be submitted in triplicate duly agreed/signed by BHEL Engineer. The contractor shall extend all necessary assistance for verification of measurements of works without any extra cost. b) Material reconciliation shall be complied on monthly basis. c) The RA bill payments are interim payments and bills shall be submitted in prescribed formats. d) Recoveries on account of electricity, water, statutory deductions etc. shall be made as per terms of contract. e) BHEL will release payment through Electronic Fund Transfer (EFT)/RTGS. f) Final bill shall be submitted after completion of works and upon material reconciliation along with all prescribed formats. g) Quoted Rates are inclusive of all labour, contractor's equipment, temporary works, consumables and all matters and things of whatsoever nature, charges for Safety Aspects/Compliance to Safety Rules including operations and maintenance services (if applicable) etc., and other services, as identified in the tender Documents, as necessary for the proper execution of the subject work. h) No claim what so ever may be, will be entertained under this contract, after duly signing the final bill along with measurement books and accepted by BHEL.
7.4.	SECURED RECOVERABLE ADVANCES:
7.4.1.	Interest Free Secured Mobilization Advance as per GCC Clause No. 2.13.1 will be payable under exceptional circumstances on certification of BHEL Construction Manager at Site. Interest Free Mobilization Advance shall be disbursed in specifically mentioned stages of major respective resource mobilization as specified hereunder:
7.4.2.	A) For Installation and Erection of Site Infrastructure by contractor i.e. site office, site stores, computer with printer.: 1% of Contract value. B) For Mobilization of required manpower at site to start the work: 1% of Contract value. C) For establishment of Calibration Laboratory with minimum required Instruments: 1% of Contract value. D) For Mobilization of 01 no. of Hydra / Farana of required capacity: 1% of Contract value. E) For Mobilization of required testing T&Ps: (Digital Multimeter - 2 Nos, LAN Tester- 01 Nos, Insulation Tester- 1 No, Allen Key Set – 1 No) at site: 1% of Contract value. Note: 1. BHEL Site-PD/CM shall be the deciding authority for assessing the admissibility of advance payment to contractor. 2. In case contractor do not fulfil the agreed conditions of payment of earlier mobilization advance, BHEL Project Director / Construction Manager will have the authority to not allow the subsequent mobilization advance to contractor.

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CHAPTER-VIII: TAXES AND DUTIES

8.	TAXES & DUTIES
8.1.	The contractor shall pay all (save the specific exclusions as enumerated in this clause) taxes, fees, license, charges, deposits, duties, tools, royalty, commissions, other charges, etc. which may be levied on the input goods & services consumed and output goods & services delivered in course of his operations in executing the contract. In case BHEL is forced to pay any of such taxes/duties, BHEL shall have the right to recover the same from his bills or otherwise as deemed fit. However, provisions regarding GST on output supply (goods/service) and TDS/TCS as per Income Tax Act shall be as per following clauses.
8.2.	GST (Goods and Services Tax)
8.2.1.	GST as applicable on output supply (goods/services) are excluded from contractor's scope; therefore, contractor's price/rates shall be exclusive of GST. Reimbursement of GST is subject to compliance of following terms and conditions. BHEL shall have the right to deny payment of GST and to recover any loss to BHEL on account of tax, interest, penalty etc. for non-compliance of any of the following condition.
8.2.2.	The admissibility of GST, taxes and duties referred in this chapter or elsewhere in the contract shall be limited to direct transactions between BHEL & its Contractor. BHEL shall not consider GST on any transaction other than the direct transaction between BHEL & its Contractor.
8.2.3.	Contractor shall obtain prior written consent of BHEL before billing the amount towards such taxes. Where the GST laws permit more than one option or methodology for discharging the liability of tax/levy/duty, BHEL shall have the right to adopt the appropriate one considering the amount of tax liability on BHEL/Client as well as procedural simplicity with regard to assessment of the liability. The option chosen by BHEL shall be binding on the Contractor for discharging the obligation of BHEL in respect of the tax liability to the Contractor.
8.2.4.	Contractor has to submit GST registration certificate of the concerned state. Contractor also needs to ensure that the submitted GST registration certificate should be in active status during the entire contract period.
8.2.5.	Contractor/Vendor has to issue Invoice/Debit Note/Credit Note indicating HSN/SAC code, Description, Value, Rate, applicable tax and other particulars in compliance with the provisions of relevant GST Act and Rules made thereunder.
8.2.6.	Vendor has to submit GST compliant invoice within the due date of invoice as per GST Law. In case of delay, BHEL reserves the right of denial of GST payment if there occurs any hardship to BHEL in claiming the input thereof. In case of goods, vendor has to provide scan copy of invoice & GR/LR/RR to BHEL before movement of goods starts to enable BHEL to meet its GST related compliances. Special care should be taken in case of month end transactions.
8.2.7.	Vendor has to ensure that invoice in respect of such services which have been provided/completed on or before end of the month should not bear the date later than last working day of the month in which services are performed.
8.2.8.	Subject to other provisions of the contract, GST amount claimed in the invoice shall be released on fulfilment of all the following conditions by the Contractor: - Supply of goods and/or services have been received by BHEL. Original Tax Invoice has been submitted to BHEL. Contractor/ Vendor has submitted all the documents required for processing of bill as per contract/ purchase order/ work order. In cases where e-invoicing provision is applicable, vendor/contractor is required to submit invoice in compliance with e-invoicing provisions of GST Act and Rules made thereunder. Contractor has filed all the relevant GST return (e.g. GSTR-1, GSTR-3B, etc.) pertaining to the invoice submitted and submit the proof of such return along with immediate subsequent invoice. In case of final invoice/ bill, contractor has to submit proof of such return within fifteen days from the due date of relevant return.

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CHAPTER-VIII: TAXES AND DUTIES

	Respective invoice has appeared in BHEL's GSTR - 2A for the month corresponding to the month of invoice and in GSTR-2B of the month in which such invoices has been reported by the contractor along with status of ITC availability as "YES" in GSTR-2B. Alternatively, BG of appropriate value may be furnished which shall be valid at least one month beyond the due date of confirmation of relevant payment of GST on GSTN portal or sufficient security is available to adjust the financial impact in case of any default by the contractor. Contractor has to submit an undertaking confirming the payment of all due GST in respect of invoices pertaining to BHEL.
8.2.9.	Any financial loss arises to BHEL on account of failure or delay in submission of any document as per contract/purchase order/work order at the time of submission of Tax invoice to BHEL, shall be deducted from contractor's bill or otherwise as deemed fit.
8.2.10.	TDS as applicable under GST law shall be deducted from contractor's bill.
8.2.11.	Contractor shall comply with the provisions of e-way bill wherever applicable. Further wherever provisions of GST Act permit, all the e-way bills, road permits etc. required for transportation of goods needs to be arranged by the contractor.
8.2.12.	Contractor shall be solely responsible for discharging his GST liability according to the provisions of GST Law and BHEL will not entertain any claim of GST/interest/penalty or any other liability on account of failure of contractor in complying the provisions of GST Law or discharging the GST liability in a manner laid down thereunder.
8.2.13.	In case declaration of any invoice is delayed by the vendor in his GST return or any invoice is subsequently amended/alterd/deleted on GSTN portal which results in any adverse financial implication on BHEL, the financial impact thereof including interest/penalty shall be recovered from the Contactor's due payment.
8.2.14.	Any denial of input credit to BHEL or arising of any tax liability on BHEL due to non-compliance of GST Law by the Contractor in any manner, will be recovered along with liability on account of interest and penalty (if any) from the payments due to the Contactor.
8.2.15.	In the event of any ambiguity in GST law with respect to availability of input credit of GST charged on the invoice raised by the contractor or with respect to any other matter having impact on BHEL, BHEL's decision shall be final and binding on the contractor.
8.3.	All taxes and duty other than GST & Cess: The contractor shall pay all (except the specific exclusion viz GST & Cess) taxes, fees, license charges, deposits, duties, tools, royalty, commissions, Stamp Duties, or other charges / levies, which may be levied on the input goods & services consumed and output goods & services delivered in course of his operations in executing the contract and the same shall not be reimbursed by BHEL. 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.
8.4.	Variation in Taxes & Duties: Any upward variation in GST shall be considered for reimbursement provided supply of goods and services are made within schedule date stipulated in the contract or approved extended schedule for the reason solely attributable to BHEL. However downward variation shall be subject to adjustment as per actual GST applicability. In case the Government imposes any new levy/tax on the output service/goods after price bid opening, the same shall be reimbursed by BHEL at actual. The reimbursement under this clause is restricted to the direct transaction between BHEL and its contactor only and within the contractual delivery period only.
8.5.	New Taxes / Levies: In case any new tax/levy/duty etc. becomes applicable after the date of Bidder's offer but before opening of the price Bid, the Bidder/Contractor must convey its impact on his price duly substantiated by documentary evidence in support of the same before opening of price bid. Claim

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CHAPTER-VIII: TAXES AND DUTIES

	for any such impact after opening the price bid will not be considered by BHEL for reimbursement of tax or reassessment of offer.
8.6.	Direct Tax: BHEL shall not be liable towards Income Tax of whatever nature including variations thereof arising out of this contract as well as tax liability of the bidder and their personnel. Deduction of tax at source at the prevailing rates shall be effected by BHEL before release of payment as a statutory obligation, unless exemption certificate is produced by the bidder. TDS certificate will be issued by BHEL as per the provisions of Income Tax Act, 1961.
8.7.	BOCW Act & Cess Act
8.7.1.	BOCW Cess is not to be borne by contractor. Refer Annexure-I for BOCW Act & Cess Act.
Annexure-I:	
Bidder may please note that the sub-contractor/bidder of BHEL engaging building or construction worker in connection with building or other construction work, are required to follow the procedures enumerated below:	
a)	It shall be the sole responsibility of the contractor as employer to ensure compliance of all the statutory obligations under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder.
b)	It shall be sole responsibility of the contractor engaging Building Workers in connection with the building or other construction works in the capacity of employer to apply and obtain registration certificate specifying the scope of work under the relevant provisions of the Building and Other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 from the appropriate Authorities.
c)	It shall be responsibility of the contractor to furnish a copy of such Registration Certificate within a period of one month from the date of commencement of Work.
d)	It is responsibility of the contractor to register under the Building and other Construction Workers' Welfare Cess Act, 1996 and deposit the required Cess for the purposes of the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 at such rate as the Central Government may, by notification in the Official Gazette, from time to time specify. However, before registering and deposit of Cess under the Building and other Construction Workers' Welfare Cess Act, 1996, the contractor will seek written prior approval from the Construction Manager.
e)	It shall be sole responsibility of the contractor as employer to get registered every Building Worker, who is between the age of 18 to 60 years of age and who has been engaged in any building or other construction work for not less than ninety days during the preceding twelve months as Beneficiary under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996.
f)	It shall be sole responsibility of the contractor as employer to maintain all the registers, records, notices and submit returns under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder.
g)	It shall be sole responsibility of the contractor as employer to provide notice of poisoning or occupation notifiable diseases, to report of accident and dangerous occurrences to the concerned authorities under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the rules made thereunder and to make payment of all statutory payments & compensation under the Employees' Compensation Act, 1923.

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CHAPTER-IX: GENERAL CONDITIONS

9.	GENERAL CONDITIONS
9.1.	GENERAL GUIDELINES FOR FIELD ACTIVITIES
9.1.1.	Contractor shall execute the works in a professional manner so as to achieve the target schedule without any sacrifice on quality and maintaining highest standards of safety and cleanliness.
9.1.2.	Contractor shall co-operate with BHEL/ owner and other Contractors working in site and arrange to perform their work in a manner so as to minimise interference with other Contractor's works. BHEL shall be notified promptly of any defect in other Contractors' works that could affect Contractor's work. If rescheduling of Contractor's work is requested by BHEL/ customer in the interest of overall site activities, the same shall be complied with by Contractor. In all cases of controversy, the decision of BHEL shall be final & binding on Contractor without any commercial implication.
9.1.3.	BHEL shall hold weekly meeting of all Contractors working at site at a time and a place to be designated by the engineer. Contractor shall attend such meetings and take notes of discussions during the meeting and the decisions of BHEL and shall strictly adhere to those decisions in performing this work. In addition to weekly meeting, BHEL may call for other meetings either with individual Contractors or with selected number of Contractors and in such a case Contractor, if called will also attend such meetings.
9.1.4.	Time is the essence of the contract and Contractor shall be responsible for performance of their work in accordance with the specified completion period and construction schedule. If at any time Contractor fall behind schedule, they shall take necessary action to recover such delays by increasing their workforce and T&Ps to comply with the time/ schedule and shall communicate such action in writing to BHEL, satisfying that their action will compensate for the delay. Contractor shall not be allowed any extra compensation for such action.
9.1.5.	BHEL shall however not be responsible for provision of additional labour and or materials or supply of any other services to Contractor except for the co-ordination work between various agencies' as set out earlier.
9.1.6.	The works under execution shall be open to inspection & supervision by BHEL/ customer at all times. Contractor shall give reasonable notice to BHEL before covering up or otherwise placing beyond the reach of inspection any work, in order that same may be verified, if so desired by BHEL/ customer.
9.1.7.	Every effort shall be made to maintain the highest quality of workmanship by stringent supervision and inspection at every stage of execution. Manufacturer's instruction manual and guidelines on sequence of erection and precautions shall be strictly followed. Should any error or ambiguity be discovered in such documents the same shall be brought to the notice of BHEL. Manufacturer's interpretation in such cases shall be binding on Contractor.
9.1.8.	Contractor shall comply with all the rules & regulations of local authorities, all statutory laws including Minimum Wages, Workmen Compensation etc. All registration and statutory inspection fees, if any, in respect of the work executed by Contractor shall be to their account.
9.1.9.	All the works such as cleaning, checking, levelling, aligning, assembling, temporary erection for alignment, opening, dismantling of certain equipment for checking & cleaning, surface preparation, edge preparation, as per general engineering practice at site, cutting, grinding, straightening, bolting/ welding, etc as may be applicable in such erection and necessary to complete the work satisfactorily, are to be treated as incidental and the same shall be carried out by Contractor as part of the work.

