Electrical Works of U#3

TECHNICAL CONDITIONS OF CONTRACT (TCC)

ERECTION, TESTING & COMMISSIONING OF ELECTRICAL PKG FOR Unit # 3 at 3X800 MW PVUNL STPP, PATRATU, JHARKHAND

BHARAT HEAVY ELECTRICALS LIMITED

TECHNICAL CONDITIONS OF CONTRACT (TCC)
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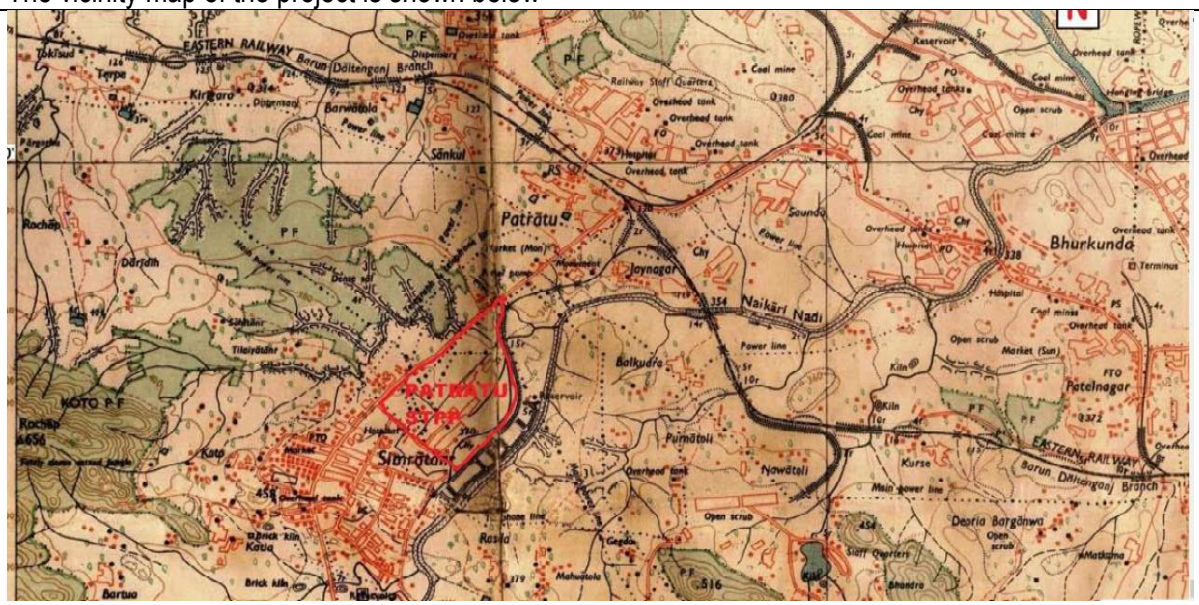
1.	**PROJECT INFORMATION**		
1.1.	Project Name	3x800 MW Patratu Vidyut Utpadan Nigam Ltd. (PVUNL) Patratu STPP	
1.2.	Plant Site Location	Near Patratu town in Ramgarh district of Jharkhand	
1.3.	Location Co-ordinate	Main Plant & Township:	
	Corner name	Latitude	Longitude
1.3.1.	Top Corner	23°39'00'' N	85°17'51.5"E
1.3.2.	Bottom Corner	23°38'12.5''N	85°17'27"E
1.3.3.	Left Corner	23°38'22.5''N	85° 17'10.6''E
1.3.4.	Right Corner	23°38'40"N	85°17'57''E
1.4.	Nearest Town/ City	Patratu -03km, Ramgarh–30km, Ranchi – 37km	
1.5.	Nearest Railway Station	Patratu-4km	
1.6.	Nearest Airport	Ranchi–45km	
1.7.	Nearest Seaport	Kolkata–424km	
1.8.	Nearest Road Access	Ranchi Patratu Ramgarh Road	
1.9.	Site Elevation	377m above MSL	
1.10.	Ambient Temperature		
1.10.1.	Mean of Daily Maximum Temperature	40°C (During May)	
1.10.2.	Mean of Daily Minimum Temperature	10.7°C (During December)	
1.10.3.	Wet Bulb Temperature	27°C (Maximum)	
1.10.4.	Annual Rainfall	311mm average annually	
1.10.5.	Wind Speed	0 to 39 km/ hr	
1.10.6.	Wind Direction	East North East to West South West	
1.10.7.	Seismic Zone	Zone III as per IS:1893	
1.10.8.	The vicinity map of the project is shown below		
			

1.10.9.	The Bidder shall visit site and get acquainted himself with the conditions prevailing at site before submission of the bid. The information given here in under are for general guidance and shall not be contractually binding on BHEL/ Owner. All relevant site data/ information as may be necessary shall have to be obtained/ collected by the Bidder.

2.	**SCOPE OF WORK**
2.1.	**Name of the Package:** ERECTION, TESTING & COMMISSIONING OF ELECTRICAL PKG OF MAIN PLANT AREA INCLUDING ACC SYSTEMS FOR Unit#3 Providing labour, supervision, T&Ps, consumables, etc for receipt from store/ storage yard, watch & ward, transportation to site, pre-assembly (as required), erection, testing, commissioning, trial run, handing over, etc, as required and receipt, storage, etc of self-supplied materials, etc for total scope defined in tender and terms & conditions of tender, taking into account of all clarifications, confirmations, agreements, corrigendum, amendment till date for complete work of Generator Transformer, Station Transformer, Unit Auxiliary Transformer, Unit Transformers, Station Aux. Transformers, other Misc Transformer, HT/ LT Bus Duct, DG Set, associated equipment/ items/ panel, Cable Tray & accessories; Cabling; Various Panel, Motor; Earthing And Lightening Protection, HT/ LT Switchgear, other misc equipment along with Illumination System; etc for Main Plant & ACC Area-U#3 of 3X800MW Patratu Super Thermal Power Project, Patratu, Jharkhand. The work under these specifications broadly covers the complete work of handling at storage yard/ stores, transportation to work site (from inside or outside plant), calibration, pre-assembly, Minor Civil job (as per requirement), erection, testing, pre-commissioning, and handing over of Main Plant Electrical System, Cabling package of Unit#3 areas, TG Building, Boiler, ESP & ID Fan Area, Pipe Rack, Transformer Yard, FGD and other related areas for Unit-3 Main Plant and ACC area readiness which are not specifically mentioned in this TCC.
2.2.	**Scope of Consortium Partner:** Consortium Partner has to execute (including Installation, Erection, Testing & Commissioning) of following equipment /Items covered under this Package: a) Power Transformer above 5 MVA rating along with associate systems b) HT Bus Ducts (IPBD & SPBD) along with associate systems
2.3.	a) Cable Tray & Accessories. b) Power Cables (HT & LT). c) Control Cables. d) HT Straight through joints and Termination Kits. e) Junction boxes and Push buttons. f) Structural Steel g) 415V Switchgear/ PCC/ MCC. h) AC/ DC Starter panel/ Local starter boxes/ Power distribution boxes/ Marshalling boxes. i) Control & Relay Panels. j) 220V DC Battery System. k) Variable Frequency Drive for CEP. l) Station Lighting. m) Above Ground Earthing and Lightning Protection systems. n) LT Bus Duct (NSPBD). o) 11/ 3.3kV Segregated Phase Bus Duct (SPBD). p) 27kV Isolated Phase Bus Duct (IPBD). q) Oil Filled Power Transformers (GT, UT, UAT, ST, SAT and Other Aux Transformers). r) Soot Blower System.

	s) Only Testing & Commissioning of certain items as mentioned in the BOQ erected by other agencies (Electrical Hoists, HVR Transformers, DG sets, etc.) t) Other Misc. associated equipment u) Electrical/Cabling/Illumination work of ACC area (ACC area is height job of approx. 50 mtr height)
2.4.	The broad areas for E&C work include: i) Boiler & its auxiliaries ii) Turbine & its auxiliaries iii) Generator & its auxiliaries iv) ESP Area v) ACC Area vi) Piping vii) All other areas of Unit-3
2.5.	BHEL is operating web based computerized Suvidha/ SDD/IPMS/SCMS/E-store 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 coordinating, data gathering in suitable format, computer operations for implementation of Suvidha/SDD/ IPMS/ SOMS 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 consumables/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/ customer. Supply scope of these items shall form part of the installation rates quoted for the item. E&C of scope shall be completed as per approved drawings & instructions received from BHEL Engineers.
2.6.	**CABLE TRAYS/ CABLE DUCTS AND ACCESSORIES**
2.6.1.	Cables shall run in cable trays mounted horizontally or vertically on cable tray support system which in turn shall be supported from floor, ceiling, overhead structures, trestles, pipe racks, trenches or other building structures.
2.6.2.	This scope of works also includes Base plate for single/double channel, Flat Plate.
2.6.3.	Horizontally running cable trays shall be clamped by bolting to cantilever arms and vertically running cable trays shall be bolted to main support channel by suitable bracket/ clamps on both top and bottom side rails at an interval of 2000mm in general. For vertical cable risers/ shafts cable trays shall be supported at an interval ranging from 1000mm to 1500mm in general. Fixing of cable trays to cantilever arms or main support channel by welding shall not be accepted. Cable tray installation shall generally be carried out as per the approved guidelines/ drawings.
2.6.4.	The cantilever arms shall be positioned on the main support channel with a minimum vertical spacing of 300mm unless otherwise indicated.
2.6.5.	Spacing between cable trays shall normally be kept 300mm for cable laying convenience and effective heat dissipation. Where direct heat radiation exists, heat isolating barriers shall be adopted.

2.6.6.	The contractor shall fix the brackets/ clamps/ insert plates using anchor fasteners. Minimum size of anchor fasteners shall be M8x50 and material shall be stainless steel grade 316 or better. Anchor fastener shall be fixed as recommended by manufacturer and as approved by site engineer. For brick wall suitable anchor fasteners shall be used as per the recommendations of manufacturer.
2.6.7.	All cable way sections shall have identification, designations as per cable way layout drawings and painted/ stenciled at each end of cable way and where there is a branch connection to another cable way. Minimum height of letter shall be not less than 75mm. For long lengths of trays, the identification shall be painted at every 10meter and at each end of cable tray & branch connection floor/ wall opening. Risers shall additionally be painted/ stenciled with identification numbers at every floor.
2.6.8.	In certain cases, it may be necessary to site fabricate portions of trays, supports and other non-standard bends where the normal prefabricated trays, supports and accessories may not be suitable. Fabricated sections of trays, supports and accessories to make the installation complete at site shall be neat in appearance and shall match with the prefabricated sections in the dimensions. They shall be applied with one coat of red lead primer, one coat of oil primer followed by two finishing coats of aluminum paint.
2.6.9.	Various types of sheet metal, galvanized cable tray, i.e., Perforated, ladder type, seal metal duct, solid bottom tray, shall be provided in standard lengths along with accessories like hardware, bends, reducers, coupler plate, tray covers, trefoil clamps and tray clamps etc.
2.6.10.	Installation of cable tray/ cable duct shall include cutting, laying, jointing, supporting, drilling holes in the support, providing tees/ reducers/ bends/ clamps as per tray route layout, Fabrication of bends/ tees/ reducers from straight length, fixing of tray covers, welding of tray on support, cleaning and application of paint (refer clause no. 2.29 for details) on weld joints. Installation of tray/ duct covers, wherever provided, will be done as a part of tray erection and no extra rates will be payable.
2.6.11.	Mentioned fabrication cable trays quoted in BOQ sl no. E1E.1 to E1E.9, are payable for the bends which are supposed to be supplied by BHEL.
2.6.12.	Fabrication of tee/ reducers from straight length of tray is within the scope of work and rate quoted shall be inclusive in unit rate (in running meter).
2.6.13.	Cable trays/ ducts have to be routed underground in cable trench, over head on structure, valves, floors etc. for various applications such as cable laying, copper tubes, conduits, thermocouple, temperature gauge capillary etc.
2.6.14.	As per the BOQ Main Cable tray and support shall be installed in Cable cellar, Boiler floors, All floors in B-C, C-D, and Mill, ID-Fan, PA-Fan, ID-Fan, ESP, Soot Blower area, BOP and other associated systems. Looping Trays shall be laid from JB to Field which is also under the scope of the contractor.
2.6.15.	Cable trays where ever is required by the other BHEL vendor (from BHEL Equipment to BHEL Equipment) are included in this contract as sizes mentioned in BOQ. Cable tray routing shall be done by the agency as per the drawing provided by PEM or Concerned BOP agency.
2.6.16.	Installation of cable racks and supports structure shall be carried out in all the required areas. Steel embedment shall be provided in the cable trenches, ceiling slabs and concrete blocks for installing the cable racks and support structures.
2.6.17.	Ladder & perforated type cable trays shall be used in cable trenches and vertical risers.
2.6.18.	Perforated cable trays shall be used in higher elevations in Boiler and TG area.
2.6.19.	Cable racks in the trenches and control room are to be shared with other contractors installing cables in different areas wherever required. Contractor shall cooperate with the other contractors in sharing the cable trays and proper dressing and clamping the cables.
2.6.20.	Cable trays in boiler & ESP area shall be supported from the boiler and ESP structures. The same shall be coordinated with Boiler/ ESP contractor.

2.6.21.	Cable trays in these areas shall be in vertical formation to avoid dust accumulation. No cable trenches shall be provided in Boiler/ ESP area.
2.6.22.	Cable tray philosophy shall be as per enclosed cable erection philosophy.
2.7.	**METAL CHANNEL FLEXIBLE BOLTABLE CABLE SUPPORT SYSTEM (ESP/ BOILER/ BOP Area/ As per the drawing provided by BHEL-PEM for main route to Auxiliary Areas etc.)**
2.7.1.	Flexible GI cable support system, consisting of single/ double channels, base plates, and cantilever arms are as per BOQ. Wherever necessary, the base plate beam clamps will be supplied for bolting. Otherwise, the base plates are to be welded to the racks or beams if necessary, at 90°.
2.7.2.	Wherever supplied, GI cable trays shall be of bolted construction only with fixing screws and coupler plates.
2.7.3.	Angle fittings, flat plate fittings, clamps for single & double channels, fasteners etc. will be supplied for fixing trays and cantilever arms and for this no separate erection charges will be paid. Quoted Rates shall be accommodated in support channel and cantilever arm erection.
2.7.4.	Metal channel boltable 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.
2.7.5.	Channel shall be supplied in standard length of six meter. Contractor shall cut the channel and assembly the rack as per site requirement. Cantilever arm is to be fixed on channel support with spring loaded nuts/ bolts as per installation drawing.
2.7.6.	Base plate/ angle fitting shall be continuously welded all around to steel members/ plate insert if provided. Brackets/ clamps shall be welded to steel surface with channel as applicable in position to ensure alignment of clamps/ channels. Weld thickness shall be 6 mm minimum. In case steel surface in not available for welding, anchor bolts is to be used for fixing the base/ angle fitting.
2.7.7.	Main support for longitudinal cable tray run in the cable vaults shall be fixed at both ends at top as well at bottom as out lined above.
2.7.8.	Galvanization damaged due to welding/ cutting shall be re-painted with cold galvanizing paint (refer Clause no. 2.29 for details).
2.7.9.	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.
2.7.10.	The Nuts & bolts should be galvanized type.
2.8.	**CABLE LAYING (POWER/ CONTROL/ INSTRUMENTATION SHIELDED/ UNSHIELDED CABLES/ PLUG-IN CABLES/ COAXIAL/ UTP/ STP/ DATA HIGHWAY, ARMOURED/ UN-ARMOURED, SINGLE-CORE/ MULTI-CORE, PVC/ HR PVC/ FRLS/ TEFLON/ PTFE/ XLPE INSULATION, OPTICAL FIBER)**
2.8.1.	Cable installation shall be carried out as per Indian Standard (IS)1255 and other relevant standards and regulations.
2.8.2.	For Cable unloading, pulling etc. following guidelines shall be followed in general:
2.8.3.	Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall be drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication, the drums may be rolled in the same direction as it was rolled during taking up the cables. For unreeling the cable, the drum shall be mounted on suitable jacks or on cable wheels and shall be rolled slowly so that cable comes out over the drum and not

	from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends. Cable ends shall be provided with sealed plastic caps to prevent damage and ingress of moisture.
2.8.4.	While laying cable, ground rollers shall be used at every 2-meter interval to avoid cable touching ground. The cables shall be pushed over the rollers by a gang of people positioned in between the rollers. Cables shall not be pulled from the end without having intermediate pushing arrangements. Pulling tension shall not exceed the values recommended by cable manufacturer. Selection of cable drums for each run shall be so planned so as to avoid using straight through joints. Care should be taken while laying the cables so as to avoid damage to cables. If any particular cable is damaged, the same shall be repaired or changed to the satisfaction of Engineer in Charge.
2.8.5.	Cables shall be laid on cable trays strictly in line with cable schedule. Where specific cable layouts are not shown on drawings, Contractor shall route these as directed by the Engineer in Charge
2.8.6.	Power and control cables shall be laid on separate tiers in line with the approved guidelines/ drawings. The laying of different voltage grade cables shall be on different tiers according to the voltage grade of the cables. In horizontal tray stacks, H.T. cables shall be laid on top most tier and cables of subsequent lower voltage grades on lower tiers of trays. Single core cable in trefoil formation shall be laid with a distance of four times the diameter of cable between trefoil center lines and clamped at every two meters. All multicore cables shall be laid in touching formation. Power and control cables shall be secured fixed to trays/ support with cable clamps/ ties with self-locking arrangement. For horizontal trays arrangements, multicore power cables and control cables shall be secured at every five-meter interval. For vertical tray arrangement, individual multicore power cables and control cables shall be secured at every one meter. After completion of cable laying work in the particular vertical tray, all the control cables shall be binded to trays/ supports by cable clamps/ ties with self-locking arrangement at every five-meter interval and at every bend. Fibre Optical cable shall be laid in trenches/ trays or as decided by BHEL.
2.8.7.	Bending radii for cables shall be as per manufacturer's recommendations and Indian Standard (IS)1255.
2.8.8.	Where cables cross roads/ rail tracks, the cables shall be laid in hume pipe/ HDPE pipe.
2.8.9.	No joints shall be allowed in trip circuits, protection circuits and CT/ PT circuits. Also joints in critical equipment in main plant area shall not be permitted. Vendor shall identify and accordingly finalize the cable drum length.
2.8.10.	In each cable run some extra length shall be kept at suitable point to enable one LT/ two HT straight through joints to be made, should the cable develop fault at a later stage. Control cable termination inside equipment enclosure shall have sufficient lengths so that shifting of termination in terminal blocks can be done without requiring any splicing.
2.8.11.	Wherever few cables are branching out from main trunk route troughs shall be used.
2.8.12.	Where there is a considerable risk of steam, hot oil or mechanical damage cable routes shall be protected by barriers or enclosures.
2.8.13.	The installation work shall be carried out in a neat workman like manner & areas of work shall be cleaned of all scraps, water, etc. after the completion of work in each area every day. Contractor shall replace RCC/ Steel trench covers after the Installation work in that particular area is completed or when further work is not likely to be taken up for some time.
2.8.14.	Separation: At least 300mm clearance shall be provided between HT power & LT power cables. minimum 200mm clearance between LT power & LT control/ instrumentation cables.
2.9.	**Segregation of Cables**
2.9.1.	All cables associated with the unit shall be segregated from cables of other units.

	Interplant cables of station auxiliaries and unit critical drives shall be segregated in such a way that not more than half of the drives are lost in case of single incident of fire. Power and control cables for AC drives and corresponding emergency AC or DC drives shall be laid in segregated routes. Cable routes for one set of auxiliaries of same unit shall be segregated from the other set.
2.9.2.	In switchyard, control cables of each bay shall be laid on separate racks/ trays.
2.9.3.	Cable tags shall be provided on all cables at each end (just before entering the equipment enclosure), on both sides of a wall or floor crossing, on each duct/ conduit entry, and at every 20 meters in cable tray/ trench runs. Cable tags shall also be provided inside the switchgear, motor control centers, control and relay panels etc. where a number of cables enter together through a gland plate. Cable tag shall be of rectangular shape for power cables and control cables. Cable tag shall be of 2 mm thick aluminum with number punched on it and securely attached to the cable by not less than two turns of 20 SWG GI wire conforming to IS:280. Alternatively, the Contractor may also provide cable tags made of nylon, cable marking ties with cable number heat stamped on the cable tags. The cable tag requirements mentioned above shall prevail over Tag requirements mentioned elsewhere in this document for HT power, LT power & control cables.
2.9.4.	While crossing the floors, un-armoured cables shall be protected in conduits up to a height of 500 mm from floor level if not laid in tray.
2.9.5.	The termination and connection of cables shall be done strictly in accordance with cable termination kit manufacturer" instructions, drawings and/ or as directed by Engineer in Charge.
2.9.6.	Cable jointer shall be qualified to carryout satisfactory cable jointing/ termination. Contractor shall furnish for review documentary evidence/ experience reports of the jointers to be deployed at site.
2.9.7.	Work shall include all clamps, fittings etc. and clamping, fitting, fixing, plumbing, soldering, drilling, cutting, taping, preparation of cable end, crimping of lug, insulated sleeving over control cable lugs, heat shrinking termination (where applicable), Elastimold termination (wherever applicable), connecting to cable terminal, shorting and grounding as required to complete the job to the satisfaction of the Engineer in Charge. Apart from termination and straight through joints of HT cables, everything is included in cable laying.
2.9.8.	The equipment will be generally provided with undrilled gland plates for cables/ conduit entry. The Contractor shall be responsible for punching of gland plates, painting and touching up. Holes shall not be made by gas cutting. The holes shall be true in shape. All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively sealed by 2mm thick aluminium sheets.
2.9.9.	Control cable cores entering control panel/ switchgear/ MCC/ miscellaneous panels shall be neatly bunched, clamped and tied with self-locking type nylon cable ties with de interlocking facility to keep them in position. Supply of cable tie is under contractor's scope.
2.9.10.	All the cores of the control cable to be terminated shall have identification by providing ferrules at either end of the core, each ferrule shall be indelible, printed single tube ferrule and shall include the complete wire number and TB number as per the drawings. The ferrule shall fit tightly on the core. Spare cores shall have similar ferrules with suffix sp1, sp2, ---etc. along with cable numbers and coiled up after end sealing.
2.9.11.	All cable terminations shall be appropriately tightened to ensure secure and reliable connections.
2.9.12.	Cable laying includes cutting to the required length, laying in overhead cable racks/ underground cable trenches/ pipes/ flexible conduits, dressing/ clamping in tray, drilling of holes in gland plates in panels and junction box, glanding, splicing, dressing of spliced wire inside the panel and JBs, providing printed ferrules (ferrule printing machines to be provided by contractor for printing necessary cross ferruling details)/ providing PVC numerical/ alphabetical/ printed ferrules (contractor to arrange adequate

	numbers of his own ferrule printing machine), termination by using crimp type copper tinned/ aluminium lugs, insulated/ un-insulated, termination (crimp, soldering, etc.), plug-in connections with insert type crimping, continuity checking, providing identification PVC/ aluminium cable tags (at both the ends and at appropriate intervals (approximately 30meter) throughout the route length and also at each bend), continuity checking, insulation resistance checking, high voltage test on HT cables. Laying of Optical fiber cables on cable trays/ cable trench shall necessarily be done using flexible conduit.
2.9.13.	The erection contractor shall supply consumables like aluminum tags, lugs and ferrules.
2.9.14.	Buried cable routes shall have marker projecting 150mm above ground and shall be spaced at an interval of 30m along the route and at every bend.
2.9.15.	No single core cable shall pass through a GI conduit/ pipe or duct singly except DC single core cables. AC single core cables shall pass through GI conduit/ pipe in trefoil formation only, or through PVC pipes confirming to IS: 4985.
2.9.16.	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.
2.9.17.	LT Power cables of cross-sectional area less than 95 sq. mm. and all control and Instrumentation cables shall be clamped in bunches by means of cable nylon ties.
2.9.18.	Wherever cable glanding is not possible, either due to the gland plate size limitations or more number of cable entries, prefab plug-in cables, etc., for such cases cables may have to be lifted inside the panel by either making cut-out in gland plate and providing rubber profile for sharp edge protection or alternatively, providing 4" or 6" PVC pipe coupling gland and these pipe coupling gland shall be supplied by contractor within the quoted rate of cable laying.
2.9.19.	Copper tinned lugs of various types (pin, ring, fork, snap-on) up to 4 sq. mm conforming to IS: 694 for cables, PVC cable ties, PVC ferrules, PVC button and tapes, cable identification tag of PVC/ metal as per site requirement, clamping and dressing material such as suitable cable ties/ clamps etc. with hardware, PVC sleeves etc. shall be supplied by the contractor within the quoted rates for cable laying. However, trefoil clamps with hardware for single core power cable shall be supplied by BHEL. No separate payment for erection of this trefoil clamp will be entertained and is included in the cable laying. The quality of material shall be got approved from BHEL Engineer prior to their use on job.
2.9.20.	Trefoil clamps for single core cables to be supplied shall be pressure die cast aluminum or fibre glass or nylon and shall include necessary fixing accessories like G.I. nuts, bolts, washers, etc. Trefoil clamps shall have adequate mechanical strength to withstand the forces generated by the peak value of maximum system short circuit current.
2.9.21.	All care should be taken to avoid abrasion, tension, twisting, kinking, and stretching of cables during installation. Rollers are to be used during pulling of cable for long length.
2.9.22.	Cable shielding – all signal cables are supplied with bare shielded copper wire/ with braided wire shield. Generally, shield wire is kept isolated at instrument/ field device end and continuity is maintained through JBs and grounded at panel end only. While terminating the shield wire either in either panel or JBs, PVC sleeves are to be used to avoid two-point earthing.
2.9.23.	Spare holes in the panels/ Instruments/ Actuators/ Motors/ JBs etc. shall be sealed by suitable method by contractor. (The cost of work and Materials such as aluminium sheet or Adhesive tape/ Plugs etc. shall be within the quoted rates for laying of cables).
2.9.24.	Insulation test of the various circuits shall be done.
2.9.25.	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.

