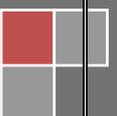


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TECHNICAL CONDITIONS OF CONTRACT (TCC)

BHARAT HEAVY ELECTRICALS LIMITED



TECHNICAL CONDITIONS OF CONTRACT (TCC)

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TECHNICAL CONDITIONS OF CONTRACT (TCC) PART I
Chapter I: Project Information

<u>PROJECT INFORMATION</u>		
SL No	Description	Details
1.1	Location	Village-Mauda, Dist- Nagpur State- Maharashtra, India.;
1.2	Nearest Railway Station	Nagpur
1.3	Nearest Airport/Seaport	Nagpur
1.4	Access By Road/Major Cities	Nagpur
1.5	Meteorological Data:	
	Dry Bulb Temperature (Max/Min)	50° C/6°C
	Humidity (Max/Min)	60%
<p>Above information furnished are for general guidance of Contractor. However, Contractor has advised to visit the site and appraise himself about the conditions of site and infrastructure available in the area for fulfilling their commitments under the contract.</p>		

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Chapter II: Scope of Works

2.0 SCOPE OF WORK

The scope of work under the specification broadly covers the receipt of materials from BHEL/NTPC (customer) stores/storage yard, handling at stores/storage yard, transportation to site of work, preassembly, erection, testing, pre-commissioning tests and checks and handing over of complete electrical and C&I work for the Flue Gas Desulphurization(FGD) system and its auxiliaries for the project.

The work under this scope being quite sophisticated and also quite extensive, for proper planning, monitoring, reporting, etc. of ongoing works, the contractor shall establish his own computer(s) and printer(s) at his site office, along with suitable operator(s), consumables, etc.

BHEL is operating web based computerized SSD/IPMS/SCMS/E-store/Suvidha etc system that includes, inter-alia, issue of materials, daily progress reporting, Contractor's running monthly billing and material reconciliation through a computerized data management system. Contractor shall install necessary hardware to hook-up with the BHEL's system and use the same for his scope of work.

The contractor shall also provide adequate and suitable manpower for co-ordinating, data gathering in suitable format, computer operations for implementation of SDD/ IPMS/ SOMS/Suvidha etc at site.

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

Supply & erection of consumable like conduit accessories & fittings, conduit boxes, saddles, clamps, flexible conduit, fixing hardwares, anchors, wedges, nuts & bolts, concrete inserts etc materials required for mounting the fixtures, consumable and other incidental materials required to complete the installation, testing & commissioning of complete lighting system for successful operation, & to the satisfaction of purchaser/ NTPC (customer). Supply scope of these items shall form part of the installation rates quoted for the item.

Some of the item have already been undertaken by the earlier electrical agency and therefore balance works left in some items. Vendor is requested to kindly go to the site and contact BHEL engineer for exact scope of work in balance item works.

The tentative scope of E&C work includes:

1. Cable tray & Accessories. (balance works)
2. HT/LT power cables (generally arm/unarmoured), LT control cables, instrument cable (generally arm/unarmoured, screened or unscreened).
3. Junction boxes for electrical, Control & Instrument system and push button.
4. Structural steel.
5. Switchgears / MCC/Bus duct (balance works)
6. Starter panel/Local starter boxes/Power distribution boxes /marshalling boxes. DCS panels, control & instrument panel, LIE, LIR, VFD etc. (balance work)
7. HT/LT Bus Duct (Balance works)
8. 12.54 MVA Transformer & Dry type Transformer (Balance work)
9. Erection and commissioning of 220 V DC and 24 V DC Battery system and Chargers, UPS, DCDB etc (balance work)
10. Testing & commissioning of DG set
11. Erection and commissioning of Earthing & Lightning Protection system.
12. Erection and commissioning of Station lighting system (balance works)
13. Erection and commissioning of Control panels. (balance works)

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Chapter II: Scope of Works

14. Erection and commissioning of Fire Detection and Alarm system.
15. Others equipment.

2.1 GENERAL REQUIREMENTS

- 2.1.1 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.
- 2.1.2 The work to be carried out under the scope of this specification covers the complete work of loading, handling, transporting, unloading, preassembly, erection, calibration, testing, air flushing, pre commissioning tests, commissioning of systems, trial run of various auxiliaries and equipment, achieving various milestones till handing over of the unit to BHEL's NTPC (customer). The work shall conform to dimensions and tolerances specified in various drawings that will be provided during the erection. If any portion of the work is found to be defective in workmanship or not conforming to drawings or other specifications, the contractor shall dismantle and re-do the work duly replacing the defective materials at his cost, failing which the work will be got done by engaging other agencies or departmentally and recoveries will be effected from contractor's bills towards expenditure incurred including approx. 30% departmental charges.
- 2.1.3 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.
- 2.1.4 The work shall be executed under the usual conditions affecting major power plant construction and in conjunction with numerous other operations at site. The contractor and his personnel shall cooperate with personnel of BHEL, BHEL's NTPC (customer), NTPC (customer)'s consultants and other contractors, coordinating his work with others and proceed in a manner that shall not delay or hinder the progress of work of the project as a whole.
- 2.1.5 The work covered under this specification is of highly sophisticated nature, requiring the best quality workmanship, supervision, engineering and construction management. The contractor should ensure proper planning and successful & timely completion of the work to meet the overall project schedule. The contractor must deploy adequate quantity of tools & plants, modern / latest construction aids etc. He must also deploy adequate trained, qualified and experienced supervisory staff and skilled personnel.
- 2.1.6 Contractor shall erect, align and commission all the equipment and auxiliaries as per the sequence & methodology prescribed by BHEL depending upon the technical and project 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.
- 2.1.7 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.
- 2.1.8 The work shall conform to dimensions and tolerances specified in the various drawings / documents that will be provided during various stages of erection. If any portion of work is found to be defective in workmanship, not conforming to drawings or other stipulations due to contractor's fault, the contractor shall dismantle and re-do the work duly replacing the defective materials at his cost, failing which the work will be got done by BHEL and recoveries will be effected from the contractor's bills towards expenditure incurred including cost of materials and approx. 30% departmental overheads of BHEL.

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- 2.1.9 BHEL reserves right to recover from the contractor any loss, which arises out of undue delay/ discrepancy/ shortage/ damage or any other causes due to contractor's lapse during any stage of work. Any loss to BHEL due to contractor's lapse shall have to be made good by the contractor.
- 2.1.10 All transport equipment, handling equipment, tools, tackles, fixtures, equipment, materials, manpower, supervisors/ engineers, consumables etc., except otherwise specified as BHEL scope of free issue, required for this scope of work shall be provided by the contractor. All expenditure including taxes and incidentals in this connection will have to be borne by him unless otherwise specified in the relevant clauses. The contractor's quoted rates should be inclusive of all such contingencies. BHEL Stores is approximately 2-3kms away from the FGD site.
- 2.1.11 During the course of erection, testing and commissioning certain rework / modification / rectification / repair / fabrication etc., may become necessary on account of feedback / revision of drawing. This will also include modifications / re-works suggested by BHEL / NTPC (customer) / other inspection group. Contractor shall carry out such rework / modification / rectification / fabrication / repair etc., promptly and expeditiously. Daily log sheets signed by BHEL engineer and indicating the details of work carried out, man-hours etc. shall be maintained by the contractor for such reworks.
- 2.1.12 All works such as cleaning, leveling, aligning, trial assembly, dismantling of certain equipments / components for checking and cleaning, surface preparation, fabrication of sheets, tubes and pipes as per general engineering practice and as per BHEL engineer's instructions at site, cutting, gouging, weld depositing, grinding, straightening, chamfering, filing, chipping, drilling, reaming, scrapping, lapping, fitting up etc., as may be applicable in such erection works and which are treated incidental to the erection works and necessary to complete the work satisfactorily, shall be carried out by the contractor as part of the work within the quoted rates.
- 2.1.13 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.
- 2.1.14 The contractor shall take delivery of the components, equipment, chemicals, lubricants etc from the BHEL stores/ storage area after getting the approval of BHEL engineer on standard indent forms of BHEL. Complete and detailed account of the materials and equipments after usage shall be submitted to the BHEL and reconciled periodically.
- 2.1.15 Contractor shall plan and transport equipments, components from storage to erection site and erect them in such a manner and sequence that material accumulation at site does not lead to congestion at site of work. Materials shall be stacked neatly, preserved and stored in the contractor's shed and at work areas in an orderly manner. In case it is necessary to shift and re-stack the materials kept at work areas/ site to enable other agencies to carry out their work or for any other reason, contractor shall do it most expeditiously. No claim for extra payment for such work will be entertained.
- 2.1.16 The contractor shall take delivery of equipment, materials from the storage yard/ stores/ sheds of BHEL/ NTPC (customer). He shall also make arrangements for verification of equipment, transportation up to site of work, safe custody, watch and ward of equipment after it has been handed over to him till these are fully erected, tested and commissioned and taken over by the NTPC (customer). The contractor should note that the transport of equipments to erection site, assembly yards etc. should be done by the prescribed route without disturbing the other works and contractors and in the most professional manner. Site store may be approx. 2-3 km from the site. Special equipments such as measuring and control equipments, panels, electronic items, switches, cables, conduits etc. shall be stored when taken over by the contractor in appropriate manner as per BHEL's instructions.
- 2.1.17 Plant materials should not be used for any temporary supports / scaffolding / preparing pre-assembly bed etc.

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- 2.1.18 The services, tests and support to be provided by the agency for the work mentioned in various sections of this tender are indicative and not exhaustive, and not limited to these for completion of the work in all respects.
- 2.1.19 The weight & dimension as mentioned against the individual items in Price Bid / Rate Schedules or elsewhere in the tender specification are indicative approximate and there may be variation in dimension & weight in actual supply of equipment. No rate variation shall be considered on this account.
- 2.1.20 The scope of work & description of system / equipment as given in the various clauses of this tender specification and rate schedule are only for understanding the system requirement, contractor shall note this point and assess the volume of work prior to submit the offer.
- 2.1.21 The contractor shall have total responsibility for all equipment and materials in his custody at contractor's stores, loose, semi-assembled, assembled or erected by him at site. He shall effectively protect the finished works from action of weather and from damages or defacement and shall also cover the finished parts immediately on completion of work as per BHEL engineer's instructions. The machined surfaces/finished surfaces should be greased and covered.
- 2.1.22 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.
- 2.1.23 The contractor shall make suitable security arrangements including employment of security personnel and ensure protection of all materials/ equipment in their custody and installed equipment from theft/ fire/ pilferage and any other damages and losses.
- 2.1.24 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 at contractor's risk and cost, 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, 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 at contractor's risk and cost. In such case, any expenditure over and above the withheld 1% amount will also be recovered suitably from the RA bills of vendor.
- 2.1.25 The entire surplus, damaged, unused materials, packaging materials / containers, special transporting frames, gunny bags, etc., shall be returned to BHEL stores by the contractor or as directed by BHEL Construction Manager.
- 2.1.26 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.
- 2.1.27 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.
- 2.1.28 Housekeeping in the erection and preassembly area is as important as the well-planned and orderly work. The access to site for inspection approaches by BHEL and NTPC (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 and switch yard 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.
- 2.1.29 The contractor shall handover all parts/materials remaining extra over the normal requirement with proper identification tags in a packed condition to BHEL stores. In case of any misuse or use over actual design requirements, BHEL reserves the right to recover the cost of parts/materials used in excess or misused. Decision of BHEL engineer in this regard will be final and binding on the contractor.

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- 2.1.30 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.
- 2.1.31 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.
- 2.1.32 Overhauling, cleaning, revisioning, servicing of equipment during erection and commissioning stages will be arranged by the contractor. All equipment shall be preserved and protected before and after erection as per the advice of BHEL engineer.
- 2.1.33 Contractor shall prepare Marked-Up drawings incorporating modifications and deviations from original drawings or prepare fresh sketch for actual installation / connection details if need be, that can be converted to "As-built" drawing.
- 2.1.34 **Contractor shall abide by the safety/ security rules and regulations as per the requirement of BHEL and BHEL's NTPC (customer). Contractor shall obtain information about all safety and security norms of BHEL and BHEL's NTPC (customer) well in advance. BHEL will not admit any claims whatsoever on account off Contractor's non-familiarization of site safety and security regulations.**

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2.2 BRIEF DESCRIPTION OF THE FGD SYSTEM

- 2.2.1 The FGD system shall be based on Wet Limestone Forced Oxidation process. Each unit shall be provided with an independent absorber.
- 2.2.2 Gas from terminal point on ID fan discharge duct shall be taken directly to the absorber through Booster Fans. In the absorber, SO₂ in flue gas shall be removed by a spray of recirculating slurry, pumped by slurry recirculation pumps.
- 2.2.3 Compressed oxidation air shall be blown through the slurry in the oxidation tank, to oxidize the Calcium sulphite to gypsum.
- 2.2.4 Clean gas from the absorber shall be taken to the Wet Chimney through three stage mist eliminators.
- 2.2.5 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.
- 2.2.6 The gypsum from the absorber(s) shall be pumped by dedicated gypsum bleed pumps to a common Gypsum Dewatering system consisting of two streams (2x100%) of primary and secondary hydrocyclone and 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.

2.3 TESTING, PRE-COMMISSIONING, AND POST COMMISSIONING

- 2.3.1 The contractor shall perform various activities during pre-commissioning, integrated testing, post-commissioning stages of equipment covered under this tender specification. It is responsibility of contractor to arranged tools & plants, test 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/ NTPC (customer). The testing activity may have to be repeated till satisfactory results are obtained and also to satisfy the requirement of NTPC (customer) / statutory Authority.
- 2.3.2 The contractor shall simultaneously start testing & commissioning activities for equipment's to match the mile stone activities of the project.
- 2.3.3 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.
- 2.3.4 Contractor shall cut/ open work, if needed, as per BHEL engineer's instructions during commissioning for inspection, checking and make good the works after inspection is over.
- 2.3.5 It shall be specifically noted that the contractor may have to work round the clock and in shifts during the pre-commissioning and commissioning period along with or without BHEL engineers and hence considerable overtime payment is involved. The contractor's quoted rates shall be inclusive of all these factors.
- 2.3.6 In case any rework/ repair / rectification/ modification / fabrication etc is required because of contractor's faulty workmanship which are noticed during the commissioning of, at any stages, the same shall be rectified by the contractor at his cost. If during the commissioning any improvement / repair / rework / rectification / fabrication / modification due to design improvement is required, the same shall be carried out by the contractor promptly and expeditiously.

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- 2.3.7 During the commissioning activities and carrying out various tests, if any of temporarily 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.
- 2.3.8 During this period, though BHEL/ client's staff will also be associated in the work, the contractor's responsibility will be to arrange for complete requirement of men and required Tools & Plants, Consumables, Scaffolding and approaches etc., till such time the commissioned unit is taken over for trial operations.
- 2.3.9 The contractor shall carry out any other tests as desired by BHEL engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning and commissioning, to demonstrate the completion of any part or whole of work performed by the contractor.
- 2.3.10 The pre-commissioning activities will start in a phased manner to meet the various milestones and shall continue till equipments are commissioned fully with all connected equipment / devices or handed over to NTPC (customer) for regular operation. In this duration other erection activities such as cabling etc., shall be carried out by other agencies even though equipments 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.
- 2.3.11 This contract includes all the areas for 2X500 MW which are not specifically mentioned in this TCC. Vendor is requested to visit site before quoting the price.**
- 2.4 WELDING, NON-DESTRUCTIVE TESTING ETC.**
- 2.4.1 Installation of equipment involves good quality welding, NDE checks etc.
- 2.4.2 Welder deployed for aluminium welding shall have experienced and approved by BHEL and BHEL's NTPC (customer) after due qualification process/testing.
- 2.4.3 Welding of all structural steel & aluminium shall be done only by the qualified and approved welders.
- 2.4.4 All the welders shall be tested and approved by BHEL engineer/ NTPC (customer)'s quality engineer before they are actually engaged on work though they may possess IBR/other certificate. BHEL reserves the right to reject any welder without assigning any reason.
- 2.4.5 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.
- 2.4.6 Welding electrodes have to be stored in enclosures having temperature and humidity control arrangement. This enclosure shall meet BHEL specifications.
- 2.4.7 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.
- 2.5 MEASUREMENTS & WASTAGE & CUTTING ALLOWANCES:**
- 2.5.1 For all payment purposes, measurement shall be made on the basis of the actual execution of work in line with drawings/documents/ site requirements. Physical measurements shall be made by the contractor in the presence of BHEL Engineer.
- 2.5.2 The measurement for cable, impulse pipes/tubes, GI pipe, conduits, flexible conduits, trays etc., shall be made on the basis of length actually laid.
- 2.5.3 All the surplus, scrap and serviceable materials, out of the quantity issued to the contractor shall be returned to BHEL in good condition and as directed by the engineer.
- 2.5.4 All materials returned to stores should carry aluminium tag indicating the size and type. Cables more than 15 meters length is termed as serviceable material and shall be returned size wise

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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.

- 2.5.5 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 (ies) will be taken as the net quantity (ies) 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.
- 2.5.6 For all site-fabricated steel items such as supports, racks, frame, Canopy etc. physical measurement shall be made and then converted to tonnage. For steel material supplied to the contractor, all scrap shall be returned to BHEL stores with due accounting.
- 2.5.7 Every month the contractor shall submit an account for all the materials issued to him by BHEL in the standard Performa prescribed for this purpose by the site in charge.
- 2.5.8 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;

S. No.	Item	% Wastage on issued Qty
01.	Each iron/steel section	2
02.	Each size of power cables	1
03.	Each size of control / shielded cable	2

- 2.5.9 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.
- 2.5.10 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.
- 2.5.11 NOTE:**
Salvageable scrap shall mean lengths of pipes/tube/conduits, multi core cables, other cables etc., that can be used one time or other at a later date and normally they are recovered from the cut-pieces of pipes, multi core cables, cables etc.
Non - Salvageable scrap means the lengths of tubes, pipes, multi core cables, cables etc., and they are from cut-pieces of tubes, pipes, multi core cables, cables etc., that cannot be used at all one time or other.
- 2.5.12 The rate of laying for LT power, control and signal cable is inclusive of glanding and termination at both ends. Glands & Lugs above 4sq mm shall be supplied by BHEL Lugs up to 4 sqmm 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 will be part of laying rates. No separate rate is applicable on this account.
- 2.5.13 The unit rates for the HT cable termination (if applicable) are exclusive of unit rates for laying of HT cables. Glands & termination kits for HT cables (3.3kV and above) shall be supplied by BHEL.