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9.1.10.	It is the responsibility of Contractor to do the alignment etc if necessary, repeatedly to satisfy engineer, with all the necessary tools & tackles, manpower etc. The alignment will be complete only when jointly certified so, by Contractor's engineer and BHEL. Also Contractor should ensure that the alignment is not disturbed afterwards.
9.1.11.	Equipment and material, in case wrongly installed, shall be removed and reinstalled to comply with the design requirement at Contractor expense, to the satisfaction of BHEL/ customer.
9.1.12.	After identification of erection materials by BHEL at BHEL's store/ storage yard, it shall be the responsibility of Contractor to take delivery of materials from BHEL's store/ storage yard by Contractor's own manpower and re-stack the leftover materials as per erection sequence at BHEL store at their own cost. The entire activities are to be carried out under supervision of BHEL.
9.1.13.	In case of Contractor's failure to meet any of the aforesaid requirements, BHEL will get the same done and cost towards this, along with BHEL's applicable overhead will be recovered from Contractor's RA bill.
9.2.	SITE VISIT
9.2.1.	Bidder should visit site and acquire full knowledge & information about site conditions. The bidder must visit site, to acquaint themselves with the conditions prevailing at site and in & around the plant premises, together with all statutory, obligatory, mandatory requirements of various authorities before submission of bid in line with condition given in NIT.
9.3.	PROTECTION
9.3.1.	Coated surfaces shall be protected against impact, abrasion, discoloration and other damages. Surfaces which are damaged shall be repainted.
9.3.2.	Electrical / Illuminations equipment, controls and insulations shall be protected against moisture and water damages. All external gasket surfaces and flange faces, couplings, rotating equipment shafts, bearings and like items shall be thoroughly cleaned and coated with rust preventive compound and protected with suitable wood, metal or other substantial type covering to ensure their full protection. All exposed threaded parts shall be greased & protected with metallic or other substantial type protectors
9.3.3.	All piping, tubing and conduit connections on equipment and equipment openings shall be closed with rough usage covers or plugs. Female threaded openings shall be closed with rough usage covers or plugs or forged steel plugs. The closures shall be taped to seal the interior of the equipment. Open ends of piping, tubing and conduit shall be sealed and taped. Lighting Fixtures are to be handled with care because of fragile nature.
9.3.4.	All other consumables including wire brush, emery papers, painting brush, CRC, petrol/diesel for cleaning etc to be supplied by Contractor within accepted rate.
9.4.	HEALTH, SAFETY & ENVIRONMENT
9.4.1.	HSE shall be guided by a separate volume (Document No. HSEP: 14: Revision: REV02: Date: 22.11.2022, HSE PLAN FOR TALCHER attached as per Annexure-5 of Chapter XI) over and above the below mentioned terms and conditions.
9.4.2.	Round the clock experienced paramedical personnel with first aid facility & ambulance including driver, fuel, etc., at site, shall be arranged by BHEL through other sub-contractors at site. However, expenditure towards above facilities shall be shared by BHEL's sub-

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	contractors working at site (actual cost distribution amongst all Contractors shall be on pro rata basis proportionate to their contract prices). In case of any dispute, Construction Manager decisions in this regard shall be binding. This will be read in conjunction with SCC Chapter-IX.
9.5.	CLEANLINESS
9.5.1.	Contractor shall be responsible for keeping the entire area allotted to him clean & free from rubbish, debris, etc. during the period of contract. Contractor shall employ enough number of special personnel to thoroughly clean his work-area at least once in a day. All such rubbish & scrap material shall be stacked or disposed in a place to be identified by BHEL/ customer. Materials and stores shall be so arranged to permit easy cleaning of area. In areas where equipment might drip oil and cause damage to floor surface, a suitable protective cover of a flame resistant, oil proof sheet shall be provided to protect floor from such damage.
9.5.2.	Similarly, labor colony, the offices and the residential areas of Contractor's employees and workmen shall be kept clean and neat to the entire satisfaction of BHEL/ customer. Proper sanitary arrangements shall be provided by Contractor, in the work-areas, office and residential areas of Contractor.
9.6.	RESPONSIBILITIES WITH REGARD TO EMPLOYMENT OF LABOUR, ETC
9.6.1.	Contractor shall also comply with the requirements of local authorities (Govt. of Odisha) with regard to employment of labours/ workers at project site. They shall comply with any other statutory requirement/ local authority requirement such as police verification of antecedents of the workmen, staff, etc. with regard to employment of labours/workers at project site. In case of workmen / supervisors deployed to project from INDIA / any other country, necessary statutory guidelines issued by Indian Govt./ concerned Govt. authorities shall be strictly complied with in addition to local laws. Skilled labour with experience in construction of large utility thermal power projects shall be deployed (preferably 100% of such skilled labours shall be sourced from India). This shall be read in conjunction with SCC Chapter -V.
9.6.2.	The Contractor shall deploy all the skilled/semiskilled/ unskilled labour including highly skilled workmen etc. These workmen should have previous experience on similar job. They shall hold valid certificates wherever necessary. 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 a tentative deployment plan of his manpower as required in GCC. Also the actual deployment will be so as to satisfy the project schedule of erection and commissioning.
9.7.	GATE PASS FORMALITIES
9.7.1.	The contractor shall make his own arrangements of gate pass for his vehicles, T&Ps etc. as prescribed and instructed by the NTPC /CISF at his own cost, each gate pass has to be endorsed by the NTPC / CISF before the pass can be used. In case of termination of the service of any of T&Ps or any vehicle during the contractual period, the contractor shall have to surrender the gate pass to the NTPC /CISF at the end of the project all the gate passes endorsed by the NTPC / CISF for use of the contractor's vehicle, T&Ps shall have to be returned.

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9.7.2.	Vehicles equipped with flame arrester will only be allowed inside the premises. Valid RC book, insurance, fitness certificate, road tax certificate, PUC, driving license, etc. is required for gate pass formalities of all vehicles. Goods carrying certificate is also required for goods category vehicles. Gate pass formalities may take some time, so contractor has to plan well in advance accordingly.
9.7.3.	The contractor shall make his own arrangements of gate pass for his employees / workers as prescribed and instructed by the NTPC /CISF at his own cost, each gate pass has to be endorsed by the NTPC / CISF before the pass can be used. In case of termination of the service of any of his employee during the contractual period, the contractor shall have to surrender the gate pass issued to the employees to the PVUNL / CISF. At the end of the project all the gate passes endorsed by the PVUNL / CISF for use of the contractor's employees shall have to be returned.
9.7.4.	Police verification and medical fitness certificate of all workers / employees of agencies is must for gate pass formalities. Contractor has to arrange the same at his own cost. Gate pass formalities may take time, so contractor has to plan well in advance accordingly.
9.7.5.	PPEs and Dangri is must for all workers and staffs working inside NTPC premises. Contractor has to arrange all these for their worker and staffs at their own cost.
9.7.6.	Deployed electricians should have valid qualification & valid electrical license for gate pass.
9.8.	LABOR CODES IMPLEMENTATION w. e. f. 21.11.2025:
9.8.1.	Labor codes implementation w. e. f. 21.11.2025: Bidder to ensure workers' right to minimum wages, the Central Government has amalgamated. A. 4 laws in the Wage Code, B. 9 laws in the Social Security Code, C. 13 laws in the Occupational Safety, Health and Working Conditions Code, 2020 D. 3 laws in the Industrial Relations Code The Central Government hereby appoints the 21st day of November, 2025 as the date on which the following provisions of the said Codes, shall come into force. 1. Social Security Code 2020 2. Occupational Safety, Health and Working Conditions Code, 2020 3. Code on Wages, 2019 4. Industrial Relations Code, 2020
9.9.	DOCUMENTATION
9.9.1.	The following information shall be furnished by the bidder within two weeks of award of contract for purchaser's approval. a. Bar chart covering planned activities at site b. Detailed organization chart Details of T&P available with contractors with documents proofs.
9.9.2.	The following information shall be furnished by the bidder after testing and inspection: Test certificates of various tests conducted at site. All inspection and test certificates shall be signed by customer's representative also, wherever called for as per field quality plan.

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	As built drawings: After successful completion, testing and commissioning of installation work, Purchaser's drawings / documents shall be updated in line with the actual work carried out and as built drawings / documents shall be submitted by the contractor as agreed for the project.
9.10.	PROJECT MANAGEMENT/ CONSTRUCTION MANAGEMENT
9.10.1.	To meet the need of construction management at site, Contractor shall comply Clause No. 6.7 to 6.17 in Chapter-VI within their accepted rates.
9.11.	INFRASTRUCTURE
9.11.1.	Contractor shall install 2 nos all in one PCs (multimedia PC work station Core-i3, 2.1 GHz or above, 500 GB HDD, 4 GB RAM, 100/ 1000 MBPS LAN card) of HP/ Compaq/ Lenevo or equivalent make with window 10 or 11 O/S and required software like MS Office 2010 Professional, AutoCAD 2009 or higher, PageMaker (7.0, etc), ADOBE PDF CREATOR and ONE NO. SCANNER (HP Scan Jet Pro 2500 or equivalent), one no laser jet printer compatible for A4 size printing (ink/ cartridge for which to be supplied as & when required) with power backup at places, as per instruction of BHEL for exclusive use of BHEL. These computers/ printers/scanners shall remain Contractor's property and they will be allowed to take out the same after completion of contract period including extension. Contractor shall provide data/ information, etc in prescribed formats for periodical updating of progress reports, material management reports, updating of network pertaining to Contractor's scope of work, etc In case Contractor fails to provide 1 No. computer and 1 No. printer or personnel as per requirement, for a continuous period of fifteen days or more, suitable penalty (as decided by Erection In Charge) may be levied from contractor's RA Bill.
9.11.2.	Contractor's site office must have facilities of communications like, E-mail, and telephone with STD facility within a month from LOA.
9.12.	SITE ORGANIZATION
9.12.1.	Contractor shall maintain a site organization of adequate strength in respect of manpower, construction machinery and other implements at all time for smooth execution of the contract headed by Site In-charge for site operations with sufficient level of authority to take site decisions. Contractor will submit organization chart (showing the name of Site In-charge) with individual bio-data indicating various levels of experts to be posted for supervision in the fields of supervision and execution, quality, material management, planning, safety, etc. The organization shall be reinforced from time to time, as required to make up slippage (if any) from the schedule without any commercial implication to BHEL. The organization chart is to be submitted within 10 days from the date of LOI.
9.12.2.	Following (minimum) engineering manpower with power plant construction background to be deployed at site by Contractor for proper execution. This requirement is in addition to the normal manpower required for installation, erection, and commissioning activities under the scope of the contract.
9.12.3.	Following (minimum) engineering manpower with power plant construction background to be deployed at site by Contractor for proper execution. This requirement is in addition to