2.9.26.	When cables pass through floors, walls etc., it shall be passed through a pipe for mechanical protection and the pipe ends sealed suitably.
2.9.27.	All the cables will be properly laid in cable trays, dressed and clamped with aluminum flats. The cable will be terminated at both ends with suitable lugs and printed ferrules and will be glanded properly. Suitable equipment and consumables for ferrule printing has to be arranged by the contractor at his own cost. For cable identification, the contractor shall provide at his cost aluminium tags at regular intervals (20 m) through each run of cable.
2.9.28.	Cable lugs/ ferrules for power cables shall be tinned copper solderless crimping type suitable for aluminium compacted conductor cables. Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipment. Cable lugs and ferrule shall conform to DIN standards.
2.9.29.	All electrical connections shall be tested for polarity and proper connections.
2.9.30.	The checking of operation of individual equipment and instruments to which the cabling/ wiring connected shall also be done by the contractor.
2.9.31.	Where power and control cables are to be laid in the same route, suitable barriers to segregate them physically shall be employed.
2.9.32.	Space equal to the diameter of cable shall be provided between power cables of six over 50 mm in diameter.
2.9.33.	Care shall be taken to avoid short bending and kinking of conductor damaging insulation and stressing the cable beyond pulling force recommended by the manufacturer. Cable shall be protected at all times from mechanical damage.
2.9.34.	The minimum radius of formed bend of an insulated cable shall be 12d for un-armoured cables and 15d for armoured cables where 'd' is the overall diameter of the cables or as per the datasheet, whichever is higher.
2.9.35.	No cable shall be laid in ducts or trenches where other services such as oil pipes, steam or water pipes are laid.
2.9.36.	Where cabling passes through brickwork or concrete work, the contractor shall provide suitable local protection against mechanical damage wherever necessary.
2.9.37.	The layout of all cables shall be arranged to give adequate clearance from other services and cables shall be routed to avoid hot zones. No extra cost shall be considered for rework.
2.9.38.	Jointing of cables shall be avoided as far as practicable. However, jointing if at all necessary, shall be done by crimping type cable joints after getting approval of BHEL Engineer.
2.9.39.	The cable schedules indicating cable sizes, tentative cables routing information will be furnished by BHEL at site to the contractor. Required steel inserts on cable trenches, ceilings of the platforms in TG hall for erecting the cables will be provided by BHEL. The contractor shall design number of cable/ racks to accommodate the cables on racks/ trays properly.
2.9.40.	Many of the cable trays and cables have to be laid in cable trenches. For this purpose, the cover of the trenches has to be opened for working in site and whenever the cables are to be laid in existing cable tray, all safety precautions have to be observed. After completing the work, the trenches have to be cleaned and covers put back into position. Contractor shall also carry out de-watering from the trenches if required and arrange pumps etc., at his cost.
2.9.41.	Cables to be laid for exhaust fan and its starter box shall be laid on the wall/ beam/ ceiling for that spacer, cleat and clamp material shall be supplied by the bidder. Cable laying rate shall be inclusive of hardware items.
2.9.42.	Looping wire at terminal block of panels and electrical actuator as shown in the inter-connection diagrams or as required is to be done by contractor at no extra cost. Re termination of control cable in

	panel or equipment side due to any reason will not be paid extra. Agency shall provide the electrician during commissioning of equipment after cable termination work if necessary.
2.9.43.	Sharp bends of cable trays shall be avoided in all type of cable trays.
2.9.44.	Contractor shall carefully plan the cutting schedule of each cable drum in consultation with BHEL site engineer such that wastage is minimized. Recovery will be made in case the wastages are exceeding the wastage allowances fixed in this contract.
2.9.45.	Testing and electrical measurement of cable installations shall conform to the requirement of IS: 1255.
2.9.46.	The rate of laying for LT power, control and signal cable is inclusive of glanding, trefoil clamps and termination at both ends. Glands & Lugs above 4 sq. mm shall be supplied by BHEL & lugs up to 4 sq. mm shall be in vendor's scope. **The LT Power Cable straight through Jointing Kit (if required) shall be in vendor's scope of supply.** The rate for erection for all these items will be part of laying rates. No separate rate is applicable on this account.
2.9.47.	The unit rates for the HT cable termination and unit rates for laying of HT cables are exclusive of each other. Glands & termination kits for HT cables (3.3kV and above) shall be supplied by BHEL/ BHEL's Customer.
2.9.48.	Cleaning and rectification work due to rusting in electrical equipment are under the contractor's scope.
2.9.49.	Apart from above, Cable Erection Philosophy should be strictly followed.
2.9.50.	**General Notes**
a)	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 Chapter-X, following guidelines shall be applicable for this tender. Decision of BHEL shall be final & binding on bidder.
b)	For new size cable tray, width of cable tray will be taken into reference and rate of installation of cable tray of nearest higher width will be pro-rated to derive the rate for installation of new cable tray.
c)	To derive the rate for laying of new size cable, OD of cable will be taken into reference and rate of laying of cable of nearest lower OD will be pro-rated to derive the rate for laying for new cable.
d)	Rate for termination of new size cable and other items will be derived based on mutually agreed modality and on approval of BHEL.
2.10.	**JUNCTION BOXES AND PUSH BUTTONS**
2.10.1.	Different types of junction boxes are to be erected by the contractor as per attached BOQ. The junction boxes are to be located at the locations jointly decided at site during erection. The junction boxes are to be erected on the frames fabricated at site. The installation of Junction Boxes/ Push Buttons (JB/ PB) should be checked for correctness and their functions.
2.10.2.	Junction boxes shall be mounted at a height of 1200mm above floor level or as specified in the drawings and shall be adequately supported/ mounted on masonry wall by means of anchor fasteners/ expandable bolts or shall be mounted on an angle, plate or other structural supports fixed to floor, wall, ceiling or equipment foundations.
2.11.	**STRUCTURAL STEEL FABRICATION AND INSTALLATION (INSTRUMENT/ JUNCTION BOX FRAME/ CABLE TRAY & MISC STRUCTURES FABRICATION)**
2.11.1.	Structural steel material like MS angles, channels, beams, flats, plates etc. shall be supplied in running meter and the same shall be used for misc. fabrication if required. and the same shall be used for fabrication of panel base frame, cable tray supports, canopies for instruments/ panels/ drives/ JBs/ Push Buttons etc., Instrument/ Junction box frames, Impulse Pipe/ Instrument Air Pipe supports and instruments etc.
2.11.2.	This shall include cutting into size, conduiting of end connections, if required, welding, grinding of excess weld deposits, drilling of holes for mounting of device/ instrument, installation at location,

	leveling, alignment, providing bracings, painting etc. No gas cut holes will be permitted. Contractor to follow the BHEL supplied welding schedule and welding procedures.
2.11.3.	All the fabricated supports/ frames for instruments, trays, pipes, electrical equipment, etc., shall be painted after sand blasting and surface preparation as per painting specifications. Paints and other associated items are in the scope of the contractor.
2.11.4.	In case, structural cable trays, bends, tees, reducers etc., are required to be fabricated from structural steel and installed, unit rate applicable for fabrication and installation of structural steel shall be applicable in such instances.
2.11.5.	Frame installation at site may involve mounting either on concrete floor by grouting/ using anchor fasteners or on steel structure by welding etc. All consumables including anchor fasteners shall be arranged by the contractor. Where required, as part of work, concrete floors may have to be chipped out to reinforcement depth for anchoring the frames. Wherever grouting is required, contractor shall arrange all the required material including cement/ grout mix, shuttering etc., necessary labour and meet all other requirements as part of work. All consumables including anchor fasteners shall be arranged by the contractor.
2.11.6.	In certain packages, galvanized members of junction box frames and instrument racks shall be supplied in cut to sizes and frame assemblies are required to be done as per drawing by bolting/ welding. The installation rate as quoted shall include the assembling of the frames.
2.11.7.	Gas cutting of tray/ impulse pipe support and holes in frame is not permitted. Only hacksaw cutting/ drilled hole shall be permitted.
2.12.	**415V LT SWITCHGEAR/ MCC & DC DISTRIBUTION BOARD/ PANELS/ STARTER BOX ETC.**
2.12.1.	Checking of installation for correctness.
2.12.2.	Mechanical functional checking/ adjustment of individual breaker.
2.12.3.	Measurement of Insulation resistance of individual breaker, complete switchgear board and combined insulation resistance of individual breaker with cable connected to drives.
2.12.4.	Testing of Protection Relay, Thermal over relay, Power transducers, Energy/ Ammeters, Voltmeters, Power factor, frequency, tri-vector meters & metering etc. in static & dynamic condition relay.
2.12.5.	Conducting test such as Insulation Resistance measurement, Ratio, polarity, magnetization characteristic, winding resistance on CT and PT.
2.12.6.	Checking of electrical control & protection interlock of individual breaker and integration with other system. Write-up on mechanical Interlocking Scheme for safe opening of rear covers & earthing interlocks for 33kv and 3.3/11kV HV Switchgear enclosed. Also, Vendor to assist during commissioning of online temperature monitoring system and online temperature monitoring system for sensor & HMI mounted.
2.12.7.	Calibration of energy meters, tri-vector meters, voltmeters, ammeters, power current & voltage transducers etc.
2.12.8.	Providing assistance for checking the electrical operation of individual breakers from remote panels/ MMI package (Metso DNA system).
2.12.9.	Other than the above, minor testing/ checks will also be involved in the generator area, which are also in the scope of the contractor. Any instruments/ tools etc. required for carrying out the above shall be arranged by the contractor within the quoted rates.
2.12.10.	The scope of Testing and Commissioning of electrically operated actuators for valves, dampers, gates, soot blowers, Hoists etc., will include meggering, providing loop wire on actuator terminal block, adjustments of mechanical/ electrical or electronic position transmitters, setting of limit/ torque switches, cable checking, internal wiring checking, local/ remote operation from MCC & MMI package (Metso DNA system), replacement of limit/ torque switches if required.

2.12.11.	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.
2.12.12.	Contractor has to repeat any test free of cost, even if already conducted, whenever required to prove and check the healthiness of system before power flow, such test could be primary injection and primary injection in CTs. CVT, Insulation resistance of system/ individual equipment, functional tests or any other tests as required by BHEL/ BHEL's client.
2.12.13.	Electrical control panels, electronic control panels, HT/ LT switchgear, 415V LT MCC, 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.
2.12.14.	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.
2.12.15.	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 affected 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.
2.12.16.	Panels have to be shifted to their locations through floor openings, temporary openings like floor grills, door etc. Which shall be a part of work and no claim whatsoever will be entertained with regard to non-availability of opening as per shortest route etc. Panels have to be erected at different locations and elevation in powerhouse building, LT & HT Switchgear room, unit control room etc.
2.12.17.	Panel and instruments once erected in position should be properly protected using necessary care to prevent ingress of dust/ moisture. This will have to be periodically cleaned and surroundings have to be kept tidy. These panels have to be regularly cleaned and surroundings tidy as per the instruction of BHEL Engineer till handing over of the set to customer is to be carried out by the contractor free of cost.
2.12.18.	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.
2.12.19.	Normally the panels shall be supplied with meters, relays, electronic modules, and contactors, push buttons etc. mounted and pre-wired. However, if such devices are supplied loose/ separately for safety in transit, contractor shall mount the same as part of panel installation work and terminating the wires on devices. No extra payment shall be made for this.
2.12.20.	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.
2.12.21.	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.
2.12.22.	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.

2.12.23.	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.
2.12.24.	Interposing Relays (24/ 48V DC) along with mounting base shall be supplied separately for mounting in the various feeders of 415V MCC Board/ Switchgear Panel Boards for unidirectional/ bi-directional drives, solenoid valves. 2 Nos. interposing relay are required to be mounted in each feeder. Internal wiring for these relays shall be pre-wired in the feeders, wires to be terminated on relay terminals (approximately quantity is 1000 Nos.) Contractor shall mount the same and terminate the wire as part of panel installation work and no extra payment shall be made for this work.
2.12.25.	The Erection, Testing and commissioning of 415V LT Switchgear/ MCC & DC Distribution Board/ Panels/ Starter Box etc. shall be in line with the Approved Field Quality Plans.
2.12.26.	**General Notes**
a)	Accepted unit rates for each SWGR/ panel shall remain firm regardless of any change in width, height, type, weight or other parameter, as furnished in tender. Decision of BHEL shall be final & binding on bidder.
b)	For variation in length within of SWGR/ panel, accepted unit rates shall remain firm.
c)	For any new panel, supplied by BHEL and not indicated in BOQ, rate of the new panel shall be arrived as per following philosophy.
d)	Length of new SWGR/ panel = A.
e)	Length of existing nearby SWGR/ panel as indicated in tender/BOQ = B
f)	Accepted unit rate for that existing SWGR/ panel = Rs C.
g)	Derived Rate for new SWGR/Panel to be considered for the purpose of additional payment/ recovery = Rs (A/B)*C
2.13.	**BATTERY/ BATTERY CHARGER**
2.13.1.	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.
2.13.2.	Battery charging/ discharging is a continuous process and skilled manpower shall be deployed by the contractor round-the-clock.
2.13.3.	Contractor shall arrange suitable load, cables, safety equipment and consumables for discharging the battery during charging and discharging cycle at his cost.
2.13.4.	Contractor shall provide skilled manpower for periodic maintenance after the battery are fully charged for the activities such as checking of electrolyte level, specific gravity, topping up with distilled water and cleaning till the set is handed over to customer and record of the same shall be maintained and submitted before handing over of the system.
2.14.	**PLANT ILLUMINATION PACKAGE (STATION LIGHTING)**
2.14.1.	Station lighting covers the complete FGD area with handling, transportation from BHEL stores / yard to work place. Erection & 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.
2.14.2.	All measuring and testing instruments required during erection, testing, commissioning and performance testing shall be arranged by the bidder.
2.14.3.	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.
2.14.4.	**GUIDELINES FOR LIGHTING SYSTEM ERECTION WORK**
i)	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 customer.
ii)	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.
iii)	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.
iv)	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
v)	After installation of lighting fixtures/receptacles, panel number and circuit number shall be painted on them at a suitable place
vi)	Work to be in-line with drawing/design philosophy as per BHEL Engineer instruction.
vii)	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 contractor shall provide the same. Cut-outs in false ceiling shall be provided by false ceiling contractor.
viii)	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 customer.
ix)	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.
x)	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.
xi)	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
xii)	After installation of lighting fixtures/receptacles, panel number and circuit number shall be painted on them at a suitable place.
xiii)	Work to be in-line with drawing/ design philosophy and as per BHEL Engineer instruction.
2.14.5.	**Lighting Fixtures and Accessories**
i)	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.
ii)	The contractor shall submit for purchaser's approval the drawings showing the detailed mounting arrangements of various types of fixtures prior to installation.

iii)	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.
iv)	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).
v)	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.
vi)	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.
vii)	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.
viii)	To distinguish emergency AC fixtures from normal AC fixtures, red painted circular mark of 1 cm dia. shall be provided on emergency fixtures.
ix)	The self-contained emergency lighting fixtures shall be installed in required areas. Mounting brackets are to be provided by the contractor.
2.14.6.	**Lighting distribution board and Lighting Panels**
i)	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.
ii)	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.
iii)	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.
iv)	LPs shall be installed by fastening to studs of not less than 12 mm dia. which will be suitably grout-ed/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.
2.14.7.	**Lighting control Switch Boxes & Receptacle Boxes**
i)	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.
ii)	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.
2.14.8.	**Conduits and Accessories**
i)	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	6
	2.5 sq. mm.	4	6
ii)	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.		
iii)	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.		
iv)	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.		
v)	Spacing of embedded conduits shall be such as to permit flow of concrete between them and in no case shall be less then 40mm.		
vi)	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.		
vii)	Conduits shall be installed in such a way as to ensure against trouble from trapped condensation.		
viii)	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.		
ix)	Conduits shall be kept, wherever possible, at least 300 mm away from hot pipes, heating devices etc.		
x)	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		
xi)	For long conduit runs junction/ pull boxes shall be provided at suitable intervals (not exceeding 10 m) to facilitate wiring.		
xii)	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.		
xiii)	Conduits lengths shall be joined by screwed 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.		
xiv)	Conduits lengths shall be joined 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.		
xv)	Water treatment plant chlorination plant lighting installations shall be made with epoxy coated steel conduits and accessories.		
xvi)	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.		

xvii)	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.
xviii)	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.
xix)	After installation, the conduits shall be thoroughly cleaned by compressed air before pulling in the wire.
xx)	Lighting fixtures shall not be suspended directly from the junction box in the main conduit run.
xxi)	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.
2.14.9.	**Lighting wires**
i)	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).
ii)	All wires in a conduit shall be drawn simultaneously. No subsequent drawing is permissible.
iii)	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.
iv)	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.
v)	A.C. normal, A.C. emergency and D.C. emergency system wiring shall run throughout in separate conduits.
vi)	Wiring shall be spliced only at junction boxes. Maximum two wires shall be connected at each terminal.
vii)	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.
viii)	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.
2.14.10.	**Junction Boxes**
i)	Necessary holes for conduit/ cable entry shall be done during installation depending on the require-ment. The holes shall be drilled/punched neatly and shall be dust/vermin proof after installation of the conduit.
ii)	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
2.14.11.	**Street Lighting/ Flood Lighting Pole**
i)	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 All the above erection work shall be done by contractor for lighting masks including making of foundations.
ii)	The lighting poles shall be painted with two coats of aluminum paint after completion of installation or as specified by purchaser.
iii)	The flood light fixtures shall be mounted on galvanized M.S. base making use of shop drilled holes or by suitable clamps. No cutting or drilling of galvanized structure is permitted.
iv)	The bidder shall submit the foundation drawings of poles for purchaser's approval., if required
2.14.12.	**Earthing of Lighting system**
i)	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

ii)	A continuous earth conductor of 14 SWG GI 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 erection shall be in contractor's scope and rates of the same shall be included in the erection rates of the respective LDB/LP.
2.14.13.	**Ceiling Fans and Regulators (If Applicable)**
i)	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.
ii)	The fan regulators shall be flush mounted on the lighting control switch boxes provided in that area.
iii)	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.
2.14.14.	**Foundation & Civil Works**
i)	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.
ii)	All foundation drawings shall be subject to the purchaser's approval. However, it shall be the re-sponsibility of the contractor to check these foundations before commencement of erection to ensure their suitability.
iii)	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.
iv)	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.
v)	The contractor shall perform all excavation and backfilling as required for ground connections and casting foundations.
vi)	Excavation shall be performed up to the required depth. Such measures shall be taken as may be necessary for protection of the wall.
vii)	The contractor shall make use of his own arrangements for pumping out any water that may be accumulated in the excavation.
viii)	All excavation shall be backfilled to the original level with good consolidation.
ix)	Re-work/ Re-erection if because of BHEL, includes removal of defective items shall be processed on unit rate as mentioned in BOQ.
2.14.15.	**STEEL FABRICATION**
i)	The steel structures supplied and fabricated by the contractor shall be made from standard quality steel sections/ flats/ plates. The steel fabricated structures shall be free from defects, cleaned of rust, grease, oil etc., and sharp edges shall be removed.
ii)	The welds shall be wire brushed or cleaned otherwise. The holes shall be touched up with metal primer.
iii)	All steel fabrications shall be painted with two coats of metal primer (lead oxide and zinc chromate in synthetic medium) followed by two coats of aluminium paint. The welds to galvanized steel shall be touched up with galvanized weld rod applied in accordance with manufacturer's instruction.
iv)	Fabrication & painting charges of structural steel shall be part of erection charges of that equipment for which the same is being used.

2.15.	**ABOVE GROUND EARTHING**
2.15.1.	All equipment shall be earthed by two separate and distinct connections. Earthing terminals will be available in all equipment supplied by BHEL. Earthing terminals will be available in all the equipment supplied by BHEL. Above ground earthing shall be carried out as per the approved drawing & Philosophy furnished by BHEL Engineer.
2.15.2.	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/ as per the drawings. Unit rate for earthing material shall be paid on running meter basis.
2.15.3.	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.
2.15.4.	The earthing conductors shall be of mild steel/ GI strip/ wires. All connections from equipment to main earthing conductors shall be made as per the earthing drawing/ as per instruction of BHEL Engineer. Suitable "Copper (CU)" Lugs are to be supplied for earthing with GI wire by the agency wherever is required.
2.15.5.	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 conductor 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.
2.15.6.	All joints in the earthing system shall be welded type. Earthing connections to all equipment including motors shall be bolted type.
2.15.7.	Earthing connections shall be free from tinning scale paint, enamel, grease, rust or dirt at the time of making joint.
2.15.8.	Metallic sheaths, screens/ shields and armour of all multicore cables shall be bonded and earthed.
2.15.9.	Earthing conductors along their run-on columns, beams, walls etc. shall be supported by suitable cleats at intervals of 750mm/ 1000 mm.
2.15.10.	Welded joints on GI earthing conductors shall be painted (Refer clause no. 2.34 for details.)
2.15.11.	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.
2.15.12.	The runway conductors at different building elevation shall be inter connected between the main risers along the column/ wall and shall also be connected to the nearest riser/ structure columns and the distance between earthing point shall not exceed 30 meters.
2.15.13.	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.
2.15.14.	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.
2.15.15.	Entire system shall be earthed in accordance with the provisions of the relevant IEC recommendations/ IS code of practice **IS 3043: 2018 (or latest)** and Indian Electricity Rules, so that the values of the step and contact potentials in case of faults are kept within safe permissible limits.
2.15.16.	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.
2.15.17.	A minimum of two spare earth rings will be provided in each floor of the building for earthing future building. All tray tiers of each section shall be connected to the runway conductor at an interval of about 10 meters.
2.15.18.	Each RCC steel column of the building will be interconnected to the floor-earthing grid in basement/ ground floor.
2.15.19.	For protective earthing separate conductor shall be used for flow of earth fault current.

2.15.20.	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.
2.16.	**BELOW GROUND EARTHING**
2.16.1.	**Treated Earth Pits**: As per PEM Specification Preparation of Treated earth pit includes supply of all items (except the electrode rod/ pipe 3-meter-long with funnel) including charcoal; salt, civil chamber with cover (as per the drawing) is in the scope of the contractor. The contractor shall also connect this pit to the earth grid (by other agency) at nominal distances of 5 to 10 meters by 40 mm rods, which are also in the scope of the contractor.
2.16.2.	**Earth electrode:** As per PEM specification, Earth electrode shall be made of 40mm diameter MS rod/ Pipe tapering of one end of electrode rod and buried as per the drawing. Civil works are also to be carried out by the contractor. The contractor shall also connect this pit to the earth grid (by other agency) at nominal distances of 5 to 10 meters by 40 mm rods, which are also in the scope of the contractor.
2.17.	**LIGHTNING PROTECTION SYSTEM**
2.17.1.	Lightning Protection system consists of Air Terminal, Base Plate, Disconnection Link with JB and Fastener.
2.17.2.	Requirement clamp, support etc. shall be the part of the installation of system, no extra payment shall be entertained.
2.17.3.	Though concrete Block shall be a part of civil, if it is not supplied than same shall be casted at site on cost plus basis as per the approved drawing.
2.17.4.	Building wise drawing shall be furnished for execution of Lightning Protection system.
2.17.5.	Any changes shall be done as per instruction of Engineer in consultation with BHEL-PEM.
2.17.6.	The Disconnecting Link shall be made at the height of 1500 mm above ground level.
2.17.7.	The Down conductor shall be laid on the wall/ structure column and fixed at the specified interval as per instruction of BHEL/as per the approved drawing.
2.17.8.	Apart from above, Typical Lightning Protection Details should be strictly followed.
2.18.	**11/ 3.3kV/ 0.433 kV (SEGREGATED/ NON-SEGREGATED/SANDWICH) PHASE BUS DUCT**
2.18.1.	Segregated/ Non-Segregated phase bus duct shall be supplied in loose shipping section along with hardware & other items. Each section shall be complete with Al alloy enclosure and conductor with epoxy bus support insulators arrangement. However other items such as silica gel breathers, inspection windows, rubber bellows, flexible & solid copper/ aluminium connector, bi-metallic strips, GI pre-fabricated supporting structure, wall frame assembly, set of hardware etc. shall be supplied loose. Galvanized iron earth bus shall be provided for enclosure continuity. All bolted joints shall have cadmium plated high tensile steel hardware.
2.18.2.	Each set of SP bus duct is meant for interconnection from low voltage side of Unit, Unit Auxiliary and Station Transformer to 11kV/ 3.3kV switchgear board and bridging bus duct between the switchgear boards.
2.18.3.	The bus duct consists of rectangular conductor made of aluminium alloy supported on post insulator and housed in aluminium sheet metal rectangular enclosure. The bus bar/ enclosures has bolted joints.
2.18.4.	The bus duct shall be supported either from bottom of the concrete slab with embedded insert plate/ TG building supporting structural members and pocket provided on foundations. The bus duct assemblies, supporting structures shall be pre-fabricated and to be assembled as per lay out drawing. The erection and testing requirement shall be similar to the isolated phase bus duct, except the welding of bus bar and enclosures.
2.18.5.	Each set of bus duct shall be supported with supporting structure, which shall be fabricated from standard steel section and hot dip galvanized. All structure & bus duct assemble shall be erected as per drawings.
2.18.6.	Pre-treatment consisting of degreasing, de-rusting etc. shall be done on all fabricated parts before painting of cubicles, cabinets, marshalling boxes and galvanization of steel structures.
2.18.7.	Except for supporting steel structures which shall be galvanized, all equipment including bus duct enclosure shall be finished with an under coats of high quality primer followed by two coats of synthetic enamel paint which shall have a thickness not less than 50 microns.
2.18.8.	The Bus Duct erection and commissioning shall be in line with the drawings released for construction.
2.18.9.	The bus duct shall include 90 Deg edge & flay bellow, wall frame assembly, end flange, adopter box, Al Flex, Cu Flex, Rubber bellow, Bus duct support structure, Phase cross over etc.
2.19.	**ISOLATED PHASE BUS DUCT 21/24kV, 24000A MAIN RUN, 14000A DELTA RUN, & 2800A TAP-OFF RUN**