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2.6 FINAL PAINTING

- 2.6.1 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 NTPC (customer)
- 2.6.2 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, shot Blasting (as applicable) etc; 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 scope of painting work is for the following areas. Primer and paint shall be sourced only from the manufacturers, approved by BHEL. In order to have consistency in painting system, it is preferable that all the supplies are sourced from one single manufacturer.
- 2.6.3 All the fabricated frames, racks, supports, panel base frame etc. wherever applicable shall be painted with two coats of primer or as per painting schedule and followed by two coats of paint as specified earlier herein. In case of G I 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. The Paint required for this purpose is in scope of Contractor
- 2.6.4 Touch-up painting of LT MCC/ Control Panels or any other equipment /devices wherever necessary.
- 2.6.5 The primer shall be compatible with the final coat paint schedule.
- 2.6.6 Full (Spray) painting of transformers, bus ducts with two coats of paint as per specification
- 2.6.7 Supply of paint, primers, other consumables etc for above and any other scope in these specifications shall be in Contractor's scope.
- 2.6.8 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 is to be done by the contractor. No dispute shall be entertained on this matter.
- 2.6.9 Colour Banding, Legend and Identification Marking, Direction marking etc. shall be in scope of the contractor.

2.7 TROUBLESHOOTING DURING PLANT OPERATION

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

- 2.8 Equipment / instruments etc., under the above scope of erection and commissioning are generally dispatched from BHEL's manufacturing units / vendor's works at site well before start of erection. 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.

2.9 STATUTORY CLEARANCES

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- 2.9.1 The contractor will have following valid certificates:**
- 2.9.2 The contractor will have the applicable valid Contractor Electrical License for Applicable Voltage System to work in Maharashtra State. All the fees and expenses in this regard shall be to the contractor's account.
- 2.9.3 Supervisory Competency Certificate of Applicable Voltage equipment for their erection, testing & commissioning for work in Maharashtra State. During the execution of work minimum two persons should be posted at site who have valid Supervisory Competency Certificate.
- 2.9.4 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.
- 2.9.5 Obtaining Statutory Approvals for Electrical Inspector or any other Governing Agency is included in the contractor scope.
- 2.9.6 Contractor should have obtained valid Electrical Contractor-ship License to carry out the Erection, Testing & Commissioning work on High/ Low Voltage electrical equipment from the appropriate statutory authority of concern state or Central Electricity Authority, as the case may be. All fees and expenses in this regard shall be in the contractor's account.
- 2.9.7 Contractor shall arrange inspection of concerned Statutory Authority for the installation, testing & commissioning of High/ Low voltage equipment covered under this tender specification and obtain their approval in appropriate format prior to charging of the equipment.
- 2.9.8 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 NTPC (customer) shall be providing technical assistance, drawing & document for submission to Statutory Authority. Contractor shall provide all logistics services in this regard.
- 2.9.9 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 applicable appropriate State or Central Statutory Authority. Contractor shall submit the particulars of Licenses held by him.
- 2.9.10 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.
- 2.9.11 If more than 20 nos. labor are employed by contractor for subject work, then labour license has to be obtained.
- 2.9.12 Compliances of All statutory formalities related to labor law, local laws, etc. is must. Registration of EPF, ESIC, PMJJBY, PMSBY is must for all labors shall be employed for subject tender.
- 2.9.13 RABs must be submitted with all supporting documents like – Signed protocol / log sheet, Wage certificate, EPF, ESIC, ECS, PMJJBY, PMSBY, etc. and other documents as per instruction of BHEL site engineer.
- 2.10 GATE PASS FORMALITIES**
- 2.10.1 The contractor shall make his own arrangements of gate pass for his vehicles, T&Ps etc. as prescribed and instructed by the other security/CISF at his own cost, each gate pass has to be endorsed by the other security / 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 other security /CISF at the end of the project all the gate passes endorsed by the other security / CISF for use of the contractor's vehicle, T&Ps shall have to be returned.
- 2.10.2 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

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- vehicles. Gate pass formalities may take some time, so contractor has to plan well in advance accordingly.
- 2.10.3 The contractor shall make his own arrangements of gate pass for his employees / workers as prescribed and instructed by the other security /CISF at his own cost, each gate pass has to be endorsed by the other security / 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 other security / CISF. At the end of the project all the gate passes endorsed by the other security / CISF for use of the contractor's employees shall have to be returned.
- 2.10.4 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.
- 2.10.5 PPEs and Dangri is must for all workers and staffs working inside NTPC (customer) premises. Contractor has to arrange all these for their worker and staffs at their own cost.
- 2.10.6 **Deployed electricians should have valid qualification & valid electrical license for gate pass .**

The contractor's scope of work is further described in the clauses hereafter:
The work will comprise of, but not limited to the following:

GENERAL:

Accepted unit rates for each SWGR/ 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 SWGR/ panel shall be based on following modality. Decision of BHEL shall be final & binding on bidder.
For variation in length within +/- 15% of SWGR/ panel, accepted unit rates shall remain firm.
For variation in length of SWGR/ 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.
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.
Length of SWGR/ panel as indicated in tender = A.
Accepted unit rate for SWGR/ panel = Rs B.
Rate per unit length (L) to be considered for the purpose of additional payment/ recovery for variation in length = Rs B/A = Rs C.
Actual length of the SWGR/ panel = D.
Additional payment/ recovery in unit rate for variation of length beyond length (1.15A/ 0.85A) = (D-1.15A)/ (0.85A-D) x C.
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.
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.
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 of for new cable.
Rate for termination of new size cable and other items will be derived based on mutually agreed modality and on approval of BHEL.

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2.11 CABLE TRAYS/ CABLE DUCTS WITH SUPPORTS AND ACCESSORIES

- 2.11.1 Various types of sheet metal, galvanized cable tray, i.e. Perforated, ladder type, sheet metal duct, solid bottom tray, pre-fabricated structural trays etc. shall be provided in standard lengths along with accessories like hardware, bends, reducers, coupler plate, tray covers and tray clamps etc. Tightening/ fastening of tray clamp shall be under contractor's scope.
- 2.11.2 Installation of cable tray/ cable duct shall include cutting, laying, jointing, supporting, drilling holes in the support, fixing tees/ reducers/ bends/ clamps/erection of cantilever/Arm/Base plates/CC1 & CC2 clamps/ single Channel and double channel etc as per tray route layout, fabrication of bends/ tees/ reducers from straight length, fixing of tray covers, welding of tray on support, cleaning and application of cold galvanizing paint 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.
- 2.11.3 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 meters). All site welds of cable trays shall be painted with approved primer and cold galvanizing paint, which shall be arranged by the contractor.
- 2.11.4 Rate of erection of CC1 and CC2 clamps are included in rate of erection of cable trays. Vendor to quote accordingly. No extra rate shall be given for CC1 & CC2 clamps erection.
- 2.11.5 Before start of work support structure/ cable tray work in cable vault, the existing cables of fire alarm system, power and control cables are to be protected to avoid the damage from fire, cutting welds and etc.
- 2.11.6 "Structural steels for support" materials are supplied to make supports for cable trays (in the buried RCC trenches, overhead tray arrangement on pipe racks and cable tray arrangement in cellars & other arrangements as applicable for the project. These are also required for making of frames for PB stations, junction boxes as per the project requirements. Drilling of holes in ISA for bolting of cable trays shall be done by Erection Agency. The holes in the cable trays shall be provided by the cable tray vendor, however in case of requirement of additional holes to be drilled for Cable Trays for the purpose of Cable Tray erection, same shall be done by the Erection Agency. Erection Agency shall ensure that all steel structure used for Electrical installation shall be painted with one coat of Red Oxide Zinc Chromate Primer of approved shade for indoor installations. Supply of Red Oxide Zinc Chromate Primer for site painting of all structural steels (required for cable tray supports) shall be in the Erection Agency's scope. Erection Agency shall ensure that after welding and drilling (if any) of the steels bracket, above mentioned paint of approved shade shall be applied. The structural steel work shall be carried out in line with the NTPC (customer)'s/ consultant's technical specifications.
- 2.11.7 In case cable trays are required to be fabricated from structural steel and installed, unit rate applicable for fabrication and installation of structural steel shall be applicable in such instance. The work will commence
- 2.11.8 Cable trays/ ducts etc. may have to be routed underground in cable trench, over head on structure, along the walls, floors etc. for various applications such as cable laying, conduits, thermocouple, temperature gauge etc.
- 2.11.9 Cutting and rerouting shall be carried out within the quoted rates for completion of work.
- 2.11.10 The cable trays shall be supported in general at a span of 1.5m horizontally and at a distance of 1m vertically.
- 2.11.11 All sharp edges and burr shall be removed.
- 2.11.12 Cable tray on the top tier shall have cover whenever running below pipes.
- 2.11.13 Cable trays shall be numbered as per layout drawing before laying of cables.

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- 2.12 CABLE LAYING (POWER/ CONTROL/ INSTRUMENTATION: SHIELDED/ UNSHIELDED/ PLUG-IN/ COAXIAL/ UTP/ STP/ DATA HIGHWAY, ARMoured/ UN-ARMoured, SINGLE/ MULTI-CORE, PVC/ HR PVC/ FRLS/ TEFLON/ PTFE/ XLPE INSULATION, OPTICAL FIBER, ETC.)**
- 2.12.1 Cable laying includes cutting to the required length, laying in overhead cable racks/ underground cable trench/ pipes/ flexible conduits, dressing/ clamping in tray, drilling of holes in gland plates in panels and junction box, glanding, splicing, dressing of spliced wire inside the panel and JBs, providing PVC numerical/ alphabetical/ printed ferrules, termination by using crimp type copper tinned/ aluminium lugs, insulated/ un-insulated, termination (crimp, soldering, etc.), plug-in connections with insert type crimping, providing identification PVC/ aluminium cable tags continuity checking, insulation resistance checking, high voltage test on HT cables. Contractor to arrange adequate numbers of his own ferrule printing machines.
- 2.12.2 All cables shall be provided with minimum of 2mm thick aluminium sheets as cable identification tags indicating cable designation in accordance with the cable schedule. The cable tags shall be provided at the ends as per cable schedule, when the cable changes direction/ elevation. The cable tags shall be of aluminium with the 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, cable may also provide cable tags made of nylon, cable marking ties with cable number heat stamped on the cable tags.
- 2.12.3 For buried cable, the marker shall project at least 150mm above ground and shall be spaced at an interval of 20m and at every change of direction.
- 2.12.4 All the cables shall be clamped to the cable trays/ support structure with the help of clamps. Cables to be strapped to tray at interval not greater than 300mm. All power cables shall be clamped individually and control cables shall be clamped in groups of 3 or 4 cables. Clamps for multicore cables shall be fabricated out of 25x3mm aluminium flats. Single core power cables shall be laid in trefoil formation and suitably clamped with Al cast/ Glass Fiber Clamp. All sharp edges and burr shall be removed. Erection Agency shall carry out the plant cabling works in line with NTPC (customer)/ consultant's Technical Specification.
- 2.12.5 Cables to be strapped to tray at interval not greater than 300mm.
- 2.12.6 Laying of Power, Control, DC supply Cable and Signal Cables are to be laid as per identified cable tray. In case of non-availability of cable tray, cable shall be laid with permission of BHEL.
- 2.12.7 Laying, etc. of Optical fibre cables on cable trays/ cable trench shall necessarily be done using flexible conduit.
- 2.12.8 Damaged cable drums also to be used within the quoted rates. No extra compensation for difficulty in cable laying due to damaged drums shall be made.
- 2.12.9 Entry to the panels and JBs may be at top, sides or bottom. All cables are required to be properly supported and clamped near to the JB/ Panel.
- 2.12.10 Spare holes in the panels/ Instruments/ Actuators/ Motors/ JBs/ etc. shall be sealed by the contractor using suitable method (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).
- 2.12.11 Wherever cable glanding is not possible, either due to the gland plate size limitations or more number of cable entries, 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.
- 2.12.12 Copper tinned lugs of various types (pin, ring, fork, snap-on) up to 4 sqmm conforming to IS: 694, PVC cable ties, PVC ferrules, PVC button and tapes, cable identification tag of PVC/ metallic as per site requirement, clamping and dressing material such as suitable cable ties/ clamps (25 x 3 mm Aluminium Flat) etc. with hardware, PVC sleeves etc. shall be supplied by the contractor

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- within the quoted rates for cable laying. Single core power cable shall be laid in trefoil formation. The quality of material shall be approved by BHEL engineer prior to their use on the job.
- 2.12.13 All care should be taken to avoid abrasion, tension, twisting, kinking, stretching of cables during installation.
- 2.12.14 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 panel or JB's, PVC sleeves are to be used to avoid two-point earthing.
- 2.12.15 Wherever cables run through ducts, conduits, valves, etc., they shall be sealed using fire/ weather proof compound. In addition to this, cable entry in panels, MCCs, instruments, electrical actuators etc., are also required to be sealed. The required material for doing so shall be included by contractor in the cabling scope.
- 2.12.16 Many of the cable trays and cables have to be laid in cable trenches. For this purpose, the covers of the trenches have to be opened for working at site and whenever the cables are to be laid in existing cable tray, all safety precautions have to be observed.
- 2.12.17 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.
- 2.12.18 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.
- 2.12.19 Contractor shall carefully plan the cutting schedule of each cable drum in consultation with site engineer such that wastages are minimized. In any case, the wastage shall not exceed the limits mentioned in this contract. Recovery will be made in case the wastages are exceeding the wastage allowances fixed in this contract.
- 2.12.20 In case of HT cable, cutting schedule is to be followed as provided by BHEL.
- 2.12.21 The HT/ LT Power and control cabling work shall be carried out in advance so that same can be terminated at panel end as the clearance is ready from the panel E&C side.
- 2.12.22 The termination and connection of cables shall be carried out strictly in accordance with manufacturer's instruction, drawings, and/ or as directed by the BHEL. The work shall include all clamping, fitting, fixing, soldering, tapping, compound filling, cable jointing, crimping, shorting, and grounding as required for the complete job. Cables shall be checked for insulation resistance before and after jointing. All erection consumables shall be in Erection Agency's scope. Termination and connection shall be carried out in such a manner as to avoid strain on the terminals. Cables shall be marked with cable numbers as per applicable drawing.
- 2.12.23 Control cable cores entering control panel/ switchgear/ MCC etc. shall be neatly bunched and served with PVC perforated tape to keep it in position at the terminal block.
- 2.12.24 Cable glands and lugs are being supplied along with corresponding equipment like Motors, LT Switchgear, Junction Boxes, PB stations, and transformers etc.
- 2.12.25 Termination and connection shall be carried out in such a manner as to avoid strain on the terminals. Cables shall be marked with cable numbers as per applicable drawing.
- 2.12.26 All cable entry points shall be properly sealed and made vermin proof and dustproof. Unusual opening, if any, shall be effectively closed. Sealing work shall be carried out with approved sealing compound having fire withstand capability for at least 03 hours.
- 2.12.27 The rate of laying for LT power, control and signal cable is inclusive of glanding and termination at both ends.
- 2.12.28 The LT Power, Control and Signal Cable straight through Jointing Kits (if required) shall be in Contractor's scope of supply. The rate of supply, and erection of these kits will be part of laying rates. No separate rate is applicable on this account.
- 2.12.29 The unit rates for the HT cable termination are exclusive of unit rates for laying of HT cables. termination kits for HT cables (3.3kV and above) shall be supplied by BHEL.
- 2.12.30 Ferrules shall be installed on all control cables cores in all junction boxes and at all terminations. The ferruling shall be cross ferruling. The ferrules shall carry terminal numbers as per drawings.

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All ferrules shall be coloured, plastic & interlocked type. Spare cores shall also be similarly ferrules, crimped with lug and aped on the ends. Spare cores shall be ferruled with individual cable number, crimped with lug and aped on the ends.

- 2.12.31 Terminal Connections: The types of cable terminations are generally as detailed below:
- a. All JB's are both side screw type.
 - b. All console tiles wiring: screwed or plug-in type to be fabricated at site.
- 2.12.32 For removal of existing Cables, Cable Induction meter of applicable Voltage is mandatory to confirm that the cable is charged or not.
- 2.12.33 Unit rate quoted for cable lying shall include the activities as defined above.

2.13 JUNCTION BOXES/ PUSH BUTTONS

Different types of junction boxes and Push buttons are to be erected by the contractor. The Push buttons are to be located at the locations jointly decided at site during erection or as per approved drawing. The push buttons are to be erected on the frames fabricated at site. Brief work will include:

- a. Checking of installation for correctness.
- b. Functional checking/ adjustment of JB/ PB for their system.
- c. Hardware for erection (Like Nuts, Bolts and Washers etc.) where ever is required shall be in the scope of the contractor.

2.14 LAYING OF PIPES AND TUBES (IMPULSE PIPE & INSTRUMENT AIR PIPE)

- 2.14.1 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.
- 2.14.2 Installation of impulse pipe of CS/ AS/ SS material shall include cleaning, air flushing, cutting to length from running meter, edge preparation, cold bending, welding of sockets/ reducers/ tee/ cross/ isolating valves/ union, nut and tail pieces/ nipples, condensing and other pots, etc., mounting of SS/ CS valve manifolds and compression fittings, providing supports, clamping, conducting leak test/ hydraulic pressure test, conducting RT/ UT and painting (refer relevant clause of TCC for details) .
- 2.14.3 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.
- 2.14.4 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.
- 2.14.5 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 drain pot/ check valves/ isolating valves, supporting clamping, conducting leak test and also seal welding of threaded joints, if required.
- 2.14.6 Threaded joints of airline shall be made leak proof by using Teflon tapes or sealing compound. All consumables (for leak proof) shall be in the scope of contractor.
- 2.14.7 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.
- 2.14.8 Contractor shall provide GI "U" clamps for impulse pipe and GI pipes within the quoted rates for installation of the same.
- 2.14.9 Impulse pipes shall be painted.
- 2.14.10 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.

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- 2.15 STRUCTURAL STEEL FABRICATION AND INSTALLATION (Instrument/ Junction Box Frame/ Panel Base Frame/ Cable Tray & Misc. Structures Fabrication)**
- 2.15.1 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 for fabrication of Local Instrument Racks, panel base frame, cable tray supports, Canopies for instruments/ panels/ drives/ JBs/ Push Buttons etc., Instrument/ Junction box frames, Impulse Pipe/ Instrument Air Pipe supports and instruments etc.
- 2.15.2 This shall include cutting to size, contouring of ends for connections if required, welding, grinding of excess weld deposits/ burrs, drilling of holes for mounting of device/ instrument, installation at location, levelling, alignment, providing bracings and painting etc. No gas cut holes will be permitted. Contractor to follow the BHEL supplied welding schedule and welding procedures.
- 2.15.3 In case, structural cable trays, bends, tees, reducers etc., are required to be fabricated from structural steel and installed, unit rate applicable for fabrication and installation of structural steel shall be applicable in such instances.
- 2.15.4 Frame installation/ cable tray accessories' installation at site may involve mounting either on concrete floor by grouting/ using anchor fasteners or on steel structure by welding etc. All consumables including anchor fasteners shall be arranged by the contractor. 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.
- 2.15.5 In certain packages, galvanized members of junction box frames and instrument racks shall be supplied in cut to sizes and frame assemblies are required to be done as per drawing by bolting/ welding. The installation rate as quoted shall include the assembling of the frames.
- 2.15.6 In certain packages, members of frames/ rack for mounting of junction boxes/ instruments may be supplied readymade. These have to be assembled prior to installation. The installation rate as quoted shall include assembly of the frames.
- 2.15.7 Gas cutting of tray/ impulse pipe support and holes in frame is not permitted. Only hacksaw cutting/ drilled hole shall be permitted.
- 2.15.8 All the fabricated supports/ frames for instruments, brackets/ racks, support steel work for tubing impulse lines/ instruments trays, pipes, electrical equipment, etc., shall be epoxy painted after shot blasting (as applicable) and surface preparation as per painting specifications. Paints and other associated items are in the scope of the contractor.
- 2.15.9 Hardware for erection (Like Nuts, Bolts and Washers, etc.) where ever is required shall be in the scope of the contractor.
- 2.16 METAL CHANNEL FLEXIBLE BOLT-ABLE CABLE SUPPORT SYSTEM**
- 2.16.1 Flexible GI cable support system, consisting of single/ double channels, base plates, and cantilever arms. 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°.
- 2.16.2 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 inclusive in quoted rates for erection of support channel and cantilever arm.
- 2.16.3 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.
- 2.16.4 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.
- 2.16.5 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

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position to ensure alignment of clamps/ channels. Weld thickness shall be 6 mm minimum. In case steel surface is not available for welding, anchor bolts are to be used for fixing the base/ angle fitting.