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	the normal manpower required for installation, erection, and commissioning activities under the scope of the contract.			
9.12.4.	For planning function of entire scope of work.	1 no with sufficient experience.		
9.12.5.	For quality inspection function of entire scope.	1 no engineer. 1 no supervisor.		
9.12.6.	Material handling area for follow-up with BHEL for timely putting up material requirement, identification of material for receipt from BHEL store/ storage yard, etc for various systems, ie cable tray, cable, DCS panels, instruments, JBs, etc.	1 no engineer. 1 no supervisor.		
	Category	Area	Package-A (Qty)	Package-B (Qty)
9.12.7.	Erection Supervisors	Boiler	2	2
		TG & Accessories	2	2
		BOP / CHP / AHP	2 (BOP)	2 (CHP) + 2 (AHP)
		FDA System	1	1
9.12.8.	Commissioning Team (Engr/Tech)	Boiler	2	2
		TG & Accessories	2	2
		BOP / CHP / AHP	2 (BOP)	2 (CHP) + 2 (AHP)
		FDA	1	1
9.12.9.	Calibration Team (Engr/Tech)	Inst. Calibration	2 (+ 2 Helpers)	2 (+ 2 Helpers)
9.12.10.	Safety Team	Safety Officer	1	1
		Safety Supervisors	2	2
9.12.11.	Deputation of above man-power shall be jointly decided at site in line with construction schedule and front availability.			
9.12.12.	Engineer/ supervisor for other functions like store & purchase, material management, planning, finance, administration, etc are to be provided as per site requirement and not considered above.			
9.12.13.	In the event of non-deputation of engineer/ supervisor by the bidder as per above agreed schedule, BHEL shall reserve the right to deduct from RA bills as per prevailing rates applicable along with overheads for Skilled, Semi-skilled & Un-skilled for arranging alternative arrangements.			
9.12.14.	BHEL reserves the right to reject or approve the list of personnel proposed by Contractor. The persons whose bio-data have been approved by BHEL will have to be posted at site and deviation in this regard will not be permitted unless specific & reasonable justification is made.			
9.12.15.	As mentioned above, a well experienced qualified engineer having a minimum of 5 years' experience or 2 Thermal Project cycles, to be designated, as 'Project Co-ordinator, shall be deployed by Contractor. Such engineer shall have adequate exposure on the job and			

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	shall remain fully involved in all planning activities, guidance etc to Contractor's own team during the complete execution period of contract.
9.12.16.	Contractor should also submit to BHEL for approval a list of T&Ps along with their fitness certificates. The tools & tackles shall not be removed from site without written permission of BHEL.
9.12.17.	Contractor should also submit network programs for the erection of various items. These networks shall show BHEL/ customer hold points (CHP), which have to be cleared by BHEL/ customer, or their authorized representatives before further erection can take place. These programs for the erection would clearly identify responsibilities of Contractor and BHEL/ customer. It is the responsibility of Contractor to get the networks approved by BHEL within four weeks of the date of finalization of award of work/ placement of LOI.
9.12.18.	Engineer/ Supervisors having a minimum of 2 years of industrial experience shall be accommodated with adequate number of Technicians / electricians and other erection staff as given in previous clauses and T&P etc. The testing Engineers / supervisors / electricians shall be identified separately for each Unit and the minimum requirement shall be as indicated in previous Clauses. Besides, there shall be separate engineers for Planning, Safety and Quality.
9.12.19.	The Site in charge shall be provided with PCs and good communication facilities like telephone, fax, email etc. at the cost and expense of the contractor. Lack of communication facilities will not be an excuse for extension of completion date.
9.12.20.	All instructions from BHEL / Customer will be directed to the contractor through the Site in-charge and he shall be responsible for all the contractor's activities at site. The contractor shall name their authorized representative prior to or immediately on commencement of operations at site.
9.12.21.	The Site In charge shall be present at site during all normal working hours and their contact address after normal working hours shall be made available to BHEL so that if any emergency arises, the presence of the contractor's site Representative at site can be called for.
9.12.22.	The contractor shall not change the site Representative without the consent of BHEL. Should BHEL require the replacement of the contractor's site Representative for justifiable reasons (including inadequate progress of work) the contractor shall ensure that replacement is made as soon as possible and work is not allowed suffering delay on this account.
9.12.23.	The contractor shall provide to the satisfaction of BHEL sufficient and qualified staff for the execution of works. If and whenever any of the contractor's staff is found guilty of any misconduct or be incompetent or insufficiently qualified in the performance of their duties the contractor shall remove them from site as directed by Site Engineer.
9.12.24.	The contractor shall ensure that all their supervisor's staff and workmen conduct themselves in a proper manner. They shall all be persons who are familiar with and skilled at the jobs allocated to them. Any misconduct / inefficiency noted on the part of the contractor's personnel shall be brought to the attention of the contractor's site

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	representative who shall immediately take such action as necessary including the removal of such misconducting / inefficient persons, if so required by the Engineer-in-Charge.
9.12.25.	The contractor shall ensure that replacement for such persons removed from site is provided immediately and the work is not allowed to suffer delay on that account.
9.13.	REPORTING DAMAGES AND CARRYING OUT REPAIRS
9.13.1.	Checking all components/ equipment at siding/ site and reporting to transport and/ or insurance authorities of any damages/ losses will be in the scope of Contractor. Necessary assistance for verification/ survey and lodging claims with underwriters and follow up to logical conclusion will also be part of this tender.
9.13.2.	Contractor shall render all help to BHEL in inspection including handling, opening packages, re-packing, re-stacking, assessing and preparing estimates for repairs of components damaged during transit, storage, 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.
9.13.3.	Contractor shall report to BHEL in writing any lost/ damages to equipment/ components during drawl of the materials from stores, in transit to site and unloading at a place of work and during erection & commissioning. The above report shall be as prescribed by BHEL site. Any consequential loss arising out of noncompliance of this stipulation will be borne by Contractor.
9.13.4.	Contractor shall carry out fabrication of any material lost/ damages as per Instructions from BHEL.
9.13.5.	BHEL, however, reserve the right to award or not to award to Contractor any of the rectification/ rework/ repairs of damages and also fabrication of components.
9.13.6.	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 be signed by Contractor's representative & BHEL. Signing of log sheets does not necessarily mean acceptance of these as extra works for payment purpose.
9.13.7.	All rectification, repairs, reworks and fabrication of components lost, which are minor and incidental to erection work (consuming up to 50 man-hours on each occasion) shall be treated as part of work without any extra cost.
9.13.8.	In case the repairs/ rectification/ rework and fabrication of materials lost, the work has been done by more than one agency including Contractor, payment towards extra charges will be on pro-rata basis and decision of BHEL in this regard is final & binding on the Contractor.
9.14.	ISSUE & HANDLING, USAGE, RECONCILIATION, RECOVERY, ETC OF BHEL'S FREE ISSUED EQUIPMENT/ MATERIALS
9.14.1.	ISSUE & HANDLING
i)	BHEL will issue various equipment/ materials/ items free of cost to Contractor as per the scope of this tender

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ii)	Contractor shall maintain proper store account for all the BHEL issued materials and shall give requisite copies of monthly computerized reconciliation statement of such account to the BHEL.
iii)	Contractor shall solely be responsible for the safety & quality of material after it is handed over and issued to Contractor by BHEL.
iv)	BHEL issued materials shall not under any circumstances taken out of the project site unless otherwise permitted by BHEL.
v)	Necessary lifting tackles, cranes, tools & plants including tractors, Crane, Farana, trailers, trucks, pulley blocks, jacks, winches, wire ropes etc, of suitable capacities and other equipments incidental to carry out this work shall have to be arranged by Contractor within the accepted rates/ price. BHEL reserve the right to inspect lifting tackles and equipment before allowing their use. Such approval however shall not relieve Contractor to ensure safe handling of equipment taking precaution to avoid any accident and damage to other equipment and personnel.
vi)	Contractor shall satisfy himself of the quality and quantity of the materials at the time of taking delivery from BHEL/ customer store/ storage yard. No claims whatsoever will be entertained by BHEL because of quality or quantity after the materials are taken by Contractor from BHEL/ customer.
vii)	Contractor shall submit to BHEL, a statement indicating estimated quantity of equipment/ materials required atleast 1 month in advance.
viii)	Contractor shall ensure that no lamination materials are taken over by them from BHEL. Wastage, if any due to above, shall not be compensated by BHEL.
ix)	Contractor has to note that all fasteners like MS/ HT/ HSFG bolts/ nuts, lock nuts, washers, etc shall be supplied by Contractor as per applicable item of price schedule of tender.
x)	Contractor to note that steel required for their enabling job like store/ site office, etc shall be arranged at their own cost.
9.14.2.	RETURN
i)	All surplus equipment/ materials issued by BHEL shall be returned by Contractor to BHEL/ customer store/ storage yard.
ii)	Surplus, unused and un-tampered materials shall be sorted and returned separately at a place directed by BHEL within project area; Return of such materials will not be entitled to any handling and incidental charges.
iii)	All wastage/ scrap (including wastage, unusable scrap) shall be returned to stores/ designated area and a receipt obtained from BHEL for material accounting purposes. Return of such material will not be entitled to any additional cost due handling and transportation and incidental charge.
iv)	Scrap for structural steel shall be returned separately.
9.14.3.	USE AND WASTAGE

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i)	Unless specified otherwise in the tender, following guidelines shall be applicable.
ii)	Theoretical consumption of various equipment/ materials shall be based on tender provision/ approved drawing/ guidelines/ mutual agreement with BHEL. No extra shall be payable for any deviation for two different procedures adopted for issue and calculation of the theoretical consumption.
iii)	Allowable wastage of the theoretical consumption shall be considered based on tender provision/ approved drawing/ guidelines/ mutual agreement with BHEL. Invisible wastage (loss of materials due to gas cutting, straightening of edges, etc) shall be limited to above specified guidelines and shall be considered for reconciliation purpose. But this invisible wastage shall be considered to be included in allowable wastage.
iv)	All wastage shall be returned to BHEL.
9.14.4.	RECONCILIATION
i)	Contractor shall submit a reconciliation statement of equipment/ materials issued to him, once in two months. The same may be submitted along with RA bill.
ii)	Contractor shall properly account for the material issued to him as specified herein to the satisfaction of BHEL certifying that the balance materials are available with Contractor's custody at site.
iii)	If it is noticed by BHEL that the wastage is high and calls recovery at the penal rate, then BHEL will proceed for recovery for the excess wastage as per penal recovery rates as specified from RA bill.
9.14.5.	RECOVERY
i)	If wastage exceeds the specified limit, recovery of excess wastage shall be made from monthly RA bill at the penal rate stipulated tender provision/ approved drawing/ guidelines/ mutual agreement with BHEL.

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CHAPTER-X: SPECIFIC INCLUSION & EXCLUSIONS

10.	SPECIFIC INCLUSION & EXCLUSIONS	
10.1.	INCLUSIONS	
10.1.1.	All Consumables/ items to be arranged by Bidder at his/ her own cost.	
10.1.2.	Lugs up to 4 sq. mm size.	
10.1.3.	Paint, primer and consumables.	
10.1.4.	LT cable Straight through jointing kits and termination kits.	
10.1.5.	Cable ferruling printing machine along with ferrule rolls.	
10.1.6.	Identification tags PVC/ Metals with tying/ fixing material, sleeve and clamps with hardware. PVC ties, SS316 ties, Ferrule, Buttons and tap for cables at both end & field instruments.	
10.1.7.	Cable Markers.	
10.2.	EXCLUSIONS (except mentioned in Chapter-12 of TCC pertaining to Package-B For AHP, CHP, GHP & LHP Area)	
10.2.1.	Metallic Cable glands.	
10.2.2.	Steel for fabrication.	
10.2.3.	Lugs beyond 4 sq. mm size.	
10.2.4.	Trefoil Clamps	
10.3.	TECHNICAL REQUIREMENTS FOR SUPPLY ITEMS	
10.3.1.	Cable Lugs	
	Type	Solderless Crimping Type
	Material	Copper/ Aluminium
	Whether Tinning required (for copper cable lugs)	Yes
	Thickness of Tinning	10 Microns
	Applicable Standard for LT cables	IS:8309
10.3.2.	Ferrules	
	Color of Ferrules	Yellow/White
	Color of Engraving	Black
10.3.3.	Tags	
	Material	Al/Fiberglass/Stainless Steel
	Marking	Engraving/Embossing/Printing
Note: The consumable should not be construed as exhaustive. They are meant for general guideline. Contractor has to supply the consumable till the Successful completion of the project. Contractor should carry out all such jobs as per the instructions of BHEL Engineer.		

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CHAPTER-XI: DRAWINGS / DOCUMENTS

11. Drawings Details (Enclosed with the NIT as Annexure):		
S No	Annexure No	Drawing Description
11.1.	Annexure-1	CABLE ERECTION PHILOSOPHY
11.2.	Annexure-2	HSE PLAN FOR TALCHER HSEP: 14: Revision: REV02: Date: 22.11.2022
11.3.	Annexure-3	BHEL T&P Hire Charges BHEL: PW:FM: FAX: T&P Hire: 2025-27 dtd. 29.08.2025
11.4.	Annexure-4	NTPC Safety Rules
Note: - The above drawings are reference purpose only. These drawings may change and vendor will have to execute the work as per final approved drawings and instruction of BHEL engineer.		