2.19.1.	Generator isolated bus duct is connected to low voltage side of single-phase power transformers and main bus duct shall have tee off connection for unit transformer, LAVT cubicles, excitation transformer and air pressurization equipment. Bus duct consist of round/ octagonal/ box hollow aluminum alloy conductor and supported inside aluminum enclosure with post insulator. Flexible connections and expansion joints are provided at terminals and intermediate point to alleviate stresses. Ring type protection current transformer will be mounted inside the bus duct.
2.19.2.	Isolated phase bus duct shall have tap connection for potential transformer, surge protector etc. housed in a metal clad cubicle, UAT and NG cubicle/ resistor cubicle. Various electrical tests have to be performed before and after erection.
2.19.3.	Bus duct enclosure/ conductor is a continuous welded type. Conductor, enclosure, makeup pieces, shunts pieces etc. have to be welded at site.
2.19.4.	The scope for Erection and testing of Isolated Phase Bus Duct shall include Transportation of material from stores/ storage yard (from inside or outside plant boundary), preparatory work such as erection of supporting structure, placement of sub-assemblies/ equipment's, alignment, edge preparation of conductor/ enclosure, welding of conductor/ enclosure, welding of shunt pieces & make up pieces, installation of seal off bushing & wall frame assemblies, shorting links, earthing, LAVT cubicle, copper flexible, copper rubber bellows, weldable/ bolted flexible, installation of air pressurizing unit and its associated piping work and cable etc., testing and commissioning.
2.19.5.	The Scope Would Include Neutral and Phase Bus Duct IR Value Measurement, Bus Duct Mounted CT's Testing, Loop Testing of CT Secondary Cabling by Secondary and Primary Injection of Bus duct, Contact Resistance Measurement for All Bus Duct Joints, HV Testing of Phase and Neutral Bus duct, Space Heater Circuit Testing and Charging, LAPT Cubicle IR Value Measurement, PTS Testing. Surge Capacitor Testing, LA Meggering, Pt Secondary Circuit Checking by Secondary and Primary Injection Testing, LAVT Cubicle Space Heater and Illumination Circuit Testing, Testing of Neutral Grounding Transformer for Ratio, IR Value and Resistance; Testing of Neutral Grounding Resistor for IR Value and Resistance, Space Heater and Illumination Circuit Charging for NGT/ NGR Cubicle, Bus duct Charging, LAVT Cubicle Charging.
2.19.6.	Pre-fabricated G.I. supporting members shall be supplied in loose condition and are to be erected as per lay out drawing. Foundation pockets and embedded plate inserts shall be provided as per lay out drawing (on floor for bottom support and on bottom of concrete slabs). Contractor shall weld the supports on insert plate and shall carry out grouting including supply of grout materials after complete alignment/ bolting of structural members. If any modification required in supporting structure due to site conditions, the same shall be carried out without any extra cost. All welded joints shall be applied cold galvanizing zinc paint. Supply of Paints, primers etc. are in the scope of the supplier, within the quoted rates.
2.19.7.	Required aluminum welding of conductor, enclosures, shunt, make up pieces, aluminum flexible etc. as detailed in drawings has to be carried out by contractor. MIG/ TIG welding shall be applicable. Contactor shall arrange necessary welding equipment/ accessory in sufficient number, filler wire, argon gas and other required consumables at his cost.
2.19.8.	During erection of bus duct/ enclosure, makeup pieces and shunts, if any modifications needed to match the alignment shall be part of work and no extra payment shall be made.
2.19.9.	All bolted joints and flanges shall be tightened with torque wrench to the approved torque. Wherever there are bolted joints, the same shall be cleaned and a layer of anti-oxidation paints shall be applied. Necessary paints etc. to be arranged by contractor within the quoted rates.
2.19.10.	Top chamber/ adapter box for line and neutral side, hood assembly at UT hood assembly at excitation transformer and at LAVT cubicle end shall have drilled hole in flange. If there is any mismatch of the hole in above with respect to the counter flange/ welded studs provided on UAT, LAVT and excitation cubicle, the contractor shall drill new holes if required.
2.19.11.	Proper sequence shall be followed during erection to avoid any mismatch and alignment problem.
2.19.12.	Prior to installation of bus duct assemblies in position, various components like conductor, insulator shall be inspected and cleaned and insulation resistance to be measured and recorded. If any insulator is found damaged, the same shall be replaced.

2.19.13.	Electrical test on current transformers and potential transformers shall have to be carried out prior to installation & during pre-commissioning. The tests are insulation resistance measurement, winding resistance, magnetization characteristic, ratio test, water ingress and air leak test on assembled bus ducts.
2.19.14.	Minor civil work such as chipping, levelling of foundation, providing pockets, drilling/ enlargement of holes in structure, bus bar etc. Which are incidental to the erection of bus duct shall not be treated as extra.
2.19.15.	All miscellaneous items such as disconnecting links, flexible, shorting bars, hardware's, conduit for wiring, marshaling box, CTs and PTs wiring through conduit, earthing materials, bus bar fish plates etc. are part of bus duct installation. Hence separate breakup quantity is not given in BOQ.
2.19.16.	Round makeup pieces for main and tee off duct shall be supplied in two halves and it involves but circumferential and horizontal welding at parting plain.
2.19.17.	Air tightness and water tightness test have to be carried out on completion of bus duct installation. In case of any leakages, contractor has to rectify and bring to the required level of air tightness/ water tightness without any extra cost.
2.19.18.	High voltage test of bus duct is to be carried out as per the instruction of BHEL engineer. Contractor shall arrange necessary test equipment/ instrument for conducting various electrical tests at his own cost.
2.19.19.	Contractor has to carry out final painting as per standard colour code recommended by BHEL. Paints and consumables shall be in contractor's scope.
2.19.20.	On welding joints, DPT test is required to be conducted.
2.19.21.	Shunt pieces shall be supplied in two halves and to be welded between two-phase bus duct at transformer end. The shunt pieces to be welded on both the side on matching plain and bus duct circumference and horizontal plain
2.19.22.	Contractor shall conduct 20 % radiography and 100% NDT test on welded joints.
2.19.23.	Any Enclosed/ attached drawings are for estimation and tendering purpose only. Contractor has to ascertain quantum of work involved. The BOQ as furnished in this tender specification for Isolated Phase Bus Duct & Segregated Phase Bus Duct are tentative/ approximate. Contractor has to ascertain the quantum of work involved and quote the lump sum value, as called in the rate schedule, without any additional compensation for any variation in length or numbers of joints.
2.19.24.	One end of the enclosure to be earthed to the station earth at shunt location where all three-phase enclosure are shorted. Wherever shunts are not provided, each phase should be earthed separately.
2.19.25.	In case of bolted bus duct, phase split covers, rubber bellows, clamping earth straps to be connected to maintain the electrical continuity and in turn enclosure gets earthed at one point.
2.19.26.	All other equipment such as LAVT, NG transformer/ resistor cubicle, air pressurization, CT chambers, junction boxes, etc. to be earthed at two points to the earth grid.
2.19.27.	Pre-treatment consisting of degreasing, de-rusting etc. shall be done on all fabricated parts before painting of cubicles, cabinets, marshalling boxes and galvanization of steel structures.
2.19.28.	Except for supporting steel structures which shall be galvanized, all equipment including bus duct enclosure shall be finished with an under coats of high-quality primer followed by two coats of synthetic enamel paint which shall have a thickness not less than 50 microns.
2.20.	**POWER TRANSFORMERS & LT AUXILIARY TRANSFORMERS**
2.20.1.	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.
2.20.2.	Single Phase 265MVA, 420/ 21kV, OFAF cooled YNd11, Generator Transformer (GT), 130/65/65 MVA, 3-phase 400/11.5/11.5kV Station Transformer, 40MVA 21/11.5kV Unit Transformer , 25MVA, 34.5/11kV Common Service Aux. Transformer ,FGD Auxiliary, Miscellaneous Transformer shall be made available to the contractor 80 to 120meters (approximately) away from the respective foundation, further unloading, transport and shifting of power transformers 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.

2.20.3.	The transformers shall be handled in such a manner so that no jerk is transferred to the core, winding and internals of the transformer.
2.20.4.	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.
2.20.5.	Placement on plinth, alignment with respect to the foundation and lay out drawings.
2.20.6.	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.
2.20.7.	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.
2.20.8.	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.
2.20.9.	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.
2.20.10.	All the accessories shall be assembled/ mounted as per OGA drawings and these should be thoroughly cleaned by spirit prior to installation.
2.20.11.	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.
2.20.12.	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.
2.20.13.	The criteria for deciding completion of drying out shall be breakdown value of oil, PPM value of contaminants in oil, resistively 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.
2.20.14.	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 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.
2.20.15.	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.
2.20.16.	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.
2.20.17.	Contractor shall discuss and finalize installation and testing activity procedure with BHEL/ customer prior to starting the work.
2.20.18.	Tests are also required to be conducted on Current Transformer, Potential Transformer & prior to/ after installation. Contractor shall also carry out oil processing/ filtration to achieve the desired results before charging and handing over of the entire system.
2.20.19.	Contractor should have valid electrical contractor license to carry out installation of high voltage equipment.
2.20.20.	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.
2.20.21.	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.
2.20.22.	Due to unforeseen reasons, if already tested and erected HV Bushing of Generator Transformer and Station Transformer need to replace at site, the contractor shall carry out the dis-mantling and replacement work of HV Bushing @20% of quoted price in case of 1-Phase Generator Transformer and @15% of quoted price in case of Station Transformer for replacement of one HV bushing.
2.20.23.	Due to Unavailability of Civil Foundation or Rail Cum Road for GT/ ST/ UT/ UAT/ SAT, if the transformers were unloaded more than the distance mentioned in TCC, the contractor shall carry out the dragging work up to their actual scope of distance @0.1% of quoted price of GT/ ST/ UT/ UAT/ SAT per meter.
2.20.24.	Following notes/ tests/ jobs for power transformer shall also be carried out by Contractor.
2.20.25.	Verify the Air cell of the Conservator and its MOG before erection. If possible, remove the Air cell from conservator and thoroughly check the conservator and MOG and its Float.
2.20.26.	Insure the Conservator Prismatic Gauge Glass hardware are in order to avoid leakage/ Spillage of oil from that portion.
2.20.27.	Oil pressure test on fully erected Transformer to be conducted
2.20.28.	All components dispatched separately should be cleaned inside and outside before being fitted
2.20.29.	Assembling of bushings is carried out according to bushings installation manual available. In case of draw rod/ lead connection of bushing with transformer lead, half connector joints to be insulated with 3 layers of crepe paper after making proper.
2.20.30.	Individual radiator/ cooler and pipework to be flushed with compressed air followed by carrying out Pressure test on individual radiator/ cooler Bank to check any leakages/ damages before start of Erection at site.
2.20.31.	The lower and upper shut-off valves for radiators/ coolers and possible headers shall be open during evacuation and oil-filling. If coolers are placed on suspension beams, which are mounted at right angle to the tank, the suspension beams shall be supported against the ground during the evacuation. Also radiators mounted on the tank wall shall be supported in a similar way. The hose for filling of oil is connected to the bottom valve of the transformer which must not be opened until the hose has been de-aerated and completely filled with oil.
2.20.32.	All shorting links on tanks, turrets and fittings to be provided as per OGA
2.20.33.	Oil Sampling shall be done as per IS 9434/ IEC: 60567.
2.20.34.	Oil filling in the conservator and also draining whenever required must be done very slowly. During oil filling, pressure in the air cell should not exceed 0.1kg/ sq.cm (1.5 psi).
2.20.35.	Check the CCU unit and also verify the outputs are working or not. also calibrate the CCU unit with the WTI/ OTI.
2.20.36.	Proper Tightness of the adjustable Resistor screw of WTI.
2.20.37.	Contact resistance of all the bolted joints in the neutral formation & grounding path.
2.20.38.	The Erection, Testing and Commissioning of GT, ST, UAT, and other auxiliary transformers shall be in line with the Approved Field Quality Plans and as per instruction of Site Engineers/ Manufacturers.
2.21.	**NAS FILTRATION & PARTICLE COUNTING OF OIL TYPE TRANSFORMER (420kV & ABOVE):**
2.21.1.	Procedure to be followed for Hot oil circulation/ drying out, oil rinsing, particle reduction and particle counting as follows: After completion of the hot oil circulation in main tank and cooler/ radiator system separately, the valves between main tank and cooler/ radiator system to be opened to allow the mixing of oil. The oil rinsing shall be carried out by connecting transformer to the oil rinsing plant connected with particle counter. Initially the oil inlet is connected to the lower portion of the tank and the outlet to the upper portion and start rinsing plant for circulation and creating turbulence of oil for approx. 1 hour. Thereafter the connection to be reversed (Oil inlet to the top of tank

<table>
<tr><td></td><td>and oil outlet to the bottom of tank) and start rinsing plant. This process to be continued till the 2 consecutive readings of particle content of the insulation oil is achieved as per below:
<table>
<tr><td>If measured with particle counter which works on ISO4402 and ISO 4406:1987</td><td>≥ 2 microns should be <10000 particle/ liter.</td></tr>
<tr><td>If measured with particle counter which works on ISO 11171 and ISO 4406:1999</td><td>≥ 4 microns should be <15000 particle/ liter.</td></tr>
</table>
It is recommended to use 35−40 kl/ hour capacity of pump in the rinsing plant.</td></tr>
<tr><td>2.22.</td><td>SOOT BLOWER SYSTEM</td></tr>
<tr><td>2.22.1.</td><td>Soot blower system comprises of motor control center having various feeders of motor starters, micro-processor-based PLC/DDCMIS panel with mimic diagram and control station, push button boxes, junction boxes, wall blowers/ LRSB with drive mechanism, integral control box with limit switch and internal wiring, inter connecting cables between field blowers and MCC, PLC/DDCMIS panel etc. The scope of work for testing, commissioning covers the items/ devices as per rate schedule and the testing, commissioning of blowers shall be carried out in close co-ordination with mechanical agencies who shall be erecting these blowers and contractor shall obtain clearance from BHEL Engineer prior to start of work. The contractor shall carry out the following works under testing & commissioning: -</td></tr>
<tr><td>2.22.2.</td><td>Pre-commissioning checks and tests on MCCs, blowers, PLC panels, energization of MCC and its feeders, wiring checks, insulation resistance measurements, testing of thermal over load relays etc.</td></tr>
<tr><td>2.22.3.</td><td>Adjustment of limit switches, torque switches, internal wiring checks, minor wiring modification to suit to system requirements for wall/ LRSB blowers.</td></tr>
<tr><td>2.22.4.</td><td>Electric operation of each blower from local, MCC and PLC panels and from Unit control board.</td></tr>
<tr><td>2.22.5.</td><td>Providing loop on terminal block of MCC individual feeders & blowers.</td></tr>
<tr><td>2.22.6.</td><td>During pre-commissioning/ post-commissioning of soot blower system, the component like TB's, limit switch, torque switch, over load relay, contactors etc. if found defective, contractor shall replace such components without any extra payment.</td></tr>
<tr><td>2.23.</td><td>DIGITAL AUTOMATIC VOLTAGE REGULATOR ALONG WITH BRUSHLESS EXCITATION SYSTEM</td></tr>
<tr><td>2.23.1.</td><td>System comprises of excitation transformer, field breaker panels, regulation, field flashing, thyristors, DAVR, Mounting of Local Instrument, Checking healthiness of diodes/ Fuses, Exciter Heater/ Blower, actuator commissioning, Dummy load test of DAVR, Checking from Control desk & Field related inputs/ outputs to commission the excitation system fully operational, field breaker panels/ cubicle along with copper bus bar/ flexible connectors including internal wiring, and associated inter connecting cables. No separate item rate is applicable. Rate quoted by contractor shall be inclusive of all above related to Excitation system.</td></tr>
<tr><td>2.24.</td><td>ELECTROSTATIC PRECIPITATOR (ESP)</td></tr>
<tr><td>2.24.1.</td><td>ESP shall have flue gas passes and each pass comprises of HT rectifier transformer (silicon oil filled), electronic controller, ESP Switch board and its bus duct, drives for Rapping/ Collecting/ Gas damper screen, heating element for hopers/ shaft and supporting insulator housing, ash level indicator and EP management system (software based) including computer interface and associated interlock and protection.</td></tr>
<tr><td>2.24.2.</td><td>Contractor to perform all the works of ESP area as per the instruction of BHEL engineer.</td></tr>
<tr><td>2.24.3.</td><td>Contractor to perform Hopper Heater conduiting, earthing and dressing work for each hopper.</td></tr>
<tr><td>2.24.4.</td><td>HT rectifier transformer shall be erected by mechanical agencies. Scope of work covered under this contract is oil filtration of transformers and erection and testing of various devices as listed in rate schedule. Contractor shall provide silicon oil filter machine as a part of scope. Contractor has also to provide operator round-the-clock for oil filtration and other necessary testing equipment. Contractor shall utilize power supply for filter machine from the source, which is given for the construction purpose, and shall arrange required cables.</td></tr>
<tr><td>2.25.</td><td>CONTROL & PROTECTION RELAY PANELS & ASSOCIATED EQUIPMENT SUCH AS SPBD/ NSPBD, GT, UNIT & STATION TRANSFORMER, HT/ LT MOTORS AND OTHER ASSOCIATED EQUIPMENT ETC.</td></tr>
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2.25.1.	Integrated Electrical testing/ commissioning of Control and Protection Relay Panels & associated equipment, etc. shall involve various activities like relay testing/ setting, simulation checks, testing of energy meters, on/ off line functional checks on integrated system.
2.25.2.	Relay testing in static condition Transformers, HT/ LT Drives, and associated system by secondary current injection at different current and recording the time duration.
2.25.3.	Relay setting and checking the stability of protection relays in static and dynamic condition during the OCC (Open Circuit Characteristic) & SCC (Short Circuit Characteristic).
2.25.4.	Testing and checking of control and protection interlock scheme in static condition and simulation of protection device contact from internal and external devices of all electrical panels.
2.25.5.	Measurement of Insulations, Winding Resistance, Polarization Index of winding of HT/ LT Drives & associated equipment/ system, DC resistance test & Impedance test during pre-commissioning stage/ commissioning stage/ post commissioning stage.
2.25.6.	Measurement of Insulations, Winding Resistance, Polarization Index of winding of Generator & associated equipment/ system, DC resistance test & Impedance test on rotor, Brushless excitation system at the time of rotor insertion as well as during pre-commissioning stage/ commissioning stage/ post commissioning stage.
2.25.7.	Functional checks/ testing of synchronizing schemes, other electrical panels during the static and dynamic by simulation/ back charging of generator transformer conditions.
2.25.8.	Monitoring & recording the various parameters during open circuit and short circuit conditions test on generator & associated field equipment like generator transformer, unit auxiliary transformer. Recording and monitoring measurement.
2.25.9.	Testing of protection current transformer for ratio test by primary injection, magnetization characteristic, polarity test, and IR measurement. Functional checks of relays of protection system by primary injection.
2.25.10.	Testing of potential transformer for ratio test by voltage ratio, polarity test, insulation resistance measurement etc., testing of surge capacitors, PT isolator in PTPS cubicle etc.
2.25.11.	Measurement of Insulation resistance of individual equipment and connected together.
2.25.12.	Calibration of energy meters, tri-vector meters, voltmeters, ammeters, current & power transducers etc.
2.25.13.	Providing temporary shorting link on bus duct or any other location while testing & normalization after the test.
2.26.	**ELECTRICAL HOIST**
2.26.1.	Electrically operated hoist of capacity varying from 2 MT to 40 MT are provided for maintenance purpose of ID/ FD/ PA fans, Mill area, Air Heater, ESP and other area in boiler. Mechanical erections of hoist components such as runway beams, hoist carriage, drive unit, etc. shall be done by another agency. The scope of work covered in this tender specification for erection & commissioning is installation of DSL system and associated accessories. The scope of work for the contract in this package is as under:
2.26.2.	**TEE IRON TYPE DSL SYSTEM: -** It consists of tee iron guide for cable trolley and associated supporting structural members, trailing cable, cable guide trolley, dog chain, switch fuse unit, limit switch, etc.
2.26.3.	**TAUT WIRE TYPE DSL SYSTEM: -** It consists of end bracket, galvanized wire rope, turn buckle/ straining bolt, real insulator/ cable guide trolley, cable, switch fuse unit, rope clamps, leather bands, dog chain, limit switch etc. DSL system shall have to be erected at higher elevation. Contractor shall take all safety measures while carrying out the work.
2.26.4.	Installation of tee iron & other structural steel member, unit rate for fabrication & installation shall be applicable and other items unit rate shall be paid, however cable dressing, fixing of leather bands, rope clamps and any incidental work such as making approaches for executing the work, scaffolding etc. shall be part of work.
2.26.5.	Commissioning & testing of electrical hoists shall include panel wiring check, IR measurement, functional check, over load relay testing, trial run, providing assistance during load test, replacement of component if required etc. However, preparatory work for load test and arrangement of load etc. shall be done by another agency.

2.27.	**GENERATOR SYSTEM TESTING**
2.27.1.	Generator stator winding resistance and PI value measurement/ check.
2.27.2.	Generator rotor winding resistance, impedance, IR value measurement before and after rotor insertion.
2.27.3.	Generator Bushing HV test.
2.27.4.	Main exciter winding resistance, IR value measurement/ check.
2.27.5.	PMG winding resistance, IR value measurement/ check.
2.27.6.	Testing and commissioning of generator and exciter accessories viz., heaters, blowers, stroboscope, diodes, enclosure lighting, potential measurement of bearings (TE &EE) etc.
2.27.7.	Meggering during drying out of generator.
2.27.8.	Meggering of generator bushing and its accessories. This test has to be conducted many times during erection and commissioning stages.
2.27.9.	Commissioning of Stroboscope, Exciter Drier, Heater and Generator Air drier.
2.27.10.	Assistance in commissioning of H2 Drier Equipment.
2.27.11.	Other than the above, minor testing/ checks will also be involved in the generator area, which are also in the scope of the contractor. Any instruments/ tools etc. required for carrying out the above shall be arranged by the contractor within the quoted rates.
2.27.12.	The scope of Testing and Commissioning of electrically operated actuators for valves, dampers, gates, soot blowers, Hoists, Cranes, Chain pulley etc., will include meggering, providing loop wire on actuator terminal block, adjustments of mechanical/ electrical or electronic position transmitters, setting of limit/ torque switches, cable checking, internal wiring checking, local/ remote operation from MCC & MMI package (Metso DNA system), replacement of limit/ torque switches if required.
2.27.13.	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.
2.27.14.	Contractor has to repeat any test free of cost, even if already conducted, whenever required to prove and check the healthiness of system before power flow, such test could be primary injection and primary injection in CTs. CVT, Insulation resistance of system/ individual equipment, functional tests or any other tests as required by BHEL/ BHEL's client.
2.27.15.	Other than the above, minor testing/ checks will also be involved in the generator area, which are also in the scope of the contractor. Any instruments/ tools etc. required for carrying out the above shall be arranged by the contractor within the quoted rates.
2.28.	**GENERAL GUIDELINES FOR ERECTION AND COMMISSIONING**
2.28.1.	**Contractor shall abide by the safety/ security rules and regulations as per the requirement of PVUNL and BHEL. Contractor shall obtain information about all safety and security norms of PVUNL well in advance. BHEL will not admit any claims whatsoever on account of Contractor's non-familiarization of site safety and security regulations.**
2.28.2.	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.
2.28.3.	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, successful & timely completion of the work to meet the overall project schedule. The contractor must deploy adequate quantity of tools & plants, measuring instruments, calibrating equipment, modern/ latest construction aids etc. He must also deploy adequately trained, qualified and experienced engineers, supervisory staff and skilled personnel. The manpower deployment identified by contractor should match requirement of sophistication involved with the items mentioned in the BOQ.

2.28.4.	The work under this scope being quite sophisticated and also quite extensive, for proper planning, monitoring, reporting, etc. of ongoing works, the contractor shall establish his own computer (1no.) and printer (1no.) at his site office, along with suitable operator(s), consumables, etc. Non-establishment of above equipment will attract penalty @Rs 10,000/ - (Rs Ten thousand only) per month.
2.28.5.	BHEL uses its own software SOMS (Site Operation and Management System)/SUVIDHA Portal/ or any other software for total project execution and billing. The contractor shall also provide adequate and suitable manpower for updating/ entries into these systems in BHEL computers at site.
2.28.6.	The work to be carried out under the scope of this specification covers the complete work of loading, handling, transporting, unloading, preassembly, erection, calibration, testing, air flushing, pre-commissioning tests, commissioning of systems, trial run of various auxiliaries, achieving various activities till handing over of the unit to BHEL's customer, providing maintenance team to cater to guarantee responsibilities and maintenance thereafter.
2.28.7.	The work shall be executed under the usual conditions affecting major power plant construction and in conjunction with numerous other operations at site. The contractor and his personnel shall cooperate with personnel of BHEL, BHEL's customer, customer's consultants and other contractors, coordinating his work with others and proceed in a manner that shall not delay or hinder the progress of work or the project as a whole.
2.28.8.	Contractor shall erect, align and commission all the equipment and auxiliaries as per the sequence & methodology prescribed by BHEL depending upon the technical requirements. Availability of materials and fronts will decide this. BHEL Engineer's decision regarding correctness of the work and method of working shall be final and binding on the contractor. No claims for extra payment from the contractor will be entertained on the ground of deviation from the methods/ sequences adopted in erection of similar sets elsewhere.
2.28.9.	The services, tests and support to be provided by the agency for the work mentioned in the various sections of this tender are indicative and not exhaustive, but not limited to these for the completion of the work in all respects.
2.28.10.	Plant materials should not be used for any temporary supports/ scaffolding/ preparing pre-assembly bed etc.
2.28.11.	The contractor shall have total responsibility for all equipment and materials in his custody at contractor's stores, or any loose, semi-assembled, assembled or erected by him at site. He shall effectively protect the finished works from action of weather and from damages or defacement 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.
2.28.12.	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.
2.28.13.	The contractor shall make all fixtures, temporary supports, steel structures required for jigs & fixtures, anchors for load and guide pulleys required for the work (including those specifically included in BHEL scope). However, necessary steel will be provided from the scrap/ surplus materials available at site.
2.28.14.	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 own cost, failing which the work will be done departmentally or by engaging other agencies and recoveries will be effected from contractor's bills towards expenditure incurred including 30% departmental charges.
2.28.15.	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.