- 2.16.6 Main support for longitudinal cable tray run in the cable vaults shall be fixed at both ends at top as well at bottom as outlined above.
- 2.16.7 Galvanisation damaged due to welding/ cutting shall be re-painted with cold galvanising paint (supply of paints is in contractor's scope).
- 2.16.8 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.

2.17 INSTALLATION OF PANELS (STARTER PANEL/ LOCAL STARTER BOX/ POWER DISTRIBUTION BOX/ MARSHALLING BOX/ CONTROL PANELS)

- 2.17.1 Electrical control panels, electronic control panels, 415-volt LT MCCs etc., are normally supplied in suite of either one/ two/ three or loose shipping sections with integral base frame or loose base frame. These panels may have to be installed as stand-alone or in-group consisting of number of panels in each row, depending upon the plant layout and foundation arrangement.
- 2.17.2 The panels shall be transported from stores to the place of installation in vertical position. Care shall be taken such that the switches, lamps, instruments etc. mounted on the panel do not get damaged during transit.
- 2.17.3 Installation of panel shall include fixing of base frame, levelling, alignment, fixing of anti-vibration pads, removal of side covers, fixing of cubical interconnection hardware, interconnection of bus bar/ bus bar jointing, wiring interconnection, welding and grouting of panels and base frames, mounting of panel canopy wherever supplied as part of panel, drilling of gland plates, sealing of panels/ cable entries. Where the base frame is not supplied as part of panel supply, the contractor shall fabricate the base frame from structural items at site. Payment for such fabrication will be effected on measured quantity at the rate applicable for structural steel fabrication and installation. Proper sealing of all the holes and cable entries (even if the cable has been laid by others) in the panel is in the contractor's scope.
- 2.17.4 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.
- 2.17.5 Panels have to be shifted to their locations through floor openings, temporary openings like floor grills, door etc. This shall be a part of work and no claim whatsoever will be entertained with regard to non-availability of opening as per shortest route etc. Panels have to be erected at different locations and elevation in depending on the detailed engineering.
- 2.17.6 Panel and instruments once erected in position should be properly protected using necessary care to prevent ingress of dust/ moisture and rainy water. This will have to be periodically cleaned and surroundings have to be kept tidy.
- 2.17.7 Whenever the panels are to be mounted on cable trenches, channel supports have to be provided across the cable trench over which the base frame of panel shall be mounted. For such work, structural steel fabrication & installation rate shall be applicable.
- 2.17.8 Normally the panels shall be supplied with instruments, relays, meters, electronic modules, contactors, push buttons, etc. mounted and pre-wired. However, if these are supplied loose/ separately for safety in transit, contractor shall mount and 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.

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- 2.17.9 Supplier's instruction manuals, packing slips, door keys etc. received along with the panels will be handed over to BHEL's engineer on opening of the panels and record of receipt of such things shall be maintained by contractor.
- 2.17.10 Regular cleaning of the panels as per the instruction of BHEL engineer till handing over of the set to NTPC (customer) is to be carried out by the contractor free of cost.
- 2.17.11 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.
- 2.17.12 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.
- 2.17.13 Interposing Relays (24/ 48 Volt DC) along with mounting base if supplied shall be supplied separately for mounting in the various feeders of 11kV/ 3.3kV HT switchgear boards and 415 Volt MCC Board for unidirectional/ bi-directional drives, solenoid valves.

2.18 CONTROL PANELS

Station C&I system panels are based on maxDNA/ metso DNA distributed digital control philosophy. MaxDNA/ 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.

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 transportation, cable laying, termination, E&C and placement of furniture (Computer tables, Computer Chairs & Printer table) against each device as given in the rate schedule.

2.19 BATTERY/ BATTERY CHARGER/ UPS

- 2.19.1 Ni-Cd/Lead Acid (or similar type) 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.
- 2.19.2 In case of Ni-Cd (or similar type) batteries are normally supplied in charged condition, due care shall be exercised while handling/ installation of the same. If the battery charge is found to be less than the required level, the charging/ discharging cycle shall be carried out as per instruction of BHEL engineer.
- 2.19.3 Battery charging/ discharging is a continuous process and skilled manpower shall be deployed by the contractor round-the-clock.
- 2.19.4 Contractor shall arrange suitable load, cables, safety equipment and consumables for discharging the battery during charging and discharging cycle at his cost.
- 2.19.5 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 NTPC (customer) and record of the same shall be maintained and submitted before handing over of the system.

2.20 FIELD INSTRUMENTATION

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- 2.20.1 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.
- 2.20.2 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 NTPC (customer).
- 2.20.3 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 NTPC (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.
- 2.20.4 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.
- 2.20.5 Installation of instrument shall also include drilling of holes and tapping for mounting of instrument and local instrument frames/ panels and supply of hardware for mounting of the instrument.
- 2.20.6 Some devices like solenoid valves, position feedback transmitters, limit switches, air filter regulators 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.
- 2.20.7 Transmitter enclosure/ open racks (LIE/ LIR) 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.
- 2.20.8 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.
- 2.20.9 For the very few cases where required, the contractor shall carry out re-orientation of bottom/ top entry arrangement for process connection if needed due to site condition in existing instrument rack/ enclosure/ JB and re-location of existing instrument including removing of the existing tubing and re-installation of the same at appropriate location due to any change in grouping of the instrument and no extra payment shall be applicable.
- 2.20.10 In certain cases, instruments/ devices are supplied on equipment or drawn by other agencies as part of mechanical package. The same are to be received or to be collected from other agencies for keeping in safe custody to avoid damages. The same are to be erected back after calibration

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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.

2.21 UNIT CONTROL DESK AND COMPONENTS

- 2.21.1 Unit control desk will be supplied in a single shipping section for erection at site.
- 2.21.2 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.
- 2.21.3 Wherever control desk/ panel is not supplied by BHEL or is in NTPC (customer) scope of supply and installation, loose item supplied by BHEL if any, shall have to be mounted by the contractor.
- 2.21.4 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.
- 2.21.5 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.

2.22 MISC. OTHER INSTRUMENT/ EQUIPMENT ERECTION, CALIBRATION AND COMMISSIONING.

- 2.22.1 Wherever panels & control valves have been erected by the mechanical contractor, calibration/ commissioning has to be carried out by the contractor.
- 2.22.2 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.
- 2.22.3 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.
- 2.22.4 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.
- 2.22.5 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.

2.23 GUIDELINES FOR ERECTION

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2.23.1 Impulse Pipelines

- a. 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.
- b. The routing of pipe lines shall include sufficient flexibility near tap off points to allow for thermal expansion of process equipment.
- c. The pipes shall be cold bent using hydraulic bending machines only.
- d. The horizontal impulse lines shall be laid with proper slopes towards the tapping point. Two root valves are to be used wherever pressure is more than 40 kg/cm² or Temp>280 °C .
- e. Supports for piping and tubing shall be adequate and in no case exceed limits shown below: -

1	1/2" NB pipe/ tube	5 ft.
2	3/4" NB pipe/ tube	5 ft.

- f. All CS impulse line welding shall be done through welding generator/ rectifier and only structural welding may be done with welding transformer.
- g. Impulse pipes of alloy steel/ SS/ carbon steel etc. shall be TIG welded. Contractor shall arrange for necessary TIG welding sets, electrodes etc.
- h. 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.
- i. Testing
On completion of pipeline installation, the pipelines shall be hydraulically tested. Contractor shall arrange for water filling pump, hydraulic test pump and standard gauges and conduct the test satisfactorily.
- j. 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 is less, in 30 minutes and there shall be no leaks at any of joints/ welds when isolated from source of pressure.
- k. All weld joint in CS, SS, AS (High Pressure) line are subject to 100% radiography test with minimum two shots per joint.

2.23.2 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.

2.23.3 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.

2.23.4 Instruments and Equipment

- a. 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.
- b. 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.
- c. 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.

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- d. 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.
- e. Contractor shall arrange for own firefighting equipment for the materials stored under contractor's custody.

2.23.5 Sub-assemblies

- a. All subassemblies should be kept in a separate place where it is easily accessible.
- b. Subassemblies should have a protective cover in case it is stored without wooden packing/ case to prevent accumulation of dust. Silica gel packets should also be kept along with it.
- c. Subassemblies should not be stacked one above the other.

2.23.6 Loose items

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

2.23.7 Guidelines for handling of electronic modules

- a. All the electronic modules shall be handled by qualified persons only.
- b. Electronic modules should only be touched when it is absolutely essential to do so.
- c. 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.
- d. The operator should not wear clothing made entirely from synthetic fibres, but a mixture containing at least 65% cotton.
- e. The PCB should always be held by front panel or by module frame and electronic components/ connectors should never be touched.
- f. The electronic modules should not be placed close to television sets or CRT units.
- g. Soldering irons and any other tools used must be grounded.
- h. 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.

2.23.8 Welding, Non-destructive testing etc.

- a. Installation of equipment involves good quality welding, NDE checks etc.
- b. Welder deployed for aluminium welding shall have experienced and approved by BHEL and BHEL's NTPC (customer) after due qualification process/ testing.
- c. Welding of all structural steel & aluminium shall be done only by the qualified and approved welders.
- d. All the welders shall be tested and approved by BHEL engineer/ NTPC (customer)'s quality engineer before they are actually engaged on work though they may possess IBR/ other certificate. BHEL reserves the right to reject any welder without assigning any reason.
- e. The welded surface shall be cleaned of slag and painted with primer paint to prevent corrosion. For this paint will be supplied by the contractor.
- f. Welding electrodes have to be stored in enclosures having temperature and humidity control arrangement. This enclosure shall meet BHEL specifications.

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- g. Certain types of coated welding electrodes, prior to their use, call for baking for specified period and will have to be held at specified temperature for specified period. Also, during execution, the coated welding electrodes have to be carried in portable ovens.

2.24 ELECTRICAL CABLING, EARTHING AND ABOVE GROUND EARTHING

2.24.1 ELECTRICAL CABLING/ WIRING

- a. All the cables will be properly laid in cable trays, dressed and clamped with aluminium flats. The cable will be terminated at both ends with suitable lugs and printed ferrules and will be glanded properly. Suitable equipment and consumables for ferrule printing has to be arranged by the contractor at his own cost. For cable identification, the contractor shall provide at his cost aluminium tags at regular intervals (as per cable schedule) through each run of cable.
- b. All electrical connections shall be tested for polarity and proper connections.
- c. Insulation test of the various circuits shall be done.
- d. The checking of operation of individual equipment and instruments to which the cabling/ wiring connected shall also be done by the contractor.
- e. Wherever supplied, GI cable trays shall be of bolted construction only with fixing screws and coupler plates.
- f. Sharp bends of cable trays shall be avoided in all type of cable trays.
- g. 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.
- h. Ladder perforated type cable trays shall be used in cable trenches and vertical risers.
- i. Perforated cable trays shall be used in higher elevations in Boiler and Generator area.
- j. 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.
- k. Where power and control cables are to be laid in the same route, suitable barriers to segregate them physically shall be employed.
- l. Space equal to the diameter of cable shall be provided between power cables of six over 50 mm in diameter.
- m. When cables pass through floors, walls etc., it shall be passed through a pipe for mechanical protection and the pipe ends sealed suitably.
- n. 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.
- o. 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.
- p. No cable shall be laid in ducts or trenches where other services such as oil pipes, steam or water pipes are laid.
- q. Where cabling passes through brickwork or concrete work, the contractor shall provide suitable local protection against mechanical damage wherever necessary.
- r. 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.
- s. 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.
- t. 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, will be provided by BHEL. The contractor shall design number of cable/ racks to accommodate the cables on racks/ trays properly.
- u. Detailed specification shall be as per instruction of site engineer.

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2.24.2 EARTHING INSTALLATIONS

- a. All equipment shall be earthed by two separate and distinct connections. Earthing terminals will be available in all equipment supplied by BHEL.
- b. The earthing conductors shall be of mild steel/ GI strip/ wires. All connections from equipment to main earthing conductors shall be made as illustrated in earthing drawing/ as per instruction of BHEL engineer. Suitable "Cu" Lugs are to be supplied for earthing with GI wire by the agency where ever is required.
- c. A continuous earthing conductor shall be installed in all cable trays and securely clamped to each tray section by suitable connectors to form a continuous earthing system. When two or more trays supporting power cables run in parallel, a continuous earthing conductor shall be provided on trays only with tap offs to the control cable trays. All valve and damper motors and rapping motors will be earthed to this conductor.
- d. All joints in the earthing system shall be welded type. Earthing connections to all equipment including motors shall be bolted type.
- e. Earthing connections shall be free from tinning scale paint, enamel, grease, rust or dirt at the time of making joint.
- f. Metallic sheaths, screens/ shields and armour of all multicore cables shall be bonded and earthed.
- g. Earthing conductors along their run on columns, beams, walls etc. shall be supported by suitable cleats at intervals as specified by BHEL site engineer.
- h. Welded joints on GI earthing conductors shall be painted as mentioned in the Typical Arrangement drawing.

2.24.3 ABOVE GROUND EARTHING

- a. The contractor shall carry out above ground earthing for all Electrical equipment, which may be erected by him, or some other agency. Different type of earthing materials shall be supplied and the contractor shall lay and connect the earthing materials as per site requirement and as detailed in drawings. Unit rate for earthing material shall be paid on running meter basis.
- b. All equipment shall be earthed by two separate and distinct connections. Earthing terminals will be available in all the equipment supplied by BHEL.
- c. Parts of all electrical equipment and machinery not intended to be live shall have two separate and distinct earth connections each to conform to the stipulation of the Indian Electricity Rules and apparatus rated 240V and below may have single earth connections.
- d. Generally, risers are provided near the structure/ equipment foundation, in case risers are not visible and buried below the foundation level, contractor shall carry out necessary earth excavation for connecting the above ground earthing strips. Wherever welding is involved necessary protective coating shall be applied on weld joints.
- e. The earthing conductors shall be mild steel/ G.I. strips/ wires. All connections from the equipment to the main earthing conductors shall be made as illustrated in earthing drawings. A copy of earthing drawing shall be provided to the successful bidder.
- f. A continuous earthing conductor shall be installed in all cables trays and securely clamped to each tray section by suitable connectors to form a continuous earthing system. When two or more trays supporting power cables run on parallel a continuous earthing conductors shall be provided on one tray only with tap-offs to the control cable trays. All valve and damper motor and rapping motors will be earthed to this conductor.
- g. If the equipment is not available at the time of earthing conductor laying tap connections from the main earthing conductor shall be brought out up to slab equipment foundation level with at least 200mm spare length left for further connections to equipment earthing terminals.
- h. Entire system shall be earthed in accordance with the provisions of the relevant IEC recommendations/ IS code of practice IS 3043-1947 and further amendments thereof and Indian

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Electricity Rules, so that the values of the step and contact potentials in case of faults are kept within safe permissible limits.

- i. If any outer shops and buildings as well as the electrical sub-stations and electrical rooms are also in contractor's scope, a ring main earthing system will be provided. Ring main earthing systems shall again be interconnected as a network to power plant main earthing mat. Internal earthing ring in the electrical equipment room shall be provided by the contractor irrespective of whether equipment of the area is in their scope or not.
- j. For different floors in a building, localized internal earthing ring shall be formed and connected to the ground earthing through vertical risers. The earthing mat shall be common to both power and lighting installations.
- k. A minimum of two spare earth rings will be provided in each floor of the building for earthing future building.
- l. Each RCC steel column of the building will be interconnected to the floor-earthing grid in basement/ ground floor.
- m. For protective earthing separate conductor shall be used for flow of earth fault current.
- n. Contractor shall carry out minor civil i.e. chipping of floor (where earth strip is to be laid on floor), removal of topsoil for laying earth strip in switchyard area, etc.
- o. It is the responsibility of contractor to provide skilled manpower for periodic maintenance after the initial commissioning till handing over the system to NTPC (customer). During this period the activities are to be carried out such as checking the electrolyte & specific gravity of individual battery, topping up of electrolyte, cleaning etc.

2.25 TRANSFORMERS

Different types of transformers like dry type shall be supplied as indicated below. Dry type service transformer will be located adjacent to their respective location/Service building.

12.5 MVA Oil type Transformer-Balance works

1600/2500kVA, Dry Type-5 no.- Balance works

The scope of work under this head is defined as below.

- a. Contractor shall transport the transformer tanks & accessories of LT power transformer and other transformers as mentioned above from BHEL stores/ Storage yard to respective foundation of unit.
- b. The transformers shall be handled in such a manner so that no jerk is transferred to the core, winding and internals of the transformer.
- c. Transformers are generally supplied in partly assembled condition. Accessories, like radiators, conservator tank, pipes, fittings, hardware's, gaskets, buchholz relay, marshaling box, relief vent, valves, pumps, cooling fans, cables, bushings, radiator headers/fans, rollers, tap changer drive unit, cables of various sizes for interconnection from marshaling control box to field devices, bushing turrets (as applicable) shall be supplied loose.
- d. Placement on plinth, alignment with respect to the foundation and lay out drawings.
- e. Internal inspection to verify the intactness of core and winding, tap changer leads, off-load switch/on load tap changer, measurement of core and core bolt insulation.
- f. All the accessories shall be assembled/ mounted as per OGA drawings and these should be thoroughly cleaned by spirit prior to installation.
- g. Contractor shall arrange required testing equipment for carrying out electrical test like voltage ratio, turn ratio, vector group, magnetic balance, winding resistance measurements, insulation resistance, Resistivity, SFRA and TAN Delta Test etc. as applicable.
- h. Contractor shall discuss and finalize installation and testing activity procedure with BHEL/NTPC (customer) prior to starting the work.