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CHAPTER-XII: BOQ CUM RATE SCHEDULE

12.	SCHEDULE OF ITEMS & WEIGHTAGES								
12.1.	This Chapter consists of Part A & Part B of Volume II "Price bid":								
12.1.1.	<table border="1"> <tr> <th colspan="2">CONTENTS</th></tr> <tr> <th>Description</th><th>Remarks</th></tr> <tr> <td>Part A: Instructions to the Bidders</td><td>Instructions</td></tr> <tr> <td>PART B: % weightage for amount of individual items of Schedule of quantity</td><td>Refer Latest Chapter-XII: Schedule of items Quantities and Factor for deriving Item Rate from the accepted Lump sum Price</td></tr> </table>	CONTENTS		Description	Remarks	Part A: Instructions to the Bidders	Instructions	PART B: % weightage for amount of individual items of Schedule of quantity	Refer Latest Chapter-XII: Schedule of items Quantities and Factor for deriving Item Rate from the accepted Lump sum Price
CONTENTS									
Description	Remarks								
Part A: Instructions to the Bidders	Instructions								
PART B: % weightage for amount of individual items of Schedule of quantity	Refer Latest Chapter-XII: Schedule of items Quantities and Factor for deriving Item Rate from the accepted Lump sum Price								
12.2.	Part A: Instructions to the Bidders								
12.2.1.	Any other entry elsewhere in the offer of the bidder shall be treated as Null and Void.								
12.2.2.	BHEL has fixed the Factors of individual items of Schedule of Quantity w.r.t. the total lump sum price (as quoted by the bidder). These item wise factors are available in Chapter-XII of Volume I TCC. Also schedule of items & Quantities are also available in Chapter-XII of Volume I TCC.								
12.2.3.	Based on the pre-fixed factors and the quoted total lump sum price, total amount against each item shall be derived by BHEL by multiplying the respective factors with total lump sum price.								
12.2.4.	Unit rate shall be derived by dividing the total amount against each item by total quantity as given in BOQ.								
12.2.5.	Item rates thus derived shall be rounded off to (04) four decimal places. Rounding off may lead to minor variation in the total lump sum price. This will be adjusted by BHEL by very minor adjustment of the derived item rates. This will be done to arrive at the exact quoted/ accepted Lump sum price given by the bidder.								
12.2.6.	For only the convenience of bidders, BHEL shall issue an excel sheet with all requisite formulae as detailed above on request from respective bidder. However, this excel sheet shall not form part of contract document								
12.3.	PART B: Schedule Items & Weightages								
12.3.1.	% weightage for amount of individual items of Schedule of quantity w.r.t. the total price as quoted by the bidder in Vol-II-Price Bid.								

BOQ WITH WEIGHTAGES FOR E/T/C of C&I WORKS AT 2X660MW Talcher U#1 & COMMON SYSTEMS

Sr. No.	Description	Unit	Qty	Factor
I1.0	CABLE TRAYS AND ACCESSORIES			
I1.0.1	Perforated cable tray and accessories (with or without cover) 50mm	Meter	10189	0.0115749081
I1.0.2	Perforated cable tray and accessories (with or without cover) 100mm	Meter	4000	0.0056372008
I1.0.3	Perforated cable tray and accessories (with or without cover) 150mm	Meter	5036	0.0076371936
I1.0.4	Ladder cable tray and accessories (with or without cover) 150mm	Meter	4000	0.0064306851
I1.0.5	Cable Duct 60x60x1000mm	Meter	500	0.0008923477
I1.0.6	Cable Duct 180x100x1000mm	Meter	300	0.0006237557

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CHAPTER-XII: BOQ CUM RATE SCHEDULE

I1.0.7	Cable Duct 250x100x1000mm	Meter	300	0.0008749648
I2A	CABLE LAYING INCLUDING EARTHING WIRES			
I2A.1	Compensating cable 2Px0.5sqmm, Tx/ Sx/ Kx/ Rx unarmoured/ armoured	Meter	14600	0.0023957591
I2A.2	2C X 1.5/2.5 sqmm armoured/ unarmoured copper cable	Meter	9600	0.0015706953
I2A.3	3C X 1.5/2.5 sqmm armoured control cable	Meter	147700	0.0248964990
I2A.4	5C X 1.5/2.5 sqmm armoured control cable	Meter	13700	0.0024864935
I2A.5	7C X 1.5/2.5 sqmm armoured control cable	Meter	6800	0.0013214473
I2A.6	10C X 1.5/2.5 sqmm armoured control cable	Meter	2100	0.0005116233
I2A.7	12C X 1.5/2.5 sqmm armoured control cable	Meter	10000	0.0027878720
I2A.8	16C X 1.5/2.5 sqmm armoured control cable	Meter	2200	0.0006886777
I2A.9	3C X 35 sqmm Aluminium Power Cable, armoured/ unarmoured	Meter	1750	0.0005182631
I2A.10	3C X 95sqmm Aluminium Power Cable, armoured/ unarmoured	Meter	2100	0.0011827241
I2A.11	Profibus/ Profinet/ STP Cable	Meter	435761	0.0999595052
I2A.12	Network UTP Cables (special termination using UTP connectors involved)	Meter	39250	0.0082909072
I2A.13	Laying & Testing, etc. of Optical Fibre Cables on cable trays, conduits etc with minor civil works	Meter	45000	0.0144308810
I2A.14	Termination/Splicing & OTDR Testing, etc. of Optical Fibre Cable including all consumables like Break-out Kits, OFC markers, etc. except Multi-Mode Pigtail.	No	300	0.0043888275
I2A.15	Hoses-1/ 4", 1/ 2", 1", SS/ Teflon, Braided/ unbraided, upto 5m length	No	124	0.0002546424
I2A.16	RS-485/RG-58 CABLE	Mtr	100	0.0000288659
I2B	CABLE LAYING INCLUDING EARTHING WIRES			
I2B.1	Screened Copper Cable 2Px0.5sqmm (Intrinsic/ non-intrinsic safe) armoured/ unarmoured	Meter	104950	0.0166982051
I2B.2	Screened Copper Cable 4Px0.5sqmm (Intrinsic/ non-intrinsic safe) armoured/ unarmoured	Meter	463820	0.0862810667
I2B.3	Screened Copper Cable 8Px0.5sqmm (Intrinsic/ non-intrinsic safe) armoured/ unarmoured	Meter	218880	0.0480898715
I2B.4	Screened Copper Cable 12Px0.5sqmm (Intrinsic/ Non-intrinsic safe) armoured/ unarmoured	Meter	88400	0.0220667591
I2B.5	Screened Copper Cable 16Px0.5sqmm (Intrinsic/ Non-intrinsic safe) armoured/ unarmoured	Meter	5000	0.0013473519
I2B.6	Screened Copper Cable 2P/ 4Cx1.0sqmm (Intrinsic/ Non-intrinsic safe) armoured/ unarmoured	Meter	3000	0.0004760363
I3	JUNCTION BOX/ PUSH BUTTON STATION			
I3.1	Junction boxes upto 48 way (FRP)	No	319	0.0049831885
I3.2	Junction boxes above 48 way	No	31	0.0006292115

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I3.3	Local Gun Maintenance Switch Box	No	16	0.0002596607
I3.4	3TT FRP Junction Box	No	14	0.0004517725
I3.5	6TT FRP Junction Box	No	22	0.0007099282
I3.6	9TT FRP Junction Box	No	10	0.0003226946
I3.7	12TT FRP Junction Box	No	10	0.0003226946
I3.8	TT JB (TYPE A, B & C)	Nos	224	0.0097657253
I4	CONDUITS/ IMPULSE PIPE/ TUBES			
I4.1	ASTM A106 Gr.C SIZE: 1/ 2" NB SCH 160	Meter	2200	0.0067584470
I4.2	ASTM A106 Gr.C SIZE: 1/ 2" NB SCH 80	Meter	17000	0.0494630802
I4.3	ASTM A106 Gr.C SIZE: 3/ 4" NB SCH 80	Meter	10000	0.0311507497
I4.4	ASTM A213 TP316H SIZE: 1/ 2" NB SCH 160	Meter	3000	0.0106269883
I4.5	ASTM A213 TP316H SIZE: 3/ 4" NB SCH 160	Meter	1000	0.0045533381
I4.6	ASTM A213 TP316H SIZE:3/ 4" NB SCH80	Meter	1400	0.0053567146
I4.7	PIPE DIA 21.3 X 3.73 SA312TP304H	Meter	50	0.0006080196
I4.8	PIPE OD 21.3 X 7.47 - SA335P22	Meter	90	0.0010944353
I4.9	TUBE OD 21.3 X 7.47 X 6000 - SA335P91	Meter	80	0.0002519917
I4.10	PIPE OD 26.7 X 3.91 - SA335P22	Meter	30	0.0003648118
I4.11	PIPE DIA 21.3 X 7.47 SA106GRC	Meter	150	0.0007567177
I4.12	PIPE DIA 21.3 X 4.78 SA106GRB / GRC	Meter	300	0.0015134354
I4.13	PIPE DIA 21.3 X 3.73 SA106GRB / GRC	Meter	2950	0.0148821143
I4.14	TUBE 21.30 X 3.73 - SA106GRB	Meter	160	0.0004195566
I4.15	TUBE 21.30 X 7.47 - SA106GRB	Meter	30	0.0000944969
I4.16	TUBE 26.70 X 3.91 - SA106GRB	Meter	80	0.0002228774
I4.17	PIPE(SMLS)- 60.3X 3.91 CS SA106 GR B	Meter	10	0.0000833236
I4.18	(1/4")/ (3/8")/ (1/2")/ (3/4")/ (1") OD SS TUBE	Meter	6160	0.0118121824
I4.19	SEAMLESS TUBE GR. T92 21.3X7.47	Meter	330	0.0010295651
I4.20	SEAMLESS C.S. TUBE 21.3X2.3	Meter	4	0.0000104889
I4.21	MATERIAL: ASTM A 182 F316H /ASTM A312 TP316HSIZE: 88.90 OD X 15 mm Thick	Meter	30	0.0001811786
I4.22	MATERIAL: ASTM A106 GR C / ASTM A105SIZE: 88.90 OD X 12 mm Thick	Meter	28	0.0001691001
I4.23	MATERIAL: ASTM A106 GR C / ASTM A105, SIZE: 88.90 OD x 7.6 mm Thick	Meter	64	0.0003865144
I4.24	SEAMLESS TUBES (GR. T22) 21.3X2.77	Meter	60	0.0001727702
I4.25	SEAMLESS A.S. TUBE 21.3X2.77 Gr T92	Meter	120	0.0003519938
I4.26	SEAMLESS A.S. TUBE D=13.5x2.6 Gr T22	Meter	76	0.0002483849
I4.27	PIPE AS PER SA106 GR C SIZE OD X THICKNESS -33.4x6.35mm	Meter	50	0.0003799258
I4.28	PIPE AS PER SA335 P92 SIZE ODxTHICKNESS -33.4x4.55mm, GRADE: GR P92	Meter	90	0.0006838665
I4.29	GI Pipe (1/ 2", 1") Heavy grade	Meter	100	0.0001473508
I4.30	HDPE conduits 2 " for Optical fiber cable laying	Meter	100	0.0001412584

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14.31	Flexible pipe/ Conduit pipe – ¾" (Zinc / Terne Coated)	Meter	1500	0.0022766929
14.32	GI Rigid Conduit pipe/ PVC Conduit pipe – 1"	Meter	2650	0.0028155086
15	MISCELLANEOUS STRUCTURAL STEEL INCLUDING FRAMES FOR PANELS/ RACKS/ INSTRUMENTS, SUPPORTS FOR CABLE TRAY/ PIPES/ TUBES, CANOPIES ETC.			
15.1	Structural steel for fabrication	MT	25	0.0067895184
15.2	Assembly and installation of Mounting Frames with loose supplied prefabricated materials like slotted angles, channels, etc.	No	50	0.0050379423
15.3	Assembly/ welding and installation of Instrument Racks with loose supplied prefabricated materials of suitable size, like angles, stands, etc. Total wt. of loose supplied items (for 10 racks): Approx. 3 Tonnes	No	10	0.0008797965
15.4	Radiographic test of weld joints	No	10	0.0000221979
16	PANELS/ CUBICLES/ RACKS/ ENCLOSURES/ MONITORS/ COMPUTER/ COMPUTER PERIPHERAL/ PLCS/ UPS/ BATTERIES			
16.1	Local Gauge Board approx. dimension 1900X1400X750mm, approx. wt. 600kg	No	11	0.0011180523
16.2	MaxDNA Control Cabinet including Marshalling and Relay Cabinet for SG, TG (non-core) & Station C&I if DDCMIS. This includes BOP C&I, Network Panels, FGD & SCR Panels, ACC Control Panels. Approx dimension 750(D)x750(W)x2295(H), Approx Weight 400kgs)			
16.2.1	Control Panel-Suit of 1 panel	Nos	41	0.0050140784
16.2.2	Control Panel-Suit of 2 panel	Nos	11	0.0020611349
16.2.3	Control Panel-Suit of 3 panel	Nos	39	0.0122988403
16.2.4	Control Panel-Suit of 4 panel	Nos	45	0.0149996436
16.2.5	Control Panel-Suit of 5 panel	Nos	3	0.0007872213
16.3	DAVR Panel	Set	1	0.0003656262
16.4	LP Dosing system	Set	1	0.0001272173
16.5	Electrical Control Panel	Set	1	0.0006323901
16.6	Condenser vacuum pump system	Set	2	0.0002276485
16.7	Positioner cabinets for LPBP CV1, LPBP CV2, Spray water CV	No	1	0.0000548984
16.8	Local Instrument Rack (LIR) for Field Transmitters. (Approx. weight 300kg)	No	93	0.0084727979
16.9	Local Instrument Enclosure (LIE) for Field Transmitters. (Approx. weight 300kg)	No	66	0.0055794492
16.10	METSO-DNA Engineering/ Operator/ Historian/ LVS/ Shift I/ C/ Historical Storage & Documentation/ Gateway/ OPC/ System Documentation/ CCTV Client stations, etc. -- PC/ Server/ Client Station with ASCII Keyboard, Mouse & 24" Colour Monitor, Mini UPS etc.	Set	67	0.0039609645