2.28.16.	During the course of erection, testing and commissioning of Electrical work, certain rework/ modification/ rectification/ repairs/ fabrication etc., will be necessary on account of feedback from various thermal power stations or units already commissioned and/ or units under erection and commissioning and also on account of design discrepancies and manufacturing defects and site operation/ maintenance requirements. This will also include modifications/ re-works suggested by BHEL/ customer/ other inspection group. Contractor shall carryout such rework/ modification/ rectification/ fabrication repairs etc. promptly and expeditiously. Claims of contractor, if any, for such works will be dealt as per clauses 2.15 of GCC.
2.28.17.	In case any rework/ repair/ rectification/ modification/ fabrication etc. is required because of contractor's faulty workmanship which are noticed during the commissioning of, at any stages, the same shall be rectified by the contractor at his cost. If during the commissioning any improvement/ repair/ rework/ rectification/ fabrication/ modification due to design improvement is required, the same shall be carried out by the contractor promptly and expeditiously. Claim if any, for such work from the contractor shall be governed by clause no. 2.15 of GCC.
2.28.18.	Daily log sheets indicating the details of work carried out, man-hours, consumables used etc., shall be maintained by the contractor and counter-signed by BHEL Engineer every day.
2.28.19.	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" drawings.
2.28.20.	All transport equipment, handling equipment, tools, tackles, fixtures, equipment, materials, manpower, supervisors/ engineers, consumables, electrodes including oxygen, acetylene argon etc. gases, primers, paints etc.; except otherwise specified as BHEL scope of free issue; required for this scope of work shall be provided by the contractor. All expenditure including taxes and incidentals in this connection will have to be borne by him unless otherwise specified in the relevant clause. The contractor's quoted rates should be inclusive of all such contingencies. Electrodes shall be baked/ dried in the electrode drying oven (range 375–425°C) to the temperature and period specified by BHEL Engineer before their use. Necessary drying oven/ portable oven shall be provided by the contractor at his cost.
2.28.21.	Equipment/ instruments required to be erected for this work, though not limited to but are generally as per rate schedule. For any items or class of work not specified herein but required for total completion of work, the same shall be carried out as per BHEL requirement. However, the payment of these items/ class of work shall be regulated as per the General Condition of the contract.
2.28.22.	Overhauling, cleaning, revisioning, servicing of equipment/ instruments, valves etc. during erection and commissioning stages will be arranged by the contractor. However, gaskets/ packing for replacement will be provided by BHEL free of cost. All equipment shall be preserved and protected before and after erection as per the advice of BHEL Engineer.
2.28.23.	The glands & lugs shall be supplied either loose or fitted with the equipment. Contractor shall take care of this aspect at the time of receipt of the equipment from BHEL stores. Contractor shall account for the quantities received with the equipment and shall hand over the same to cabling agency under intimation to BHEL Engineer. Contractor shall extend all necessary help & co-ordinate with the cabling agency during the course of work.
2.28.24.	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, 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. In such case, any expenditure over and above the withheld 1% amount will also be recovered suitably from the RA bills of vendor.
2.28.25.	All works such as cleaning, leveling, aligning, trial assembly, dismantling of certain equipment/ components for checking and cleaning, surface preparation, fabrication of sheets, tubes and pipes as per general engineering practice and as per BHEL Engineer's instructions at site, cutting, gouging, weld depositing, grinding, straightening, chamfering, filing of cut outs/ openings for mounting of console inserts, modules, indicators, recorders, chipping, drilling of holes, reaming, scrapping, cable laying, dressing, lapping, fitting up etc. as may be applicable in such erection works are treated as incidentals to erection work and are necessary to complete the work satisfactorily shall be carried out by the contractor as part of the work within the quoted rates.
2.28.26.	All equipment shall be handled very carefully to prevent any damage or loss. No bare wire ropes, slings etc. shall be used for unloading and/ or handling of the equipment without the specific written permission of the BHEL Engineer. The equipment from the storage yard shall be moved to the actual site of erection/ location at the appropriate time as per the direction of BHEL Engineer so as to avoid damage/ loss of such equipment at site.
2.28.27.	Contractor shall provide necessary resources for completion of such work within the stipulated time schedule. Value of such work shall be included while computing the total value of work finally executed for all contractual purposes, particularly for contract variation purpose.
2.28.28.	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.
2.28.29.	Housekeeping in the erection and preassembly area is as important as well-planned and orderly work. The access to site for inspection approaches by BHEL and customer engineers and leading of the material shall be made available by the contractor at all times. The shifting and re-shifting of erection materials, tools and plants and clearance of restrictions, filling of ditches, undulation near preassembly, boiler area and switch yard 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.
2.28.30.	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.
2.28.31.	All pipes and tubes, equipment, instruments issued to contractor and kept at site for erection shall be covered with plastic caps/ steel caps or shall be closed with suitable plugs by the contractor.
2.28.32.	Contractor shall calibrate, erect, commission all the equipment, cabinets/ panels and cabling etc. as per sequence prescribed by BHEL at site. The sequence of erection/ commissioning methodology will be decided by the BHEL Engineers depending upon the availability of materials/ work fronts etc. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the methods of erection/ commissioning adopted in erection/ commissioning of similar jobs or for any reasons whatsoever.
2.28.33.	Descriptions of certain packages appearing in the rate schedule are available in this section and also in Appendix-I (Chapter-XIII), to give general idea to bidder about the type of equipment to be erected, calibrated, tested and commissioned.

2.28.34.	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.
2.28.35.	The contractor shall take delivery of the components, equipment's, 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 equipment's after usage shall be submitted to the BHEL and reconciled periodically.
2.28.36.	The contractor shall take delivery of equipment, materials from the storage yard/ stores/ sheds of BHEL/ customer. He shall also make arrangements for verification of equipment, transportation up to site of work (from inside or outside plant boundary), safe custody, watch and ward of equipment after it has been handed over to him till these are fully erected, tested and commissioned and taken over by the customer. The contractor should note that the transport of equipment's to erection site, assembly yards etc. should be done by the prescribed route without disturbing the other works and contractors and in the most professional manner. Special equipment's such as measuring and control equipment's, panels, electronic items, SF6 breakers, switches, cables, conduits etc. shall be stored when taken over by the contractor in appropriate manner as per BHEL's instructions.
2.28.37.	Contractor shall plan and transport equipment's, 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.
2.28.38.	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.
2.28.39.	Bidder to ensure security of equipment/Panels/items, even if doors and windows are mounted or not in panel room.
2.29.	**STATUTORY LICENCES AND OTHER RELATED REQUIREMENTS**
2.29.1.	The contractor should have the applicable Contractor Electrical License for Applicable Voltage System to work in Orissa State.
2.29.2.	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 concerned state or Central Electricity Authority, as the case may be. All fees and expenses in this regard shall be to the contractor's account.
2.29.3.	Supervisory Competency Certificate of Applicable Voltage for equipment erection, testing & commissioning classes as defined in this tender specification, issued by applicable appropriate State or Central Statutory Authority. During the execution of work minimum two persons should be posted at site who have valid Supervisory Competency Certificate.
2.29.4.	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.
2.29.5.	Contractor shall be responsible for all necessary Liasioning work with Statutory Authority towards the certification of installation/ works. BHEL/ BHEL's Customer shall provide technical assistance, drawings & documents for submission to Statutory Authority. Contractor shall provide all logistical services in this regard.

2.29.6.	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.
2.29.7.	If the contractor does not have these licenses and statutory requirements, then the contractor has to arrange them to work in the concerned state (Orissa) where the project is being executed within 6 weeks of mobilization at site for carrying out the works covered under this contract.
2.30.	**COLLECTION OF MATERIALS**
2.30.1.	The contractor shall take delivery of equipment, materials from the storage yard/ stores/ sheds of BHEL/ customer. He shall also make arrangements for verification of equipment, safe custody, watch and ward of equipment after it has been handed over to him till these are fully erected, tested and commissioned and taken over by the customer. The contractor should note that the transport of equipment to erection site, assembly yards etc. should be done by the prescribed route in the most professional manner without disturbing other ongoing works of various contractors. Special equipment such as laboratory equipment, measuring and control equipment, electronic items, SF6 Breakers, gauges, panels, console inserts, switches, transmitters, controllers, cables, conduits etc. shall be stored when taken over by the contractor in appropriate manner as per BHEL's instructions. The contractor should also note that while taking delivery of materials from BHEL stores (open/ closed), it may be necessary to handle other items which could be blocking the exit route of the materials. This aspect shall be taken care of in the quoted rates and no extra payment shall be done in this regard. It shall be the contractor's responsibility to arrange necessary cranes/ tractors, trailer, trucks, slings, labor, etc., for transport of equipment.
2.30.2.	Note: - Damaged cable drums or any damaged items also to be shifted within the quoted rates. No extra compensation for difficulty in shifting due to damaged drums shall be made in this regard.
2.30.3.	The distance between storage area and erection site is approx. 3-4km. However, this location may change at the discretion of the BHEL's customer. Contractor shall plan and transport equipment, components from storage to erection site and erect them in such a manner and sequence that material accumulation at site does not lead to congestion at site of work. Materials shall be stacked neatly, preserved and stored in the Contractor's shed and at work areas in an orderly manner. In case it is necessary to shift and re-stack the materials kept at work areas/ site to enable other agencies to carry out their work or for any other reason, same shall be done by Contractor most expeditiously as incidental to work.
2.30.4.	The panels shall be transported from stores to the place of installation in vertical position. Care shall be taken such that the switches, lamps, instruments etc. mounted on the panel do not get damaged during transit.
2.30.5.	Contractor shall plan and transport equipment/ components from storage yard/ sheds to erection site and erect them in such a manner and in a sequence that material accumulation at site should not lead to congestion. Materials shall be stacked neatly, preserved and stored in the contractor's shed and work areas in an orderly manner. It may be specifically noted that the space available may be limited and accumulation of material may lead to the necessity of shifting and restacking the materials to enable other agencies to carry on with their work or to comply with customer's requirements. If required, the contractor shall arrange shifting of surplus material expeditiously (no claim for extra payment for such work will be entertained) failing which the same will be arranged by BHEL and all charges together with departmental charges will be recovered from his bills.
2.30.6.	The contractor shall take delivery of the components, equipment, chemicals, lubricants etc. from the storage area/ sheds of BHEL/ customer after getting the approval of BHEL/ customer on standard

	indent forms to be specified by BHEL/ customer. Complete and detailed account of the materials and equipment after usage shall be submitted to the BHEL and reconciled periodically.
2.30.7.	The contractor shall handover all the damaged, unused materials, package materials, containers, special transporting frames, gunny bags, parts/ materials remaining extra over the normal requirement with proper identification tags in a packed condition to BHEL stores. In case of any misuse or use over actual design requirements, BHEL reserves the right to recover the cost of parts/ materials used in excess or misused. Decision of BHEL Engineer in this regard will be final and binding on the contractor.
2.30.8.	Equipment/ instruments etc., under the scope of erection and commissioning are generally dispatched from BHEL's Manufacturing Units/ vendor's works to erection site well before the start of erection. 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.
2.30.9.	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's from theft/ fire/ pilferage and any other damages and losses.
2.31.	**GUIDELINES FOR HANDLING AND STORAGE**
2.31.1.	After unloading at site, the package of the equipment shall be inspected for external damage. In case the package is damaged, package number and details of damage should be noted. The details of damage should be reported to concerned site Engineer.
2.31.2.	Cases should be opened/ unpacked using correct nail pullers. While opening the planks, care should be taken to see that equipment inside is not damaged. Cases should not be unpacked in areas where they are exposed to rain, water/ liquid splashing, dust or other harmful materials like chlorine gas, sulphur dioxide etc.
2.31.3.	After opening the case, all supports provided for transport are to be removed with due care.
2.31.4.	Immediately after unloading at site, the electronic equipment should be kept in a covered area. Handling and lifting of package should be done without jerks or impacts. Packing case should not be dropped or slid along the floor under any circumstances. Suitable forklift should be used to move the case to its final position. All above points are to be strictly followed as electronic equipment may get damaged due to vibration and shock.
2.31.5.	Hinged frames should not be opened when equipment is not secured to floor as this is likely to cause it to topple over. The hinged frame can be opened only if the equipment is still fixed on to bottom wooden pallet.
2.31.6.	The equipment should preferably be stored in its original package and should not be unpacked until it is absolutely necessary for its installation or advised by BHEL Engineer. The equipment should be best protected in its cases. It should be arranged away from walls.
2.31.7.	The wooden pallet provided for packing itself can be retained on raised platform to protect equipment from ground damps, sinking into and to circulate air under the stored equipment. This will also help in lifting the package with fork-lifter.
2.31.8.	Periodic inspection of silica gel placed inside the equipment is necessary. It has to be replaced or regenerated when de-colorization takes place.
2.31.9.	Due care should be taken to ensure that the equipment is not exposed to fumes, gases etc., which can affect electrical contacts of relays and terminal boards.

2.31.10.	The storage room and the equipment should be checked at regular interval to ensure protection from termites, mould growth, condensation of water etc., which can damage the equipment.
2.31.11.	All the equipment, materials and goods kept in the store room should be identified and registered in a book. Inspection report should be recorded. Any discrepancy observed should be communicated to site Engineer.
2.31.12.	The packing material shall be retained if the cubicle is to be repacked after inspection.
2.31.13.	All sub-assemblies should be kept in a separate place where they are easily accessible.
2.31.14.	Sub-assemblies should have a protective cover in case they are stored without wooden packing/ case to prevent accumulation of dust. Silica gel packets should also be kept along with it.
2.31.15.	Sub-assemblies should not be stacked one above the other.
2.31.16.	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.
2.31.17.	All the electronic modules shall be handled by qualified personnel only.
2.31.18.	Electronic modules should only be touched when it is absolutely essential to do so.
2.31.19.	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.
2.31.20.	The operator should not wear clothing made entirely from synthetic fibres, but a mixture containing at least 65% cotton.
2.31.21.	The PCB should always be held by front panel or by module frame and electronic components/ connectors should never be touched.
2.31.22.	The electronic modules should not be placed close to television sets or CRT units.
2.31.23.	Soldering irons and any other tools used must be grounded.
2.31.24.	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.
2.32.	**MEASUREMENTS, WASTAGE & CUTTING ALLOWANCE**
2.32.1.	The contractor shall not waste any materials issued to him. In case it is observed at any stage that the wastage/ excess utilization of materials is not within the permissible limits, recovery for the excess quantity used or wasted will be effected with departmental charges from the contractor. Decision of BHEL on this will be final and binding on the contractor.
2.32.2.	For all payment purposes, measurement shall be made on the basis of the execution of drawings/ physical measurements/instruction from BHEL engineer. Physical measurements shall be made by the contractor in the presence of the BHEL Engineer.
2.32.3.	The measurement for cable, impulse pipes/ tubes, GI pipe, conduits, flexible conduits, trays etc., shall be made on the basis of length actually laid.
2.32.4.	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 BHEL Engineer.
2.32.5.	All materials returned to stores should carry aluminium tag indicating the size and type. Power cables more than 15 meters' length and control cables more than 5 meters' length is termed as serviceable material and shall be returned size wise and category wise to the owner's stores/ yard. Cable of serviceable length being returned to the stores in drums shall have their free ends sealed and the balance lengths on the drum(s) shall be noted and certified by the Engineer-in-charge. This shall be applicable only for the purpose of accounting the cables issued for installation.

<table>
<tr><td>2.32.6.</td><td>While carrying out material reconciliation with contractor, all the above points will be considered. All serviceable material returned by the contractor shall be deducted from the quantities issued for the respective sizes and categories and the balance quantity will be taken as the net quantity issued to the contractor. Material reconciliation shall be done and allowable scrap quantity calculated as per wastage allowance percentage specified below. 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.</td></tr>
<tr><td>2.32.7.</td><td>The entire surplus, damaged, unused materials, packaging materials/ containers, special transporting frames, gunny bags, etc., shall be returned to BHEL stores by the contractor.</td></tr>
<tr><td>2.32.8.</td><td>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.</td></tr>
<tr><td>2.32.9.</td><td>The contractor shall ensure that all the packing materials and protection devices used for the various equipment’s during transit and storage are removed before this equipment are erected in position.</td></tr>
<tr><td>2.32.10.</td><td>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.</td></tr>
<tr><td>2.32.11.</td><td>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.</td></tr>
<tr><td>2.32.12.</td><td>The erection contractor shall make every effort to minimize wastage during erection work. Cutting and wastage allowance shall be computed on length, weight of material actually used, measured and accepted. In any case, the wastage shall not exceed the following limits:
<table>
<tr><th>S. No.</th><th>Item</th><th>%age Wastage of Erected Qty</th></tr>
<tr><td>a)</td><td>Each iron/ steel fabricated section</td><td>2</td></tr>
<tr><td>b)</td><td>Each size of power Cables</td><td>1</td></tr>
<tr><td>c)</td><td>Each size of control Cables</td><td>2</td></tr>
<tr><td>d)</td><td>GI pipes</td><td>1</td></tr>
</table></td></tr>
<tr><td>2.32.13.</td><td>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.</td></tr>
<tr><td>2.32.14.</td><td>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.</td></tr>
<tr><td>2.32.15.</td><td>NOTE:</td></tr>
<tr><td>a)</td><td>Salvageable scrap shall mean lengths of pipes, multi-cables, other cables etc., that can be used one time or other at a later date and normally they are recovered from the cut-pieces of pipes, multicore cables, cables etc.</td></tr>
<tr><td>b)</td><td>Non - Salvageable scrap means the lengths of tubes, pipes, multicore cables, cables etc., and they are from cut-pieces of tubes, pipes, multicore cables, cables etc., that cannot be used at all one time or other.</td></tr>
</table>

c)	As per the contract material like cable tray and accessories, cables, tray supports shall be supplied by BHEL and customer. Reconciliation shall be done and duly submitted every month with joint signature to BHEL and Customer.
2.33.	**FINAL PAINTING**
2.33.1.	The contractor shall provide the Primer (ROZC as per IS:2074) for the scope of painting work for protection of site weld joints and gas cut locations. Contractor shall also arrange to provide the required thinner and other consumables, T&P etc. required for application of ROZC Primer. **All paints and thinners** shall be sourced only from PVUNL/BHEL approved manufacturers. Some of them are as listed under: • M/ s Asian Paints • M/ s Berger paints • M/ s Jenson & Nicholson • M/ s Shalimar Paints • M/ s Akzo Nobel • M/ s Kansai Nerolac Paints **Any other as approved by PVUNL/BHEL**
2.33.2.	In order to have consistency in painting system, it is preferable that all the supplies are sourced from one single manufacturer.
2.33.3.	The contractor shall provide all the primer, paint, and other consumables like brush, cleaning agents etc. All T&Ps, manpower, supervision is in contractor's scope. Painting shall be carried out as per colour scheme approved by BHEL/ BHEL's customer.
2.33.4.	Touch up paintings on damaged areas: Surface preparation by manual tools, wire brush/ emery paper etc. Minimum 6" peripheral area, adjoining to damaged area to be covered. If metal surface is exposed; it is to be painted with Zinc rich epoxy (70 micron) or suitable primer with existing paint scheme. If primer is intact, intermediate & top coat to be done with specified DFT in scheme.
2.33.5.	All the fabricated frames, instrument racks, Junction box frames, Push button frames, trays/ impulse pipes, supports, panel base frame, etc., wherever applicable shall be first painted with two coats of primer paint (red chromate zinc primer) and then two coats of epoxy-based paint of approved shade (decided by BHEL Engineer) after thoroughly cleaning the surface of dust, rust, scale, grease, oil, etc., by wire brushing, scrapping or any other suitable method like sand blasting/ shot blasting. The quoted rates should be inclusive of all these including supply of paints and consumables.
2.33.6.	All metal parts of the equipment including supports, structures, etc., as applicable shall be painted after thoroughly cleaning the surface from dust, rust, greases, oils, scales, etc., by wire brush, scrapping, sand blasting/ shot blasting (as applicable) as specified in relevant erection documents. The above parts shall then be painted with specified two coats of specified paint over the shop primer/ paint. Also, where the shop primer/ paint has peeled off, the affected area shall be cleaned thoroughly by the specified method and then primer coat applied. Similarly, certain components may be supplied without any primer/ paint coat from shop. The surface of such items shall be cleaned as per specifications, coated with suitable primer and then coated with final paint coats. The dry film thickness after final coat should be as per specification. The color, shade etc. shall be as per specification. Painting schedule will be furnished at site.
2.33.7.	Other equipment like JBs, Panels, transmitter racks, Local gauge boards etc., shall be painted with two coats of synthetic enamel paint/ any other approved by BHEL/PVUNL.. The quoted rates should be inclusive of application of two final coats of synthetic enamel paint. All the consumables such as wire brush, other cleaning materials, painting implements, etc., is to be arranged by the contractor at his

	own cost. All equipment painting will be done by spray painting. The quoted rates should be inclusive of all these including
2.33.8.	All the weld joints of GI cable trays and GI structural members shall be applied with red oxide and aluminium paint/ any other approved by BHEL/PVUNL and then coated with bitumen.
2.33.9.	All damaged surfaces of galvanized or un-galvanized faces of steel structures etc. shall be brushed up and painted with red primer paint followed by two coats of aluminium paint/ enamel paint to the satisfaction of Engineer. The contractor has to arrange all the materials for painting at his cost.
2.33.10.	Welded joints on GI earthing conductors shall be coated with one coat of bituminous paint/ any other approved by BHEL/PVUNL. in case of buried earth grid or earth flats to be laid in cable trench. For site welded GI strips/ wires which are exposed these are required to be painted with one coat of cold galvanizing zinc paint. Contractor to arrange the required paints and other items at his cost.
2.33.11.	In case of GI Structure, the cold galvanizing paint to be applied as touch up where ever needed. This is to be done as per instruction of BHEL Engineer.
2.33.12.	The primer shall be compatible with the final coat paint schedule.
2.33.13.	Full (spray) painting of Dry-type & Oil-filled transformers, bus ducts with two coats of paint (any other approved by BHEL/PVUNL) as per specification. For Transformers and Oil Tanker, External surface of transformer and accessories- Chemical resistant epoxy zinc phosphate primer, MIO (Micaceous iron oxide) as intermediate paint followed by polyurethane finish paint.
2.33.14.	Colour Banding, Legend and Identification Marking, Equipment nomenclature, Direction marking etc. shall be in scope of the contractor.
2.33.15.	Touch-up painting of 415V & 220 V DC switchgear, Control Panels or any other equipment/ devices wherever necessary. Treatment as per IS: 6005. Two coats of lead oxide primer followed by powder painting with final paint shade of RAL 9002/any other approved by BHEL/PVUNL.
2.33.16.	The primer shall be compatible with the final coat paint schedule.
2.33.17.	Supply of paint, primers, other consumables etc. for above and any other scope in these specifications shall be in Contractor's scope.
2.33.18.	Irrespective to scopes of painting & supply of paint mentioned elsewhere it is to be noted that supply of paint, primers, other consumables etc. for all primer/ painting works to be done by the contractor, shall be in Contractor's scope. No dispute shall be entertained on the above matter.
2.33.19.	**TRANSFORMERS & BUS DUCTS**
i)	Exposed metal surfaces of Transformers and Bus Ducts erected by the contractor shall be painted with two coats of Finish Paint after thoroughly cleaning the surface from dust, rust, greases, oils, scales, etc., by wire brush, scrapping, machine buffing, water washing and any other appropriate method as specified in relevant erection documents. Bus Ducts shall first be coated with two coats of Primer before application of Finish Paint. Colour Banding, Legend and Identification Marking, Direction marking etc. shall be in scope of the contractor.
2.33.20.	**STRUCTURAL**
i)	Structural components may be supplied without any primer/ paint coat from shop. The surface of such items shall be cleaned as per specifications and then coated with two coats of Primer.
2.33.21.	**PANELS, JUNCTION BOXES**
i)	Panels and Junction Boxes shall be Touch-up painted as and where original shop paint is peeled off. Necessary surface cleaning and preparation shall be done by the contractor as per relevant painting codes followed by two coats of Primer and two coats of Finish Paint.
2.34.	**WELDING, NON-DESTRUCTIVE TESTING ETC.**
2.34.1.	Installation of equipment involves good quality welding, NDE checks etc.