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- i. Tests are also required to be conducted on Current Transformer, Potential Transformer & prior to /after installation. Contractor shall also carryout oil processing / filtration to achieve the desired results before charging and handing over of the entire system.
- j. Internal inspection on receipt of Transformer at site in presence of supplier is made mandatory. There may be time gap between first inspection and second inspection (which may be just before assembly of transformer accessories). If applicable, Nitrogen cylinders of appropriate purity shall be arranged by contractor as a part of scope of work within the quoted rates for transformer.
- ~~k. Miscellaneous Transformer shall be made available to the contractor 80 to 120meters (approximately) away from the respective foundation, further transport and shifting to the foundation shall be in the scope of this work. The shifting operation may require dragging either on ground with suitable arrangement or dragging after fixing of wheels on rail track. It may also require turning of transformer at suitable locations en-route to foundation. The contractor shall arrange wooden sleepers, winches, jacks, rails, crane, plates etc. at his cost for this operation. However, all loose accessories shall have to be shifted from stores/ storage yard.~~
- l. Transformers are generally supplied in partly assembled condition either filled with oil up to the core end winding level or gas filled. Accessories, like radiators, conservator tank, pipes, fittings, hardware's, gaskets, Buchholz relay, marshaling box, relief vent, valves, pumps, cooling fans, cables, bushings, radiator headers/ fans, rollers, tap changer drive unit, cables of various sizes for interconnection from marshaling control box to field devices, bushing turrets and oil in Barrels shall be supplied loose.
- m. Placement on plinth, alignment with respect to the foundation and lay out drawings.
- n. Internal inspection to verify the intactness of core and winding, tap changer leads, off-load switch/ on load tap changer, measurement of core and core bolt insulation.
- o. In case transformers are supplied partly oil filled/ gas filled, after internal inspection, the transformer shall be kept under vacuum (for a period to be decided by site engineer) and treated oil to be filled up to required level.
- p. Each drum of oil to be tested for BDV and if BDV is less, then each drum should be filtered separately. This treated oil to be filled in the transformers and auxiliaries.
- q. Contractor shall arrange storage tank of approx. 10 kl capacity, internally sand blasted and with one coat of oil resistance paint. Oil from drums to be transferred in storage tank and filtration to be carried out to achieve the required BDV/ withstand value. This treated oil to be filled in the transformers and auxiliaries. However, for low capacity transformer, a separate storage tank for mass filtration may not be required.
- r. All the accessories shall be assembled/ mounted as per OGA drawings and these should be thoroughly cleaned by spirit prior to installation.
- s. Drying out of transformer and filtration of oil in cooling bank, pipeline, diverter tank of tap changer etc. to be done with ultra-vacuum filtering machine of adequate capacity. Drying out process shall be carried out round-the-clock and contractor shall deploy trained manpower for this purpose.
- t. During dry out process, contractor has to plot the curve for insulation resistance value/ time/ oil temperature. Hourly reading to be recorded till completion of the dry out.
- u. The criteria for deciding completion of drying out shall be breakdown value of oil, PPM value of contaminants in oil, resistivity of oil, insulation resistance value and polarization index. The contractor shall carry out minimum two cycles of dry out for achieving the required dew point or as per the BHEL Standards.
- v. Filter machine capacity if found to be inadequate, or in case of failure of an existing machine, alternative arrangement is required to be done to meet the required result and

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time. It is to be particularly noted that that as per exigencies of site working contractor will have to arrange more oil filtration machines as per site requirement.

- w. Due to unforeseen reasons the commissioning of transformer is delayed after first drying out and if required, the contractor shall carry out the oil filtration of assembled transformer. For full re-filtration, payment will be made at 25% of quoted price of Transformer.
- x. Contractor shall arrange required testing equipment for carrying out electrical test like voltage ratio, turn ratio, vector group, magnetic balance, winding resistance measurements, and BDV value of oil, Tan Delta Measurement of Bushings & Winding, insulation resistance, measurement of oil PPM, Acidity, Resistivity, SFRA and TAN Delta Test. The Contractor shall arrange to carry out DGA Test of Oil Sample before and after first successful charging of Generator Transformer and Station Transformer. The contractor shall arrange oil sample testing for PPM/ Resistivity or any other tests applicable for oil sample at approved testing laboratory/ BHEL Bhopal at his own cost including all incidental expenses.
- y. Contractor shall discuss and finalize installation and testing activity procedure with BHEL/ NTPC (customer) prior to starting the work.
- z. Tests are also required to be conducted on Current Transformer, Potential Transformer & prior to/ after installation. Contractor shall also carryout oil processing/ filtration to achieve the desired results before charging and handing over of the entire system.
- aa. Contractor should have valid electrical contractor license to carry out installation of high voltage equipment.
- bb. Internal inspection on receipt of Transformer at site in presence of supplier is made mandatory. There may be time gap between first inspection and second inspection (which may be just before assembly of transformer accessories). Nitrogen cylinders of appropriate purity shall be arranged by contractor as a part of scope of work within the quoted rates for transformer.
- cc. Process of Nitrogen (Use only dry Nitrogen gas to IS: 1747 with -60 Dew point) purging of transformer winding before proceeding for oil filling/ filtration is made mandatory by BHEL. Contractor shall arrange adequate number of nitrogen cylinders of appropriate purity. The purging process will be declared as completed on successful achievement of dew point measurement. It may be required to repeat the process till acceptable value of dew point is achieved.
- dd. The Erection, Testing and Commissioning of transformers shall be done in line with the Approved Field Quality Plans and as per instruction of Site Engineers/ Manufacturers manual.**

2.26 11/3.3 kV HT SWITCHGEAR, 415 VOLT LT SWITCHGEAR

GENERAL

- a. Erection of the concerned switchgear.
- b. Checking of installation for correctness.
- c. Mechanical functional checking/ adjustment of individual breaker.
- d. Measurement of Insulation resistance of individual breaker, complete switchgear board and combined insulation resistance of individual breaker with cable connected to drives.
- e. Testing of Relays, Power transducers, Energy Meters, Ammeters, Voltmeters, Power factor, frequency, tri-vector meters & metering, etc. in static & dynamic condition relay.
- f. Checking of electrical control & protection interlock of individual breaker and integration with other system.

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- g. Calibration of energy meters, tri-vector meters, voltmeters, ammeters, power current & voltage transducers, etc.
- h. Provide assistance for checking the electrical operation of individual breakers from remote panels/ MMI package (maxDNA system).

2.27 ELECTRICAL ACTUATORS

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

2.28 PLANT ILLUMINATION PACKAGE (STATION LIGHTING)

- a. Station lighting covers the complete FGD area with handling, transportation from BHEL stores / yard to work place. Erection (wherever applicable) & Commissioning of lighting material like LDB (Including Lighting transformer for AC /DC) Type, LP, lighting luminaires (with Complete accessories), Switch Boxes, Junction Boxes, Receptacles, Ceiling Fan, Emergency lighting, Poles, Conduits, Rigid/Flexible PVC coated conduit, Wires, structural Steel, Hume Pipe, ~~High Mast~~, cabling in Tray and Underground excavated trench, earthing above and below ground, earth pit for poles and ~~high mast~~ as per the drawing, etc.
- b. All measuring and testing instruments required during erection, testing, commissioning and performance testing shall be arranged by the bidder.
- c. Supply of necessary hardware such as double compression cable glands, conduit fittings viz. couplers, elbows, bends, tees, circular boxes, conduit accessories viz. clips, saddles, spacing plates, entry bushes, lock nuts, plugs, heavy duty lugs, ferrules, expansion fasteners, ball & sockets, earth clips, fan boxes, clamps, screws, pull out boxes etc. are in the scope of bidder. No separate rate shall be payable for the above.
- d.

2.28.1 GUIDELINES FOR LIGHTING SYSTEM ERECTION WORK

- a. The contractor shall be responsible if any parts of lighting fixtures, LDBs, LPs are lost or damaged and lamps are broken during installation. All damage and thefts shall be made good by the contractor till the installation is handed over to the NTPC (customer).
- b. The contractor shall note that for any change in the location of lighting panels, lighting fixtures, switch boxes/receptacles, no extra charges will be paid so long as the modifications are indicated to the contractor before commencement of the work on that particular equipment or circuit.
- c. The contractor shall have a separate cleaning gang to clean all equipment under erection as well as the work area and the project site at regular intervals to the satisfaction of Engineer-in-charge.
- d. Except as specifically approved by the Engineer-in-Charge, installation of exposed conduits, mounting of lighting fixtures, etc. shall be taken up only after other services such as piping, air ducting, cable tray/bus duct hangers, structural bracing's etc. in a particular area have been installed
- e. After installation of lighting fixtures/receptacles, panel number and circuit number shall be painted on them at a suitable place
- f. Work to be in-line with drawing/design philosophy as per BHEL Engineer instruction.

2.28.2 GUIDELINES FOR LIGHTING SYSTEM ERECTION WORK.

- a. The contractor shall work in co-ordination with civil, air-conditioning, ventilation & switchgear vendors. Where holes or openings in walls and floors are required for routing the conduits, the

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contractor shall provide the same. Cut-outs in false ceiling shall be provided by false ceiling contractor.

- b. The contractor shall be responsible if any parts of lighting fixtures, LDBs, LPs are lost or damaged and lamps are broken during installation. All damage and thefts shall be made good by the contractor till the installation is handed over to the NTPC (customer).
- c. The contractor shall note that for any change in the location of lighting panels, lighting fixtures, switch boxes/receptacles, no extra charges will be paid so long as the modifications are indicated to the contractor before commencement of the work on that particular equipment or circuit.
- d. The contractor shall have a separate cleaning gang to clean all equipment under erection as well as the work area and the project site at regular intervals to the satisfaction of Engineer-in-charge. In case this is not done, the purchaser will have the right to carry out the cleaning operation and any expenditure incurred in this regard will be to the contractor account.
- e. Except as specifically approved by the Engineer-in-Charge, installation of exposed conduits, mounting of lighting fixtures, etc. shall be taken up only after other services such as piping, air ducting, cable tray/bus duct hangers, structural bracing's etc. in a particular area have been installed
- f. After installation of lighting fixtures/receptacles, panel number and circuit number shall be painted on them at a suitable place.
- g. Work to be in-line with drawing/ design philosophy and as per BHEL Engineer instruction.

2.28.3 **Lighting Fixtures and Accessories.**

- a. Lighting fixtures of appropriate type as per the lighting layout drawings shall be installed by the contractor. The type of mounting arrangement of fixtures shall be selected from the typical arrangements shown in enclosed fixture mounting details drawings in section - E. The type of mounting will generally be indicated on the layout drawings. The exact mounting will, however, be decided at site depending upon the actual space/ other facilities available at site.
- b. The contractor shall submit for purchaser's approval the drawings showing the detailed mounting arrangements of various types of fixtures prior to installation.
- c. Wooden plugs in walls and ceilings for fixing of lighting fixtures and accessories are not acceptable. A suitable fool-proof method (preferably using nylon rawl plug) of fixing these shall be offered and this be subject to the purchaser approval.
- d. The bracket for mounting the lighting fixtures on boiler platforms shall be fabricated at site using GI conduit with a reducing socket to suit the fixture and clamped to the hand rails. However, the clamping of these conduits at points of large vibrations should be avoided. The fixing shall be strong enough to withstand vibrations and wind velocity. If a roof (or other platform over the platform is available, the fixture will be pendant mounted (supported to the structural members of the platform above).
- e. Flood lights shall be mounted on steel base facing the tentative direction shown on drawings. Bolts shall be tightened with spring washers. Terminals connection to the flood lights shall be through flexible conduits.
- f. In the rooms where false ceilings are provided, the lighting fixtures shall be supported separately by false ceiling grid of roof over false ceiling if it is of steel structural or form ceiling and not by the false ceiling board. The arrangement shall be to the approval of purchaser. The erection rate of lighting fixtures shall include the supply of steel brackets, supporting, anchoring material, hardware and also steel brackets/hangers for bridging the gap above false ceilings, etc., required for installation of lighting fixtures as shown in the approved fixture mounting arrangement drawings.
- g. A four (4) way terminal junction box type F shall be provided near each lighting fixture, for loop-in, loop-out and off connection of lighting wires or as required.
- h. To distinguish emergency AC fixtures from normal AC fixtures, red painted circular mark of 1 cm dia. shall be provided on emergency fixtures.

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- i. The self-contained emergency lighting fixtures shall be installed in required areas. Mounting brackets are to be provided by the contractor.

2.28.4 Lighting distribution board and Lighting Panels.

- a. Lighting DB's consisting of lighting transformer etc, shall be mounted on floor and LP's shall be mounted on the walls/columns/steel structures at the locations indicated in the drawings.
- b. Suitable Space provision for LDB mounting on floor would be made by the purchaser. The contractor will supply necessary foundation bolts and do the grouting to fix up the LDBs.
- c. LPs shall be installed by fastening to studs of not less than 12 mm dia. which will be suitably grouted/welded to the wall/column by the contractor. All the required accessories including studs for the erection of the panel shall be supplied by the contractor. If Mounting channels are required for, LPs the same will be provided by contractor.

2.28.5 Lighting control Switch Boxes & Receptacle Boxes.

- a. The locations of switch/receptacle boxes will be approximately as shown in the drawings. The exact location shall be finalised by the contractor in consultation with the engineer-in-Chief.
- b. All switch/ receptacle boxes in offices and control room shall be flush mounted in the wall. In other areas they shall be mounted on wall or column.

2.28.6 Conduits and Accessories

- a. All lighting wires shall be run inside the conduit. Size of conduit shall be selected as per the table given below.

Size of Wire	Max. number of wires in	
	20mm conduit	25mm conduit
1.5 sq. mm.	4	
2.5 sq. mm.	4	6

- b. Conduit shall run along wall, floor, ceiling, on steel structures, embedded in wall, floor, for ceiling, in accordance with relevant layout drawings. The contractor shall closely co-ordinate his work with the civil contractor. Exposed conduits shall be run in straight lines parallel to building columns, beams and walls. Unnecessary bends and crossings shall be avoided to present a neat appearance. In the office area as specified conduits shall be embedded along the entire run. It is the responsibility of the lighting contractor to co-ordinate with the civil contractor of these buildings.
- c. Conduit shall be clamped on to approved type spacer plates or brackets by saddles or U-bolts. The spacer plates or brackets in turn, shall be securely fixed to the building steel by welding and to concrete or brick work by grouting or by nylon rawl plugs.
- d. Embedded conduits shall be securely fixed in position to preclude any movement. In fixing embedded conduit, if welding or brazing is used, extreme care should be taken to avoid any injury to the inner surface of the conduit.
- e. Spacing of embedded conduits shall be such as to permit flow of concrete between them and in no case shall be less than 40mm.
- f. For direct embedding in soil, the conduits shall be coated with an asphalt base compound. Concrete pier or anchor shall be provided where necessary to support the conduit rigidly and to hold it in place.
- g. Conduits shall be installed in such a way as to ensure against trouble from trapped condensation.
- h. The contractor shall make available at site dies for threading various conduits. Running threads shall be avoided as far as practicable. Where it is unavoidable, check nut shall be used. All field thread ends shall be reamed after threading and anti-corrosive paint applied.

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- i. Conduits shall be kept, wherever possible, at least 300 mm away from hot pipes, heating devices etc.
- j. Slip joints shall be provided when conduits cross structural expansion joints or where long run of exposed conduits are installed, so that temperature change will cause no distortion due to expansion or contraction of conduit run
- k. For long conduit runs junction/ pull boxes shall be provided at suitable intervals (not exceeding 10 m) to facilitate wiring.
- l. Conduits shall be securely terminated at LPs/ junction boxes or lighting fixtures by proper fastening with a lock put on inside and outside. The number of conduits terminating at LP's shall not exceed the permissible number considering the glanding area of lighting panel. Conduit terminations shall be made water & vermin proof.
- m. Conduits lengths shall be jointed by acrowed couplers. Conduit shall be cleanly cut. The cut ends shall be within three (3) degrees of square with the conduit axis. Cut ends shall be reamed and all burrs and sharp edges removed.
- n. Conduits lengths shall be jointed connection and shall be made thoroughly water-tight and rust-proof by application of a thread compound which will not insulate the joints. White lead will be uses for embedded conduit and red lead for exposed conduit.
- o. Water treatment plant chlorination plant lighting installations shall be made with epoxy coated steel conduits and accessories.
- p. Field bends shall have a minimum radius of four (4) times the conduit diameter. All bends shall be free of kinks, indentations or flattened surfaces. Heat shall not be applied in making any conduct bend. Separate bends may be sued for this purpose.
- q. The entire metallic conduit system, whether embedded or exposed, shall be electrically continuous and thoroughly grounded where slip joints used, suitable bending shall be provided around the joint to ensure a continuous ground circuit.
- r. Conduits and fittings shall be properly protected during construction period against mechanical injury. Conduit ends shall be plugged or capped to prevent entry of foreign material.
- s. After installation, the conduits shall be thoroughly cleaned by compressed air before pulling in the wire.
- t. Lighting fixtures shall not be suspended directly from the junction box in the main conduit run.
- u. Conduits in control room, service building, laboratory building and other air-conditioned areas will be surface mounted on the roof above false ceiling, however vertical drops of conduits will be concealed along walls and finally plastered by bidder (including minor chipping works) for better aesthetics.

2.28.7 **Lighting wires**

- a. Lighting wires from lighting panels to junction boxes and junction boxes to lighting fixtures, switch boxes and receptacle boxes shall run in conduits (Rigid/flexible).
- b. All wires in a conduit shall be drawn simultaneously. No subsequent drawing is permissible.
- c. Wires shall not be pulled through more than two equivalent 90 deg. bends in a single conduit run. Wherever required, suitable conduit junction boxes/pull boxes shall be provided. All types of wiring, concealed or unconcealed shall be capable of easy inspection.
- d. Receptacles and lighting circuits shall be fed from different circuits. The switch controlling these circuits shall be on the live side (phase wire) of the circuits.
- e. A.C. normal, A.C. emergency and D.C. emergency system wiring shall run throughout in separate conduits.
- f. Wiring shall be spliced only at junction boxes. Maximum two wires shall be connected at each terminal.
- g. In vertical run of wires in conduit the wires shall be suitably supported by means of wooden/hard rubber plugs at each pull/junction box.