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16.11	Printers (80/ 132 col Dot Matrix, A3 Inkjet, A3/ A4 LaserJet, A3 Color LaserJet, Heavy Duty Line Impact Dot Matrix, etc.)	Set	3	0.0001070617
16.12	Station LAN Network System consisting of Test Server (1 No), NMS server (1 No), Station LAN server (2 Nos), Domain Controller (2 Nos), Multifunction network firewall (5 Nos), with IPS/IDS features with connectivity from station LAN to employers IT LAN, connectivity to remote service center, connectivity to PC Stations, township and other plant locations.	Set	1	0.0002585730
16.13	Graphic Interface Unit	No	15	0.0012863332
16.14	Control Desk/ CRT desk (approx 4m)	No	3	0.0011366944
16.15	Control Desk/ CRT desk (approx 8m)	No	2	0.0012414069
16.16	Computer furniture for all Servers, PCs, Printers, Locker sets, Almirahs, Conference Table (COMPUTER TABLE - 6 Nos, PRINTER TABLE - 2 Nos, PRINTER RACK - 2 Nos, KEYPAD - 5 Nos, LOCKER - 5 Nos, ALMIRAH - 5 Nos, COMPUTER CHAIR - 48 Nos, CONFERENCE TABLE - 1 No)	Set	1	0.0004123374
16.17	PC Rack / Server Rack	Nos	21	0.0007379111
16.18	Workstation Furniture 1 Section (WS1)	Nos	7	0.0011702299
16.19	Workstation Furniture 2 Sections (WS2)	Nos	12	0.0040122170
16.20	SWAS Sample handling system with racks, panels and chiller	Set	6	0.0057227988
16.21	SWAS Analyzer Panel including various analyzers	Set	1	0.0012083946
16.22	TSI for Main Turbine including its HMI & printers	Set	1	0.0005331662
16.23	TSI for TDBFP including its HMI & printers	Set	1	0.0004021063
16.24	Vibration monitoring system for Pumps, Fans & Pulverisers including sensor mounting blocks and brackets, casing vibration sensor, Phase marker sensor and monitoring rack with electronic modules.	Set	1	0.0005693135
16.25	Vibration monitoring system for ACW, CW Pumps at CWPB including sensor mounting blocks and brackets, casing vibration sensor, Phase marker sensor and monitoring rack with electronic modules.	Set	1	0.0004757211
16.26	LVS (Large Video Screen) - alongwith loose supplied items.	Set	18	0.0082940478
16.27	Gravimetric Feeder Panel including Electronic control panel, Power Cabinet and Feeder Mounted C&I Equipments	Set	7	0.0011504527
16.28	SONIC Tube Leak Detection System.	Set	1	0.0006258993

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16.29	Furnace Flame CCTV System including local panel, wall mounted cabinet, High Temperature Flame Viewing Camera and all accessories like camera, monitor, etc.	Nos	2	0.0007087539
16.30	Pulveriser Dynamic Classifier - VFD Cabinet	No	7	0.0014243482
16.31	APH Leakage Control System consisting of DCS Panel & Field mounted Junction Boxes, teflon cables, etc	Set	1	0.0019849498
16.32	Generator Instrumentation cabinet including annunciator (approx. weight 450kg, approx dimension 800x800x2300mm)	No	1	0.0001742010
16.33	Generator End Winding Vibration Monitoring System (approx. dim. 2300x800x600mm, approx. wt. 150kg)	Set	1	0.0002094000
16.34	24V DC POWER SUPPLY SYSTEM -751 Amp FOR SG SYSTEMS 1X 100% modular rectifier banks, 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 38 No. per set.	Set	2	0.0044466403
16.35	24V DC POWER SUPPLY SYSTEM-390 Amp FOR TG SYSTEMS 1X 100% modular rectifier banks, 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 19 No. per set.	Set	2	0.0031202472
16.36	24V DC POWER SUPPLY SYSTEM - 710 Amp for SAC UNIT -1&2 COMMOM & HMI NETWORK PANELS 1X 100% modular rectifier banks, 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 38 cells per set.	Set	2	0.0041675154
16.37	24V DC POWER SUPPLY SYSTEM - 787 Amp for BOP & HMI NETWORK PANELS 1X 100% modular rectifier banks, 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 38 cells per set	Set	2	0.0044466403

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16.38	24V DC POWER SUPPLY SYSTEM - 105 Amp for SG C&I LOAD LOCATED IN FOPH/AUX BOILER CER 1X 100% modular rectifier banks, 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 19 cells per set.	Set	2	0.0031202472
16.39	24V DC POWER SUPPLY SYSTEM - 457 Amp for DM/PT & HMI NETWORK PANELS WS PACKAGE 1X 100% modular rectifier banks, 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 19 cells per set.	Set	2	0.0031202472
16.40	24V DC POWER SUPPLY SYSTEM - 88 Amp for CW TREATMENT/CLO2 WS PACKAGE 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 19 cells per set.	Set	2	0.0031202472
16.41	24V DC POWER SUPPLY SYSTEM - 28 Amp for RWPH WS PACKAGE 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 19 cells per set.	Set	2	0.0031202472
16.42	24V DC POWER SUPPLY SYSTEM - 22 Amp for ETP WS PACKAGE 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 19 cells per set.	Set	2	0.0031202472
16.43	24V DC POWER SUPPLY SYSTEM - 121 Amp for SAC PANELS AT SERVICE BUILDING 1X 100% modular rectifier banks, 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 19 cells per set.	Set	2	0.0031202472
16.44	24V DC POWER SUPPLY SYSTEM - 72 Amp for SAC PANELS AT CWP 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board.	Set	2	0.0031202472

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	1X 100% (BHMS)–common for both the sets. Total cells are 19 cells per set.			
16.45	24V DC POWER SUPPLY SYSTEM - 39 Amp for SAC PANELS AT MAKEUP WATER 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 19 cells per set.	Set	2	0.0031202472
16.46	24V DC POWER SUPPLY SYSTEM - 121 Amp for SAC PANELS AT ADMIN BLDG 1X 100% modular rectifier banks, 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 19 cells per set.	Set	2	0.0031202472
16.47	24V DC POWER SUPPLY SYSTEM - 55 Amp for SAC PANELS AT CANTEEN BLDG 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 19 cells per set.	Set	2	0.0031202472
16.48	24V DC POWER SUPPLY SYSTEM - 737 Amp for ESP &FGD LOADS, ALONG WITH HMI NETWORK PANELS, AHP LOADS, SAC LOADS CR & BOP C&I LOAD @ ESP 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 38 cells per set.	SET	2	0.0044466403
16.49	Unit UPS (160 kVA 1. 2 x 100% parallel redundant chargers and inverters with input isolation transformers 2. Bypass line transformers & voltage stabilizer 3. static switch manual bypass switch, 4. 2 x 100% ACDB, 5. 1x100% (BHMS) 6. 1 x 100%Ni Cd battery bank - UPS Battery- 287 Cells with BHMS (650AH)	Set	1	0.0050013187
16.50	FDG UPS (80 kVA 1. 1 x 100% parallel redundant chargers and inverters with input isolation transformers 2. Bypass line transformers & voltage stabilizer 3. static switch manual bypass switch, 4. 2 x 100% ACDB, 5. 1x100% (BHMS) 6. 1 x 100%Ni Cd battery bank - UPS Battery- 180 Cells with BHMS (300AH)	Set	1	0.0025006593

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16.51	UPS (10 kVA 1. 1 x 100% parallel redundant chargers and inverters with input isolation transformers 2. Bypass line transformers & voltage stabilizer 3. static switch manual bypass switch, 4. 2 x 100% ACDB, 5. 1x100% (BHMS) 6. 1 x 100%Ni Cd battery bank - UPS Battery- 180 Cells with BHMS (70-150AH)	Set	2	0.0014871170
16.52	Online mini UPS with 30 min back up approximate weight 10kg.	Set	10	0.0015768007
16.53	Power Distribution Boards	No	5	0.0004275500
16.54	Power Distribution Panel	No	2	0.0005735905
17	INSTRUMENTS/ DEVICES INCLUDING SENSORS/ CELLS/ PROBES ETC			
17.1	Air filter regulators/ Lubricators (1/4", 1/2", 1", 0-6kg, 0-10kg)	No	8	0.0000378079
17.2	Solenoid valves (3-way, AC/ DC, 1/4", 1/2", 1", NPT/ BSP, single/ dual coil)	No	160	0.0007719096
17.3	Pressure Switch/ DP Switch/ DP indicating switch/Chute Block Switch	No	38	0.0003538834
17.4	Temperature Switch/ Thermostat	No	2	0.0000179412
17.5	Electronic Level Switch (with amplifier, etc), RF, Capacitance or conductivity type	No	81	0.0023225678
17.6	Pressure Transmitter/ Differential Pressure Transmitter/ Thermal Expansion Meter/Tension Meter (Profibus Type/Conventional)	No	835	0.0089225899
17.7	Temp Transmitter- Dual input/ Din rail mounted (Profibus type & Conventional)	No	1960	0.0162116004
17.8	Level Transmitter (with amplifier etc) (Displacer/ Displacement/ RADAR/Ultrasonic/Guided Wave Radar (GWR) Type)	No	91	0.0029470636
17.9	Speed transmitter	No	2	0.0000182559
17.10	Pressure Gauge/ DP gauge/ DP Indicator	No	642	0.0048407392
17.11	Temperature Gauge (all types)/ Temperature Indicator/Bimetallic Thermometer/ Gas filled Thermometer	No	314	0.0028369804
17.12	Level Indicator/ Level Gauge	No	19	0.0004595182
17.13	Flow Transmitter/ Flow Indicator/ Flow Switch/ Flow Meter (Nozzle/Orifice/Magnetic)	No	96	0.0022376798
17.14	Thermocouple/Thermowell/ RTDs along with converters wherever applicable	No	1449	0.0124237583
17.15	Heavy duty Limit Switches	No	24	0.0000797094
17.16	MTM Thermocouple upto 17m length	No	1384	0.0341355393
17.17	MTM Thermocouple over 17m upto 22m length	No	972	0.0294242721
17.18	MTM Thermocouple over 22m upto 28m length	No	520	0.0168171490
17.19	MTM Thermocouple over 28m upto 36m length	No	88	0.0030890827

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17.20	MTM Thermocouple over 36m upto 48m length	No	30	0.0011226485
17.21	O2 (OXYGEN) Analyzer	Set	16	0.0024426922
17.22	SOX/NOX/CO (Combined-CEMS) Analyzer / Flue Gas Analyzer including all accessories	Set	1	0.0008786907
17.23	CO/Velocity/HF/NOX/SOX/NH3/Gas Flow Analyzer including all accessories	Set	4	0.0029733336
17.24	Acoustic pyrometer - 8 transceiver system, cables & erection materials	Set	2	0.0013750456
17.25	Dust/ Opacity Analyzer	Nos	7	0.0029618564
17.26	Mercury Analyzer	Set	1	0.0003944096
17.27	Flame Scanner with Local Indicator	Set	32	0.0010182105
17.28	I/ P Converter	No	12	0.0001048386
17.29	SADC Power Cylinders	No	14	0.0006870335
17.30	Shear Pin Failure Indicator Box	No	4	0.0001324021
17.31	Furnace Temperature probe including local panel/ box and all accessories.	No	2	0.0002633651
17.32	HEA Exciter system	Set	20	0.0007585249
17.33	Position Transmitter / Position Feedback Transmitter	No	30	0.0004768687
17.34	Moisture Sensor probe and dew point monitor	Set	1	0.0000745507
17.35	Conductivity Cells and Transmitter	Set	3	0.0001266016
17.36	Ultrasonic Flow Transmitter/ Meter (Including Valve Passing Detection)	No	18	0.0005842731
17.37	Mass Flow Meter	No	1	0.0000226134
17.38	Density Meter	No	2	0.0001093047
17.39	Averaging Pitot Tube	No	2	0.0000621196
17.40	GO Switch	No	4	0.0002155469
18	COMMISSIONING AND TESTING ACTIVITIES FOR EQUIPMENTS ERECTED BY OTHER AGENCIES, LIKE CONTROL VALVES, ON/OFF VALVES, ELECTRICAL/ PNEUMATIC VALVES, ACTUATORS, SOLENOID VALVES, VALVES, LIMIT SWITCHES, ERV CONTROLLERS, POWER CYLINDERS, PRESSURE & TEMPERATURE			
18.1	Electrical regulating drives: (3 Way Valve, damper)	No	5	0.0000916654
18.2	Pneumatic regulating drives: (Valve, damper)	No	210	0.0067461781
18.3	Pneumatic On/ Off drives: (Valve, damper)	No	5	0.0001729174
18.4	Commissioning of Hydraulic actuators	No	10	0.0002115187
18.5	Corner valve/ Trip valves commissioning	No	12	0.0001586334
18.6	Only healthiness checking of embedded RTD/ Thermocouple	No	439	0.0022343276
18.7	Limit Switches (checking and adjusting only).	No	12	0.0000397390
18.8	HPSU Skid for ST Governing Control	Set	1	0.0001795810
18.9	ST Governing Console Board	Set	2	0.0002987213