2.34.2.	Welder deployed for aluminium welding shall have experienced and approved by BHEL and BHEL's Customer after due qualification process/ testing.
2.34.3.	Welding of all structural steel & aluminium shall be done only by the qualified and approved welders.
2.34.4.	All the welders shall be tested and approved by BHEL Engineer/ BHEL's Customer before they are actually engaged on work even though they may possess IBR/ other certificates. BHEL reserves the right to reject any welder without assigning any reason.
2.34.5.	The welded surface shall be cleaned of slag and painted with primer paint to prevent corrosion. For this paint will be supplied by the contractor.
2.34.6.	Welding electrodes have to be stored in enclosures having temperature and humidity control arrangement. This enclosure shall meet BHEL specifications.
2.34.7.	Certain types of coated welding electrodes, prior to their use, call for baking for specified period and will have to be held at specified temperature for specified period. Also, during execution, the coated welding electrodes have to be carried in portable ovens.
2.35.	**INTEGRATED ELECTRICAL TESTING/ COMMISSIONING**
2.35.1.	The brief scope of work under is defined as below, but not limited to the following. Contractor shall discuss & finalize testing procedure with BHEL Engineer In-Charge for the test to be conducted on Generator Control & Relay Panel testing. Drawing & documents shall be provided by BHEL at the time of testing. BHEL decision in this regard shall be final and binding on the contractor.
2.35.2.	The contractor shall prepare all erection/ commissioning log sheets and protocols/ test certificates as per field quality plan, and is signed by the concerned BHEL/ BHEL's Customer engineer and submit the same to BHEL engineer as per his instruction.
2.35.3.	Contractor shall maintain the charged and commissioned equipment till the same is taken over by customer.
2.36.	**CALIBRATION, TESTING & COMMISSIONING** Calibration, testing & commissioning activity as specified in this technical specification and rate schedule against various equipment, devices, systems etc. are broadly classified below. However, there may be some overlapping between the activities (erection, calibration and testing, commissioning.) The classification of activity is only a guideline for understanding the total volume of work in each activity. The contractor shall have no claim for performing or providing manpower for such overlapping work, which is also within the scope of the work.
2.37.	**CALIBRATION**
2.37.1.	Verification after drawing of material of various types, range of the field devices with respect to instrument schedule, data sheet or system document.
2.37.2.	Codification of instruments as per system tag numbers
2.37.3.	Calibration/ adjustment of instrument as per system requirement/ set values.
2.37.4.	Providing head correction in case of pressure measurement as per calculated values or actual measured value for the instrument, which are used for interlock protections/ monitoring. This is generally applicable for turbine/ generator, lube oil systems, lube oil system of fans etc.
2.37.5.	Verification of installation of instruments for range, type, tag number as per physical location of process point as per process, instrumentation diagram.
2.37.6.	Checking and ensuring the proper function of instrument.
2.37.7.	All the recorders shall be made functional with proper chart movement and ink marking.
2.37.8.	Preparation of computerized calibration certificates in the formats specified by BHEL Engineers and getting those signed by the customer is in the scope of the contractor.
2.38.	**ERECTION CHECKS**
2.38.1.	Withdrawal of material from store, verification, inspection as per shipping list, drawings and documents.

2.38.2.	Preservation, up keeping, safe custody of the erected equipment till handing over to the customer.
2.38.3.	Verification of installation as per drawing and document for the correctness of cabling, JBs, impulse pipe, various field device, panels, instruments etc.
2.38.4.	Continuity check and IR value check of cables.
2.38.5.	Verification of correction of cable termination with respect to instrument, electrical hook-up diagram, panel interconnection diagram, JB schedule.
2.38.6.	Checking earthing of the equipment and cable shield wire continuity.
2.38.7.	Energizing the functional group control panels and field devices.
2.38.8.	Flushing of impulse pipe before making the instruments process connections through.
2.38.9.	Any leakages, damages to impulse pipe, field device connections, air connections etc. Shall be fully attended by contractor.
2.38.10.	All cable glands/ piping/ tubing to be fixed as per installation requirement before commissioning.
2.39.	**TESTING, COMMISSIONING & TRIAL OPERATION**
2.39.1.	Checking/ verification of binary/ analogue input and output signal from field and panel and up to recording/ indicating instrument/ HMI monitors.
2.39.2.	Checking the operating electrical/ pneumatic drive through functional group panel, remote control desk, HMI, CRT operation and repeatability and smooth operation to be checked.
2.39.3.	Checking the interlock, protection and alarm for various processes by simulation of field devices/ process changes.
2.39.4.	Adjustment of limit switches/ feedback position transmitter checking the actuator for correct Limit switch operation for correct position indication and repeatability shall be ensured.
2.39.5.	Motor IR value measurement, bearing/ winding RTD checking, drying out of motor after erection of equipment by mechanical agency, providing assistance for trial run of motor which includes monitoring temperature rise winding/ bearing during trial run.
2.39.6.	Contractor shall prepare calibration/ testing report/ protocols and get it signed from BHEL & Customer.
2.39.7.	During trial run of various systems, if the performance of any instrument is found erratic, un-satisfactory and requires re-adjustment, re-calibration etc., and the defect shall be attended by contractor.
2.39.8.	Observing and checking the performance of the various devices on load/ process variation. Any deficiencies/ defect noticed during the variable load conditions, the same should be attended properly.
2.39.9.	Check the operation of various controls in manual/ auto mode for smooth functioning.
2.39.10.	Clearing of all bad/ invalid signals noticed during commissioning.
2.39.11.	Providing necessary assistance for **Trial Operation** of the unit is in scope of this specification. Smooth operation and availability of all instrument/ controls of the systems installed under the scope herein, shall be ensured by the contractor. Contractor shall provide adequate number of skilled manpower and T&P for this purpose. Interruption in Trial Operation for reasons attributable to the Contractor shall result in re-start of the Trial Operation all over again; consequential extension in Time Schedule/ Contract Period shall be to the contractor's account.
2.39.12.	If any small wiring correction or minor modification in control panel wiring is noticed during the commissioning, it shall be carried out as a part of commissioning activity.
2.39.13.	**The trial run of the complete facility as an integral unit shall be conducted for 720 continuous hours. During the period of trial run of 720 hours, the unit shall operate continuously at full rated load for a period of not less than 72 hours.**
2.40.	**POST-COMMISSIONING**
2.40.1.	Contractor shall rectify the defect observed/ informed by BHEL/customer after/ during the trial run.
2.40.2.	Contractor shall submit the as- built drawing as per guidelines and instruction of BHEL Engineer.

2.40.3.	After trial run/ handing over of the equipment, if due to unforeseen reasons, certain works crop up; the contractor shall provide all the assistance.
2.41.	**TROUBLESHOOTING DURING PLANT OPERATION**
2.41.1.	During pre-commissioning/ commissioning stages when the plant will be under various stages of operation, it will be necessary to have continuous (day and night) presence of suitable manpower along with required tools to attend to any defects etc. that may arise during such operation. The contractor will be required to put such personnel in shifts in the designated areas. The bidder must also take this aspect into consideration.
2.42.	**TESTING, PRE-COMMISSIONING, AND POST COMMISSIONING**
2.42.1.	The work is also inclusive of various commissioning activities of BHEL scope. The various activities, tests, trial runs may have to be repeated till satisfactory results are obtained and also to satisfy the requirements of customer/ consultant/ statutory authorities like boiler inspector, electrical inspector etc.
2.42.2.	The contractor shall perform various activities during pre-commissioning, integrated testing, post-commissioning stages of equipment covered under this tender specification. It is responsibility of contractor to 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/ Customer. The testing activity may have to be repeated till satisfactory results are obtained and also to satisfy the requirement of Customer/ statutory Authority.
2.42.3.	The contractor shall simultaneously start testing & commissioning activities for equipment to match the mile stone activities of the project.
2.42.4.	In case any malfunctioning and/ or defects are found during tests, trial runs such as loose components, undue noise or vibration, strain on connected equipment etc., the contractor shall immediately attend to these defects/ malfunctions and take necessary corrective measures. If any readjustment and realignment is necessary, the same shall be done as per BHEL Engineer's instructions.
2.42.5.	The pre-commissioning activities will start prior to light up of boiler and various trials, commissioning operations shall continue till the unit is handed over to customer. Simultaneous commissioning activities will be in progress in various areas, checking of equipment erected, making ready for trial runs, alkali flushing, chemical cleaning, mass flushing etc. All these works need specialized gangs including electrician/ instrument mechanics in each area. Contractor shall earmark separate manpower for various commissioning activities. This manpower shall not be disturbed or diverted. The mobilization of these commissioning gangs shall be such that planned activities are taken up in time and also completed as per schedule and the work undertaken round the clock if required. It is the responsibility of contractor to discuss on day to day/ weekly/ monthly basis the requirement of manpower, consumables, tools and tackles with BHEL Engineer and arrange for the same. If at any time the requisite manpower, consumables, T&P are not arranged then BHEL shall make alternate arrangements and necessary recoveries with overhead cost will be made from the bills of the contractor.
2.42.6.	During pre-commissioning, commissioning, post commissioning and trial operation stages of various systems, certain category of manpower with T&P and consumables will have to be provided to BHEL Commissioning Engineers exclusively at their disposal. It shall be the responsibility of the contractor to provide engineers, electricians, technicians, helpers, fitters etc. along with necessary consumables, hand tools, calibration equipment etc., for the various commissioning activities in progress. During peak months there could be requirements of separate commissioning gangs simultaneously in even up to 12 to 15 areas. Contractor has to augment the manpower as and when required as per work demand and necessity at site. The quoted rates shall include this.
2.42.7.	The mobilization of these commissioning groups shall be such that planned activities are taken up in time and also completed as per schedule and work undertaken round the clock if required. It is responsibility of contractor to discuss on day to day/ weekly/ monthly basis the requirement of manpower, consumables, tools & tackles/ testing equipment with BHEL Engineers and arrange for the same. If at any time the requisite manpower, consumables, testing equipment etc. are not arranged then BHEL shall make alternative arrangements and necessary recoveries with overhead cost will be made from the running bills.

2.42.8.	Contractor shall cut open works if needed as per BHEL Engineer's instructions during commissioning for inspection, checking and make good the works after inspection is over without any extra payment.
2.42.9.	It shall be specifically noted that contractor manpower may have to be engaged round the clock simultaneously at different areas and hence considerable number of personnel and their overtime payment may be involved. This aspect must be considered by the contractor while quoting their rate. No additional compensation by for the same shall be payable, irrespective of number of persons engaged or number of working hours per day.
2.42.10.	It is the responsibility of contractor to provide for necessary labor, tools and tackles and consumables till the completion of work under these specifications even in case erection, testing and commissioning of this work is delayed due to reasons not attributable to the contractor.
2.42.11.	For electrical works, 415V and above, the contractor has to bring qualified electricians.
2.42.12.	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.
2.42.13.	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.
2.42.14.	During this period, though BHEL/ client's staff will also be associated in the work, the contractor's responsibility will be to arrange for complete requirement of men and required T&Ps, consumables, scaffolding and approaches etc., till such time the commissioned unit is taken over for trial operations.
2.42.15.	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.
2.42.16.	The pre-commissioning activities will start in phased manner to meet the various milestones and shall continue till equipment are commissioned fully with all connected equipment/ devices or handed over to customer for regular operation. In this duration other erection activities such as cabling etc., shall be carried out by other agencies even though equipment are partially commissioned/ charged. In order to co-ordinate the work such as issue of safety permit, normalization and compliance of other requirement, contractor shall keep team of experienced engineer, supervisor, technician and helper in each shift as decided by BHEL Engineer. The team shall take instruction from BHEL Engineer for day-to-day work and shall not be diverted for other work. No extra payment shall be made for their services.
2.42.17.	Certain systems may be supplied with portable programming units, which are to be connected at various locations during pre-commissioning to handing over. Necessary cabling interconnecting the programming units and other connected panels has to be carried out by the contractor and are to be dismantled after work. For the purpose of testing, monitoring, commissioning, etc., these programming units will have to be repeatedly connected and disconnected at various locations. These will be considered as part of commissioning activities and no separate payment will be entertained for the above.
2.42.18.	The scope covers the erection, testing and commissioning of 1750 kVA and 1010 KVA DG system including control cable laying and termination between the DG AMF Panel, Battery Charger, and distribution board and battery. Installation of battery and connection to engine starter. DG Control Panels and CT erection are under the contractor's scope.
2.43.	**FOUNDATION, ERECTION, TESTING & COMMISSIONING OF PACKAGE SUB-STATION (PSS):**
2.43.1.	Supply of materials as required for erection, testing & commissioning of 11kV/433V Package Substation.
2.43.2.	Leveling of substation yard, supply and spreading of 40mm size stone aggregate of 75mm thick for an area of approx size 8m x 6m, supply and construction of Brick work with cement mortar 1:6 of 230 mm thick and 450 mm height all-round the substation yard, plastering the brick work in CM 1:6 , white washing etc complete. Dimension are tentative.
2.43.3.	Supply and construction of foundation as per supplier foundation drawing for 500kVA. Package Substation. Apprx size 4400 mm x 4400 mm x500 mm height (size may vary as per the drawing) from ground level and including excavation of plinth pit and base concreting and plastering, white washing etc. as per the instruction of BHEL site engineer.

2.43.4.	Supply and fixing of 3.15mm GI chain linked wire fencing height 2m for the substation of size 8m x 6m including grouting of 3m height ISA 75 fabricated posts at an interval of 1.5m (2m vertical 0.5m slanting, 0.5m grouting) and three runs of barbed wire along with the fencing on the slanting angle post, fixing of mesh with post by 50x6mm MS flat with fasteners (2 nos./post) and earthing of fencing by 8 SWG GI wire and providing finish aluminum painting of all steel materials etc. Supplied structural steel materials are used for fencing posts.
2.43.5.	Supply and installation of 1m x 2m height MS gate made of MS Angle, channel/rolled sections including supply and fixing of hinges, locking arrangement etc including providing finish aluminum painting etc.
2.43.6.	Supply and Erection of 3m long 50mm dia 3.6 mm thick medium class GI funnel type earth electrode with filling of bentonite earthing powder as per standard, four side brick work chambers with cement plastering, white washing and removable type RCC/ cast iron cover plate. Scope includes supply of required betonite eathing powder, cement, brick, sand, RCC/cast iron cover plate. Minium 06 earthpits per substation. Substation earthing shall be carried out by using supplied 50x6, 25x6 and 25x3 mm earth flats.
2.44.	**Interconnection Between Unit#1, Unit#2 & Unit#3:** Interconnection/termination/jointing of various equipment/systems/pipes/Busducts etc. at all above mentioned terminal points in between different Units shall be in the scope of Package Vendor unless specified elsewhere in the tender document.
2.45.	**Work in ACC Area**
2.45.1.	Work in ACC Area takes place at around 60-meter height from ground level which requires more safety precaution. Electrical Works at this height shall be inclusive of Man Lifter / Sky Climber whatever required for height work. This work is separately mentioned in BOQ as Part-B having higher rate than normal Electrical Works.

3.	FACILITIES IN THE SCOPE OF CONTRACTOR/ BHEL (SCOPE MATRIX)

S. No.	Description (PART I)	Scope / to be taken care by		Remarks
		BHEL	Bidder	
3.1.	**ESTABLISHMENT**			
3.1.1.	FOR CONSTRUCTION PURPOSE:			
i)	Open space for office (as per availability)	Yes		Location will be finalized after joint survey with owner
ii)	Open space for storage (as per availability)	Yes		Location will be finalized after joint survey with owner
iii)	Construction of bidder's office, canteen and storage building including supply of materials and other services		Yes	
iv)	Bidder's all office equipment, office/ store/ canteen consumables		Yes	
v)	Canteen facilities for the bidder's staff, supervisors and engineers etc.		Yes	
vi)	Firefighting equipment like buckets, extinguishers etc.		Yes	
vii)	Fencing of storage area, office, canteen etc. of the bidder		Yes	
3.1.2.	FOR LIVING PURPOSES OF THE BIDDER			
i)	Open space for labour colony (as per availability)		Yes	Agency has to make his own arrangement at his own cost.
ii)	Labour Colony with internal roads, sanitation, complying with statutory requirements		Yes	
3.2.	**ELECTRICITY**			
3.2.1.	Electricity for construction purposes only of Voltage 415/ 440V, 3phase, 50Hz	Yes		Chargeable based on the prevalent rates of DISCOM. Any penalty due to non-maintenance of power factor by the customer shall be passed on to the contractor.

S. No.	Description (PART I)	Scope / to be taken care by		Remarks
		BHEL	Bidder	
i)	Single point source	Yes		At a distance of 1000m from site (Distance is only tentative, it may vary up-to an extent depending on site condition)
ii)	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
iii)	Duties and deposits including statutory clearances if applicable		Yes	
3.2.2.	Electricity for the office, stores, canteen etc. of the bidder			
i)	Single point source	Yes		At a distance of 1000m from site (Distance is only estimated, it may vary up-to an extent depending on site condition).
ii)	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
iii)	Duties and deposits including statutory clearances if applicable		Yes	
3.2.3.	Electricity for living accommodation of the bidder's staff, engineers, supervisors etc.		Yes	Agency has to make his own arrangement at his own cost.
i)	Single point source		Yes	
ii)	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
iii)	Duties and deposits including statutory clearances if applicable		Yes	
3.3.	**WATER SUPPLY**			
3.3.1.	For construction purposes: (Single point source provided by BHEL on chargeable basis)	Yes		
i)	Making the water available from single point		Yes	Agency has to make his own arrangement at his own cost.
ii)	Further distribution as per the requirement of work including supply of materials and execution		Yes	

S. No.	Description (PART I)	Scope / to be taken care by		Remarks
		BHEL	Bidder	
3.3.2.	Water supply for bidder's office, stores, canteen etc.			
i)	Making the water available at single point		Yes	
ii)	Further distribution as per the requirement of work including supply of materials and execution		Yes	
3.3.3.	Water supply for Living Purpose			
i)	Making the water available at single point		Yes	
ii)	Further distribution as per the requirement of work including supply of materials and execution		Yes	
3.4.	**LIGHTING**			
i)	For construction work (supply of all the necessary materials) 1. At office/ storage area 2. At the preassembly area 3. At the construction site/ area		Yes	
ii)	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	
iii)	Providing the necessary consumables like bulbs, switches, etc. during the course of project work		Yes	
iv)	Lighting for the living purposes of the bidder at the colony/ quarters		Yes	
3.5.	**COMMUNICATION FACILITIES FOR SITE OPERATIONS OF THE BIDDER**			
i)	Telephone, fax, internet, intranet, e-mail etc.		Yes	
3.6.	**COMPRESSED AIR (wherever required for the work)**		**YES**	
i)	Supply of Compressor and all other equipment required for compressor & compressed air system including pipes, valves, storage systems etc		Yes	

S. No.	Description (PART I)	Scope / to be taken care by		Remarks
		BHEL	Bidder	
ii)	Installation of above system and operation & maintenance of the same		Yes	
iii)	Supply of the all the consumables for the above system during the contract period		Yes	
3.7.	**Demobilization of all the above facilities**		**YES**	
3.8.	**TRANSPORTATION**			
a	For site personnel of the bidder		Yes	
b	For bidder's equipment and consumables (T&P, Consumables etc.)		Yes	
3.9.	**ERECTION FACILITIES**			
3.9.1.	Engineering works for construction:	Yes		NOT APPLICABLE
i)	Providing the erection/ constructions drawings for all the equipment covered under this scope	Yes		
ii)	Drawings for construction methods	Yes	Yes	In consultation with BHEL
iii)	As-built drawings – where ever deviations observed and executed and also based on the decisions taken at site- example – routing of small bore pipes		Yes	Changes are to be marked in drawing & handover to BHEL on completion of work.
iv)	Shipping lists etc. for reference and planning the activities	Yes		NOT APPLICABLE
v)	Preparation of site erection schedules and other input requirements		Yes	In consultation with BHEL
vi)	Review of performance and revision of site erection schedules in order to achieve the end dates and other commitments	Yes	Yes	In consultation with BHEL
vii)	Weekly erection schedules based on S. No. e		Yes	In consultation with BHEL
viii)	Daily erection/ work plan based on S. No. g		Yes	In consultation with BHEL

S. No.	Description (PART I)	Scope / to be taken care by		Remarks
		BHEL	Bidder	
ix)	Periodic visit of the senior official of the bidder to site to review the progress so that work is completed as per schedule. It is suggested this review by the senior official of the bidder should be done once in every two months.		Yes	
x)	Preparation of preassembly bay		Yes	NOT APPLICABLE
xi)	Laying of racks for gantry crane if provided by BHEL or brought by the contractor/ bidder himself		Yes	NOT APPLICABLE
xii)	Arranging the materials required for preassembly		Yes	NOT APPLICABLE
xiii)	COIVD-19 Preventive Measure		Yes	

3.10.	**ELECTRICITY**
3.10.1.	The construction power (415V) will be provided at a single point for construction purpose only on chargeable basis. Further distribution is to be arranged by the bidder at his cost. Construction power shall be provided from the nearest Substation/ tapping point at a distance of approx. 1000m from site. The distance is only estimated; it may vary up to an extent depending on site condition.
3.10.2.	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.
3.10.3.	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 customer with appropriate statutory requirements shall be the responsibility of the tenderer/ contractor.
3.10.4.	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.
3.10.5.	Necessary "Capacitor Banks" to improve the Power factor as directed by PVUNL shall be provided by the contractor at his cost. Penalty if any levied by customer on this account will be recovered from contractor's bills.
3.10.6.	The required energy meter for measuring power consumption shall be arranged by the contractor and taken care by the contractor.
3.10.7.	Contractor has to make his own arrangements for his electricity requirement for his labour colony at his cost.

3.10.8.	As there are bound to be interruptions in regular power supply, power cut/ load shedding in any construction sites, contractor should make his own arrangement for alternative source of power supply through deployment of adequate number of DG sets at their cost during the power breakdown/ failure to get urgent and important work to go on without interruptions. No separate payment shall be made for this contingency.
3.11.	**CONSTRUCTION WATER**
3.11.1.	Water (Raw water) required for construction purposes will be provided at one single point within the plant area on chargeable basis. The further distribution is to be arranged by the bidder at his cost. Construction water shall be provided at a distance of 1000m from site. Distance is only estimated, it may vary up to an extent depending on site condition.
3.11.2.	The required water meter for measuring the consumption shall be provided and installed by the contractor. The required pumps & accessories, pipes for drawing water from the points and further distribution will be arranged by the contractor at their cost. BHEL is not responsible for any loss or damage to the contractor's equipment due to any reason. Any dispute regarding water consumption and distribution, the BHEL engineer decision will be final and binding.
3.11.3.	The water charges may vary from time to time as per PVUNL prevailing charges, any dispute regarding consumption, the BHEL engineer decision will be final. In case of non-availability of water, the contractor shall make his own arrangements of water suitable for construction to have uninterrupted work. No separate payment shall be made for any contingency arrangement made by contractor, due to delay/ failure for providing water supply. Contractor has to make his own arrangements for his water requirement for his labour colony at his cost.
3.11.4.	In case of non-availability of water, the contractor shall make his own arrangements of water suitable for construction purpose to have uninterrupted work. No separate payment shall be made for any contingency arrangement made by contractor, due to delay/ failure for providing water supply. Contractor has to make his own arrangements for his water requirement for his labour colony at his cost.
3.12.	**DRINKING WATER**
3.12.1.	Bidder shall provide drinking water at the work spot at their cost.
3.13.	**LIGHTING FACILITY (CONSTRUCTION LIGHTING)**
3.13.1.	Adequate lighting facilities such as flood lamps, hand lamps and area lighting shall be arranged by the contractor at the site of construction, pre assembly yard and contractor's material storage area etc. at his cost.
3.14.	**OTHER FACILITIES**
3.14.1.	Adequate water less urinals shall be arranged by the contractor within quoted rates, at site of construction at different level and different areas like boiler structure, with proper disposal arrangement.

3.14.2.	Vendors have to comply requirements of HSE & Statutory requirement in line with BHEL HSE plan, PVUNL Safety requirement, Jharkhand/ Central statutory requirement.
3.14.3.	Vendors have to arrange labour rest sheds, drinking water facility, toilets, canteen facility as per local labour act/ BOCW act. Maintaining hygiene and disposal of debris, scraps, canteen items and area cleaning is included in vendor's scope.
3.14.4.	Agency has to arrange trained scaffolding experts with accreditation from statutory agencies with proper experience and they will issue fitness certificates for safe use. Such kind of qualified scaffolding experts will vary as per job requirement. At the same time, training has to be given by these experts at regular intervals for their own workers for increasing no. of experts.
3.14.5.	Agencies HSE officers should have sufficient experience as per rule 209 of BOCW act central rule 1998. Agencies HSE officers will be part of BHEL HSE Team and they will be responsible for giving training on HSE issues in addition to normal field works and other normal site requirements.
3.14.6.	Preparation of method statement, HIRA, Job Safety analysis, permit to work, Lifting plans, and all supporting documents as required for starting & continuation of work/ job is in vendor's scope.
3.14.7.	Hydras are not allowed for materials transport, only pick and carry cranes shall be deployed by the agency.
3.14.8.	First aid centre will be maintained by BHEL and cost will be proportionately recovered from vendors.
3.14.9.	Vendor has to arrange land within his quoted rate for making labour colony. Vendors labour colony has to be maintained with proper hygiene, drinking water, bathroom water, lighting arrangement, sewerage system. These facilities are to be regularly maintained including drains, surrounding, upkeep of labour colony. BHEL/ PVUNL & local statutory authorities will visit labour colony from time to time and all healthy conditions are to be maintained by vendor.
3.14.10.	Scaffolding pipes, clamps, safety nets, floor grills for working platforms are to be made of good quality with proper certifications as per IS Codes.
3.15.	**DEWATERING**
3.15.1.	Contractor shall ensure at all times that the work area & approach/ access roads are free from accumulation of water, so that the materials are safe and the erection/ progress schedule are not affected. No separate claim in this regard shall be admitted by BHEL.
3.16.	**LAND FOR SITE OFFICE**
3.16.1.	To establish a temporary site office, fabrication yard and storage area at the job site, open space will be provided free of charges. Contractor has to make his own arrangements for labour colony.
3.16.2.	BHEL shall not provide to the contractor any residential accommodation to any of his staff and the contractor has to make his own arrangements.