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- h. All lighting wires shall be crimped using suitable type of solderless, crimping, tinned fork type copper lugs. Cost of the lugs shall be included in the erection price of wire.
- 2.28.8 **Junction Boxes**
- a. 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.
 - b. 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)
- 2.28.9 **Street Lighting/ Flood Lighting Poles**
- a. The lighting poles shall be erected by the contractor at locations shown in the street lighting layout. The erection work shall include making of foundations (with supply of all materials). Installation of necessary wiring/ cabling, junction/ switch box and mounting of assembled fittings etc. All the above erection work (including supply of necessary material) shall be done by contractor for street light poles including making of foundations.
 - b. The lighting poles shall be painted with two coats of aluminium paint after completion of installation or as specified by purchaser.
 - c. The flood light fixtures shall be mounted on galvanised M.S. base making use of shop drilled holes or by suitable clamps. No cutting or drilling of galvanised structure is permitted.
 - d. The bidder shall submit the foundation drawings of poles for purchaser's approval, if required
- 2.28.10 **Earthing of Lighting system**
- a. All junction boxes, receptacles, switch boxes, lighting fixtures, conduit etc. shall be earthed in compliance with the provision of I.E. rules and applicable Indian Standard amended up to date or as specified in the approved Drawing by PEM
 - b. A continuous earth conductor of G.I. wire shall be run all along each conduit run and bonded at every 600 mm by not less than two turns of the same size of wires. This conductor shall be connected to the earth bus of lighting panel from which the conduits originate. All junction boxes, receptacles, lighting fixtures etc. shall be connected to this GI earth conductor. All lighting panels and LDBs shall be earthed by GI flats to the purchasers earthing bus. The supply of GI flat and erection shall be in contractor's scope and rates of the same shall be included in the erection rates of the respective LDB/LP.
- 2.28.11 **Ceiling Fans and Regulators (If Applicable)**
- a. The contractor shall install the ceiling fans and regulators at the locations shown in the relevant drawings. The exact location will however, be decided at site in consultation with engineer-in-charge.
 - b. The fan regulators shall be flush mounted on the lighting control switch boxes provided in that area.
 - c. Hook along with rubber bush shall be supplied and grouted by contractor in ceiling for mounting the fan. All necessary material and hard wares for installation shall be supplied by contractor.
- 2.28.12 **Foundation & Civil Works**
- a. Equipment foundations, for street lighting Poles/Flood Lighting Poles, street lighting panel and other panels mounting foundation and other civil work including supply of cement, steel and other materials as per relevant drawings and specification clauses shall be provided by the contractor. Cost of foundation works, including supply of necessary material is to be quoted as part of E & C rates for these items.

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- b. All final adjustment of foundation levels, chipping and dressing of foundation surfaces, setting and grouting of anchor bolts, sills, inserts and fastening devices shall be carried out by the contractor including minor modification of civil work as may be required for erection.
- c. Any cutting of masonry/ concrete work, which is necessary, shall be done by the contractor at his own cost and shall be made good to match the original work. The contractor shall obtain approval of the purchaser before proceeding with any cutting of masonry/concrete work.
- d. The contractor shall perform all excavation and backfilling as required for ground connections and casting foundations.
- e. Excavation shall be performed up to the required depth. Such measures shall be taken as may be necessary for protection of the wall.
- f. The contractor shall make use of his own arrangements for pumping out any water that may be accumulated in the excavation.
- g. All excavation shall be backfilled to the original level with good consolidation.
- h. Re-work/Re-erection work includes removal of defective items shall be processed on unit rate as mentioned in BOQ.

2.28.13 **SUPPORT TO OTHER VENDORS**

- a. The vendor within the quoted rates will extend certain facilities and support to other vendors (like vendor for Erection and Commissioning of Public Address, Telephone, Air-conditioning etc.).
- b. Transportation assistance of the materials from BHEL stores to the intended locations, lifting facilities (cranes), supervision during erection, supervision during commissioning and other co-ordination.

2.28.14 **FIRE DETECTION & ALARM SYSTEM**

- a. 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.
- b. All MCC / switch gear room / Control room shall be provided with Multisensor type detectors.
- c. All Conveyors and Cable Galleries shall be provided with Linear Heat Sensing Cable detectors.
- d. All cable galleries shall be provided with Multisensor type detector.
- e. 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. NTPC (customer) will make arrangement of TAC approved agency 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.

2.28.15 **TREFOIL CLAMP**

As per this tender, suitable trefoil clamps shall be supplied by the BHEL as quantities mentioned in the BOQ.

2.28.16 **BATTERY/ BATTERY CHARGER**

- a. Lead Acid/Ni-Cd (or similar type) 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.
- b. Battery charging/ discharging is a continuous process and skilled manpower shall be deployed by the contractor round-the-clock.
- c. Contractor shall arrange suitable load, cables, safety equipment and consumables for discharging the battery during charging and discharging cycle at his cost.
- d. 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

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distilled water and cleaning till the set is handed over to NTPC (customer) and record of the same shall be maintained and submitted before handing over of the system.

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Chapter III: Facilities in the scope of Contractor/BHEL

S. No.	Description	Scope / to be taken care by		Remarks
		BHEL	Bidder	
1.1	PART I ESTABLISHMENT			
1.1.1	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 build 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 er etc.		Yes	
f	Firefighting equipments like buckets, extinguishers etc		Yes	
g	Fencing of storage area, office, canteen etc of the bidder		Yes	
1.1.2	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 statutory requirements		Yes	
1.1.3	ELECTRICITY			
a	Electricity for construction purposes of Voltage 415/440 V			
b	Single point source	Yes		Chargeable as per the rates of Maharashtra Electricity Distribution Board. At a distance of 500 M from site (Distance is only approximate, it may vary upto an extent depending on site condition)
c	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
d	Duties and deposits including statutory clearances if app		Yes	
1.1.4	Electricity for the office, stores, canteen etc of the bidde			

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Chapter III: Facilities in the scope of Contractor/BHEL

S. No.	Description	Scope / to be taken care by		Remarks
		BHEL	Bidder	
	PART I			
a	Single point source	Yes		Chargeable as per the rates of Maharashtra Electricity Distribution Board At a distance of 500 M from site (Distance is only approximate, it may vary upto an extent depending on site condition)
b	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
c	Duties and deposits including statutory clearances if appli		Yes	
1.1.5	Electricity for living accommodation of the bidder's staff engineers, supervisors etc		Yes	
a	Single point source		Yes	Agency has to make his own arrangement at his own cost.
b	Further distribution including all materials, Energy Meter Protection devices and its service		Yes	Agency has to make his own arrangement at his own cost.
c	Duties and deposits including statutory clearances if app		Yes	
1.2.0	WATER SUPPLY			
1.2.1	For Construction purposes:			Free
a	Making the water available at single point		Yes	
b	Further distribution as per the requirement of work inclu supply of materials and execution		Yes	
1.2.2	Water supply for bidder's office, stores, canteen etc			
a	Making the water available at single point		Yes	
b	Further distribution as per the requirement of work inclu supply of materials and execution		Yes	
1.2.3	Water supply for Living Purpose			
a	Making the water available at single point		Yes	Contractor has to make their own arrangements
b	Further distribution as per the requirement of work inclu supply of materials and execution		Yes	Contractor has to make their own arrangements
1.3.0	LIGHTING			
a	For construction work (supply of all the necessary materi 1. At office/storage area 2. At the preassembly area 3. At the construction site /area		Yes	

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

S. No.	Description	Scope / to be taken care by		Remarks
		BHEL	Bidder	
	PART I			
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 during the course of project work		Yes	
d	Lighting for the living purposes of the bidder at the colony / quarters		Yes	
1.4.0	COMMUNICATION FACILITIES FOR SITE OPERATIONS OF BIDDER			
a	Telephone, fax, internet, intranet, e-mail etc		Yes	
1.5.0	COMPRESSED AIR wherever required for the work		Yes	
1.7.0	Demobilization of all the above facilities		Yes	
1.8.0	TRANSPORTATION			
a	For site personnel of the bidder		Yes	
b	For bidder's equipments and consumables (T&P, Consumables etc)		Yes	

3.1 Electricity:

- 3.1..1 The construction power (415V) will be provided at a single point for construction purpose only at chargeable basis and the further distribution is to be arranged by the bidder at his cost. Construction power shall be provided from the nearest Substation / tapping point.
- 3.1..2 Any duty, deposit involved in getting the Electricity shall be borne by the bidder. As regards to contractor's office shed also, all such expenditure shall be borne by the contractor.
- 3.1..3 Provision of distribution of electrical power from the given single central common point to the required places with proper distribution boards, approved cables and cable laying including supply of all materials like cables, switch boards, pipes etc., observing the safety rules laid down by electrical authority of the State / BHEL / their NTPC (customer) with appropriate statutory requirements shall be the responsibility of the tenderer / contractor.
- 3.1..4 BHEL is not responsible for any loss or damage to the contractor's equipment as a result of variations in voltage / frequency or interruptions in power supply.
- 3.1..5 Necessary "Capacitor Banks" to improve the Power factor shall be provided by the contractor at his cost. Penalty if any levied by NTPC (customer) on this account will be recovered from contractor's bills.

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

3.2 Tentative List of Major T&P to be deployed by the Contractor

1.0	T&P DEPLOYED BY CONTRACTOR		
S. No.	EQUIPMENT	Capacity	Qty.
1.	Trailer along with pulling unit	APR	APR
2.	Mobile Crane	upto 40T	APR
3.	Hydraulic jacks	APR	APR
4.	Copper tube bender and cutter sizes 6mm, 8mm, 1/2", 1/4"	APR	APR
5.	Oil filtration machine and tank	APR	APR
6.	Transformer oil testing kit	APR	APR
7.	Welding sets with accessories and ovens for welding electrodes backing and holding	APR	APR
8.	Pipe bending machine – 2" size	APR	APR
9.	Dye sets for threading upto 2" pipe.	APR	APR
10.	Tap sets for both BSP and NPT threads upto 1" each	APR	APR
11.	Crimping tools up to all size of cables under scope of work	APR	APR
12.	Hydraulic crimping tool	APR	APR
13.	Vacuum Cleaner (Industrial)	APR	APR
14.	Grinding Machine	APR	APR
15.	Drilling Machines	APR	APR
16.	Electric Winches	APR	APR
17.	Phase sequence indicator	APR	APR
18.	Digital Multimeters 3½ digit of reputed make	APR	APR
19.	Digital ,6 ½, 41/2 digit Motwane/HIL/Fluke	APR	APR
20.	Analog multimeters	APR	APR
21.	250V/500V/1000/5000V rated Hand operated megger Mains/battery operated	APR	APR
22.	Digital Megger	APR	APR
23.	Insulation tester mains operated 2500/5000V	APR	APR
24.	Earth resistance tester	APR	APR
25.	HV Test Kit	APR	APR
26.	Wheatstone bridge	APR	APR
27.	Micro ohmmeter	APR	APR
28.	Tong Testers AC 5/10,25/60/300 ,Amp Range ,of reputed make	APR	APR
29.	Tong Testers DC 30/60/300 A	APR	APR
30.	Stop watch	APR	APR
31.	Tele talk 2 wire system	APR	APR
32.	Torque wrench(12-60 Nm,50-225 Nm)	APR	APR
33.	Ferrule printing machine	APR	APR
34.	Dial gauges	APR	APR
35.	Dead Weight Tester rated 400 Kg/cm2 with weights & test gauge facility	APR	APR
36.	Oil temperature bath suitable to calibrate the instruments range 0-300 deg. C with standard temp. gauges & thermostatic control	APR	APR
37.	Standard gauges 12" dial size make	APR	APR

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

38.	A) 0-1 kg/cm ² pressure gauge (vacuum gauge) B) 0 – 5 or 6 kg/cm ² pressure gauge C) 0 – 10 kg/cm ² – do – D) 0 – 25 kg/cm ² – do – E) 0 – 60 kg/cm ² – do – F) 0 – 100 kg/cm ² –do – G) 0 – 250 kg/cm ² – do – H) 0 – 600 kg/cm ² – do – I) 0.2 to 1 kg -- do --	APR	APR
39.	Manometers (+/-) 1000 mm water column With hand bulb for lab and small manometers for field purpose.	APR	APR
40.	Manometer (+/-) 500mm mercury column with hand bulb for lab and small manometer for field purpose.	APR	APR
41.	Inclined manometer (+/-) 300 mm water column	APR	APR
42.	Portable air compressor with drier and regulator rated for 7 to 10 kg/cm ²	APR	APR
43.	Vacuum pump	APR	APR
44.	Standard milliamps / millivolts source of reputed make. Range 0to 50 ma and 0 to 100 mv	APR	APR
45.	DC power supply 0-50 VDC, 5 A make “Aplab” or equivalent (variable source)	APR	APR
46.	Single phase variac 250 V, 8 amp	APR	APR
47.	3 phase variac rating 5 amps	APR	APR
48.	Glass thermometer 0-120 deg. C, 0-200 deg.C and 0-600 deg.C	APR	APR
49.	Primary current injection kit	APR	APR
50.	Secondary current injection kit up to 300 amp	APR	APR
51.	DC shunt 400 amp 75 mv	APR	APR
52.	Digital Tachometer non-contact type 0 to 4000 rpm	APR	APR
53.	Decade resistance box	APR	APR
54.	Relay testing kit	APR	APR
55.	DC Ammeter	APR	APR
56.	DC Voltmeter	APR	APR
57.	Voltmeter AC	APR	APR
58.	Ammeter AC	APR	APR
59.	Oil specific gravity and PPM measuring equipment	APR	APR
60.	Dew point measurement instrument	APR	APR
61.	Oscilloscope	APR	APR
62.	Electric blower	APR	APR
63.	Equipment and consumables for LPI/MPI test on impulse pipes	APR	APR
64.	Three phase distribution board with complete setup for drawl & distribution of construction power	APR	APR
65.	Electric cables for drawl & distribution of construction power, heating machines	APR	APR

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

66.	Dewatering pump	APR	APR
67	Winding resistance kit (Dry type transformer with accuracy of 0.1% and 0-100 amps range)	APR	APR
68	Fork Lifter for panel/equipment handling	APR	APR
69	Sky climber	APR	APR
NOTES:			
1	The above list is only indicative and these T&Ps may not be required for entire contract period but contractor shall ensure the availability of the T&Ps as per work requirement and T&P Deployment schedule. T&P Deployment schedule shall be finalized at site in consultation with BHEL Engineer based on the work fronts/work requirement. BHEL decision shall be final and binding regarding the T&P deployment schedule. Contractor shall mobilize / maintain the T&P's as per the deployment schedule notified time to time by BHEL Engineer.		
2	APR- Contractor has to deploy T&P, MMD, IMTE as per requirement of site and as decided by BHEL Engineer.		
3	If any one of T&P mentioned above is not needed for proper execution of scope of work, provided contractor has not utilized BHEL free issued T&P for completing such work, no recovery from contractor shall be applicable.		
4	Any additional item required in addition to above mentioned T&P for proper execution of scope of work, contractor has to arrange such T&P within quoted rate on the instruction of BHEL in writing in a reasonable period within two weeks from the written instruction from BHEL.		
5	i.) In case deployment of T&P w.r.t requirement/schedule, is delayed or deployed for a shorter period or abnormal down time of T&P or ii) in case T&P w.r.t requirement was not deployed by the contractor as per instruction of BHEL and BHEL had to deploy either its own T&P or iii.)BHEL had to deploy the T&P from outside agency, then recovery shall be done from the contractor as under:		
5.1	In case BHEL had to deploy its own T&P, hire charges of T&P applicable for outside agencies as per extant guidelines for "Hire Charges on issue of Capital Tools & Plants" shall be recovered.		
5.2	In case BHEL had to deploy the T&P from outside agency, actual hiring cost plus applicable overheads shall be recovered		
6	All the tools and tackles/measuring instruments shall be duly tested/calibrated and valid certificate to that effect should be submitted to BHEL site in-charge before the start of work.		
7	T&P's mentioned above shall be specifically deploy as per the respective packages. However, as per work requirement and availability of T&Ps the inter use in Material Handling and Mechanical works may be permitted as per the instruction of the BHEL Engineer.		
8	If the work related to T & Ps mentioned above is completed then, BHEL can release that T & P during contract period / extended period if any. However, written permission shall be taken by contractor from BHEL construction Manager for releasing the T&P.		

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

3.3 CONSUMMABLES

The supply of following materials/ consumables are to be arranged by the contractor as part of the contractual scope.

S. No.	Description
1	Welding electrodes for welding AS/CS/SS pipe and other welding from BHEL approved vendors only
2	Filler wire for argon welding
3	Argon, oxygen and acetylene gas
4	Provision for temporary scaffoldings.
5	GI “U” clamps with nuts and washers for impulse and GI pipe clamping.
6	Round aluminium tags (30mm dia. x 3mm thick)
7	Teflon tape and insulation tape.
8	Hold tight / bitumen tape for GI pipe coupling.
9	Required paints and primer from BHEL approved vendors only.
10	Solder wire (60/40)
11	Protocol/calibration report sheets as per BHEL format.
12	Panel/JB sealing compound material (for cable entry from bottom/top of panel).
13	PVC cable tie, aluminium strip and hardware for clamping of cables, copper tube, and temperature gauge capillary.
14	Copper lugs up to 4 sq. mm, PVC sleeve of different size, PVC button & tape
15	Supply of Structure Steel for station lighting as per requirement.
16	Supply of Hume pipe as per requirement
17	Spacer GI & Spacer epoxy
18	Saddle GI & Saddle Epoxy
19	Checknut GI & Checknut Epoxy
20	Inspection bend GI & Inspection bend Epoxy
21	Solid bend GI & Solid bend Epoxy
22	Circular Boxes GI & Circular Boxes Epoxy
23	Ball & Socket
24	Nylon Grips
25	Wooden Screw & Machine Screw
26	Reducer, PVC Brush & Sleeves
27	Cu Lugs , Earth Clip, Anchor Fastener , Ferrules, Flexible Coupler
28	Flexible rod & Cu clad rod for pole earthing
29	GS Flat ‘U’ Clamps for pole JB fixing
30	GI Bolts ‘U’ Clamps fixing
31	GI Conduit sleeves
32	Accessories required for handrail mounted fixture
33	GI bolts & Nuts for Fixture & CG box fixing
34	GI bolts & Nuts with washers for panels
35	Primer & Oxide paint for pole & MS structure painting
36	Aluminium paint for pole & MS structure painting

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

37	Double Compression Glands
38	Fan Boxes
39	Ferrules (PVC) and suitable for ferrule printing.

NOTE: The above list is only indicative. The contractor to arrange all consumables as requirement to complete the scope of work.

Note:- Supply & erection of consumable like conduit accessories & fittings, conduit boxes, saddles, clamps, flexible conduit, fixing hardwares, anchors, wedges, nuts & bolts, concrete inserts etc materials required for mounting the fixtures, consumable and other incidental materials required to complete the installation, testing & commissioning of complete lighting system for successful operation, & to the satisfaction of purchaser/ NTPC (customer). Supply scope of these items shall form part of the installation rates quoted for the item.