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18.10	HPBP Governing Skid (4 Nos Pr. & Temp. control valve and 1 No Spray Block Valve)	Set	1	0.0001389555
18.11	Skid mounted Instruments of TDBFP Gov. Oil Console: Approx. qty of instruments is PG/ DPG - 10 no., Pressure Switch -24 no., etc.	Set	2	0.0002469438
18.12	Fan Lube oil skid	Set	6	0.0006504530
18.13	Pulveriser Lube oil skid	Set	9	0.0011013463
18.14	Gravimetric Feeder commissioning comprising of feeder mounted C&I equipments like belt motion monitor, load cells, speed probes, etc.	Set	7	0.0007570140
18.15	Seal Oil Level/ Pr Tsr Instrument Rack (Removal, calibration & refixing of rack mounted instruments)	Set	1	0.0001180263
18.16	Primary Water DP Instrument Rack (Removal, calibration & refixing of rack mounted instruments)	Set	1	0.0001322653
18.17	MDBFP Hydraulic Coupling mounted instruments	Set	1	0.0000985036
18.18	HWL-1 and 2 Control valve skid instrumentation	Set	1	0.0001389555
18.19	Remote commissioning of Electrical actuators	No	450	0.0068901887
18.20	Remote commissioning of Soot Blower System	No	1	0.0000122432
18.21	Lube Oil Purifier, Control Cabinet :- 1600 X 1000 X 350, Weight (In Kg) Empty:-2300 Flooded:-3000	Nos	4	0.0002533534
18.22	H2 Gas Analyser Cabinet	Nos	1	0.0001417434
18.23	RH/SH-ERV Controller Box With Pressure Switch	Nos	4	0.0002172631
I9A	POWER CYLINDERS			
I9.1	Mill Discharge Valve power cylinders (set of four)	Set	9	0.0005169573
I9B	MISCELLANEOUS ITEMS (ITEMS NOT COVERED UNDER ABOVE HEADS)			
I9B.1	Earth Flat 50X6 mm size (for 150mm Tray earthing)	Mtrs	2850	0.0028231770
I9B.2	Earth Flat 25X3 mm size (for 50mm &100m Tray earthing)	Mtrs	2000	0.0008835104
I9B.3	Electronic Earth Pit including earth pit Chamber	No	15	0.0015984801
I9B.4	Coal Bunker Level Monitoring System - Radar type set for all bunkers for 09 mills. The system will further contains approximately: Field Mounted 3D RADAR LEVEL TRANSMITTER MODEL: ULM-3D-5 -14 Nos, LOCAL CONTROL PANEL (LCP) - 4 Nos, Operator Station (OPS) for Coal Bunker level Monitoring	Set	1	0.0010573808
I9B.5	MASTER CLOCK SYSTEM PANEL (800x800x2100mm) and slave clocks system	Set	1	0.0011046003
I9C	FDA ITEMS (FIRE DETECTION AND ALARM SYSTEM)			
19C.1	Cables 1P/2C x 1.5 mm ² - FRLS Type	Mtrs	90000	0.0147252680
19C.2	Cables 1P/2C x 1.5 sq.mm - MICC Type	Mtrs	15000	0.0056569954
19C.3	Cables 1P/2C x 2.5 mm ² - FRLS Type	Mtrs	25000	0.0040903522

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19C.4	Cables 1P/2C x 2.5 sq.mm - MICC Type	Mtrs	5000	0.0018856651
19C.5	Optical Fiber Cable - FRLS	Mtrs	13000	0.0040949348
19C.6	Digital LHS Cable including interface devices - around 50 Nos and erection of J-Hook and Chain in Conveyor	Mtrs	60000	0.0117052367
19C.7	End of Line Resistance Box	Nos.	250	0.0075172765
19C.8	Junction Box for Cables	Nos.	100	0.0015216140
19C.9	Multisensor Detectors	Nos	3000	0.0296984395
19C.10	Heat Detectors	Nos	100	0.0001041605
19C.11	Probe Detectors (ROR type) for Fuel tanks with Flameproof Junction box	Nos	10	0.0000206443
19C.12	Beam Detectors	Nos	8	0.0000829602
19C.13	Solar Blind Infrared Ember Detector	Nos	30	0.0003443788
19C.14	Solenoid Valve	Nos	160	0.0004700326
19C.15	Pressure Switch with Root valve	Nos	280	0.0026075618
19C.16	Local Control panel for Deluge Valve	Nos	160	0.0019863213
19C.17	Fire Alarm Panels - Approx. size :: in mm 1000 x 600 x 300 (H x W X D)	Nos	10	0.0006533001
19C.18	Repeater Panels Approx. size :: in mm 300 x 500 x 100 (H x W X D)	Nos	1	0.0001042477
19C.19	Remote IO Panel	Nos	1	0.0001493310
19C.20	PLC Panel	Nos	1	0.0001493310
19C.21	Manual Call Points(Indoor)	Nos	230	0.0022315510
19C.22	Manual Call Points(Outdoor)	Nos	130	0.0012613114
19C.23	Manual Call Points(Flameproof)	Nos	20	0.0001940479
19C.24	Pressure Transmitter	Nos	28	0.0009582465
19C.25	Diff. Pressure Gauge/Pressure gauge	Nos	56	0.0004820862
19C.26	Diff. Pressure Switch	Nos	1	0.0000122314
19C.27	Flow switches	Nos	2	0.0000244628
19C.28	Level transmitters	Nos	4	0.0001368986
19C.29	Vent Valve	Nos	4	0.0000117508
19C.30	Level Switches for Fuel Tank	Nos	4	0.0001368799
19C.31	Limit Switch	Nos	320	0.0009100642
19C.32	Level indicator	Nos	2	0.0000172159
19C.33	Interface Modules	Nos	1000	0.0020564353
19C.34	Hooter cum Strobe (Conventional)	Nos	220	0.0021778856
19C.35	Siren (3 km)	Nos	1	0.0000098995
19C.36	Response Indicators	Nos	600	0.0059396879
19C.37	Exit Sign (Back Lit)	Nos	230	0.0022768804
19C.38	Operator workstation, Printer, Furniture for PC	SET	8	0.0018134853

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19C.39	UPS with battery / 24V DC Power Supply Module with Battery Back Up	Nos	52	0.0015635935
				1.0000000000

BOQ WITH WEIGHTAGES FOR E/T/C of C&I WORKS AT 2X660MW Talcher U#2 & AHP, CHP, LHP & GHP

Sr. No.	Description	Unit	Qty	Factor
I1.0	CABLE TRAYS AND ACCESSORIES			
I1.0.1	Perforated cable tray and accessories (with or without cover) 50mm	Meter	10189	0.0126432619
I1.0.2	Perforated cable tray and accessories (with or without cover) 100mm	Meter	4000	0.0061575095
I1.0.3	Perforated cable tray and accessories (with or without cover) 150mm	Meter	5036	0.0083420998
I1.0.4	Ladder cable tray and accessories (with or without cover) 150mm	Meter	4000	0.0070242317
I1.0.5	Cable Duct 60x60x1000mm	Meter	500	0.0009747106
I1.0.6	Cable Duct 180x100x1000mm	Meter	300	0.0006813278
I1.0.7	Cable Duct 250x100x1000mm	Meter	300	0.0009557233
I2A	CABLE LAYING INCLUDING EARTHING WIRES			
I2A.1	Compensating cable 2Px0.5sqmm, Tx/ Sx/ Kx/ Rx unarmoured/ armoured	Meter	14100	0.0025272662
I2A.2	2C X 1.5/2.5 sqmm armoured/ unarmoured copper cable	Meter	11700	0.0020909716
I2A.3	3C X 1.5/2.5 sqmm armoured control cable	Meter	165700	0.0305085717
I2A.4	5C X 1.5/2.5 sqmm armoured control cable	Meter	80200	0.0158994726
I2A.5	7C X 1.5/2.5 sqmm armoured control cable	Meter	16800	0.0035660859
I2A.6	10C X 1.5/2.5 sqmm armoured control cable	Meter	31100	0.0082762392
I2A.7	12C X 1.5/2.5 sqmm armoured control cable	Meter	10000	0.0030451901
I2A.8	16C X 1.5/2.5 sqmm armoured control cable	Meter	30200	0.0103262312
I2A.9	19C X 1.5/2.5 sqmm armoured control cable	Meter	67000	0.0229091884
I2A.10	3C X 35 sqmm Aluminium Power Cable, armoured/ unarmoured	Meter	1750	0.0005660983
I2A.11	3C X 95sqmm Aluminium Power Cable, armoured/ unarmoured	Meter	2100	0.0012918885
I2A.12	Profibus/ Profinet/ STP Cable	Meter	175795	0.0440477614
I2A.13	Network UTP Cables (special termination using UTP connectors involved)	Meter	31500	0.0072679935
I2A.14	Laying & Testing, etc. of Optical Fibre Cables on cable trays, conduits etc with minor civil works	Meter	47000	0.0164634092
I2A.15	Termination/Splicing & OTDR Testing, etc. of Optical Fibre Cable including all consumables like Break-out Kits, OFC markers, etc. except Multi-Mode Pigtail.	No	320	0.0051135065
I2A.16	Hoses-1/ 4", 1/ 2", 1", SS/ Teflon, Braided/ unbraided, upto 5m length	No	124	0.0002781457

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I2A.17	RS-485/RG-58 CABLE	Mtr	100	0.0000315302
I2B	CABLE LAYING INCLUDING EARTHING WIRES			
I2B.1	Screened Copper Cable 2Px0.5sqmm (Intrinsic/ non-intrinsic safe) armoured/ unarmoured	Meter	75050	0.0130430641
I2B.2	Screened Copper Cable 4Px0.5sqmm (Intrinsic/ non-intrinsic safe) armoured/ unarmoured	Meter	460500	0.0935701342
I2B.3	Screened Copper Cable 8Px0.5sqmm (Intrinsic/ non-intrinsic safe) armoured/ unarmoured	Meter	265800	0.0637887508
I2B.4	Screened Copper Cable 12Px0.5sqmm (Intrinsic/ Non-intrinsic safe) armoured/ unarmoured	Meter	97800	0.0266665436
I2B.5	Screened Copper Cable 16Px0.5sqmm (Intrinsic/ Non-intrinsic safe) armoured/ unarmoured	Meter	52500	0.0154529681
I2B.6	Screened Copper Cable 24Px0.5sqmm (Intrinsic/ Non-intrinsic safe) armoured/ unarmoured	Meter	22000	0.0132690661
I2B.7	Screened Copper Cable 2P/ 4Cx1.0sqmm (Intrinsic/ Non-intrinsic safe) armoured/ unarmoured	Meter	1000	0.0001733247
I3	JUNCTION BOX/ PUSH BUTTON STATION			
I3.1	Junction boxes upto 48 way (FRP)	No	256	0.0043681564
I3.2	Junction boxes above 48 way	No	26	0.0005764344
I3.3	Local Gun Maintenance Switch Box	No	16	0.0002836271
I3.4	3TT FRP Junction Box	No	12	0.0004229749
I3.5	6TT FRP Junction Box	No	20	0.0007049581
I3.6	9TT FRP Junction Box	No	9	0.0003172312
I3.7	12TT FRP Junction Box	No	9	0.0003172312
I3.8	TT JB (TYPE A, B & C)	Nos	217	0.0103337465
I3.9	Installation of Junction box, mounting pad Phase marker bracket, Shaft vibration sensors & other related accessories near HT drives and its driven equipment in the field. (1 set consists of total 10 sensors -5 for Drive / 5 for Driven Equipment and its JB/Cabling from sensor to JB)	Sets	8	0.0026982471
I3.10	Installation of Junction box, mounting pad Phase marker bracket, Shaft vibration sensors & other related accessories near HT drives in the field. (1 set consists of total 5 sensors for motor and its JB/Cabling from sensor to JB)	Sets	8	0.0013491230
I4	CONDUITS/ IMPULSE PIPE/ TUBES			
I4.1	ASTM A106 Gr.C SIZE: 1/ 2" NB SCH 160	Meter	2200	0.0073822457
I4.2	ASTM A106 Gr.C SIZE: 1/ 2" NB SCH 80	Meter	14000	0.0444940415
I4.3	ASTM A106 Gr.C SIZE: 3/ 4" NB SCH 80	Meter	9700	0.0330051584
I4.4	ASTM A213 TP316H SIZE: 1/ 2" NB SCH 160	Meter	3000	0.0116078500
I4.5	ASTM A213 TP316H SIZE: 3/ 4" NB SCH 160	Meter	1000	0.0049736072
I4.6	ASTM A213 TP316H SIZE:3/ 4" NB SCH80	Meter	1400	0.0058511346