3.16.3.	Contractor has to furnish along with their offer, the details of requirements of area of space for his temporary site office, stores / storage shed.
3.16.4.	Location and area requirement for office / storage sheds / fabrication yard shall be discussed and mutually agreed to.
3.17.	**SITE ORGANISATION**
3.17.1.	The contractor shall provide adequate staffing in the following areas in addition to the staffing requirements of execution as instructed/ informed by BHEL:
i)	Overall planning, monitoring & control.
ii)	Quality control and quality assurance.
iii)	Materials management.
iv)	Safety, fire & security.
v)	Industrial relations and fulfilment of labour laws and other statutory obligations.
3.17.2.	The contractor shall maintain a site organization of adequate strength in respect of manpower, construction machinery and other implements at all times for smooth execution of the contract. This organization shall be reinforced from time to time, as required to make up for slippage from the schedule without any commercial implication to BHEL. The site organization shall be headed by a competent construction manager having sufficient authority to take decisions at site.
3.17.3.	The contractor should also submit to BHEL for approval a list of construction equipment, erection tools, tackle etc. prior to commencement of site activities. These tools & tackles shall not be removed from site without written permission of BHEL.
3.17.4.	**CONSTRUCTION MANAGEMENT**
3.17.5.	Based on the approved program, Contractor shall submit a program of construction/ erection/ commissioning for the implementation. These programs would be amplified showing start of erection and subsequent activities and shall form the basis for site execution and detail monitoring. The three-monthly rolling program with the first month's program being tentative based on the site condition would be prepared based on these programs. Contractor shall also be involved along with BHEL/ customer to tie up detailed resources mobilization plan over the period of the contract matching with the performance targets.
3.17.6.	The program would be jointly finalized by Site In-charge of Contractor with BHEL/ customer as well as the site-planning representative. The erection program will also identify sequential events matching financial turnover.
3.17.7.	Contractor is liable to furnish all documentary evidences towards payment of Works Contract Tax as and when required by BHEL.
3.17.8.	**CONSTRUCTION OF TEMPORARY OFFICE, STORES, ETC**
3.17.9.	Contractor shall arrange at their own cost cleaning & grading of area allotted, construction of their temporary office, stores, go-down, fabrication yards, etc and also watch & ward.

4.	T&PS AND MMES TO BE DEPLOYED		
4.1.	**List of major testing & measuring equipment/ tools and tackles to be arranged/ brought by contractor for each Package**		
S. No.	**Description**	**UoM**	**Qty**
1.	Capacitance & Tan Delta Kit		As per rqmt
2.	Capacitance Meter having range of 20 pF –100MF +/ - 1%	Nos.	1
3.	CFB & ZFB kit or equivalent for testing of Relay & Distance Protection	Nos. Each	1
4.	Container for Transformer Oil Sampling	Nos.	As per rqmt
5.	DC power supply 0-250 V, 10 A make “Aplab” or equivalent (variable source)	Nos.	6
6.	DC Resistance Meter (μΩ Meter)	Nos.	1
7.	DC shunt 400 A 75 mV	Nos.	3
8.	Dead weight tester rated 400 kg/ cm2 and with weights and test gauge facility. Make ‘Budenberg' or ‘Ravika’	Nos.	2
9.	Decade resistance box	Sets	6
10.	Digital Tong Tester 0-1/ 5 A AC	Nos.	1
11.	Digital Tong tester AC 5/ 10 and 25/ 60/ 300 A of reputed make	Nos. Each	2
12.	Digital Tong tester DC 30/ 60/ 300 A	Nos.	2
13.	Equipment and consumables for LPI/ MPI test on impulse pipes	Sets	2
14.	Ferrule printing machine	Nos.	2
15.	Fire proof tarpaulin		As per rqmt
16.	Frequency source 45 to 55 Hz with 110V	Nos.	1
17.	Function Generator	Nos.	2
18.	Glass thermometer 0-120 °C, 0-200 °C and 0-600 °C	Nos. Each	2
19.	HV Test Kit AC: 0 –20 kV & DC: 0- 25 kV Preferably with dry type transformer	Nos. Each	As per rqmt
20.	Inclined manometer (+/ -) 300 mm water column	Nos.	2
21.	Industrial type vacuum cleaner	Nos.	2
22.	Insulation Tester Hand Operated 250V/ 500V/ 1000V rated mains/ battery operated	Nos.	2
23.	Insulation Tester Mains Operated 2500/ 5000V	Nos.	1
24.	Insulation Tester Motorised Operated/ Electronic with selective range of 500/ 1000/ 2500/ 5000 V. Range 0.5 MΩ to 10000 MΩ	Nos.	3
25.	Manometers (+/ -) 500 mm mercury column with hand bulb for lab and small manometer for field purpose.	Nos.	2
26.	Meters for time measurement of breaker opening & closing time	Nos.	1

S. No.	Description	UoM	Qty
27.	Micro Ohm meter/ Ducter(mV Volt Drop Test Kit) 0-200 A DC, 0-2000 μΩ with suitable calibrated cable leads for current injection & mv drop	Nos.	1
28.	Muffle furnace – 800 °C with standard temperature gauges	Nos.	2
29.	Multimeters		
30.	A) Digital, 3 1/ 2 digit Motwane/ HIL/ Fluke	Nos.	16
	B) Analog: Motwane make	Nos.	10
	C) Digital, 4 1/ 2 digit Motwane/ HIL/ Fluke	Nos.	10
31.	Oil specific gravity and PPM measuring instrument	Nos.	1
32.	Oil temperature bath suitable to calibrate the instruments range 0 – 200 °C with standard temperature gauges and thermostatic control	Nos.	4
33.	Oscilloscope 100MHz	Nos.	1
34.	Other Protective Devices		As per rqmt
35.	Phantom Load Test Kit		As per rqmt
36.	Phase Sequence Indicator	Nos.	2
37.	Polarity Test Kit	Nos.	1
38.	Portable air compressor with drier and regulator make “Toshniwal/ Khosla” rated for 7 to 10 kg/ cm2	Nos.	7
39.	PPM Tester for Transformer Oil	Nos.	1
40.	Primary Injection Kit with pair of leads & clamps for testing CTS	Sets	1
41.	Protective Earth rod suitable for 220/ 400 kV System having leakage current meter, 70 sq. mm. cable & clamps (reputed make)	Nos.	2
42.	Relay Testing Kit	Nos.	1
43.	Rheostat	Nos.	3
44.	RTD/ Pt 100 source	Nos.	4
45.	Secondary current injection kit up to 300 A	Nos.	As per rqmt
46.	Secondary injection Kit 7500 A	Nos.	As per rqmt
47.	Secondary Injection kit with integral timer for relay testing with cable leads & Banna plugs selective range 5A & 1A (Range for relay setting))	Set	As per rqmt
48.	Silicon Oil Filter Machine for HVR	Nos.	1
49.	Mineral Oil Filter Machine for HVR	Nos.	1
50.	Single Phase Variac 250 V, 8 A	Nos.	2
51.	Single Phase Variac 250V, 28 A	Nos.	2
52.	Soldering iron “Soldron” make 25 W	Nos.	11
53.	Standard gauges 12” dial size make “Budenberg” or ”H Guru” or “Odin”		
54.	A) –1– 0 kg/ cm2 pressure gauge (vacuum gauge)	Nos.	2
	B) 0 – 5 or 6 kg/ cm2 pressure gauge	Nos.	2
	C) 0 – 10 kg/ cm2 pressure gauge	Nos.	2

S. No.	Description	UoM	Qty
	D) 0 – 25 kg/ cm2 pressure gauge	Nos.	2
	E) 0 – 60 kg/ cm2 pressure gauge	Nos.	2
	F) 0 – 100 kg/ cm2 pressure gauge	Nos.	2
	G) 0 – 250 kg/ cm2 pressure gauge	Nos.	2
	H) 0 – 600 kg/ cm2 pressure gauge	Nos.	2
	I) 0.2 to 1 kg pressure gauge	Nos.	2
55.	Standard milliamps/ millivolts source of reputed make. Range 0 to 60 mA and 0 to 100 mV	Nos.	6
56.	Stop Watch	Nos.	2
57.	Tachometer (Non-Contact Type) (0-4000 rpm)	Nos.	3
58.	Teletalk 2 wire system/ Group Mobile	Sets	28
59.	Temperature Gun Digital Type	Nos.	1
60.	Three Phase Shifter	Nos.	1
61.	Three Phase Variac 05 A	Nos.	2
62.	Three Phase Variac 15 A	Nos.	2
63.	Transformer oil BDV test kit 0-100kV with 2.5 mm air gap		As per rqmt
64.	Transformer oil purification plant with vacuum pump for evacuation transformer along with accessories & hoses of 750/ 1000/ 6000 LPH		As per rqmt
65.	Transformer turns Ratio test kit	Nos.	1
66.	Two way intercom set with 50 to 100 m cable for checking the cables continuity	Sets	2
67.	Wattmeter AC/ DC 0-125-250 V, 0-5-10 A	Nos.	1
68.	Earth Resistance Tester	Nos.	1
69.	NAS Filtration Machine	Nos.	As per rqmt
4.2.	**HANDLING EQUIPMENTS**		
1.	Chain pulley block/ turfer		As per rqmt
2.	Cranes, trucks, Trailer (10-12T), Hydra/ Farana etc. for transportation and erection of equipment		As per rqmt
3.	D-shackles		As per rqmt
4.	Manila ropes		As per rqmt
5.	Nylon Slings		As per rqmt
6.	Steel wire ropes		As per rqmt
7.	Turn buckles		As per rqmt
8.	24V AC Transformer & Hand lamps	Nos.	10
9.	Cable Rollers		As per rqmt
10.	Chain Pulley Blocks 5/ 10 T	Nos. Each	2

S. No.	Description	UoM	Qty
11.	Copper tube bender and cutter sizes 6mm, 8mm, 1/ 2", 1/ 4"	Nos. Each	2
12.	Crimping tool up to all sizes of Cables under scope of work	Nos. Each	4
13.	Die sets for threading up to 2" pipe.	Sets	3
14.	Distribution boards with power cable complete as required		As per rqmt
15.	Drilling machines 1/ 4", 1/ 2", 3/ 4" & 1"	Nos. Each	4
16.	Dynamometers		As per rqmt
17.	Electrician tool kit	Nos.	15
18.	Electrode drying ovens		As per rqmt
19.	Fire extinguishers (Type: as required)	Nos.	5
20.	Fire proof tarpaulin		As per rqmt
21.	Flood light fittings	Nos.	30
22.	Grinding machine	Nos.	15
23.	Hydraulic Crimping Tool for conductor/ shield wire		As per rqmt
24.	Hydraulic Jacks 250T/ 100T Capacity		As per rqmt
25.	Measuring instruments like Micrometres and Callipers	Sets Each	3
26.	Mechanical tool kit for fitters	Nos.	15
27.	TIG/ MIG Welding Machine with accessories air cool type	Sets	4
28.	Painting brush		As per rqmt
29.	Personal computer and accessories, Printer	Sets	1
30.	Pipe bending machine – 2" size	Nos.	3
31.	Safety belts and Safety helmets		As per rqmt
32.	Shearing Machine		As per rqmt
33.	Spirit level	Nos.	5
34.	Tap sets for both BSP and MPT threads up to 1" each	Sets Each	4
35.	Torque Wrench Set (Till 225Nm)	Nos. Each	2
36.	Tuffer Capacity 15T	Nos.	4
37.	Welding Generators	Nos.	12
38.	Dewatering Pump	Nos	As per rqmt
39.	Welding Transformers	Nos.	12
40.	Man-lifter as per requirement	Nos	1

 # Fire Arc suits are under the contractor's scope as per the requirement.

4.3.	**The 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	Ferrules (PVC) and suitable for ferrule printing.
16	Any other consumables as per the requirement.
	NOTE:
a)	Instruments shown above are for the regular works only. However, separate sets of tools and instruments are to be arranged and provided to commissioning gang. If contractor fails to arrange the testing instruments as listed above, BHEL site will arrange the instruments at the cost of contractor.
b)	The list of instruments/ equipment and their quantities to be brought by the contractor as shown above is only indicative. Any other instruments/ equipment is required for the execution of the work is to be necessarily arranged by the contractor. The testing/ calibration instruments which are used to be duly calibrated in the interval prescribed by BHEL engineer from the BHEL approved agencies. And test certificate to be furnished.
c)	The testing/ calibration instruments which are used to be duly calibrated in the interval prescribed by BHEL Engineers from the reputed agencies decided by BHEL and test certificate to be furnished. Contractor to submit calibration report from recognized agency prior to deployment of same at site and periodical calibration of the same to be arranged by contractor as per procedure of BHEL.
d)	This above list is only indicative and neither exhaustive nor limiting. Contractor shall deploy all necessary T&P to meet the schedules & as prescribed by BHEL engineer and required for completion of work.
e)	In the eventuality of contractor not deploying / abnormal down time of T&P/cranes in his scope during the period specified above, and BHEL arranges for the same [BHEL's own cranes], prevailing BHEL Corporate Crane hire charges (which may vary from time to time) shall be recovered from the contractor's running bills. Corresponding pages of Corporate Crane hire charges are enclosed as part of tender document as file titled "Annexure-15- BHEL T&P Hire Charges". In case BHEL arrange the T&P/Crane through hiring, actual hiring charges with 5% over head shall be recovered from the contractor's running bills.
Other than the aforesaid, one computer, printer and other necessary peripherals will have to be maintained by the contractor in his site office as mentioned in Scope of Work.	

4.4.	**T&P, MMD TO BE PROVIDED BY CONTRACTOR**
4.4.1.	Tentative list of T&P to be deployed by Contractor for successful completion of work is given in the at the start of this tender.
4.4.2.	It may be noted that the list is not exhaustive and is only for general guidance. Contractor shall provide all necessary T&P (other than those specified to be provided by BHEL, if any) MMD, handing equipment for timely completion of total work as per contract. In case of project requirement, some activities may have to pre-pone. In such case, Contractor may have to deploy additional T&P. Accepted rate shall be inclusive of such requirements.
4.4.3.	In the event of any failure on the part of Contractor progress of work suffers, BHEL, at their discretion may also terminate the contract and take out any or whole amount of contract from the scope of Contractor. In line with this, in the event of failure of Contractor to deploy necessary & sufficient T&Ps, BHEL also reserve the right to arrange the same including transportation from any of BHEL site/ other agency & charges, as applicable, in case progress of work is suffered. The decision of BHEL in this regard will be final and binding on the Contractor.
4.4.4.	Mobilization schedule as mutually agreed at site for major T&Ps, have to be adhered to so as to meet the project requirement. Contractor will have to give advance intimation & certification regarding capacity, etc prior to dispatch of heavy equipments. However, depending on project requirement, availability of inputs, the deployment schedule may be revised/ modified based on mutual agreement between BHEL and Contractor.
4.4.5.	All T&P and MMDs, which are required for successful and timely execution of work covered under this tender, shall be arranged & provided by Contractor at his own cost in working condition.
4.4.6.	After completion of major quantum of work as to be agreed by BHEL, Contractor may be permitted to take out any of his T&P, MMD progressively, if deemed fit by Construction Manager, BHEL based on review of work progress & balance work program. The same will be jointly agreed and recorded. BHEL's decision in this regard will be final & binding on Contractor.
4.5.	**TEST CERTIFICATE FOR T&P**
4.5.1.	All T&Ps, MMDs, lifting tackles and pulling devices, wire rope, slings to be deployed by Contractor must bear valid/ latest test certificates for their suitability, and the documents shall be preserved at site.
4.5.2.	In case of expiry of validity of any test certificate during construction, Contractor shall revalidate the same well in advance, so that construction activities do not suffer on account of non-availability of such test certificates.
4.5.3.	Contractor shall submit to BHEL for approval a list of T&Ps along with their fitness certificates. The T&Ps, MMDs, etc shall not be removed from site without written permission of BHEL.
4.6.	**MMEs / MMRs**
4.6.1.	Contractor shall ensure deployment of reliable and calibrated MMEs (Measuring and Monitoring Equipment). The MMEs shall have test /calibration certificates from authorised / Government approved / Accredited agencies traceable to National / International Standards. Retesting / re-calibration shall also be arranged at regular intervals during the period of use as advised by BHEL Engineer within the contract price. The contractor will also have alternate arrangements for such MMEs so that work does not suffer when the particular equipment /instrument is sent for calibration. Also if any MMEs not found fit for use, BHEL shall have the right to stop the use of such item and instruct the contractor to deploy proper item and recall i.e. repeat the readings taken by that instrument, failing which BHEL may deploy MME and retake the readings at Contractor's cost.
4.6.2.	Contractor shall provide all the Measuring Monitoring Equipment (MMEs) required for completion of the work satisfactorily. These MMEs shall be of brand, quality and accuracy specified by BHEL Engineer and should have necessary calibration and other certificates as per the requirement of BHEL Engineer.

	Decision of BHEL Engineer regarding acceptance or otherwise of the measuring instruments / gauges / tools for the work under this specification, is final and binding on the contractor. BHEL shall give an indicative list of MMEs required for this work else where in this contract and to be made available by the contractor. The list will be reviewed by BHEL site as per the requirement of approved FQPs and the contractor shall meet any augmentation needed wherever required.
4.6.3.	It is the responsibility of the contractor to prove the accuracy of the testing / measuring / calibrating equipment brought by him based on the periodicity of calibration as called for in the BHEL's quality assurance standards/BHEL Engineer's instructions.
4.6.4.	Re-work necessitated on account of use of invalid MMEs shall be entirely to the contractor's account. He shall be responsible to take all corrective actions, including resource augmentation if any, as specified by BHEL to make-up for the loss of time.
4.6.5.	In the courses of erection, it may become necessary to carry repeated checks of the work with instruments recently calibrated, re-calibrated. BHEL may counter / finally check the measurements with their own MMEs. Contractor shall render all assistance in conduct of such counter /final measurements.
4.7.	**MEASURING AND MONITORING DEVICE (MMD)**
4.7.1.	Contractor shall provide within accepted rates/ price, all MMDs as necessary for such work.
4.7.2.	Contractor shall ensure deployment of reliable & calibrated MMDs. The MMDs shall have valid calibration certificate from authorized/ Govt approved /NABL accredited agencies. Contractor shall also keep provision of alternate engagement for such MMDs so that the work does not suffer when a particular MMD is sent for calibration. Re-testing/ re-calibration shall also be arranged by Contractor at their own cost at regular interval during the period of use as advised by BHEL.
4.7.3.	In the event of failure of Contractor to bring necessary and sufficient MMDs, BHEL may arrange for the same. The entire cost towards this along-with overhead shall be paid by Contractor or deducted from Contractor's bills.

5.	T&Ps AND MMEs TO BE DEPLOYED BY BHEL ON SHARING BASIS
5.1.1.	EOT crane in TG Hall (265/ 25 MT) without Operator-2 Nos; For handling and erection within TG hall on sharing basis as available and subject to their accessibility and approachability.
5.1.2.	Above T&P will be provided on sharing basis only. Contractor has to plan his activities well in advance and inform BHEL Engineer in charge/ Construction Manager the date of actual use. The decision of BHEL Engineer in-charge/ CM on this will be final and binding.
5.2.	**TOOLS & PLANTS TO BE PROVIDED BY BHEL**
5.2.1.	For T&P issued by BHEL, Contractor and BHEL shall maintain joint protocol about the condition of all items taken from BHEL's custody and returned after use. SContractor shall not use this equipment for purposes other than the scope of work given in this tender.
5.2.2.	It is the responsibility of Contractor to keep these equipment always in working condition and ensure their safe return in working condition to BHEL's store subject to normal wear & tear.
5.2.3.	After use of T&P items issued by BHEL the same shall be returned to BHEL in good working condition subject to normal wear & tear failing which recoveries at the book value of the item or the market rate prevailing at the time of returning the items, whichever is higher, shall be made from the payments due to Contractor. BHEL's decision regarding condition evaluation shall prevail.
5.2.4.	Any damage/ breakdown maintenance of T&Ps arising out of improper handling by Contractor shall be to the account of Contractor. BHEL reserve the right to repair the same to its own satisfaction at the cost of Contractor. During such outage of T&P, BHEL shall not be responsible to provide any alternative. Contractor shall arrange for such alternative arrangement at their own cost.
5.2.5.	Contractor shall return BHEL, T&Ps issued to them in good working condition as & when desired by BHEL (on completion or reduction of work load). If return of equipment is delayed by Contractor, hire charges as applicable shall be levied by BHEL from time it was requisitioned till the time of actual return. Hire charges shall also be charged on T&P returned in damaged/ un-serviced condition to BHEL till its satisfactory repair. Equipment returned in damaged un-serviced condition shall be got repaired by BHEL at their discretion and entire cost of repair with BHEL overheads shall be recovered from Contractor.
5.2.6.	In case of any T&P (issued to Contractor) remain idle without valid reason, BHEL shall withdraw the T&P immediately for allotment to other agency next in priority and no compensation shall be entertained on this account by BHEL.
5.2.7.	The T&Ps will be issued on sharing basis and distribution of these shall be done at the discretion of Construction Manager, BHEL as per requirement/ priority of the job and availability of these items. In the event of non-availability of crane, BHEL may explore the possibility of providing alternate higher/ nearby capacity crane, found separable with BHEL site. However, this is not a binding for BHEL. Such cranes of higher capacity (if provided by BHEL) will also be issued on same conditions as applicable to cranes listed in the relevant annexure.
5.2.8.	In the event of any damage or theft occurring to the issued T&Ps, while in use with Contractor, due to their negligence, the same shall be repaired/ replaced by Contractor at their own cost within the time stipulated by Construction Manager, BHEL. Contractor's failure to do so shall entitle BHEL to get the above done through any agency and cost along with overheads shall be recovered from Contractor's RA bill.
5.2.9.	The items mentioned in relevant annexure are for general guidance only. Except the referred items, Contractor has to deploy all other T&Ps required for proper & satisfactory completion of the job.
5.2.10.	Increasing/ shortening of crane boom to suit work requirements shall have to be arranged by Contractor at their cost. In case of non-availability of T&Ps to be provided by BHEL due to any reason, Contractor

	shall plan/ amend/ alter their activities to meet erection/ commissioning targets in consultation with BHEL. No additional compensation will be given for this.
5.2.11.	Normal/ schedule maintenance of T&P issued to Contractor on shared basis shall be carried out by BHEL as per requirement. Contractor shall plan/ alter their activities in line with availability of cranes, issued by BHEL on sharing basis.
5.2.12.	Actual use of T&P including marching as per entry in log-book duly certified by BHEL engineer shall be considered for calculation of overtime charges.
5.2.13.	T&P issued shall be used only for designated scope of work as per direction of BHEL.
5.2.14.	In the event Contractor fails to use and/ or maintain BHEL T&P according to BHEL's instructions, BHEL reserve the right to withdraw such T&P without any notice and no claim in this regard shall be entertained and Contractor shall be responsible for delay in execution on this account.
5.2.15.	It shall be responsibility of Contractor to take delivery of T&P from stores or place of use of T&P by other agencies at project site, transport the same to site and return the same to BHEL store/ place as intimated by BHEL at project site in good working conditions after use.
5.2.16.	EOT crane shall be made available to Contractor in TG hall free of charges for erection purpose as per availability on shared basis. As the operator will be from other agency, Contractor will do necessary co-ordination.
5.2.17.	Availability of EOT crane may be affected from time to time due to routine preventive maintenance or break down maintenance. Contractor have to make alternative arrangement or plan/ amend/ alter their actions to suit the above condition and Contractor will not be entitled to any compensation due to this non-availability of the crane to maintain the schedule.
5.2.18.	Services of EOT crane will be provided to other agencies working in power house building or adjacent area as required. Decision of BHEL engineer for allocation of EOT crane will be final. Contractor has to make adjustments accordingly.
5.2.19.	It is not obligatory on the part of BHEL to provide any T&P or other materials other than those specifically agreed to do so by BHEL in the tender. However, depending upon availability & job requirement, BHEL/ customer may make available any T&P or other material to Contractor on chargeable basis. Hiring charge will be based on standard followed by BHEL/ customer, as applicable. Hire charge will be recovered from Contractor's RA bills/ security deposit or any other dues in one installment.

6.	**TIME SCHEDULE & MOBILIZATION**
6.1.	**Initial Mobilization** After issue of LOA (though Fax/courier/email) the contractor shall report to the Construction Manager/Site In-Charge of BHEL at site within Two weeks (14 days) from date of LOA for Kick-off meeting regarding mobilization of manpower, T&Ps and date of start of work and detailed completion program etc. The contractor has to subsequently augment his resources in such a manner that the project milestones are completed on specified schedules and entire work completed within the entire contract period, as specified in the following clause from the date of start of work, in a manner required by BHEL to match with the project schedule.
6.2.	**Commencement of Contract Period**: BHEL Engineer will certify the actual date of start of work after adequate mobilization of manpower, major equipment and required T&P by the contractor. In case of discrepancy, the decision of BHEL shall be considered to be final and binding to contractor. Based on the availability of civil foundations, drawings and material from BHEL, contractor may have to advance the erection activity after getting clearance from Construction Manager, or the erection activity may get delayed due to site conditions. The contractor shall complete all the works in the scope of this contract within the contract period. Pending points identified by the customer/BHEL during the execution of the contract are to be liquidated during the contract period itself.
6.3.	**Schedule of Completion:** The contract period for completion of entire work under scope shall be as mentioned hereunder, from the "START OF CONTRACT PERIOD" as specified earlier for completion of the entire work **in respective Packages.**

Package	**Contractual Completion Schedule (Month)**
Name of the Package: ERECTION, TESTING & COMMISSIONING OF ELECTRICAL PKG OF MAIN PLANT AREA INCLUDING ACC SYSTEMS FOR Unit#3	17 Months

6.4. The contractor has to subsequently augment his resources in such a manner that following major milestones of erection & commission are achieved on specified schedules:

S. No.	**MAJOR MILESTONE**	**Tentative Schedule w.r.t date of start of work of Unit-3**
1	ND HYDRO TEST	7th Month
2	BOILER LIGHT UP	10th Month
3	SYNCHRONIZATION	14th Month
4	COMPLETION OF FACILITIES	17th\ Month

Agency for above package has to expedite their work in order to meet the milestones as indicated above.

NOTE: Above time schedule is only tentative and in order to meet above schedule in general, and any other intermediate targets set, to meet customer/ project schedule, contractor shall arrange &

augment all necessary resources from time to time as per the instructions of BHEL Engineer w.r.t. monthly plan and review format (F-14).