TECHNICAL CONDITIONS OF CONTRACT (TCC) PART I
Chapter – V: T&Ps to be deployed by BHEL free of hire charges
on sharing basis

List of T&P to be provided by BHEL Free of Hire Charges on sharing basis:

NIL

TECHNICAL CONDITIONS OF CONTRACT (TCC) PART I
Chapter – VI: Time Schedule

1.0	TIME SCHEDULE															
A	<p>Entire work shall be carried out in accordance with the broad schedule for FGD system as furnished below, within the stipulated completion period. This schedule will undergo review and based on progress vis-à-vis project requirement, contractor shall submit revised schedule for approval of BHEL/NTPC (customer).</p> <table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"> <thead> <tr> <th style="width: 10%; text-align: center;">SL No.</th> <th style="width: 60%;">Milestones</th> <th style="width: 30%;">(Tentative Schedule) By</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td>11KV Switchgear charging</td> <td style="text-align: center;">Aug-2026</td> </tr> <tr> <td style="text-align: center;">2</td> <td>3.3KV Switchgear charging</td> <td style="text-align: center;">Sept-2026</td> </tr> <tr> <td style="text-align: center;">3</td> <td>LT Switchgear Charging</td> <td style="text-align: center;">Oct-2026</td> </tr> <tr> <td style="text-align: center;">4</td> <td>Completion of Facilities</td> <td style="text-align: center;">Dec-2026</td> </tr> </tbody> </table> <p>Above time schedule is tentative and in order to meet above schedule in general, and any other intermediate targets set, to meet NTPC (customer)/project schedule, contractor shall arrange & augment all necessary resources from time to time as per the instructions of BHEL.</p>	SL No.	Milestones	(Tentative Schedule) By	1	11KV Switchgear charging	Aug-2026	2	3.3KV Switchgear charging	Sept-2026	3	LT Switchgear Charging	Oct-2026	4	Completion of Facilities	Dec-2026
SL No.	Milestones	(Tentative Schedule) By														
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3	LT Switchgear Charging	Oct-2026														
4	Completion of Facilities	Dec-2026														

B. PROVISION OF PENALTY IN CASE OF SLIPPAGE OF INTERMEDIATE MILESTONES:

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

Milestones	Activities	To be completed by
M1	11KV Switchgear charging	Aug-2026
M2	LT Switchgear Charging	Oct-2026

Notes:

1. Refer clause no 7 of IMPORTANT INFORMATION of the NIT regarding modalities against provision of penalty in case of slippage of Intermediate Milestones.
2. In order to meet above schedule in general, and any other intermediate targets set, to meet NTPC (customer)/project schedule, contractor shall arrange & augment all necessary resources from time to time as per the instructions of BHEL.
3. 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.
4. 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

TECHNICAL CONDITIONS OF CONTRACT (TCC) PART I

Chapter – VI: Time Schedule

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.

5. **The Contract period shall be 09 months from the date of commencement of work at site.** Erection, Testing, Calibration and Commissioning of permanent equipment required for completion of system shall be completed within the time schedule given above.
6. M1& M2 are the intermediate LD milestone. Milestones LD shall be applicable if the delay in achieving the milestone solely attributable to the contractor.
7. In order to meet above schedule and other intermediate targets/ activities as set by BHEL Engineer-in-charge at site & to meet NTPC (customer) requirements/ project schedule, contractor shall arrange all necessary resources and work force in consultation with BHEL Engineer at site to undertake works concurrently in all possible fronts as made available to contractor.
8. Contractor shall note that individual milestones as above shall be achieved as per schedule furnished above.
9. If work is not completed within contract period, the same may be extended at the discretion of BHEL as per General Condition of Contract provisions.
10. 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.
11. BHEL, owing to its commitment to their NTPC (customer), may ask contractor to compress the total completion schedule by up to 15%. This will result in advancement of various milestones. Contractor shall plan his activities and mobilize additional resources accordingly to the satisfaction of BHEL engineer within the quoted rates.
12. The manpower, T&Ps, MMEs will be required in phases which may vary considerably depending on the requirement of important milestones, co-ordination with other agencies, co-ordination with BHEL/ BHEL's NTPC (customer). It is the responsibility of the contractor to constantly keep in touch with BHEL's Engineer-in-Charge at site for planning and deployment of these resources.

C. COMMENCEMENT OF CONTRACT PERIOD AND TENTATIVE SCHEDULE

1. The contract shall commence from the date of deployment of contractor's T&P, proper site setup and start of erection of first equipment. All the above three conditions are to be fulfilled (certified by BHEL engineer) for deciding the date of commencement/start of the contract period. The contractor has to subsequently augment his resources in such a manner that daily activities shall be completed on daily basis and the entire work is completed within the time schedule/ contract period. Mobilization of contractor's resources shall be made and augmented from time to time in such a manner that the work in scope is carried out in an un-interrupted manner and major milestones of project are achieved on specified schedules.
2. The contractor shall complete all the work in the scope of this contract within the contract period.
3. Subject to availability of materials and other inputs, it is the responsibility of the contractor to carry out work to achieve the monthly progress and keep up the schedules.
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.
5. In order to meet above schedule, and any other intermediate Schedule/ targets as set by BHEL/ NTPC (customer), to meet NTPC (customer) and project schedule requirements,

TECHNICAL CONDITIONS OF CONTRACT (TCC) PART I

Chapter – VI: Time Schedule

Contractor shall make the note of above and will mobilize his manpower and resources. Contractor shall meet the above schedule / Intermediate targets as set by BHEL Engineer/ NTPC (customer) at site and contractor shall augment the manpower/ resources accordingly within the quoted price without any compensation.

6. 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.

D DEFINITION OF WORK COMPLETION

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

E MATERIAL RE-CONCILIATION

The contractor shall do material re-conciliation periodically.

TECHNICAL CONDITIONS OF CONTRACT (TCC)
Chapter-VII: Payment Terms

TERMS OF PAYMENT FOR ELECTRICAL WORKS (90%) FOR FRESH WORK ITEMS		
S. No.	Activity/ Work Description	%age of Unit Rate
E	PRO RATA PAYMENTS (90%)	
1.0	Cable tray and accessories	
1.1	Fabrication and fixing/ welding/ bolting in position	75%
1.2	Earthing of cable trays	5%
1.3	Numbering of cable trays	5%
1.4	Covering of trays where ever envisaged	5%
	Total =	90%
2.0	Cable laying including Earth wires	
2.1	Laying of cables/ wires	65%
2.2	Glanding & Termination (Except HT Termination) & Testing	10%
2.3	Charging of cables	5%
2.4	Dressing and clamping of cables	10%
	Total =	90%
3.0	Junction box/ Push button station (local)	
3.1	Erection including fixing of terminal blocks where ever applicable	80%
3.2	Name plate fixing where ever applicable, Labelling (both inside and outside) and Commissioning of connected equipment	10%
	Total =	90%
4.0	Miscellaneous Structural steel including frames for Panels/ Racks/ Instruments, supports for cable tray/ pipes/ tubes, Canopies etc.	
4.1	Fabrication/Pre assembly/Erection, Alignment, welding/bolting and if applicable chipping/grouting/painting	90%
	Total =	90%
5.0	DG sets/ Switch Gears/ MCC/ PCC/ Distribution Boards/ Marshalling Box/ Starter Units/ Dry Transformers/ Electrical Hoists/ Panels/ Cubicles/ Desks/ UPS/ Batteries/ Chargers/ VFD/ LA assy/ NGT/ NGR/ SP/ Miscellaneous Equipment/ etc.	
5.1	Placement, Alignment and coupling/interconnection where ever applicable, erection of associated accessories etc.	50%
5.2	Pre-commissioning checks and tests	25%
5.3	Charging, Loop testing and commissioning	5%
5.4	Nomenclature/Name-plate/Painting etc	5%
5.5	System commissioning	5%
	Total =	90%
6.0	Earthing/ Lightning protection strips, Earthing pits	
6.1	Fabrication, erection, alignment, welding/ bolting of earthing/ lightning protection strips; earth pits completion	80%
6.2	Testing/commissioning/Connection to equipment	10%
	Total =	90%
7.0	LT/ HT Bus Ducts	
7.1	Pre assembly of Bus Ducts and accessories, erection, alignment, bolting/ welding etc. complete with supporting structure	70%

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-VII: Payment Terms

7.2	Pre commissioning checks	10%
7.3	Testing, Charging and Painting (as applicable)	10%
	Total =	90%
8.0	Oil Filled Transformers (Generator, Station, UAT, Station Service etc.)	
8.1	Placement on foundation and alignment	25%
8.2	Erection of associated auxiliaries/ assemblies, oil filling, etc.	30%
8.3	Dry out including oil filtration	20%
8.4	Pre-commissioning checks/Testing	10%
8.5	Charging and Painting (as applicable)	5%
	Total =	90%
9.0	Testing/ Commissioning of Equipment (like motors, actuators, ESP transformer, misc. equipment, etc.) erected by other agencies	
9.1	Testing & pre-commissioning checks	70%
9.2	System commissioning	20%
	Total =	90%
10.0	HT termination/Straight through jointing kits	
10.1	Kit termination	65%
10.2	Testing	15%
10.3	Charging	10%
10.4	Termination, HT Termination, Straight through jointing etc. : on pro rata basis	90%

TERMS OF PAYMENT FOR C&I WORKS (90%)		
S. No.	Activity/ Work Description	% of Unit Rate
	Main E&C Equipment/ Items	
I	PRO RATA PAYMENTS (90%)	
1.0	Cable tray and accessories	-
1.1	Fabrication and fixing/ welding/ bolting in position	85%
1.2	Covering of trays where ever envisaged	5%
-	Total=	90%
2.0	Cable laying	-
2.1	Laying of Cables/Wires	60%
2.2	Glanding, Termination and Testing	15%
2.3	Commissioning of cables	5%
2.4	Dressing & Clamping of cables	10%
-	Total=	90%
3.0	Junction box/ Push button station (local)	-
3.1	Erection including fixing of terminal blocks where ever applicable	80%
3.2	Name plate fixing where ever applicable, Labelling (both inside and outside), Earthing and Commissioning of connected equipment	10%
	Total =	90%
4.0	Conduits/ impulse pipe/ tubes	

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-VII: Payment Terms

4.1	Fabrication, Laying and Erection	65%
4.2	Leak Test/ Hydraulic Test (where ever applicable, otherwise clubbed with next activity)	10%
4.3	Dressing, clamping, tagging and painting where ever applicable	8%
4.4	Testing & commissioning of associated equipment/ system	7%
	Total =	90%
5.0	Miscellaneous Structural steel including frames for Panels/ Racks/ Instruments, supports for cable tray/ pipes/ tubes, Canopies etc.	
5.1	Fabrication/Pre assembly/Erection, Alignment, welding/bolting and if applicable chipping/grouting/painting	90%
	Total =	90%
6.0	Panels/ Cubicles/ Desks/ Racks/ Enclosures/ Monitors/ Computers/ Computer peripherals/ PLCs/ UPS/ Batteries	
6.1	Erection and alignment	65%
6.2	Fixing of loose items/ instruments where ever applicable	10%
6.3	Pre commissioning checks, Charging of panel and Loop testing etc.	10%
6.4	System commissioning	5%
	Total =	90%
7.0	Instruments/ Devices including Sensors/ Cells/ Probes etc.	
7.1	Calibration/ Testing/ Pre erection checks	30%
7.2	Erection/Placement and fixing of loose items/accessories/Pre commissioning checks/loop testing/Simulation testing as required	50%
7.3	Remote/ local commissioning as required	10%
	Total =	90%
8.0	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.	
8.1	Removal & re-fixing/Fixing loose supplied components, including tubing/hose, regulators, etc.(where ever applicable, otherwise clubbed with next activity)	35%
8.2	Calibration/ Local testing - commissioning readiness	30%
8.3	Local Commissioning & Loop Testing as required	15%
8.4	System Commissioning or Remote Commissioning as required	10%
	Total =	90%
9.0	Miscellaneous items (items not covered under above heads)	
10.1	Erection	50%
10.2	Alignment	15%
10.3	Testing	15%
10.4	Completion	10%
	Total =	90%

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-VII: Payment Terms

The progressive payment for erection, testing and commissioning on accepted price of contract value for C&I & Electrical Package rates will be released as per the break up given hereunder:

Payment for Balance work Items : 90 % of payment shall be made against the completion of each activity mentioned against the item .

Note: Payment shall be made on actual basis as per the work executed at site measured and certified by BHEL engineer.

2.0

II	STAGE/ MILESTONE PAYMENTS (10%)	
1	Punch List points/ pending points liquidation	2%
2	Area cleaning, temporary structures cutting/ removal and return of scrap	2%
3	Submission of 'As Built Drawings'	2%
4	Material Reconciliation	2%
5	Completion of contractual obligation	2%
	Total for Stage/ Milestone Payments (10%)	10%

Note: Payment shall be made on actual basis as per the work executed at site measured and certified by BHEL engineer.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-VIII: TAXES AND DUTIES

1. TAXES, DUTIES, LEVIES (Rev 14 dated 09/10/2020)

1. All taxes excluding GST, GST Cess & BOCW Cess but including, Royalties, fees, license, deposits, commission, any State or Central Levy and other charges whatsoever, if any, shall be borne by you and shall not be payable extra.

2. Any increase of the taxes excluding GST, GST Cess & BOCW Cess, at any stage during execution including extension of the contract shall have to be borne by the contractor. Quoted/ accepted rates/ price shall be inclusive of all such requirements. Please note that since GST on output will be paid by BHEL separately as enumerated below, your quoted rates/ price should be after considering the Input Credit under GST law at your end.

3. **GST :**

The successful bidder shall furnish proof of GST registration .GST along with Cess (as applicable) legally leviable & payable by the successful bidder as per GST Law, shall be paid by BHEL. Hence Bidder shall not include GST along with Cess (as applicable) in their quoted price.

4. GST charged in the Tax Invoice/Debit note by the contractor shall be released separately to the contractor only after contractor files the outward supply details in GSTR-1 on GSTN portal and input tax credit of such invoice is matched with corresponding details of outward supply of the contractor and has paid the GST at the time of filing the monthly return

5. E-invoicing under GST has been implemented with effect from 1st October 2020 for all the taxable persons having turnover more than the threshold limit in any preceding financial year from 2017-18 onwards. Therefore, for all the taxable persons falling under the purview of E-invoice, it is mandatory to mention a valid unique Invoice Reference No. (IRN) and QR code as generated from E-Invoicing portal of the Government for the purpose of issuing a valid Tax Invoice. Only an E-invoice issued in the manner prescribed under rule 48(4) of CGST Rules shall be treated as valid invoice for reimbursement of GST amount.

If the successful Bidder is not falling under the purview of E-Invoicing then he has to submit a declaration in that respect along with relevant financial statements.

6. Bidder shall note that the GST Tax Invoice complying with GST Invoice Rules (Section 31 of GST Act & Rules referred there under) wherein the 'Bill To' details will as below:

BHEL GSTN – As per **Annexure -1**

NAME -- Bharat Heavy Electricals Limited

ADDRESS – Site address

7. Bidder to immediately intimate on the day of removal of Goods (in case of any supply of goods) to BHEL along with all relevant details and a scanned copy of Tax Invoice to below email ids to enable BHEL to meet its GST related compliances :-

Email id ---- to be intimated later on.

In case of delay in submission of the abovementioned documents on the date of dispatch, BHEL may incur penalty /interest for not adhering to Invoicing Rules under GST Law. The same will be liable to be recovered from the successful bidder, if such delay is not attributable to BHEL.

8. In case of raising any Supplementary Tax Invoice (Debit / Credit Note) Bidder shall issue the same containing all the details as referred to in Section 34 read with Rule 53.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-VIII: TAXES AND DUTIES

9. Bidder shall note that in case GST credit is delayed/ denied to BHEL due to delayed / non receipt of goods and /or tax invoice or expiry of the timeline prescribed in GST Law for availing such ITC, or any other reasons not attributable to BHEL, GST amount shall be recoverable from the vendor along with interest levied / leviable on BHEL, as the case may be.

10. Bidder shall upload the Invoices raised on BHEL in GSTR-1 within the prescribed time as given in the GST Act. Bidder shall note that in case of delay in declaring such invoice in your return and GST credit availed by BHEL is denied or reversed subsequently as per GST Law , GST amount paid by BHEL towards such ITC reversal as per GST law shall be recoverable from the bidder along with interest levied / leviable on BHEL.

11. Way Bill: Successful Bidder to arrange for way bill / e-waybill for any transfer of goods for the execution of the contract.

The Bidder has to make their own arrangement at their cost for completing the formalities, if required, with Issuing Authorities, for bringing materials, plants & machinery at site for execution of the works under this contract, Road Permit/ Way Bill, if required, shall be arranged by the contractor and BHEL will not supply any Road Permit/ Way Bill for this purpose.

12. **New taxes and duties:-**Any New taxes & duties, if imposed subsequent to due date of offer submission as per NIT & TCN, by statutory authority during contract period including extension, if the same is not attributable to you, shall be reimbursed by BHEL on production of relevant supporting document to the satisfaction of BHEL. However, you shall obtain prior approval from BHEL before depositing new taxes and duties.

Benefits and/or abolition of all existing taxes must be passed on to BHEL against new Taxes, if any, proposed to be introduced at a later date.

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 must convey its impact on his price duly substantiated by documentary evidence in support of the same before opening of the price bids. Claim for any such impact after opening the price bid will not be considered by BHEL for reimbursement of tax or reassessment of offer.

13. For transportation work, bidder shall declare in his quotation whether he is registered under GST, if yes, whether he intends to claim GST on forward charge basis. In absence of this declaration, BHEL will proceed further with the assumption that bidder intends not to claim GST on forward charge basis. However, in case of GST registered transporter, the amount to the extent of goods and service tax will be retained till BHEL avails the credit of GST. Further, transporter shall issue tax invoice which inter alia includes gross weight of the consignment, name of the consigner and the consignee, registration number of vehicle in which the goods are transported, details of goods transported, details of place of origin and destination, GSTIN of the person liable for paying tax whether as consigner, consignee or goods transport agency, and also containing other information as mentioned under rule 46.

14. **TDS under Income Tax shall be deducted at prevailing rates on gross invoice value from the running bills unless exemption certificate from the appropriate authority/ authorities is furnished.**

15. **TDS under GST shall be deducted at prevailing rates on applicable value from the running bills.**

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-VIII: TAXES AND DUTIES

16. TCS under Income Tax 1961 has been implemented with effect from 1st October 2020 for every seller having turnover more than threshold limit during financial year immediately preceding financial year in which the sale of goods is carried out, who receives any amount as consideration for sale of any goods of the value or aggregate of such value exceeding threshold limit other than export of goods or who is already covered under other provision of section 206C, collect from the buyer, TCS as per applicable rates of the sale consideration exceeding threshold limit subject to following conditions

- i. Buyer shall be as per clause (a) of section 206C- (1H)
- ii. Seller shall be as per clause (b) of section 206C- (1H)
- iii. No TCS is to be collected, if the seller is liable to collect TCS under other provision of section 206C or the buyer is liable to deduct TDS under any provision of the Act and has deducted such amount.

If Successful Bidder is falling under the purview of TCS then he has to submit a declaration in that respect along with relevant financial statements before the start of work or if bidder is falling under preview of TCS during the work in progress then bidder is compulsorily required to submit relevant financial statement in the beginning of the respective FY.

For TCS claim, vendor has to submit relevant documents required as per Income Tax Act.