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I4.7	PIPE DIA 21.3 X 3.73 SA312TP304H	Meter	50	0.0006641393
I4.8	PIPE OD 21.3 X 7.47 - SA335P22	Meter	90	0.0011954508
I4.9	TUBE OD 21.3 X 7.47 X 6000 - SA335P91	Meter	80	0.0002752503
I4.10	PIPE OD 26.7 X 3.91 - SA335P22	Meter	30	0.0003984836
I4.11	PIPE DIA 21.3 X 7.47 SA106GRC	Meter	150	0.0008265621
I4.12	PIPE DIA 21.3 X 4.78 SA106GRB / GRC	Meter	300	0.0016531241
I4.13	PIPE DIA 21.3 X 3.73 SA106GRB / GRC	Meter	2950	0.0162557204
I4.14	TUBE 21.30 X 3.73 - SA106GRB	Meter	160	0.0004582813
I4.15	TUBE 21.30 X 7.47 - SA106GRB	Meter	30	0.0001032189
I4.16	TUBE 26.70 X 3.91 - SA106GRB	Meter	80	0.0002434488
I4.17	PIPE(SMLS)- 60.3X 3.91 CS SA106 GR B	Meter	10	0.0000910143
I4.18	(1/4")/ (3/8")/ (1/2")/ (3/4")/ (1") OD SS TUBE	Meter	6160	0.0129024365
I4.19	SEAMLESS TUBE GR. T92 21.3X7.47	Meter	330	0.0011245931
I4.20	SEAMLESS C.S. TUBE 21.3X2.3	Meter	4	0.0000114570
I4.21	MATERIAL: ASTM A 182 F316H /ASTM A312 TP316HSIZE: 88.90 OD X 15 mm Thick	Meter	30	0.0001979013
I4.22	MATERIAL: ASTM A106 GR C / ASTM A105SIZE: 88.90 OD X 12 mm Thick	Meter	28	0.0001847078
I4.23	MATERIAL: ASTM A106 GR C / ASTM A105, SIZE: 88.90 OD x 7.6 mm Thick	Meter	64	0.0004221894
I4.24	SEAMLESS TUBES (GR. T22) 21.3X2.77	Meter	60	0.0001887167
I4.25	SEAMLESS A.S. TUBE 21.3X2.77 Gr T92	Meter	120	0.0003844825
I4.26	SEAMLESS A.S. TUBE D=13.5x2.6 Gr T22	Meter	76	0.0002713106
I4.27	PIPE AS PER SA106 GR C SIZE OD X THICKNESS -33.4x6.35mm	Meter	50	0.0004149927
I4.28	PIPE AS PER SA335 P92 SIZE ODxTHICKNESS -33.4x4.55mm, GRADE: GR P92	Meter	90	0.0007469868
I4.29	GI Pipe (1/ 2", 1") Heavy grade	Meter	100	0.0001609512
I4.30	HDPE conduits 2 " for Optical fiber cable laying	Meter	100	0.0001542965
I4.31	Flexible pipe/ Conduit pipe – ¾" (Zinc / Terne Coated)	Meter	1500	0.0024868297
I4.32	GI Rigid Conduit pipe/ PVC Conduit pipe – 1"	Meter	2650	0.0030753775
I5	MISCELLANEOUS STRUCTURAL STEEL INCLUDING FRAMES FOR PANELS/ RACKS/ INSTRUMENTS, SUPPORTS FOR CABLE TRAY/ PIPES/ TUBES, CANOPIES ETC.			
I5.1	Structural steel for fabrication	MT	25	0.0074161850
I5.2	Assembly and installation of Mounting Frames with loose supplied prefabricated materials like slotted angles, channels, etc.	No	50	0.0055029399
I5.3	Assembly/ welding and installation of Instrument Racks with loose supplied prefabricated materials of suitable size, like angles, stands, etc. Total wt. of loose supplied items (for 10 racks): Approx. 3 Tonnes	No	10	0.0009610009
I5.4	Radiographic test of weld joints	No	10	0.0000242468

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I6	PANELS/ CUBICLES/ RACKS/ ENCLOSURES/ MONITORS/ COMPUTER/ COMPUTER PERIPHERAL/ PLCS/ UPS/ BATTERIES			
I6.1	Local Gauge Board approx. dimension 1900X1400X750mm, approx. wt. 600kg	No	11	0.0012212476
I6.2	MaxDNA Control Cabinet including Marshalling and Relay Cabinet for SG, TG (non-core) & Station C&I if DDCMIS. This includes BOP C&I, Network Panels, FGD & SCR Panels, ACC Control Panels. Approx dimension 750(D)x750(W)x2295(H), Approx Weight 400kgs)			0.0000000000
I6.2.1	Control Panel-Suit of 1 panel	Nos	38	0.0050761266
I6.2.2	Control Panel-Suit of 2 panel	Nos	7	0.0014326937
I6.2.3	Control Panel-Suit of 3 panel	Nos	34	0.0117117032
I6.2.4	Control Panel-Suit of 4 panel	Nos	42	0.0152918244
I6.2.5	Control Panel-Suit of 5 panel	Nos	3	0.0008598811
I6.3	DAVR Panel	Set	1	0.0003993732
I6.4	LP Dosing system	Set	1	0.0001389593
I6.5	Electrical Control Panel	Set	1	0.0006907592
I6.6	Condenser vacuum pump system	Set	2	0.0002486602
I6.7	Positioner cabinets for LPBP CV1, LPBP CV2, Spray water CV	No	1	0.0000599655
I6.8	Local Instrument Rack (LIR) for Field Transmitters. (Approx. weight 300kg)	No	90	0.0089562868
I6.9	Local Instrument Enclosure (LIE) for Field Transmitters. (Approx. weight 300kg)	No	61	0.0056327284
I6.10	METSO-DNA Engineering/ Operator/ Historian/ LVS/ Shift I/ C/ Historical Storage & Documentation/ Gateway/ OPC/ System Documentation/ CCTV Client stations, etc. -- PC/ Server/ Client Station with ASCII Keyboard, Mouse & 24" Colour Monitor, Mini UPS etc.	Set	47	0.0030350482
I6.11	Printers (80/ 132 col Dot Matrix, A3 Inkjet, A3/ A4 Laserjet, A3 Colour Laserjet, Heavy Duty Line Impact Dot Matrix, etc)	Set	5	0.0001949057
I6.12	Graphic Interface Unit	No	14	0.0013113899
I6.13	Control Desk/ CRT desk (approx 4m)	No	4	0.0016554804
I6.14	Control Desk/ CRT desk (approx 8m)	No	2	0.0013559877
I6.15	Computer furniture for all Servers, PCs, Printers, Locker sets, Almirahs, Conference Table (COMPUTER TABLE - 6 Nos, PRINTER TABLE - 2 Nos, PRINTER RACK - 2 Nos, KEYPAD - 5 Nos, LOCKER - 5 Nos, ALMIRAH - 5 Nos, COMPUTER CHAIR - 48 Nos, CONFERENCE TABLE - 1 No)	Set	1	0.0004503958
I6.16	PC Rack / Server Rack	Nos	15	0.0005757284
I6.17	Workstation Furniture 1 Section (WS1)	Nos	2	0.0003652118
I6.18	Workstation Furniture 2 Sections (WS2)	Nos	6	0.0021912705

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16.19	SWAS Sample handling system with racks, panels and chiller	Set	5	0.0052091734
16.20	SWAS Analyzer Panel including various analyzers	Set	1	0.0013199283
16.21	TSI for Main Turbine including its HMI & printers	Set	1	0.0005823769
16.22	TSI for TDBFP including its HMI & printers	Set	1	0.0004392204
16.23	Vibration monitoring system for Pumps, Fans & Pulverisers including sensor mounting blocks and brackets, casing vibration sensor, Phase marker sensor and monitoring rack with electronic modules.	Set	1	0.0006218606
16.24	LVS (Large Video Screen) - alongwith loose supplied items.	Set	18	0.0090595811
16.25	Gravimetric Feeder Panel including Electronic control panel, Power Cabinet and Feeder Mounted C&I Equipments	Set	7	0.0012566385
16.26	SONIC Tube Leak Detection System.	Set	1	0.0006836693
16.27	Furnace Flame CCTV System including local panel, wall mounted cabinet, High Temperature Flame Viewing Camera and all accessories like camera, monitor, etc.	Nos	2	0.0007741713
16.28	Pulveriser Dynamic Classifier - VFD Cabinet	No	7	0.0015558143
16.29	APH Leakage Control System consisting of DCS Panel & Field mounted Junction Boxes, teflon cables, etc	Set	1	0.0021681589
16.30	Generator Instrumentation cabinet including annunciator (approx. weight 450kg, approx dimension 800x800x2300mm)	No	1	0.0001902796
16.31	Generator End Winding Vibration Monitoring System (approx. dim. 2300x800x600mm, approx. wt. 150kg)	Set	1	0.0002287275
16.32	24V DC POWER SUPPLY SYSTEM -751 Amp FOR SG SYSTEMS 1X 100% modular rectifier banks, 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 38 No. per set.	Set	2	0.0048570613
16.33	24V DC POWER SUPPLY SYSTEM-390 Amp FOR TG SYSTEMS 1X 100% modular rectifier banks, 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 19 No. per set.	Set	2	0.0034082433

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16.34	24V DC POWER SUPPLY SYSTEM - 787 Amp for BOP & HMI NETWORK PANELS 1X 100% modular rectifier banks, 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 38 cells per set	Set	2	0.0048570613
16.35	24V DC POWER SUPPLY SYSTEM - 22 Amp for CHP RUN OFF WS PACKAGE 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 19 cells per set.	Set	2	0.0034082433
16.36	24V DC POWER SUPPLY SYSTEM - 193 Amp for AHP LOADS AT CLASSIFIER MCC 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 19 cells per set.	Set	2	0.0034082433
16.37	24V DC POWER SUPPLY SYSTEM - 121 Amp for AHP LOADS AT SILO MCC 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 19 cells per set.	Set	2	0.0034082433
16.38	24V DC POWER SUPPLY SYSTEM - 39 Amp for AHP LOADS AT AWRS MCC 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 19 cells per set.	Set	2	0.0034082433
16.39	24V DC POWER SUPPLY SYSTEM - 176 Amp for AHP LOADS AT AHS & HMI NETWORK PANELS AT AHS MCC 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 19 cells per set.	Set	2	0.0034082433
16.40	24V DC POWER SUPPLY SYSTEM - 264 Amp for CHP LOADS AT BUNKER MCC 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board.	Set	2	0.0034082433

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	1X 100% (BHMS)–common for both the sets. Total cells are 19 cells per set.			
16.41	24V DC POWER SUPPLY SYSTEM - 176 Amp for CHP LOADS AT TRACK HOPPER MCC 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 19 cells per set.	Set	2	0.0034082433
16.42	24V DC POWER SUPPLY SYSTEM - 110 Amp for CHP LOADS AT CHP & HMI NETWORK PANELS @ CRUSHER HOUSE 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 19 cells per set.	Set	2	0.0034082433
16.43	24V DC POWER SUPPLY SYSTEM - 545 Amp for ESP &FGD LOADS, ALONG WITH HMI NETWORK PANELS, AHP LOADS, SAC LOADS CR & BOP C&I LOAD @ ESP 1X 100% Nickel - Cadmium batteries for one (1) hour duty, 1X 100% DC distribution board. 1X 100% (BHMS)–common for both the sets. Total cells are 38 cells per set.	Set	2	0.0048570613
16.44	Unit UPS 160 kVA 1. 2 x 100% parallel redundant chargers and inverters with input isolation transformers 2. Bypass line transformers & voltage stabilizer 3. static switch manual bypass switch, 4. 2 x 100% ACDB, 5. 1x100% (BHMS) 6. 1 x 100%Ni Cd battery bank - UPS Battery- 287 Cells with BHMS (650AH)	Set	1	0.0054629360
16.45	CHP & AHP UPS 80 kVA 1. 1 x 100% parallel redundant chargers and inverters with input isolation transformers 2. Bypass line transformers & voltage stabilizer 3. static switch manual bypass switch, 4. 2 x 100% ACDB, 5. 1x100% (BHMS) 6. 1 x 100%Ni Cd battery bank - UPS Battery- 180 Cells with BHMS (300AH)	Set	2	0.0054629360