The above schedule shall be advanced, if there are requirements to advance the project to meet the project requirement. No extra payment whatsoever shall be paid on this account.

6.5. **Intermediate milestones:**

Two Major Intermediate Milestones are identified as M1 and M2.

	Milestone Name	Tentative Schedule from start of work of Package
		Unit-3
M1	BOILER LIGHT UP	10th Month
M2	SYNCHRONIZATION	14th Month

Contractor shall plan their work in such a manner so as to meet the above construction schedule & project schedule, in consultation with BHEL/ customer. **M1** & **M2 are the intermediate LD milestone. Contractor shall submit detailed L1/L2 schedule separately for the package after getting LOI from BHEL and prior to issuance of detailed work order**.

6.5.1. Provision of Penalty in case of slippage of Intermediate Milestones:

a) In case of slippage of Two Major Intermediate Milestones, mentioned as M1 & M2 above, delay Analysis shall be carried out on achievement of each of these two Intermediate Milestones in reference to F-14.
b) In case delay in achieving M1 Milestone is solely attributable to the contractor, 0.5% per week of executable contract value*, limited to maximum 2% of executable contract value, will be withheld.
c) In case delay in achieving M2 Milestone is solely attributable to the contractor, 0.5% per week of executable contract value*, limited to maximum 3% of executable contract value, will be withheld.
d) Amount already withheld, if any against slippage of M1 milestone, shall be released only if there is no delay attributable to contractor in achievement of M2 Milestone.
e) Amount required to be withheld on account of slippage of identified intermediate milestone(s) shall be withheld out of respective milestone payment (if any) and balance amount (if any) shall be withheld @10% of RA Bill amount from subsequent RA bills.
f) Final deduction towards LD (if applicable), on account of delay attributable to contractor shall be based on final delay analysis on completion / closure of contract. Withheld amount, if any due to slippage of identified intermediate milestone(s) shall be adjusted against LD or released as the case may be.
g) In case of termination of contract due to any reason attributable to contractor before completion of work, the amount already withheld against slippage of intermediate milestones shall not be released and be converted into recovery.
h) Contractor shall make all possible efforts to expedite the activities, in case of delay of any intermediate milestone, to maintain overall project completion schedule.

*Executable Contract Value - Value of work for which inputs/ fronts were made available to contractor and were scheduled for execution till the date of achievement of that milestone.

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

6.7.7.	The contractor shall submit quarterly statement report regarding consumption of all consumables for cost analysis purposes.
6.7.8.	The contractor shall submit a report of any damage, shortage, discrepancy etc., every week detailing in this regard. Non-submission of report would be considered as no shortage of materials.
6.7.9.	The manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.
6.7.10.	**The monthly report as a booklet shall be submitted at the end of every month and shall contain the following details: -** a) Progress photographs in colour. b) Erection progress in terms of the respective work areas against planned c) Site Organization chart of engineers & supervisors as on the last day of the month with further mobilization plan. d) Safety implementation report in the format. Pending material and any other inputs required from BHEL for activities planned during the subsequent month.
6.7.11.	**Site Data Digitalisation: Daily Activity Log, M-Book and Subcontracting Billing Module: -** a) Refer Vendor Portal System with links: for ref. https://pshq.bhel.in/sddvp/ b) Login ID and Password shall be provided by respective package manager. c) Contractor by clicking 'Daily Work Photos', shall upload area wise photos on daily basis. d) Contractor by clicking 'Daily Activity Log', shall update site activities on daily basis. e) Contractor by clicking 'Measurement Book', shall enter Measurement Book in Format and BOQ. f) Contractor shall raise their RA Bills along with supporting documents (such as Quality and HR Document – Vetted by Customer Etc.) and checklist through SDD portal only. g) Contractor shall comply the system requirement. h) Refer Vendor Manual for further details. **Note:** The contractor shall be required to provide all facilities including manpower for the aforementioned activities, without any cost implications to the BHEL.
6.7.12.	Agency shall extend all support towards inputs for Project Management to PMC team, IPMS system or any other system/tool for project monitoring and control.
6.8.	**General Terms:**
6.8.1.	Contractor shall submit daily work program based on above construction schedule. Deferment of schedule is not acceptable, unless specifically called for by BHEL. Contractor will adhere to schedule and resource planning to be augmented to ensure completion as per schedule. Slippage from adherence to this schedule will attract penalty/ LD as per tender provision.
6.8.2.	Periodic progress reviews on the entire activities of execution in respect of supply & works in scope of Contractor will be held once in a month at Nagpur/ site. These meetings will be attended by reasonably higher officials of Contractor and will be used as a forum for discussing all areas where progress needs to be speeded up. Contractor shall be further responsible for ensuring that suitable steps are taken to meet various targets decided upon such meetings. Review shall be done in applicable BHEL format (F-14 etc) and shall have to be signed jointly by BHEL engineer and site in-charge of vendor. This signed document shall form the basis for furure delay analysis of the project.
6.8.3.	The contractor shall complete all the work in the scope of this contract within the contract period. Subject to availability of materials and other inputs, it is the responsibility of the contractor to carry out work to achieve the monthly progress and keep up the schedules.
6.8.4.	Contractor shall draw the monthly erection program along with BHEL Engineer indicating the work to be achieved and event to be completed. Once the program is drawn, he shall adhere to the same. Contractor

	shall plan and erect the materials as it is received at site. The monthly planned percentage shall take into consideration the material available at site before the start of the month and also any material received during the month. Contractor shall mobilize his resources required to achieve the monthly programs.
6.8.5.	Contractor shall specifically note that there is likely to be some delay in supplies of materials/ release of work fronts/ other reasons. Contractor shall have to work round the clock on such critical activities as a part of catch up program to meet the project requirement to the extent possible and shall also provide required resources as part of scope of work.
6.8.6.	In order to meet above schedule in general, and any other intermediate targets set, to meet customer/ project schedule, contractor shall arrange & augment all necessary resources from time to time as per the instructions of BHEL.
6.8.7.	In case the activities in the schedule are to be advanced, the related structural activities in the scope of the contractor are to be advanced to meet the project requirement. No extra payment whatsoever shall be paid on this account.
6.8.8.	The contractor shall submit area-wise L3 schedule within 7 days in consultation with BHEL. The detailed L3 schedule shall be approved by BHEL and same shall be implemented. Bidder shall submit L3 schedule in MS Projects to meet the agreed project schedule covering various mile stone activities and their split-up details such as mobilization, procurement of materials, fabrication & erection activities. This schedule shall also clearly indicate the interface facilities/ inputs applicable in each package.
6.9.	**DEFINITION OF WORK COMPLETION**
6.9.1.	The contractor's scope of work under these specifications will be deemed to have been completed in all respect, only when all the activities are completed satisfactorily and so certified by BHEL site in charge. The decision of BHEL in this regard shall be final and binding on the contractor.
6.10.	**MATERIAL RE-CONCILIATION & SHORT CLOSURE OF CONTRACT**
6.10.1.	The BOQ is for Package: ERECTION, TESTING & COMMISSIONING OF ELECTRICAL PKG OF MAIN PLANT AREA INCLUDING ACC SYSTEMS FOR Unit#3. The contractor shall do material re-conciliation periodically. In extreme case if need arises, BHEL may short close the contract.
6.11.	**SCHEDULE COMPRESSION**
6.11.1.	BHEL, owing to its commitment to their customer, may ask contractor to compress the total completion schedule by up to 15%. This will result in advancement of various milestones. For achieving the same, contractor shall plan his activities and mobilize additional resources accordingly to the satisfaction of BHEL engineer within the quoted rates.

7.	TERMS OF PAYMENT	
The progressive payment for erection, testing and commissioning on accepted price of contract value for Electrical Package rates will be released as per the break up given hereinafter:		
S. No.	**Activity/ Work Description**	**%age of Unit Rate**
7.1.	**PRO RATA PAYMENTS (85%)**	
7.1.1.	**Cable tray and accessories**	
A)	Fabrication and fixing/ welding/ bolting in position	60%
B)	Earthing of cable trays	10%
C)	Numbering of cable trays	8%
D)	Covering of trays where ever envisaged	7%
	Total =	**85%**
7.1.2.	**Cable laying including Earth wires**	
A)	Laying of cables/ wires	45%
B)	Glanding & Termination (Except HT Termination) & Testing	15%
C)	Charging of cables	10%
D)	Dressing and clamping of cables	15%
	Total =	**85%**
7.1.3.	**Junction box/ Push Button Station (local)**	
A)	Erection including fixing of terminal blocks where ever applicable	75%
B)	Name plate fixing where ever applicable, Labelling (both inside and outside) and Commissioning of connected equipment	10%
	Total =	**85%**
7.1.4.	**Miscellaneous Structural steel including frames for Panels/ Racks/ Instruments, supports for cable tray/ pipes/ tubes, Canopies etc.**	
A)	Fabrication/Pre assembly/Erection, Alignment, welding/bolting and if applicable chipping/grouting/painting	85%
	Total =	**85%**
7.1.5.	**DG sets/ Switch Gears/ MCC/ PCC/ Distribution Boards/ Marshalling Box/ Starter Units/ Electrical Hoists/ Panels/ Cubicles/ Desks/ UPS/ Batteries/ Chargers/ VFD/ LA Assy/ NGT/ NGR/ SP/ Miscellaneous Equipment/ Station lighting etc.**	
A)	Placement, Alignment and coupling/interconnection where ever applicable, erection of associated accessories etc.	50%
B)	Pre-commissioning checks and tests	10%
C)	Charging, Loop testing and commissioning	15%
D)	Nomenclature/Name-plate/Painting etc	5%
E)	System commissioning	5%
	Total =	**85%**
7.1.6.	**Earthing/ Lightning protection strips, Earthing pits/Rubber mat etc**	
A)	Fabrication, erection, alignment, welding/ bolting of earthing/ lightning protection strips; earth pits completion/insulation	60%
B)	Testing/commissioning/Connection to equipment	25%
	Total =	**85%**
7.1.7.	**LT/ HT Bus Ducts**	

A)	Pre assembly of Bus Ducts and accessories, erection, alignment, bolting/ welding etc. complete with supporting structure	50%
B)	Pre commissioning checks	20%
C)	Testing, Charging and Painting (as applicable)	15%
	Total =	**85%**
7.1.8.	**Oil Filled Transformers (Generator, Station, UAT, Station Service etc.)**	
A)	Placement on foundation and alignment	25%
B)	Erection of associated auxiliaries/ assemblies, oil filling, etc.	25%
C)	Dry out including oil filtration	15%
D)	Pre-commissioning checks/Testing	10%
E)	Charging and Painting (as applicable)	10%
	Total =	**85%**
7.1.9.	**Testing/ Commissioning of Equipment (like motors, actuators, ESP transformer, misc. equipment, etc.) erected by other agencies**	
A)	Testing & pre-commissioning checks	65%
B)	System commissioning	20%
	Total =	**85%**
7.1.10.	**HT Termination/Straight through Jointing Kits/Trefoil Clamps**	
A)	Kit termination/Jointing/Clamping	50%
B)	Testing	20%
C)	Charging/checking	15%
	Total =	**85%**
	Total =	**85%**
7.2.	**STAGE/ MILESTONE PAYMENTS (15%)**	
a)	Boiler Light Up	1%
b)	Chemical Cleaning	1%
c)	Steam Blowing	1%
d)	Safety Valve Floating	1%
e)	Oil Flushing (TG)	1%
f)	Barring Gear (TG)	1%
g)	Rolling and Synchronisation (STG)	1%
h)	Coal Firing	1%
i)	Full Load	1%
j)	COD	1%
k)	Trial Operation	1%
l)	Punch List points/ pending points liquidation	1%
m)	Area cleaning, temporary structures cutting/ removal and return of scrap	1%
n)	Submission of 'As Built Drawings'	1%
o)	Material Reconciliation	1%
	Total for Stage/ Milestone Payments (15%)	**15%**

7.3.	Progressive Payment/ Final Payment: The payments for works under the scope of this contract for both the packages shall be as per clause no 2.6; 2.22; 2.23 of General Conditions of Contract and Volume-IB, Chapter-X of SCC.
7.4.	**Documents required for RA Bill:**
	GST Complied Invoice of the work done as per approved BBU.
	WAM -6 for RA Bill.
	Jointly signed Measurement sheet/ Protocols
	Power of Attorney before submission of Bill.
	Validity of Bank Guarantees as applicable under the contract.
	Monthly HSE Compliance Certificate certified by BHEL- Safety
	Material reconciliation statement along with RA Bill (Monthly basis).
	HR/IR compliance documents:
	i) Wages payment sheet as per applicable minimum wages. ii) Proof of PF contribution submission. iii) Proof of ESI/ WC contribution submission iv) Proof of Bonus payment as per Bonus Act if applicable. v) Proof of EL payment if applicable. vi) Any other statutory document if applicable.
7.5.	**Documents required for Final Bill:**
	The final bill is drawn as soon as the entire work is completed. From the final amount due, all amounts already claimed up to the previous running account bill will be deducted. It should be ensured that in the final bill the following additional particulars have been provided:
	a) Final Bill in WAM-7 Format. b) 'No claim' certificate from the contractor. c) Clearance certificates where ever applicable viz. Clearance Certificates from Customer, various Statutory Authorities like Labour department, PF Authorities, Commercial Tax Department etc. d) Final Material re-conciliation statement duly approved by BHEL. e) Indemnity Bond as per prescribed format. f) Deviation statement showing the difference between the actuals and as per the contract. g) Final Delay Analysis.
7.6.	**General Notes**
7.6.1.	The payment for running bills will be released after submission of running bill complete in all respects with all documents. It is the responsibility of the contractor to make his own arrangements for making timely payments towards labour wages, statutory payments, outstanding dues etc. and other dues in the meanwhile. No interest shall be payable for the delayed payment (if any).
7.6.2.	The measurements sheets of work done in a month shall be submitted in triplicate duly agreed/signed by BHEL Engineer. The contractor shall extend all necessary assistance for verification of measurements of works without any extra cost.
7.6.3.	Material reconciliation shall be complied on monthly basis.
7.6.4.	The RA bill payments are interim payments and bills shall be submitted in prescribed formats.
7.6.5.	Recoveries on account of electricity, water, statutory deductions etc. shall be made as per terms of contract.

7.6.6.	BHEL will release payment through Electronic Fund Transfer (EFT)/RTGS.
7.6.7.	Final bill shall be submitted after completion of works and upon material reconciliation along with all prescribed formats.
7.6.8.	Quoted Rates are inclusive of all labour, contractor's equipment, temporary works, consumables and all matters and things of whatsoever nature, charges for Safety Aspects/Compliance to Safety Rules including operations and maintenance services (if applicable) etc., and other services, as identified in the tender Documents, as necessary for the proper execution of the subject work.
7.7.	**SECURED RECOVERABLE ADVANCES:**
7.7.1.	Interest Free Secured Mobilization Advance as per GCC Clause No. 2.13.1 will be payable under exceptional circumstances on certification of BHEL Construction Manager at Site. Interest Free Mobilization Advance shall be disbursed in specifically mentioned stages of major respective resource mobilization as specified hereunder:
7.7.2.	1. For Mobilization of 01 no. of 10T-12T Trailer: 1% of Contract value 2. For Mobilization of 01 no. of Hydra / Farana of required capacity: 1% of Contract value 3. For Mobilization of required T&Ps: (Chain pulley blocks, Insulation Tester, Cutter & Drill M/c – minimum 2 nos each) at site to start the work: 1% of Contract value 4. For Mobilization of required manpower at site to start the work: 1% of Contract value 5. For Installation and Erection of Site Infrastructure by contractor i.e. site office, site stores, computer with printer, etc.: 1% of Contract value **Note:** a) BHEL Site-PD/CM shall be the deciding authority for assessing the admissibility of advance payment to contractor. b) In case contractor do not fulfil the agreed conditions of payment of earlier mobilization advance, BHEL Project Director / Construction Manager will have the authority to not allow the subsequent mobilization advance to contractor.

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

	iv) In cases where e-invoicing provision is applicable, vendor/contractor is required to submit invoice in compliance with e-invoicing provisions of GST Act and Rules made thereunder. v) Contractor has filed all the relevant GST return (e.g. GSTR-1, GSTR-3B, etc.) pertaining to the invoice submitted and submit the proof of such return along with immediate subsequent invoice. In case of final invoice/ bill, contractor has to submit proof of such return within fifteen days from the due date of relevant return. vi) Respective invoice has appeared in BHEL's GSTR - 2A for the month corresponding to the month of invoice and in GSTR-2B of the month in which such invoices has been reported by the contractor along with status of ITC availability as "YES" in GSTR-2B. Alternatively, BG of appropriate value may be furnished which shall be valid at least one month beyond the due date of confirmation of relevant payment of GST on GSTN portal or sufficient security is available to adjust the financial impact in case of any default by the contractor. Contractor has to submit an undertaking confirming the payment of all due GST in respect of invoices pertaining to BHEL.
8.2.9.	Any financial loss arises to BHEL on account of failure or delay in submission of any document as per contract/purchase order/work order at the time of submission of Tax invoice to BHEL, shall be deducted from contractor's bill or otherwise as deemed fit.
8.2.10.	TDS as applicable under GST law shall be deducted from contractor's bill.
8.2.11.	Contractor shall comply with the provisions of e-way bill wherever applicable. Further wherever provisions of GST Act permit, all the e-way bills, road permits etc. required for transportation of goods needs to be arranged by the contractor.
8.2.12.	Contractor shall be solely responsible for discharging his GST liability according to the provisions of GST Law and BHEL will not entertain any claim of GST/interest/penalty or any other liability on account of failure of contractor in complying the provisions of GST Law or discharging the GST liability in a manner laid down thereunder.
8.2.13.	In case declaration of any invoice is delayed by the vendor in his GST return or any invoice is subsequently amended/altered/deleted on GSTN portal which results in any adverse financial implication on BHEL, the financial impact thereof including interest/penalty shall be recovered from the Contactor's due payment.
8.2.14.	Any denial of input credit to BHEL or arising of any tax liability on BHEL due to non-compliance of GST Law by the Contractor in any manner, will be recovered along with liability on account of interest and penalty (if any) from the payments due to the Contactor.
8.2.15.	In the event of any ambiguity in GST law with respect to availability of input credit of GST charged on the invoice raised by the contractor or with respect to any other matter having impact on BHEL, BHEL's decision shall be final and binding on the contractor.
8.2.16.	Variation in Taxes & Duties: Any upward variation in GST shall be considered for reimbursement provided supply of goods and services are made within schedule date stipulated in the contract or approved extended schedule for the reason solely attributable to BHEL. However downward variation shall be subject to adjustment as per actual GST applicability. In case the Government imposes any new levy/tax on the output service/goods after price bid opening, the same shall be reimbursed by BHEL at actual. The reimbursement under this clause is restricted to

	the direct transaction between BHEL and its contactor only and within the contractual delivery period only. In case any new tax/levy/duty etc. becomes applicable after the date of Bidder's offer but before opening of the price Bid, the Bidder/Contractor must convey its impact on his price duly substantiated by documentary evidence in support of the same before opening of price bid. Claim for any such impact after opening the price bid will not be considered by BHEL for reimbursement of tax or reassessment of offer.
8.2.17.	Income Tax: TDS/TCS as applicable under Income Tax Act, 1961 or rules made thereunder shall be deducted/collected from contractor's bill.
8.3.	**BOCW Act & Cess Act**
8.3.1.	**BOCW Cess is not to be borne by contractor.** Refer Annexure-I for BOCW Act & Cess Act.
Annexure-I:	
Bidder may please note that the sub-contractor/bidder of BHEL engaging building or construction worker in connection with building or other construction work, are required to follow the procedures enumerated below:	
i)	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.
ii)	It shall be sole responsibility of the contractor engaging Building Workers in connection with the building or other construction works in the capacity of employer to apply and obtain registration certificate specifying the scope of work under the relevant provisions of the Building and Other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 from the appropriate Authorities.
iii)	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.
iv)	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.
v)	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.
vi)	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.
vii)	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.

9.	GENERAL CONDITIONS
9.1.	**Brief Scope of Work**
9.1.1.	Intent of this tender is to provide services for execution of work according to most modern & proven techniques & codes. Omission of specific reference to any method, equipment or material necessary for proper & efficient services towards installation of the equipment shall not relieve Contractor of the responsibility of providing such services/ facilities to complete the work or portion of work awarded to him. Accepted rates/ price shall deem to be inclusive of all such contingencies.
9.1.2.	It is not the intent of this tender to specify herein all the details of erection, commissioning, etc. However, the system shall conform in all respects to high standards of quality & workmanship for performing the required duties in a manner acceptable to BHEL/ purchaser who will interpret the meaning of drawings, specifications and shall be entitled to reject any work or material, which in his judgments is not in full accordance herewith.
9.1.3.	Omission of specific reference to any method, equipment or material necessary for proper & efficient working of the plant shall not relieve Contractor of the responsibility of providing such facilities to complete the work at accepted rates. Any mismatch/ defect found due to mistake in work shall have to be rectified by Contractor free of cost. Inspection by BHEL/ customer does not relieve Contractor of responsibility of executing quality erection.
9.1.4.	Following shall be the responsibility of Contractor and have to be provided within accepted rates/ prices. • Provision as required of all types of labour, supervisors, engineers, watch & ward, tools & tackles, calibrated MMD as specified and otherwise required for the work, consumables for erection, testing, commissioning, etc including handling. • Proper out-turn as per BHEL plan and commitment. • Completion of work as per BHEL/ project schedule. • Good quality and accurate workmanship for proper performance of equipment. • Repair and rectification. • Preservation/ re-conservation of all components during storage, erection, commissioning till handing over. Dismantling, removal of debris, leveling etc of all temporary buildings, structures, pipelines, cables, etc as per instruction of BHEL/ customer on completion of work. If Contractor fails to do so, BHEL will get the job done through other agency and the cost along with applicable overhead will be recovered from Contractor. Decision of BHEL in this regard shall be final & binding on Contractor. However, the scope of dismantling & leveling the area is limited only to Contractor's site office, yard, other spaces occupied by Contractor.
9.1.5.	BHEL - Power Sector (WR) is ISO 9001-2008 certified company. Quality of work, to customer's satisfaction and as per system requirements are the essence of ISO:9001-2008 certification. The bidder in all respects will organise his work, systems, environment, process control documentation, T&Ps, measuring and monitoring devices (MMDs) etc as per instructions of BHEL engineer.
9.1.6.	Contractor shall comply with HSE (Health, Safety & Environment) requirements of BHEL and follow all applicable Operational Control Procedures (OCPs) within quoted rate/ price.
9.1.7.	Contractor shall construct closed/ semi closed/ open stores shed for proper storage of items received by them without extra cost.
9.1.8.	Contractor should use fire proof tarpaulin only to cover any material either in open or at a covered area.
9.1.9.	Contractor should deploy portable fire extinguishers of required number in his office, stores and work areas.
9.1.10.	Earthing of equipment including instruments is also included under his scope.

9.1.11.	Contractor shall take the full responsibility of testing, pre-commissioning and commissioning of the equipment being installed by him or installed by others but being commissioned by him under the overall supervision of BHEL. It shall be the responsibility of Contractor to arrange all the testing/ measuring instruments and complete all testing, pre-commissioning, commissioning activities for the particular equipment as per relevant standards, code of practice, manufacturer's instructions, applicable quality plans for installation, testing, commissioning and BHEL norms. All these will be witnessed by BHEL/ representative of BHEL/ customer and reports signed jointly. Contractor shall submit a check list to BHEL prior to taking up testing, commissioning activities which shall be approved by BHEL and the activities shall be carried out in accordance with the check list.
9.1.12.	Contractor has to arrange all safety appliances required during acid filling/ charging of battery and other items like sp gravity meter, thermometer, jerry cans, funnels, etc. Resistance box with all interconnecting cables, PVC drums for water loads, etc of suitable rating/ capacity for carrying out capacity/ discharge test of batteries shall be arranged. Also, maintenance of battery parameters, after commissioning till handing over to owner shall be carried out.
9.1.13.	Rotation of motor terminal boxes and minor modification to suit cable termination, if required shall be carried out at no extra cost.
9.1.14.	For soot blowers, valves and dampers, operated through associated MCCs, entire commissioning including setting of limit/ torque switch and position feedback unit, electrical control gear of actuators of MOVs & damper, changing of actuator components such as cards, transformer etc. is included in the scope of Contractor.
9.1.15.	Before starting erection job, Contractor shall ensure that the area is sufficiently cleaned against ingress of dust & water, and all debris are cleared off from the floor to a designated area as per instruction of BHEL. Contractor shall arrange to get the working area and surroundings cleaned daily to ensure a dust free atmosphere for working.
9.1.16.	The accuracy of all equipment, instruments and their functioning shall be established before they are permitted for use on the job. If the engineer doubts the accuracy of the precision tools any time during erection, Contractor shall arrange the checking of tools/ equipment/ instruments at his cost.
9.1.17.	Foundations for all equipment shall be provided by BHEL. Dimensions & locations of foundations, pockets, anchor bolt shall be checked by Contractor for their correctness as per drawings/ documents. Further, top elevation of foundations shall be checked with respect to bench marks, etc. All minor adjustments of foundation level, dressing and chipping of foundation surfaces up to 50 mm, enlarging the pockets in foundations, etc as may be required for erection of equipment/ plants shall be carried out by Contractor within the accepted rates/ price.
9.1.18.	While on the job, care is essential to avoid too much chipping and resultant lowering of level. In case of excess chipping Contractor has to arrange additional packing plates as per requirements provided it is allowed by BHEL engineer. When required by manufacturers, the embedded sub-sole plates shall be scraped and checked with Prussian blue to get the required contact with frames.
9.1.19.	Contractor shall ensure perfect matching of packer plates including scraping and blue matching with foundation by dressing the foundation, as well as perfect matching between packer plates and base plate of equipment to the satisfaction of BHEL engineer.
9.1.20.	All civil works, viz grouting/ excavation/ casting of foundation anchor points for derricks, winches, guy ropes, fastening, etc and foundations required for any other temporary supports/ works, as required for safe & efficient operation of tools & tackles, shall be Contractor's responsibility. For these civil works all materials excluding normal cement and required facilities will have to be arranged by Contractor at their own cost.