17. Refer Annexure – 2 for BOCW Act & Cess Act.

ANNEXURE-1

State wise GSTIN no.s of BHEL

Sl. No	Projects under state	GSTIN
1	Andhra Pradesh	37AAACB4146P7Z8
2	Bihar	10AAACB4146P1ZU
3	Chhattisgarh	22AAACB4146P1ZP
4	Gujarat	24AAACB4146P1ZL
5	Jharkhand	20AAACB4146P5ZP
6	Madhya Pradesh	23AAACB4146P1ZN
7	Maharashtra	27AAACB4146P1ZF
8	Orissa	21AAACB4146P1ZR
9	Telangana	36AAACB4146P1ZG

ANNEXURE-2

BOCW Act & Cess Act

Bidder may please note that the sub-contractor/bidder of BHEL engaging building or construction worker in connection with building or other construction work, are required to follow the procedures enumerated below:

1. It shall be the sole responsibility of the contractor as employer to ensure compliance of all the statutory obligations under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder.
2. It shall be sole responsibility of the contractor engaging Building Workers in connection with the building or other construction works in the capacity of employer to apply and obtain registration certificate specifying the scope of work under the relevant provisions of the Building and Other

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-VIII: TAXES AND DUTIES

Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 from the appropriate Authorities.

3. It shall be responsibility of the contractor to furnish a copy of such Registration Certificate within a period of one month from the date of commencement of Work.

4. It is responsibility of the contractor to register under the Building and other Construction Workers' Welfare Cess Act, 1996 and deposit the required Cess for the purposes of the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 at such rate as the Central Government may , by notification in the Official Gazette, from time to time specify. However, before registering and deposit of Cess under the Building and other Construction Workers' Welfare Cess Act, 1996, the contractor will seek written prior approval from the Construction Manager.

5. It shall be sole responsibility of the contractor as employer to get registered every Building Worker, who is between the age of 18 to 60 years of age and who has been engaged in any building or other construction work for not less than ninety days during the preceding twelve months as Beneficiary under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996.

6. It shall be sole responsibility of the contractor as employer to maintain all the registers, records, notices and submit returns under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder.

7. It shall be sole responsibility of the contractor as employer to provide notice of poisoning or occupation notifiable diseases, to report of accident and dangerous occurrences to the concerned authorities under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the rules made thereunder and to make payment of all statutory payments & compensation under the Employees' Compensation Act, 1923.

8. It shall be the responsibility of the sub-contractor as employer to make payment/deposit of applicable cess amount on the extent of work involving building or construction workers engaged by the sub-contractor within a period of one month from the receipt of payment. It shall also be responsibility of the Contractor to furnish BHEL on monthly basis, Receipts/ Challans towards Deposit of the Cess under the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder along with following statistics :

(i) Number of Building Workers employed during preceding one month.

(ii) Number of Building workers registered as Beneficiary during preceding one month.

(iii) Disbursement of Wages made to the Building Workers for preceding wage month.

(iv) Remittance of Contribution of Beneficiaries made during the preceding month

9. BHEL shall reimburse the contractor the Cess amount deposited for the purposes of the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 under the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder. However, BHEL shall not reimburse the Fee paid towards the registration of establishment, fees paid towards registration of Beneficiaries and Contribution of Beneficiaries remitted.

10. It shall be responsibility of the Building Worker engaged by the Contractor and registered as a beneficiary under the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 to contribute to the Fund at such rate per mensem as may be specified

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-VIII: TAXES AND DUTIES

by the State government by notification in the Official Gazette. Where such beneficiary authorizes the contractor being his employer to deduct his contribution from his monthly wages and to remit the same, the contractor shall remit such contribution to the Building and other construction Workers' Welfare Board in such manner as may be directed by the Board , within the fifteen days from such deduction.

11. Bidders may please note that though the quoted price is exclusive of BOCW (which will be reimbursed by BHEL as per sub-clause 9 above) , however, If at any point of time during the contract period, non-compliance of the provisions of the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder is observed, BHEL reserves the right to deduct the applicable cess (1%) on the contract value and penalty (if any, imposed by Cess Authorities) from the payables on account of non-compliance.

12. The contractor shall declare to undertake any liability or claim arising out of employment of building workers and shall indemnify BHEL from all consequences / liabilities / penalties in case of non-compliance of the provisions of the Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and the Building and other Construction Workers' Welfare Cess Act, 1996 and the rules made thereunder.

TECHNICAL CONDITIONS OF CONTRACT (TCC)
Chapter IX: Specific Inclusion

9.1 SPECIFIC INCLUSIONS

SPECIFIC INCLUSIONS MATRIX

S. No.	Description	Scope/ to be taken care by		Remarks
		BHEL	Bidder	
1	Lugs up to 4 sq. mm size	-	Yes	
2	Lugs beyond 4 sq. mm size	Yes	-	For GI wire earthing
3	Paint, primer and consumables		Yes	
4	LT cable straight through jointing Kits		Yes	
5	HT Termination Kits	Yes	-	
6	Clamps with hardware (Trefoil explicitly mentioned in BOQ)	Yes	-	For single core HT cable
7	Clamps with hardware		Yes	As per requirement for LT cables
8	Identification tags/ name plates with, PVC/ metals, sleeve and clamps with hardware for cables at both end and field instruments. PVC ties, Buttons and tap		Yes	
9	Steel for fabrication	Yes	-	
10	Cable ferruling numbers and characters.	-	Yes	
11	Cable Markers	-	Yes	

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)
Chapter X: Specific Exclusion

10.1 SPECIFIC EXCLUSIONS

N.A.

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-XI Schedule of items Quantities and Factor for deriving Item Rate from the accepted Lump-sum Price

SCHEDULE OF ITEMS QUANTITIES AND FACTOR FOR DEPRIVING ITEM RATE FROM THE ACCEPTED LUMPSUM PRICE.

This Chapter consists of Part A & Part B of Volume II "Price bid":

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-X: Schedule of items Quantities and Factor for deriving Item Rate from the accepted Lump sum Price

Part A: Instructions to the Bidders

Any other entry elsewhere in the offer of the bidder shall be treated as Null and Void.

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-XI of Volume I TCC. Also schedule of items & Quantities are also available in Chapter-XI of Volume I TCC.

Based on the pre-fixed factors and the quoted total lump sum price, individual item rates shall be derived by BHEL by multiplying the respective factors with total lump sum price.

Item rates thus derived shall be rounded off to zero 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.

For only the convenience of bidders, BHEL has issued an excel sheet with all requisite formulae as detailed above. However, this excel sheet shall not form part of contract document.

PART B: % weightage for amount of individual items of Schedule of quantity w.r.t. the total price (as quoted by the bidder in Part C of Vol-II-Price Bid Specification)

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-XI Schedule of items Quantities and Factor for deriving Item Rate from the accepted Lump-sum Price

PART B: % weightage for amount of individual items of Schedule of quantity w.r.t. the total price (as quoted by the bidder in Part C of Vol-II-Price Bid Specification)

Sl. No.	Description of Items	UOM	QTY	Factor Components
E1	Cable Trays & Accessories			
E1A	Cable Trays Complete With Coupler Plates, Fasteners, Clamps And Fixing Hardwares Etc Erection Including Support & Covers Fabrication - Balance Work			
E1A.1	Galvanised Ladder type cable tray, W=600mm-Balance Work			
E1.A.1.1	Fabrication and fixing/ welding/ bolting in position	Mtr	498.00	0.00544264644549
E1.A.1.2	Earthing of cable trays	Mtr	498.00	0.00036284309637
E1.A.1.3	Numbering/Tagging of cable trays (including touch up painting & numbering on sides)	Mtr	3,458.50	0.00251986515820
E1.A.1.4	Covering of trays where ever envisaged	Mtr	498.00	0.00036284309637
E1A.2	Galvanised Perforated type cable tray, W=600 mm- Balance Work			
E1A.2.1	Fabrication and fixing/ welding/ bolting in position	Mtr	578.00	0.00947011781448

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-XI Schedule of items Quantities and Factor for deriving Item Rate from the accepted Lump-sum Price

E1A.2.2	Earthing of cable trays	Mtr	578.00	0.00063134118763
E1A.2.3	Numbering/Tagging of cable trays (including touch up painting & numbering on sides)	Mtr	1,454.00	0.00158818354121
E1A.2.4	Covering of trays where ever envisaged	Mtr	578.00	0.00063134118763
E1A.3	Galvanised Ladder type cable tray, W=300mm - Balance Work			
E1A.3.1	Fabrication and fixing/ welding/ bolting in position	Mtr	500.00	0.00525882728105
E1A.3.2	Earthing of cable trays	Mtr	500.00	0.00035058848540
E1A.3.3	Numbering/Tagging of cable trays (including touch up painting & numbering on sides)	Mtr	922.50	0.00064683575557
E1A.3.4	Covering of trays where ever envisaged	Mtr	500.00	0.00035058848540
E1A.4	Galvanised Ladder type cable tray, W=150mm	Mtr	500.00	0.00577707221467
E1A.5	Galvanised Perforated type cable tray, W=150mm	Mtr	500.00	0.00634112264319
E1A.6	Galvanised Perforated type cable tray, W=300mm- Balance Work			
E1A.6.1	Fabrication and fixing/ welding/ bolting in position	Mtr	500.00	0.00563901053860
E1A.6.2	Earthing of cable trays	Mtr	500.00	0.00037593403591
E1A.6.3	Numbering/Tagging of cable trays (including touch up painting & numbering on sides)	Mtr	557.50	0.00041916645004

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-XI Schedule of items Quantities and Factor for deriving Item Rate from the accepted Lump-sum Price

E1A.6.4	Covering of trays where ever envisaged	Mtr	500.00	0.00037593506456
E1A.6.5	Galvanised Perforated type cable tray, W=100mm	Mtr	200.00	0.00172147423614
E1A.6.6	Galvanised Perforated type cable tray, W=50mm	Mtr	200.00	0.00184025307749
E1B	Section-E1A: Flexible Cable Tray Support And Accessories			
E1B.1	Single Channel (in standard length of 6meter per piece)	Mtr	571.00	0.00902159315158
E1B.2	Double Channel (in standard length of 6meter per piece)	Mtr	114.00	0.00198949427069
E1C	Section E1B: Cantilever Arm (Each Complete With, 2 Nos.-M12 Hex. Bolt & Washer, 2 Nos.-M12 Spring Nuts, 2 Nos.-M6 Pan Head Screws & Washer, 2 Nos.-M6 Spring Nuts).			
E1C.1	620mm long for 600mm wide trays	No	300.00	0.00473107587401
E1C.2	320mm long for 300mm wide trays	No	200.00	0.00205811012652
E1D	Section E1C: Clamps & Fittings (Complete With Required Hardware I.E. Spring Nuts / Washers, Trestle Bracket, Etc. As Required For Complete Installation)			
E1D.1	Base plate for single channel.	No	122.00	0.00058213698101
E1D.2	Base plate for double channel.	No	28.00	0.00014742687811
E2	Cable Laying			

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter-XI Schedule of items Quantities and Factor for deriving Item Rate from the accepted Lump-sum Price

E2.A	11/11 KV, UE, Aluminium Conductor XLPE insulated power cable (armoured/un-armoured)			
E2.A.1	1C-630	Mtr	5,400.00	0.06428039539348
E2.A.2	3C-150	Mtr	3,650.00	0.02368181378424
E2.B	3.3/3.3 KV, UE, Aluminium Conductor XLPE insulated power cable (armoured/un-armoured)			
E2.B.1	3C-150/ 3C-185	Mtr	2,370.00	0.02406681704369
E2.C	LT POWER CABLES (armoured/un-armoured)			
E2.C.1	3 C X240 SQ MM	Mtr	200.00	0.00161052068865
E2.C.2	3 C X150 SQ MM	Mtr	980.00	0.00597370866470
E2.C.3	3 C X10 SQ MM	Mtr	2,880.00	0.00570038188282
E2.C.4	3 C X16 SQ MM	Mtr	1,080.00	0.00178408652985
E2.C.5	3 C X25 SQ MM	Mtr	4,900.00	0.01351928173105
E2.C.6	3 C X35 SQ MM	Mtr	2,880.00	0.00714317541735
E2.C.7	3 C X50 SQ MM	Mtr	4,660.00	0.01600844453001
E2.C.8	3 C X95 SQ MM	Mtr	3,120.00	0.01284536500064

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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E2.C.9	1C X630 SQ MM	Mtr	900.00	0.00438593167774
E2.C.10	1C X400 SQ MM	Mtr	150.00	0.00105764633728
E2.C.11	2C X2.5 SQ MM	Mtr	6,775.00	0.01057753798949
E2.C.12	2C X25 SQ MM	Mtr	270.00	0.00046426570806
E2.C.13	3.5Cx25 sq mm	Mtr	200.00	0.00072616382343
E2.C.14	4C X10 SQ MM/ 3CX6 SQMM	Mtr	3,030.00	0.00610974590370
E2.C.15	4C X2.5 SQ MM	Mtr	800.00	0.00154889851947
E2.C.16	3C X2.5 SQ MM	Mtr	5,760.00	0.00983770128555
E2.D	LT CONTROL CABLES			
E2.D.1	3Cx1.5 sq mm	Mtr	6,125.00	0.00916583972835
E2.D.2	5Cx1.5 sq mm	Mtr	1,750.00	0.00270430370748
E2.D.3	5Cx2.5 sq mm	Mtr	1,700.00	0.00268962167071
E2.D.4	12Cx1.5 sq mm	Mtr	1,025.00	0.00247780216458
E2.D.5	14Cx1.5 sq mm	Mtr	2,200.00	0.00458971898815
E2.E	SCREENED CONTROL CABLES (F/G Type)			

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E2.E.1	2Px0.5 sq mm	Mtr	13,375.00	0.01867285684801
E2.E.2	4Px0.5 sq mm	Mtr	14,050.00	0.02248665076335
E2.E.3	8Px0.5 sq mm	Mtr	150.00	0.00027695801804
E2.E.4	12Px0.5 sq mm	Mtr	2,100.00	0.00438288454706
E2.E.5	20Px0.5 sq mm	Mtr	2,300.00	0.01306443111052
E2.E.6	Profibus Cables	Mtr	1,500.00	0.00218514210640
E2.E.7	Ethernet cables	Mtr	6,500.00	0.01669928852542
E3	Junction Box/Push button station			
E3.A	Push Button			
E3.A.1	Start Stop push button station	No.	40.00	0.00297459048701
E4	Fabrication & Erection of Structural Steel			
E4.1	Structural steel	MT	0.50	0.00113622496715
E5	DG sets/Switch Gears/MCC/PCC/Distribution Boards/Marshalling Box/Starter Units/ Dry Transformers / Electrical Hoists/ Panels/Cubicles/Desks/UPS/ Batteries/ Chargers/VFD/ LA assy/ NGT/ NGR/ SP/Miscellaneous equipment/ etc.			
E5A	Erection & Commissioning of Diesel Generating set			

TECHNICAL CONDITIONS OF CONTRACT (TCC)

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E5A.1	DG AMF Panel- 1400x800x700 mm	Set	1.00	0.00179775942651
E5A.2	DG Aux DB-1000x1000x600 mm	Set	1.00	0.00229760127531
E5B	HT SWITCHGEAR-11 /3.3 KV SWITCHBOARD			
E5B.1	11 kV switchboard consists of approx. 20 panels , Approx. dimensions 16400X2584X2400 mm- Balance Work			
E5B.1.2	Pre-commissioning checks and tests	Set	1.00	0.00467816865283
E5B.1.3	Charging, Loop testing and commissioning	Set	1.00	0.00093563373057
E5B.1.4	Nomenclature/Name-plate/Painting etc	Set	1.00	0.00093563373057
E5B.1.5	System commissioning	Set	1.00	0.00093563373057
E5B.2	3.3 kV switch board consists of approx. 29 panels , Approx. dimensions 23780X2584X2400 mm- Balance Work			
E5B.2.1	Pre-commissioning checks and tests	Set	1.00	0.00530870442778
E5B.2.2	Charging, Loop testing and commissioning	Set	1.00	0.00106174088556
E5B.2.3	Nomenclature/Name-plate/Painting etc	Set	1.00	0.00106174088556
E5B.2.4	System commissioning	Set	1.00	0.00106174088556

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E5B.3	Modification in Magawin make 11KV Breaker Panel Dimension 4920X2584X2349 mm- Balance Work			
E5B.3.1	Pre-commissioning checks and tests	Set	6.00	0.00140345059585
E5B.3.2	Charging, Loop testing and commissioning	Set	6.00	0.00028069011917
E5B.3.3	Nomenclature/Name-plate/Painting etc	Set	6.00	0.00028069011917
E5B.3.4	System commissioning	Set	6.00	0.00028069011917
E5C	LOW VOLTAGE SWITCHGEAR			
E5C.1	415V, FGD MCC0-1, (Apprx. Dimension 17000x1700x2450 mm)- Balance Work			
E5C.1.1	Pre-commissioning checks and tests	No.	1.00	0.00614487366805
E5C.1.2	Charging, Loop testing and commissioning	No.	1.00	0.00122897473361
E5C.1.3	Nomenclature/Name-plate/Painting etc	No.	1.00	0.00122897473361
E5C.1.4	System commissioning	No.	1.00	0.00122897473361
E5C.2	415V, FGD MCC-2, (Apprx. Dimension 16000x1700x2450 mm)- Balance Work			
E5C.2.1	Pre-commissioning checks and tests	No.	1.00	0.00614487366805

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E5C.2.2	Charging, Loop testing and commissioning	No.	1.00	0.00122897473361
E5C.2.3	Nomenclature/Name-plate/Painting etc	No.	1.00	0.00122897473361
E5C.2.4	System commissioning	No.	1.00	0.00122897473361
E5C.3	Common GDWS (Approximate Dimension: 21000 x 1700 x 2450 mm)- Balance Work			
E5C.3.1	Pre-commissioning checks and tests	No.	1.00	0.00569541191032
E5C.3.2	Charging, Loop testing and commissioning	No.	1.00	0.00113908238206
E5C.3.3	Nomenclature/Name-plate/Painting etc	No.	1.00	0.00113908238206
E5C.3.4	System commissioning	No.	1.00	0.00113908238206
E5C.4	Emergency MCC(Approximate Dimension: 9000 x 1700 x 2450 mm)- Balance Work			
E5C.4.1	Pre-commissioning checks and tests	No.	1.00	0.00270220191373
E5C.4.2	Charging, Loop testing and commissioning	No.	1.00	0.00054044038275
E5C.4.3	Nomenclature/Name-plate/Painting etc	No.	1.00	0.00054044038275
E5C.4.4	System commissioning	No.	1.00	0.00054044038275