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16.46	UPS 10 kVA 1. 1 x 100% parallel redundant chargers and inverters with input isolation transformers 2. Bypass line transformers & voltage stabilizer 3. static switch manual bypass switch, 4. 2 x 100% ACDB, 5. 1x100% (BHMS) 6. 1 x 100%Ni Cd battery bank - UPS Battery- 180 Cells with BHMS (70-150AH)	Set	1	0.0008121883
16.47	Online mini UPS with 30 min back up approximate weight 10kg.	Set	10	0.0017223380
16.48	Power Distribution Boards	No	5	0.0004670125
16.49	Power Distribution Panel	No	2	0.0006265324
17	INSTRUMENTS/ DEVICES INCLUDING SENSORS/ CELLS/ PROBES ETC			
17.1	Air filter regulators/ Lubricators (1/4", 1/2", 1", 0-6kg, 0-10kg)	No	8	0.0000412976
17.2	Solenoid valves (3-way, AC/ DC, 1/4", 1/2", 1", NPT/ BSP, single/ dual coil)	No	160	0.0008431562
17.3	Pressure Switch/ DP Switch/ DP indicating switch/Chute Block Switch	No	34	0.0003458574
17.4	Temperature Switch/ Thermostat	No	2	0.0000195972
17.5	Electronic Level Switch (with amplifier, etc), RF, Capacitance or conductivity type	No	77	0.0024116578
17.6	Pressure Transmitter/ Differential Pressure Transmitter/ Thermal Expansion Meter/Tension Meter (Profibus Type/Conventional)	No	739	0.0086256231
17.7	Temp Transmitter- Dual input/ Din rail mounted (Profibus type & Conventional)	No	1866	0.0168586596
17.8	Level Transmitter (with amplifier etc) (Displacer/ Displacement/ RADAR/Ultrasonic/Guided Wave Radar (GWR) Type)	No	41	0.0014503525
17.9	Speed transmitter	No	2	0.0000199409
17.10	Pressure Gauge/ DP gauge/ DP Indicator	No	575	0.0047357207
17.11	Temperature Gauge (all types)/ Temperature Indicator/Bimetallic Thermometer/ Gas filled Thermometer	No	314	0.0030988312
17.12	Level Indicator/ Level Gauge	No	19	0.0005019313
17.13	Flow Transmitter/ Flow Indicator/ Flow Switch/ Flow Meter (Nozzle/Orifice/Magnetic)	No	83	0.0021132281
17.14	Thermocouple/Thermowell/ RTDs along with converters wherever applicable	No	1407	0.0131771136
17.15	Heavy duty Limit Switches	No	24	0.0000870666
17.16	MTM Thermocouple upto 17m length	No	1384	0.0372862196
17.17	MTM Thermocouple over 17m upto 22m length	No	972	0.0321401065
17.18	MTM Thermocouple over 22m upto 28m length	No	520	0.0183693570
17.19	MTM Thermocouple over 28m upto 36m length	No	88	0.0033742023

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17.20	MTM Thermocouple over 36m upto 48m length	No	30	0.0012262680
17.21	O2 (OXYGEN) Analyzer	Set	16	0.0026681505
17.22	SOX/NOX/CO (Combined-CEMS) Analyzer / Flue Gas Analyzer including all accessories	Set	1	0.0009597931
17.23	CO/Velocity/HF/NOX/SOX/NH3/Gas Flow Analyzer including all accessories	Set	4	0.0032477697
17.24	Acoustic pyrometer - 8 transceiver system, cables & erection materials	Set	2	0.0015019611
17.25	Dust/ Opacity Analyzer	Nos	7	0.0032352331
17.26	Mercury Analyzer	Set	1	0.0004308133
17.27	Flame Scanner with Local Indicator	Set	32	0.0011121904
17.28	I/ P Converter	No	12	0.0001145151
17.29	SADC Power Cylinders	No	10	0.0005360329
17.30	Shear Pin Failure Indicator Box	No	4	0.0001446227
17.31	Furnace Temperature probe including local panel/ box and all accessories.	No	2	0.0002876735
17.32	HEA Exciter system	Set	20	0.0008285361
17.33	Position Transmitter / Position Feedback Transmitter	No	30	0.0005208833
17.34	Moisture Sensor probe and dew point monitor	Set	1	0.0000814317
17.35	Conductivity Cells and Transmitter	Set	3	0.0001382869
17.36	Ultrasonic Flow Transmitter/ Meter (Including Valve Passing Detection)	No	16	0.0005672897
17.37	Mass Flow Meter	No	1	0.0000247006
17.38	Density Meter	No	2	0.0001193935
17.39	Averaging Pitot Tube	No	2	0.0000678532
17.40	GO Switch	No	4	0.0002354417
18	COMMISSIONING AND TESTING ACTIVITIES FOR EQUIPMENTS ERECTED BY OTHER AGENCIES, LIKE CONTROL VALVES, ON/OFF VALVES, ELECTRICAL/ PNEUMATIC VALVES, ACTUATORS, SOLENOID VALVES, VALVES, LIMIT SWITCHES, ERV CONTROLLERS, POWER CYLINDERS, PRESSURE & TEMPERATURE			
18.1	Electrical regulating drives: (3 Way Valve, damper)	No	5	0.0001001261
18.2	Pneumatic regulating drives: (Valve, damper)	No	202	0.0070881265
18.3	Pneumatic On/ Off drives: (Valve, damper)	No	5	0.0001888775
18.4	Commissioning of Hydraulic actuators	No	10	0.0002310417
18.5	Corner valve/ Trip valves commissioning	No	12	0.0001732751
18.6	Only healthiness checking of embedded RTD/ Thermocouple	No	439	0.0024405541
18.7	Limit Switches (checking and adjusting only).	No	12	0.0000434069
18.8	HPSU Skid for ST Governing Control	Set	1	0.0001961561

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18.9	ST Governing Console Board	Set	2	0.0003262930
18.10	HPBP Governing Skid (4 Nos Pr. & Temp. control valve and 1 No Spray Block Valve)	Set	1	0.0001517810
18.11	Skid mounted Instruments of TDBFP Gov. Oil Console: Approx. qty of instruments is PG/ DPG - 10 no., Pressure Switch -24 no., etc.	Set	2	0.0002697365
18.12	Fan Lube oil skid	Set	6	0.0007104893
18.13	Pulveriser Lube oil skid	Set	9	0.0012029996
18.14	Gravimetric Feeder commissioning comprising of feeder mounted C&I equipments like belt motion monitor, load cells, speed probes, etc.	Set	7	0.0008268857
18.15	Seal Oil Level/ Pr Tsr Instrument Rack (Removal, calibration & refixing of rack mounted instruments)	Set	1	0.0001289200
18.16	Primary Water DP Instrument Rack (Removal, calibration & refixing of rack mounted instruments)	Set	1	0.0001444732
18.17	MDBFP Hydraulic Coupling mounted instruments	Set	1	0.0001075954
18.18	HWL-1 and 2 Control valve skid instrumentation	Set	1	0.0001517810
18.19	Remote commissioning of Electrical actuators	No	450	0.0075261470
18.20	Remote commissioning of Soot Blower System	No	1	0.0000133732
18.21	Lube Oil Purifier, Control Cabinet: - 1600 X 1000 X 350, Weight (In Kg) Empty: -2300 Flooded: - 3000	Nos	4	0.0002767377
18.22	H2 Gas Analyser Cabinet	Nos	1	0.0001548261
18.23	RH/SH-ERV Controller Box with Pressure Switch	Nos	4	0.0002373163
I9A	POWER CYLINDERS			
19.1	Mill Discharge Valve power cylinders (set of four)	Set	9	0.0005646720
I9B	MISCELLANEOUS ITEMS (ITEMS NOT COVERED UNDER ABOVE HEADS)			
19B.1	Earth Flat 50X6 mm size (for 150mm Tray earthing)	Mtrs	2850	0.0030837537
19B.2	Earth Flat 25X3 mm size (for 50mm &100m Tray earthing)	Mtrs	2000	0.0009650576
19B.3	Electronic Earth Pit including earth pit Chamber	No	15	0.0017460185
19B.4	Coal Bunker Level Monitoring System - Radar type set for all bunkers for 09 mills. The system will further contain approximately: Field Mounted 3D RADAR LEVEL TRANSMITTER MODEL: ULM-3D-5 -14 Nos, LOCAL CONTROL PANEL (LCP) - 4 Nos, Operator Station (OPS) for Coal Bunker level Monitoring	Set	1	0.0011549761
I9C	FDA ITEMS (FIRE DETECTION AND ALARM SYSTEM)			
19C.1	Cables 1P/2C x 1.5 mm2- FRLS Type	Mtrs	10000	0.0017871553
19C.2	Cables 1P/2C x 1.5 sq.mm - MICC Type	Mtrs	5000	0.0020597103
19C.3	Cables 1P/2C x 2.5 mm2 - FRLS Type	Mtrs	3000	0.0005361466

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I9C.4	Cables 1P/2C x 2.5 sq.mm - MICC Type	Mtrs	2000	0.0008238841
I9C.5	Optical Fiber Cable - FRLS	Mtrs	2000	0.0006881375
I9C.6	Digital LHS Cable including interface devices - around 50 Nos and erection of J-Hook and Chain in Conveyor	Mtrs	15000	0.0031964049
I9C.7	End of Line Resistance Box	Nos.	50	0.0016422229
I9C.8	Junction Box for Cables	Nos.	50	0.0008310288
I9C.9	Multisensor Detectors	Nos	1000	0.0108131931
I9C.10	Heat Detectors	Nos	50	0.0000568872
I9C.11	Beam Detectors	Nos	2	0.0000226543
I9C.12	Solenoid Valve	Nos	15	0.0000481328
I9C.13	Pressure Switch with Root valve	Nos	40	0.0004068911
I9C.14	Local Control panel for Deluge Valve	Nos	15	0.0002034053
I9C.15	Fire Alarm Panels - Approx. size: in mm 1000 x 600 x 300 (H x W X D)	Nos	2	0.0001427198
I9C.16	Manual Call Points (Indoor)	Nos	70	0.0007418543
I9C.17	Manual Call Points(Outdoor)	Nos	30	0.0003179375
I9C.18	Limit Switch	Nos	30	0.0000931933
I9C.19	Interface Modules	Nos	200	0.0004492485
I9C.20	Hooter cum Strobe (Conventional)	Nos	80	0.0008650554
I9C.21	Response Indicators	Nos	200	0.0021626386
I9C.22	Exit Sign (Back Lit)	Nos	70	0.0007569235
I9C.23	UPS with battery / 24V DC Power Supply Module with Battery Back Up	Nos	10	0.0003284446
I10C	Supply of Consumables for AHP, CHP, LHP & GHP related E&C works			
I10C.01	Glands, Lugs and other Consumables for Control/Signal Cable Glanding& Termination Upto cable OD upto 22mm	Nos	3000	0.0024177381
I10C.02	Glands, Lugs and Other Consumables for Control/Signal Cable Glanding& Termination Upto cable OD Above 22mm upto 25mm	Nos	2400	0.0022357795
I10C.03	Glands, Lugs and Other Consumables for Control/Signal Cable Glanding& Termination Upto cable OD Above 25mm upto 38mm	Nos	1000	0.0009315748
I10C.04	Staright through jointing Kit and other consumables for Control/Signal Cable straight through joint upto 7C/4P cable	Nos	10	0.0000551068
I10C.05	Staright through jointing Kit and other consumables for Control/Signal Cable straight through joint above 7C/4P upto 14C/6P/4T including	Nos	10	0.0000661287
I10C.06	Staright through jointing Kit and other consumablesControl/Signal Cable straight	Nos	10	0.0001653204

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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	through joint above 14C/6P/4T upto 30C/20P/10T including			
I10C.07	LT Power cable Gland cable OD Above 28mm Upto 35mm	Nos	5	0.0000102666
I10C.08	LT Power cable Gland cable OD Above 35mm Upto 45mm	Nos	5	0.0000153936
I10C.09	LT Power cable straight through jointing kit for 3C/3.5C/4C upto 35 Sq.mm including supply of Staright through joiting Kit and other consumables	Nos	5	0.0000961252
I10C.10	LT Power cable straight through jointing kit for 3C/3.5C/4C Above 35 Sq.mm upto 95 Sq.mm including supply of Staright through joiting Kit and other consumables	Nos	5	0.0000996668
				1.0000000000