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E5C.5	415V AC & ventilation MCC OSA (Approximate Dimension: 18000 x 1700 x 2450 mm)- Balance Work			
E5C.5.1	Pre-commissioning checks and tests	No.	1.00	0.00385240185482
E5C.5.2	Charging, Loop testing and commissioning	No.	1.00	0.00077048037096
E5C.5.3	Nomenclature/Name-plate/Painting etc	No.	1.00	0.00077048037096
E5C.5.4	System commissioning	No.	1.00	0.00077048037096
E5D	Dry Type Transformer			
E5D.1	11/0.433KV,2500kVA,Dry type Transformer Total Weight 8600 Kg Approx- Balance Work			
E5D.1.1	Pre-commissioning checks and tests	No.	2.00	0.00743498032072
E5D.1.2	Charging, Loop testing and commissioning	No.	2.00	0.00148699606414
E5D.1.3	Nomenclature/Name-plate/Painting etc	No.	2.00	0.00148699606414
E5D.1.4	System commissioning	No.	2.00	0.00148699606414
E5D.2	11/0.433KV,1600kVA,Dry type transformer, Total Weight 6000 Kg Approx.- Balance Work			
E5D.2.1	Placement, Alignment and coupling/interconnection where ever applicable, erection of associated accessories etc.	No.	3.00	0.01115247048107

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E5D.2.2	Pre-commissioning checks and tests	No.	3.00	0.00223049409621
E5D.2.3	Charging, Loop testing and commissioning	No.	3.00	0.00223049409621
E5D.2.4	System commissioning	No.	3.00	0.00223049409621
E5E	STATION Lightning			
E5E.A	Lighting Distribution Board (LDB)			
E5E.A.1	AC LDB Type LDB-H (12) without transformer (including cubicle suitable for 2 nos. 100 kVA transformer)- Balance Work			
E5E.A.1.1	Pre-commissioning checks and tests	No.	1.00	0.00036230849997
E5E.A.1.2	Charging, Loop testing and commissioning	No.	1.00	0.00007246169999
E5E.A.1.3	Nomenclature/Name-plate/Painting etc	No.	1.00	0.00007246169999
E5E.A.1.4	System commissioning	No.	1.00	0.00007246169999
E5E.A.2	100kVA transformer for housing in 1.1.1 - Normal Non encapsulated type- Balance Work			
E5E.A.2.1	Pre-commissioning checks and tests	No.	2.00	0.00048349221310
E5E.A.2.2	Charging, Loop testing and commissioning	No.	2.00	0.00009669844262
E5E.A.2.3	Nomenclature/Name-plate/Painting etc	No.	2.00	0.00009669844262

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E5E.A.2.4	System commissioning	No.	2.00	0.00009669844262
E5E.A.3	AC LDB Type LDB-F (8) without transformer (including cubicle suitable for 2 nos. 50 kVA transformer)- Balance Work			
E5E.A.3.1	Pre-commissioning checks and tests	No.	1.00	0.00037729750945
E5E.A.3.2	Charging, Loop testing and commissioning	No.	1.00	0.00007545950189
E5E.A.3.3	Nomenclature/Name-plate/Painting etc	No.	1.00	0.00007545950189
E5E.A.3.4	System commissioning	No.	1.00	0.00007545950189
E5E.A.4	50kVA transformer for housing in 1.2 - Normal encapsulated type-- Balance Work			
E5E.A.4.1	Pre-commissioning checks and tests	No.	2.00	0.00070317069057
E5E.A.4.2	Charging, Loop testing and commissioning	No.	2.00	0.00014063413811
E5E.A.4.3	Nomenclature/Name-plate/Painting etc	No.	2.00	0.00014063413811
E5E.A.4.4	System commissioning	No.	2.00	0.00014063413811
E5E.A.5	AC WDB Type WDB-H (12)- Balance Work			
E5E.A.5.1	Pre-commissioning checks and tests	No.	1.00	0.00043167784897

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E5E.A.5.2	Charging, Loop testing and commissioning	No.	1.00	0.00008633556979
E5E.A.5.3	Nomenclature/Name-plate/Painting etc	No.	1.00	0.00008633556979
E5E.A.5.4	System commissioning	No.	1.00	0.00008633556979
E5E.A.6	100kVA transformer for housing in AC WDB- Balance Work			
E5E.A.6.1	Pre-commissioning checks and tests	No.	1.00	0.00029229644100
E5E.A.6.2	Charging, Loop testing and commissioning	No.	1.00	0.00005845928820
E5E.A.6.3	Nomenclature/Name-plate/Painting etc	No.	1.00	0.00005845928820
E5E.A.6.4	System commissioning	No.	1.00	0.00005845928820
E5E.A.7	DCLDB Type LDB-D (6)- Balance Work			
E5E.A.7.1	Pre-commissioning checks and tests	No.	1.00	0.00028114246794
E5E.A.7.2	Charging, Loop testing and commissioning	No.	1.00	0.00005622849359
E5E.A.7.3	Nomenclature/Name-plate/Painting etc	No.	1.00	0.00005622849359
E5E.A.7.4	System commissioning	No.	1.00	0.00005622849359
E5E.B	Lighting Panels (LP)			
E5E.B.1	AC Normal /Emergency indoor Type LP – A (12) [with timer]	No.	2.00	0.00064615117444

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E5E.B.2	AC Normal /Emergency indoor Type LP – A (18) [with timer]	No.	1.00	0.00036661543207
E5E.B.3	DC indoor Type LP – D (6)	No.	1.00	0.00031108254639
E5E.C	Lighting Luminaires (complete with accessories)			
E5E.C.1	Luminaires Type FC06 (LED)	No.	235.00	0.01372625540439
E5E.C.2	Luminaires Type FC26 (LED)	No.	65.00	0.00432463393812
E5E.C.3	Luminaires Type SB02 (LED)	No.	6.00	0.00044334794505
E5E.C.4	Luminaires Type FC81 (LED)	No.	39.00	0.00237282865526
E5E.C.5	Luminaires Type SF63	No.	15.00	0.00101650066896
E5E.C.6	Luminaires Type FC07 .	No.	13.00	0.00073840026991
E5E.C.7	Luminaires Type FC33 .	No.	7.00	0.00039760014534
E5E.C.8	Luminaires Type FC34	No.	8.00	0.00047476390690
E5E.D	Switch boxes for individual control of circuits (Switchboards consisting of switch boxes, switches, switch plates and fixing accessories.)			
E5E.D.1	Type SWB1	No.	19.00	0.00082360166290
E5E.D.2	Type SWB2	No.	4.00	0.00017933261177

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E5E.D.3	Type SWB3	No.	6.00	0.00028827249334
E5E.D.4	Type SWB4	No.	3.00	0.00014156743907
E5E.E	Junction boxes			
E5E.E.1	Type JB-F	No.	386.00	0.03728332680923
E5E.E.2	Type JB-FE	No.	49.00	0.00500919552197
E5E.E.3	Type JB-S	No.	20.00	0.00201117692721
E5E.F	Receptacles			
E5E.F.1	Type RA	No.	14.00	0.00080962705735
E5E.F.2	Type RB	No.	5.00	0.00045367591532
E5E.F.3	Type RC	No.	3.00	0.00022166521331
E5E.G	Poles including civil work [Fabricated swaged, stell tubular with swan neck arrangement, GALVANISED]			
E5E.G.1	Type PS2	No.	14.00	0.01051330659177
E5E.G.2	Type PF2 (Flood light)	No.	14.00	0.00973227221625
E5E.I	Wires			
E5E.I.1	1x2.5 mm2 Cu PVC	Mtr	13,470.00	0.00570534867210

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E5E.I.2	1x 4 mm ² Cu PVC	Mtr	1,130.00	0.00054856998524
E5E.J	Hot dip Galvanised Rigid Steel Conduits (Heavy Duty)			
E5E.J.1	20 mm dia GI conduit, 1.6 mm thick	Mtr	2,860.00	0.01657664870128
E5E.J.2	25 mm dia GI conduit, 1.6 mm thick	Mtr	450.00	0.00290782957561
E5E.J.3	20 mm dia GI conduit with epoxy coating, 1.6 mm thick	Mtr	50.00	0.00018542718464
E5E.K	Conduit/Hoses/Pipes			
E5E.K.1	20 mm dia LEAD coated conduit	Mtr	295.00	0.00127323497240
E5F	220V Battery & Battery Charger			
E5F.1	220 V DC Lead-acid(90AH)/Ni cd battery (150AH) single string . Each cell dimension is 1475 x 700 x 700 mm. Total Weight 250 kg. along with 220V Battery Chargers (500A)	Set	2.00	0.05229662355047
E5G	VFD Panel			
E5G.1	Transportation from stores / storage yards to erection site, erection, assembly, testing & commissioning of Variable Frequency Drive System for RC Pump consist of IGBT based VFD Panel (4227 x1255x 2800 mm) consisting Dry Type Transformer, Breaker Panel, MCC Panel etc- Balance Work			
E5G.1.1	Pre-commissioning checks and tests	Set	2.00	0.00540971020033

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E5G.1.2	Charging, Loop testing and commissioning	Set	2.00	0.00108194204007
E5G.1.3	Nomenclature/Name-plate/Painting etc	Set	2.00	0.00108194204007
E5G.1.4	System commissioning	Set	2.00	0.00108194204007
E6	Earthing/Lightning Protection Strips. Earthing Pits			
E6A	BELOW/ABOVE GROUND EARTHING			
E6A.1	GS FLAT 25x6 mm	Mtr	200.00	0.00147132888313
E6A.2	GS FLAT 50x6 mm	Mtr	650.00	0.00593817902005
E6A.3	GS FLAT 70x10 mm/ 65X8 MM	Mtr	640.00	0.00623816675972
E6A.4	GI wire 4 mm dia (8 SWG)	Mtr	2,540.00	0.00187056277653
E7	LT/HT BUS DUCTS			
E7A	SEGREGATED PHASE BUS DUCT			
E7A.1	3.3 KV , 2500A,(Approx. total length 29 Mtr.)			
E7A.1.1	Pre assembly of Bus Ducts and accessories, erection, alignment, bolting/welding etc. complete with supporting structure- Balance Work	SET	0.55	0.00322949063465
E7A.1.2	Pre commissioning checks	SET	1.00	0.00083882873627
E7A.1.3	Testing, Charging and Painting (as applicable)	SET	1.00	0.00083882873627
E7B	LT Bus Duct			

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E7B.1	2500 A, Approx. length of each I/c is 10 Mtr.Total length is 20 Mtr.Balance Work			
E7B.1.1	Pre assembly of Bus Ducts and accessories, erection, alignment, bolting/welding etc. complete with supporting structure	Set	1.75	0.00413211949641
E7B.1.2	Pre commissioning checks	Set	2.00	0.00067463175452
E7B.1.3	Testing, Charging and Painting (as applicable)	Set	2.00	0.00067463175452
E7B.2	2500 A, Approx. length of each I/c is 15 Mtr.Total length is 15 Mtr.(Tie breaker)-Balance Work			
E7B.2.1	Pre assembly of Bus Ducts and accessories, erection, alignment, bolting/welding etc. complete with supporting structure	Set	0.50	0.00143759718218
E7B.2.2	Pre commissioning checks	Set	1.00	0.00041074205205
E7B.2.3	Testing, Charging and Painting (as applicable)	Set	1.00	0.00041074205205
E7B.3	4000 A Approx. length of each I/c is 10 Mtr.Total length is 40 Mtr-Balance Work			
E7B.3.1	Pre commissioning checks	Set	2.00	0.00067463126031
E7B.3.2	Testing, Charging and Painting (as applicable)	Set	2.00	0.00067463126031
E8	Oil Filled Transformer			

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E8.1	Transportation up to foundation, Assembly, testing & commissioning of Three Phase , 11/3.54 KV, 12.54 MVA ONAF, Auxiliary transformer along with HV/LV/LVN Porcelain bushings, radiators, conservator, marshalling panel, HV Cable box with is connecting chamber, Buchholz relay, Cable box supports, PRV, piping, NGR 3.3 kV etc.-Balance Work			
E8.1.1	Erection of associated auxiliaries/ assemblies, oil filling, etc.	Set	2.00	0.02246083348526
E8.1.2	Dry out including oil filtration	Set	2.00	0.01497388899017
E8.1.3	Pre-commissioning checks/Testing	Set	2.00	0.00748694449509
E8.1.4	Charging and Painting (as applicable)	Set	2.00	0.00374347224754
E9	ONLY TESTING & COMMISSIONING			
E9.1	750 KVA, 3 phase, 415 V skid-mounted diesel generator set Overall dimension: 9000 x 2500 x 3750 mm	Set	1.00	0.00082641895605
E9.2	Testing and commissioning of 3.3/6.6 &11 KV HT motors including dryout.	No.	16.00	0.01124985333015
E9.3	Motor Operated Actuators/ Gates/ Dampers	No.	18.00	0.00256219481489
E9.4	Pneumatic Valve	No.	25.00	0.00465640756384
E10	OTHER ITEMS			
E10A	HT CABLE TERMINATION KITS (Armoured/Un-armoured)			

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E10A.1	TERM. KIT 11KV 1C-630 AL	Nos	12.00	0.00466628439535
E10A.2	TERM. KIT 11KV 3C-150 AL	Nos	2.00	0.00059193034847
E10B	Trefoil clamps			
E10B.1	11KV 1C-630 AL UA , XLPE Cable	No	1,334.00	0.02206740638609
E10C	Fire Proof Sealing			
E10C.1	Fire Proof Sealing	Sq Mtr	8.00	0.00074597617917
I4	Conduits/Impulse pipe/tubes			
I4.1	ASTM A106 Gr.C Size:1/2" Sch 80	Mtr	200.00	0.00437353404939
I4.2	ASTM A106 Gr.C Size:3/4" Sch 80	Mtr	100.00	0.00251733212900
I6	Panels/Cubicles/Racks/Enclosures/Monitors/Computer/Computer peripheral/PLCs/UPS/Batteries			
I6.1	DCS Control Panel 750 x750x 2067 mm-Balance Work			
I6.1.1	Erection and alignment	No.	2.00	0.00185634156341
I6.1.2	Fixing of loose items/instruments where ever applicable	No.	35.00	0.00499784267073
I6.1.3	Pre commissioning checks, Charging of panel and Loop testing etc	No.	35.00	0.00499784267073
I6.1.4	System commissioning	No.	35.00	0.00249892133536

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16.2	Network Panel 2067 X 800 X 800 mm, weight 400 kg-Balance Work			
16.2.1	Fixing of loose items/instruments where ever applicable	No.	1.00	0.00013862227135
16.2.2	Pre commissioning checks, Charging of panel and Loop testing etc	No.	1.00	0.00013862227135
16.2.3	System commissioning	No.	1.00	0.00006931113567
16.3	VMS Panel (1500 x800x 2000 mm)--Balance Work			
16.3.1	Fixing of loose items/instruments where ever applicable	Set	2.00	0.00074702584770
16.3.2	Pre commissioning checks, Charging of panel and Loop testing etc	Set	2.00	0.00074702584770
16.3.3	System commissioning	Set	2.00	0.00037351292385
16.4	LIE/LIR/TTE	No.	45.00	0.06796683216364
16.5	Operator Station (OPS) /Engineering Activity station/Historian Station Having 24 " LED Monitor, and other loose supplied items like Key board, Mouse, Modems, UPS, inter connecting power and communication cables etc	No.	3.00	0.00156290973440
16.6	Color laser jet Printer	No.	1.00	0.00027850069110
16.7	DC Ethernet switch	No.	1.00	0.00007436738026
16.8	Computer Furniture for all server , PCs, Printers etc	Set	4.00	0.01390740410757

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16.9	Control Desk (each)	No.	1.00	0.00453906843712
16.10	12 V DC Lead Acid battery 180 Ah in each battery bank. Dimension is 521 x 278 x 270 mm. Weight 55.1 kg.	No	4.00	0.01419247473662
16.11	24 V, 360 Ah ,DC Battery Charger . weight 100 Kg including stand-Balance Work			
16.11.1	Fixing of loose items/instruments where ever applicable	No.	1.00	0.00070962369141
16.11.2	Pre commissioning checks, Charging of panel and Loop testing etc	No.	1.00	0.00070962369141
16.11.3	System commissioning	No.	1.00	0.00035481184570
16.12	30 kVA UPS System. Dimension is 3000X1000X2015mm. Weight is 1000kg/unit along with ACDB , dimension is 900X900X2015mm. Weight is 600kg/unit. & UPS Battery, Ni cd type consists 180 No. cell of 210 Ah in each battery bank. Each set dimension is 4000 x 950 x 1835 mm. Weight of set is 5000 Kg.-Balance Work			
16.12.1	Fixing of loose items/instruments where ever applicable	Set	1.00	0.00158921423830
16.12.2	Pre commissioning checks, Charging of panel and Loop testing etc	Set	1.00	0.00158921423830
16.12.3	System commissioning	Set	1.00	0.00079460711915
16.13	Opacity Monitors	Set	2.00	0.00235484963552

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17	Instruments/Devices including sensors/Cells/Probes etc			
17.1	Electronic Transmitter (Pressure & Differential pressure transmitter) with probe and all accessories	No.	39.00	0.01061998771865
17.2	Temperature Transmitters	No.	95.00	0.00795359523037
17.3	Flow transmitter	No.	12.00	0.00166304507072
17.4	Temperature Gauge Gas Filled Type/Temp. gauge/Temp. gauge MIST (Mercury in Steel thermometer)	No.	7.00	0.00050048556491
17.5	Pressure/Differential Pressure Gauges	No.	34.00	0.00223199774354
17.6	Flow Element (Pitot Tube)/Flow indicator/Flow gauge	No.	2.00	0.00054759038149
17.7	PH Analyser	Set	2.00	0.01068176865614
17.8	SO2 Analyser along with probe , interconnection tubing , cabling etc.	Set	2.00	0.01100609195722
17.9	O2 Analyser along with electronic unit & accessories.	Set	2.00	0.00244199619652
17.10	Temp/ Pressure/ DP switches	No.	10.00	0.00089023435590
17.11	Solenoid valve	No.	42.00	0.00165606401844
17.12	Level transmitter/Level gauge/Level indicator	No.	10.00	0.00217280880883
17.13	Flow switches	No.	10.00	0.00179513681626

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17.14	Angular Positioning Transmitter	No.	2.00	0.00075348837155
18	Commissioning and Testing activities for Equipments erected by other agencies			
18.1	RTD Based Temperature Transmitter	No.	8.00	0.00042424121499
19	Miscellaneous Items			
19A	FIRE DETECTION & ALARM SYSTEM			
19A.1	Fire Alarm Panel	No.	1.00	0.00063776642056
19A.2	Multisensor Detector with base	No.	157.00	0.01205891049510
19A.3	Control modules with enclosure	No.	13.00	0.00103889034647
19A.4	hooter cum strobe	No.	13.00	0.00099850612806
19A.5	MCP with mounting back box (Indoor)	No.	5.00	0.00040228499959
19A.6	Exit Signs	No.	15.00	0.00115212451858
19A.7	Operator Workstation	No.	1.00	0.00043983168753
19A.8	PC alongwith accessories like Monitor, Printer, UPS, furniture, etc	Set	1.00	0.00258594199619
19A.9	Loop Cable (2C x 1.5 sqmm, armoured)	Mtr.	1,000.00	0.00161112453849

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I9A.10	Laying, Termination & Testing, etc. of Optical Fibre Cables on cable trays, conduits etc with minor civil works	Mtrs	1,600.00	0.00419784689223
TOTAL AMOUNT				1.00000000000000