9.1.21.	All minor civil works for main equipments including drilling, chipping, enlarging cutouts, foundation pockets, cable cut outs, etc will have to be carried out by Contractor at no extra cost. Grouting of equipments erected by Contractor as per procedure is included in the scope. Materials like special cement, sand aggregates, etc including shuttering, curing, etc shall be arranged without any extra cost.
9.1.22.	All other points shall be as per the terms & conditions and specification along with aforesaid references together with amendments incorporated thereto.
9.2.	**SITE VISIT**
9.2.1.	Bidder should visit site and acquire full knowledge & information about site conditions. The bidder must visit site, to acquaint themselves with the conditions prevailing at site and in & around the plant premises, together with all statutory, obligatory, mandatory requirements of various authorities before submission of bid.
9.3.	**GENERAL TECHNICAL REQUIREMENT (CODES AND STANDARDS)**
9.3.1.	The work must be performed according to the most recent relevant codes, standards, accident prevention regulations and local rules and legal regulations.
9.3.2.	All materials and equipment supplied and all work carried out as well as calculation sheets, drawings, quality and class of goods, methods of inspection, specific design features of equipment and parts and acceptances of partial plants shall comply in every respect with the applicable standards, codes and regulations to be chosen from the following:
9.3.3.	It is contractor's responsibility to provide sufficient evidence that any national or other standard the Contractor proposes (other than those mentioned above) will ensure an equivalent or higher standard.
9.3.4.	Except where otherwise specified, the plant/equipment shall comply with the appropriate agreed internationally accepted Standard Specification as mentioned elsewhere in contract specifications, each incorporating the latest revisions at the time of tendering. Where no internationally/domestic accepted standard is applicable, the Contractor shall give all particulars and details as necessary; to enable BHEL to identify all of the plant/equipment in the same detail as would be possible had there been a Standard Specification.
9.3.5.	Where the Contractor proposes alternative codes or standards he shall include in his tender one copy (in English) of each Standard Specification to which materials offered shall comply. In such case, the adopted alternative standard shall be equivalent or superior to the standards mentioned in the specification.
9.3.6.	In case bidder proposes any IS code, it shall be verified by reputed institutions like IIT that the proposed code is equivalent or superior to the codes mentioned above. Comparison report shall be established and provided to BHEL/Owner for information. Such report shall highlight the main items of the code, including material composition, material properties, design clauses and others as required. Report shall identify deviations of both codes and give justification for this deviation.
9.3.7.	The bidder shall ensure that design will consider material properties as per approved code.
9.3.8.	In the event of any conflict between the codes & standards referred above, and requirements of this specification, the requirements which are more stringent shall govern.
9.3.9.	Wherever specified or required the plant/equipment shall conform to various applicable statutory regulations at Jharkhand. Wherever required, obtaining approval for plant/ equipment supplied under the specification from statutory authorities shall be the responsibility of the Contractor.
9.4.	**GENERAL SERVICES TO BE RENDERED BY BIDDER**
9.4.1.	Services for construction, fabrication, erection, testing, trial run, commissioning/ completion of various equipment & accessories/ items under the contract shall include but not be limited to the following.

9.4.2.	Collecting materials from store/open yard from time to time for fabrication/ erection as per construction program and unloading as per flow of consignment. Contractor shall be custodian of all materials issued till the plant/ equipment is officially taken over by BHEL/ customer after complete erection, commissioning/ completion. Contractor shall maintain adequate security personnel and security measures for proper precaution and safety of material.
9.4.3.	Trial run, commissioning of individual equipment/ sub-systems to the satisfaction of BHEL/ BHEL's advisor/ owner.
9.4.4.	Deployment of all skilled & unskilled manpower required for erection supervision, watch & ward, commissioning/ completion and other services to be rendered under this tender.
9.4.5.	Deployment of all erection tools & tackle, construction machinery, transportation vehicles and all other implements in adequate number and size, appropriate for erection work to be handled under scope of this tender except otherwise specified.
9.4.6.	Supply of all consumables, eg welding electrodes, gases for gas cutting job, etc as well as materials required for temporary supports, scaffolding etc as necessary for such construction work, unless specified otherwise.
9.4.7.	Providing support services for Contractor's erection staff eg construction of site offices, temporary stores, residential accommodation and transport to work site for erection personnel, watch and ward for security and safety of the materials under Contractor's custody etc, as required.
9.4.8.	Maintaining proper documentation of all site activities undertaken by Contractor as per proforma, mutually agreed with BHEL, submitting monthly progress reports as also any such document as & when desired by BHEL/ customer, taking approval of all statutory authorities eg, Electrical Inspector, Factory Inspector, Provident Fund authority etc. for respective portions of work under the jurisdiction of such statutes of laws.
9.4.9.	All the materials issued to the bidder by BHEL shall be reconciled by the bidder and the unused materials have to be returned back to BHEL stores/ yard or any other place as specified by BHEL. A material reconciliation statement showing the details of materials issue/return duly signed by BHEL engineer shall have to be submitted by the bidder.
9.4.10.	As part of overall project management activity, Contractor shall be responsible for proper co-ordination of erection activities during various phases of execution of the contract. Contractor shall identify a person designated as Site Incharge, with whom BHEL shall interact on matters related to execution of the contract. The Site Incharge shall be the single point contact person on behalf of Contractor. BHEL shall interact with the Site Incharge only on all matters on co-ordination between BHEL and Contractor. For timely completion of work Contractor may have to work in one or more shifts. He will not be eligible for any extra charge on this account.
9.4.11.	Contractor shall confine all their field operations to those works which can be performed without subjecting the equipment and materials to adverse effects, during inclement weather conditions, like monsoon, storms, etc and during other unfavourable construction conditions. No field activities shall be performed by Contractor under conditions which might adversely affect quality & efficiency thereof, unless special precautions or measures are taken by Contractor in proper & satisfactory manner in performance of such works and with concurrence of BHEL. Such unfavourable construction conditions in no way relieve Contractor of their responsibility to perform work as per schedule.

9.4.12.	Contractor shall supply all skilled workmen like mill-wright fitters, welders, gas cutters, electricians, riggers, sarangs, erectors, carpenters, pipe fitters, masons, laggers, tin-smiths, instrument technicians/machanics etc, as required, in addition to other skilled, semi-skilled and unskilled workmen required for all works of handling, transportation from site store to erection site (from inside or outside plant boundary) erection, testing, commissioning/ completion contemplated under this tender. Only fully trained and competent men with previous experience on the job shall be employed. They shall hold valid certificates wherever necessary. BHEL reserve the right to decide on suitability of workers and other personnel who will be employed by Contractor. BHEL reserves the right to insist on removal of any employee of Contractor at any time, if found unsuitable and Contractor shall forthwith remove him.
9.4.13.	Supervisory staff employed by Contractor shall be technically qualified and experienced in the area of work. They shall ensure proper out turn of work and discipline on the part of labour put on the job by Contractor and in general see that the works are carried out in a safe & proper manner and in coordination with other labour and staff employed directly by BHEL or other Contractors of BHEL and BHEL's client.
9.4.14.	Contractor shall also furnish daily labour report showing by classification the number of employees engaged in various categories of work a progress report of work as required by BHEL.
9.4.15.	The work shall be executed under the usual conditions affecting major power plant construction and in conjunction with numerous other operations at site. Contractor and their personnel shall co-operate with other personnel, and other Contractors, co-ordinating their work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.
9.4.16.	Contractor's supervisory staff shall execute the work in the most substantial & workman like manner in the stipulated time. Accuracy of work and aesthetic finish are essential part of this contract. Contractor shall be responsible to ensure that assembly and workmanship conform to the dimensions and tolerance given in the drawing/ instruction given by BHEL from time to time.
9.4.17.	It is the responsibility of Contractor to engage their workman in shifts or on overtime basis for achieving target set by BHEL during erection, commissioning/ completion, testing. Bidder's quoted rate shall include all these contingencies.
9.4.18.	Any other service, although not specifically called for but required for a contract of the size and nature indicated in the tender.
9.4.19.	After completion of commissioning activity of equipment/ systems, Contractor shall prepare test reports/protocols which shall include all relevant information related to various commissioning checks, tests carried out, any deviations/ commissioning noticed wrt intended design requirements, sequence of various commissioning activities as actually adopted vis-à-vis as recommended in the procedures, program schedule achieved and any other such information as required .These test reports/protocols shall be submitted in requisite number of copies to BHEL/ BHEL's advisor/ owner during the commissioning activities.
9.5.	**PROTECTION**
9.5.1.	Equipment having anti-friction or sleeve bearings shall be protected by weather tight enclosures. Coated surfaces shall be protected against impact, abrasion, discoloration and other damages. Surfaces which are damaged shall be repainted.
9.5.2.	Electrical equipments, controls and insulations shall be protected against moisture and water damages. All external gasket surfaces and flange faces, couplings, rotating equipment shafts, bearings and like items shall be thoroughly cleaned and coated with rust preventive compound and protected with suitable wood, metal or other substantial type covering to ensure their full protection. All exposed threaded parts shall be greased & protected with metallic or other substantial type protectors

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

9.6.10.	It is the responsibility of Contractor to do the alignment etc if necessary, repeatedly to satisfy engineer, with all the necessary tools & tackles, manpower etc. The alignment will be complete only when jointly certified so, by Contractor's engineer and BHEL. Also Contractor should ensure that the alignment is not disturbed afterwards.
9.6.11.	Equipment and material, in case wrongly installed, shall be removed and reinstalled to comply with the design requirement at Contractor expense, to the satisfaction of BHEL/ customer.
9.6.12.	After identification of erection materials by BHEL at BHEL's store/ storage yard, it shall be the responsibility of Contractor to take delivery of materials from BHEL's store/ storage yard by Contractor's own manpower and re-stack the leftover materials as per erection sequence at BHEL store at their own cost. The entire activities are to be carried out under supervision of BHEL.
9.6.13.	In case of Contractor's failure to meet any of the aforesaid requirements, BHEL will get the same done and cost towards this, along with BHEL's applicable overhead will be recovered from Contractor's RA bill.
9.7.	**QUALITY CONTROL & QUALITY ASSURANCE**
9.7.1.	**INSPECTION & FIELD QUALITY ASSURANCE**
i)	Contractor shall carry out all activities conforming to the approved Field Quality Plan (FQP) & technical instructions as revised from time to time. 'Total Quality' shall be the watchword of the work and contractor shall strive to achieve the quality standards, procedures laid down by BHEL. He shall follow all the instructions as per BHEL drawings and quality standards. Contractor shall provide the services of quality assurance engineer as per the relevant clauses.
ii)	Preparation of quality assurance log sheets and protocols with customer / consultants / statutory authority, welding logs, NDE records, testing & calibration records and other quality control and quality assurance documentation as per BHEL engineer's instructions, is within the scope of work / specification. These records shall be submitted to BHEL / customer for approval from time to time.
iii)	The protocols between contractor and customer / BHEL shall be made for correctness of foundations, materials, procedures, at each stage of installation, generally as per the requirement of customer / BHEL. This is necessary to ensure elimination of errors and to avoid accumulation and multiplication of errors.
iv)	A daily log book (with proper indexing) should be maintained by every supervisor / engineer of contractor, for respective area of work, on the job for detailing and incorporating alignment/ clearance / centering / levelling readings and inspection details of various equipment, etc. This log book shall be always accessible to BHEL engineers. High pressure welding (as applicable under the scope of this contract) details like serial number of weld joints, welders name, date of welding, details of repair, heat treatment etc. will be documented in welding log as per BHEL Engineer's instructions. Record of radiography (as applicable under the scope of this contract) containing details like serial number of weld joints, date of radiography, repairs, if any, re-shots etc shall also be maintained as per BHEL Engineer's instructions. Record of heat treatments (as applicable under the scope of this contract) performed shall be maintained as prescribed by BHEL.
v)	The performance of welders (as applicable under the scope of this contract) will be reviewed from time to time as per the BHEL standards. Welders' performance record shall be furnished periodically for scrutiny of BHEL's Engineer. Corrective action as informed by BHEL shall be taken in respect of those welders not conforming to these standards. This may include removal/ discontinuance of concerned welder(s).Contractor shall arrange for the alternate welders immediately.
vi)	Only welders duly authorized by BHEL / customer / consultant after welder qualification test as per ASME Sec-Ix / AWS D1.1 (as applicable) shall be engaged on the work. All the welders shall carry identity cards as per the proforma prescribed by BHEL / Customer / Consultant.

vii)	Any re-laying or re-termination of cables / re-erection of instruments / recalibration of instruments etc. required due to contractor's mistake and found at any stage inspection, shall be carried out by the contractor at no extra cost. Repair / rectification procedure to be adopted to make any job acceptable shall be subject to the approval of BHEL.
viii)	Weekly Quality Review Meeting at site shall be organised by BHEL to discuss quality issues and next weeks' inspection plans. Site in-charge of the contractor along with QAEs of the contractor must be present in the meeting with closure report of the issues raised by BHEL in the previous meetings.
9.7.2.	**REQUIREMENT OF ISO 9001**
i)	The basic philosophy of the Quality Management System under ISO 9001 is to define the organizational responsibility, work as per documented procedures, verify the output with respect to acceptance norms, identify the non-conforming product / procedure and take corrective action for removal of non-conformance specifying the steps for avoiding recurrence of such non-conformities, & maintain the relevant quality records. The non-conformities are to be identified through the conduct of periodical audit of implementation of quality systems at various locations/stages of work. Suppliers / vendors of various products / services contributing in the work are also considered as part of the quality management system. As such the contractor is expected not only to conform to the quality management system of BHEL but also it is desirable that they themselves are accredited under any quality management system standard.
ii)	BHEL reserves the right to carry out quarterly quality audits and quality surveillance of the systems and procedures of contractor's quality management. Contractor shall provide all necessary assistance to enable BHEL to carry out such audit & surveillance.
iii)	Quality audits / approval of the results of test & inspection will not prejudice the right of BHEL to reject an equipment service not giving desired performance and shall not in no way limit the liabilities and responsibilities of the contractor in earning satisfactory performances of equipment / service as per specification.
9.7.3.	**INSPECTION BY TS / FES / QA ENGINEERS OF BHEL UNITS / ENGINEERING CENTRES**
i)	Apart from day-to-day inspection by BHEL Engineers stationed at Site and Customer's Engineers, stage inspection of equipment under erection and commissioning at various stages may also be conducted by teams of Engineers from Field Engineering Services of BHEL's Manufacturing Units, Quality Assurance teams from Field Quality Assurance, Unit/Factory Quality Assurance and Commissioning Engineers from Technical Services etc. Contractor shall arrange all labour, tools and tackles etc along with proper access for such stage inspections freeof cost.
ii)	Any modifications suggested by BHEL FES and QA Engineers' team shall be carried out. Claims of contractor, if any, shall be dealt as per applicable clause of the contract, and provided such modifications have not arisen for reasons attributable to the contractor.
9.8.	**CONFORMANCE TO THE STATUTORY REQUIREMENTS (AS APPLICABLE UNDER THE SCOPE OF THE CONTRACT)**
9.8.1.	The work to be executed under these specifications has to be offered for inspection, at appropriate stages of work completion, to various statutory authorities for compliance with applicable regulations. The work-related statutory inspections, though not limited to, are as under: 1) Electrical Inspector 2) Factory Inspector, Labour Commissioner, PF Commissioner and other authorities connected to this project work.

	The scope includes getting the approvals from the statutory authorities, which includes arranging for inspection visits of statutory authority periodically as per BHEL Engineer's instructions, arranging materials for ground inspection and following up the matter with them. Contractor shall also make all arrangements for offering the Products / Systems for inspection at location, as applicable, to the concerned authority.
9.9.	**OTHER STATUTORY REQUIREMENTS**
9.9.1.	The Contractor shall submit a copy of Labour License obtained from the Licensing Officer (Form VI) u/r25 read with u/s 12 of Contract Labour (R&A) Act 1970 & rules and Valid WC Insurance copy or ESI Code (if applicable) and PF code no. along with the first running bill.
9.9.2.	The contactor shall submit monthly running bills along with the copies of monthly wages (of the preceding month) u/r78(1)(a)(1) of Contract Labour Rules, copies of monthly return of PF contribution with remittance Challans under Employees Provident Fund Act 1952 and copy of renewed WC Insurance policy or copies of monthly return of ESI contribution with Challans under ESI Act 1948 (if applicable) in respect of the workmen engaged by them.
9.9.3.	The Contractor should ensure compliance of Sec 21 of Contract Labour (R&A) Act 1970 regarding responsibility for payment of Wages. In case of "Noncompliance of Sec 21 or non-payment of wages" to the workmen before the expiry of wage period by the contactor, BHEL will reserve its right to pay the workmen under the orders of Appropriate authority at the risk and cost of the Contractor.
9.9.4.	The Contractor shall submit copies of Final Settlement statement of disbursal of retrenchment benefits on retrenchment of each workmen under I D Act1948, copies of Form 6-A (Annual Return of PF Contribution) along with copies of PF Contribution Card of each member under PF Act and copies of monthly return on ESI Contribution – Form 6 under ESI Act 1948 (if applicable) to BHEL along with the Final Bill.
9.9.5.	In case of any dispute pending before the appropriate authority under ID Act 1948, WC Act 1923 or ESI Act 1948 and PF Act 1952, BHEL reserve the right to hold such amounts from the final bills of the Contractor which will be released on submission of proof of settlement of issues from the appropriate authority under the act.
9.9.6.	In case of any dispute prolonged / pending before the authority for the reasons not attributable to the contractor, BHEL reserves the right to release the final bill of the contractor on submission of Indemnity bond by the contractor indemnifying BHEL against any claims that may arise at a later date without prejudice to the rights of BHEL.
9.10.	**DEPLOYMENT OF SKILLED / SEMI-SKILLED TRADESMEN**
9.10.1.	The contractor shall, at all stages of work deploy skilled / semi-skilled tradesmen who are qualified and possess certificate in particular trade from CPWD Training Institute / Industrial Training. Institute / National Institute of Construction Management and Research (NICMAR), National Academy of Construction, CIDC or any similar reputed and recognized Institute managed / certified by State / Central Government. The number of such qualified tradesmen shall not be less than 20% of total skilled / semi-skilled workers required in each trade at any stage of work. The contractor shall submit number of man days required in respect of each trade, its scheduling and the list of qualified tradesmen along with requisite certificate from recognized Institute to Engineer-in-Charge for approval. Notwithstanding such approval, if the tradesmen are found to have inadequate skill to execute the work of respective trade, the contractor shall substitute such tradesmen within two days of written notice from Engineer-in-Charge. Failure on the part of contractor to obtain approval of Engineer-in-Charge or failure to deploy qualified tradesmen will attract a compensation to be paid by contractor at the rate of Rs. 100 per such tradesman per day. Decision of Engineer-in-Charge as to whether particular tradesman possesses requisite skill and amount of compensation in case of default shall be final and binding.
9.11.	**ELECTRICAL INSPECTORATE'S APPROVAL**

9.11.1.	Contractor is responsible for getting Electrical Inspector/statutory authority's approval for all electrical installation covered in their scope. This also includes the Electrical equipment that are erected by mechanical contractor for which commissioning assistance is to be provided by the Electrical contractor.
9.11.2.	All electrical installation covered in contractor's scope which also includes equipment covered in commissioning assistance are to be inspected/approved by the electrical inspector/statutory authority. For getting electrical inspector approval, contractor shall arrange the following: a. Work Completion certificate for all the equipment covered in the contract b. Details of Equipment (specification). c. Test results conducted at site for all the equipment including electrical equipment erected by Mechanical contractor. Any other documents as required by statutory authority. Any expenditure related to documentation shall be borne by contractor.
9.11.3.	Contractor shall carry out the modifications/rectifications, if any, as suggested by the authority at their cost. However, it is not applicable for equipment erected by Mechanical contractor.
9.11.4.	Contractor shall also have valid electrical installation license on their company as well as for individuals acceptable to respective state electrical inspectorate requirement.
9.11.5.	The contractor shall arrange necessary statutory inspections and obtain certificate for installation work at their cost. Any Expenditure related to documentation shall be borne by the contractor. Contractor shall pay all fees relates to electrical inspectorate approval. However, BHEL shall reimburse all statutory fees on production of receipts (FEES FOR VISITS, INSPECTION FEES, REGISTRATION FEES and any other statutory fees).
9.11.6.	**Any modification work required by inspector shall be attended by the contractor. Modifications which had raised due to execution deficiencies are at the cost of contractor whereas modifications which are due design change shall be treated as extra work.**
9.12.	**HEALTH, SAFETY & ENVIRONMENT**
9.12.1.	HSE shall be guided by a separate volume (**Document No. WRHPP: PVUNL Rev-02, HEALTH, SAFETY AND ENVIRONMENT PLAN FOR PVUNL 3x800MW Patratu Site dated 01.07.2018**) over and above the below mentioned terms and conditions.
9.12.2.	Round the clock experienced paramedical personnel with first aid facility & ambulance including driver, fuel, etc., at site, shall be arranged by BHEL through other sub-contractors at site. However, expenditure towards above facilities shall be shared by BHEL's sub-contractors working at site (actual cost distribution amongst all Contractors shall be on pro rata basis proportionate to their contract prices). In case of any dispute, Construction Manager decisions in this regard shall be binding.
9.13.	**CIVIL WORKS, FOUNDATIONS AND GROUTING**
9.13.1.	Foundations for all equipment shall be provided by BHEL. The dimensions & locations of the foundations, pockets, anchor bolt shall be checked by Contractor for their correctness as per drawings. Further, top elevation of foundations shall be checked with respect to bench marks, etc. All minor adjustments of foundation level, dressing & chipping of foundation surfaces up to 50 mm, enlarging the pockets in foundations, etc as may be required for erection of equipment/ plants shall be carried out by Contractor within accepted rates/ price.
9.13.2.	While on the job, care is essential to avoid too much chipping and resultant lowering of level. In case of excess chipping, Contractor has to arrange additional packing plates as per requirements provided it is allowed by BHEL.

9.13.3.	Contractor shall ensure perfect matching of packer plates including scraping & blue matching with foundation by dressing foundation, as well as perfect matching between packer plates & base plate of equipment to BHEL's satisfaction.
9.13.4.	All civil works, viz grouting/ excavation/ casting of foundation anchor points for derricks, winches, guy ropes, fastening, etc and foundations required for any other temporary supports/ works, as required for safe & efficient operation of tools & tackles, shall be the Contractor's responsibility. For these civil works all materials excluding cement and required facilities will have to be arranged by Contractor at their own cost.
9.13.5.	All minor civil works for main equipment including drilling, chipping, enlarging cut-out, column foundation pockets, cable cut outs, etc will have to be carried out by Contractor at no extra cost. Grouting of equipment erected by Contractor as per procedure is included in scope. Providing & grouting of pocket holes, under base-plates of structural steel/ machinery including roughening of surface, cleaning, ramming, curing, etc, all complete with CONBEXTRA GP-1 or equivalent like Sika is included in scope. Materials like grouting compound, cement, sand, aggregates, etc shall be arranged by Contractor at no extra cost to BHEL.
9.14.	**CLEANLINESS**
9.14.1.	Contractor shall be responsible for keeping the entire area allotted to him clean & free from rubbish, debris, etc. during the period of contract. Contractor shall employ enough number of special personnel to thoroughly clean his work-area at least once in a day. All such rubbish & scrap material shall be stacked or disposed in a place to be identified by BHEL/ customer. Materials and stores shall be so arranged to permit easy cleaning of area. In areas where equipment might drip oil and cause damage to floor surface, a suitable protective cover of a flame resistant, oil proof sheet shall be provided to protect floor from such damage.
9.14.2.	Similarly, labor colony, the offices and the residential areas of Contractor's employees and workmen shall be kept clean and neat to the entire satisfaction of BHEL/ customer. Proper sanitary arrangements shall be provided by Contractor, in the work-areas, office and residential areas of Contractor.
9.15.	**OTHER FACILITIES TO BE PROVIDED BY CONTRACTOR**
9.15.1.	Contractor shall provide all necessary scaffolding materials, temporary structures, as may be required and necessary safety devices etc.
9.15.2.	Contractor's responsibly with regard to operator, fuel, lubricants and daily upkeep of T&Ps provided by BHEL is further detailed in relevant section.
9.15.3.	Contractor shall maintain & operate his tools & plants in such a way that major breakdowns are avoided. In the event of major breakdown, Contractor shall make alternative arrangements expeditiously so that progress of work is not hampered.
9.15.4.	For welding, use of welding generators/ rectifiers only is permitted.
9.15.5.	Temporary toilet blocks are to be constructed/ fabricated at different areas as per mutual agreement for maintaining proper sanitation.
9.15.6.	Construction and maintenance of necessary approach & access roads surrounding the work area shall be in the scope of Contractor within accepted rates.
9.16.	**RESPONSIBILITIES WITH REGARD TO EMPLOYMENT OF LABOUR, ETC**
9.16.1.	Contractor shall also comply with the requirements of local authorities (Govt. of Jharkhand) with regard to employment of labours/workers at project site. They shall comply with any other statutory requirement/ local authority requirement such as police verification of antecedents of the workmen, staff, etc. with regard to employment of labours/workers at project site. In case of workmen / supervisors deployed to project from INDIA / any other country,

	necessary statutory guidelines issued by Indian Govt./ concerned Govt. authorities shall be strictly complied with in addition to local laws. Skilled labour with experience in construction of large utility thermal power projects shall be deployed (preferably 80% of such skilled labours shall be sourced from India).
9.16.2.	BHEL/ customer may insist for witnessing the regular payment to the labour. They may also like to verify relevant records for compliance with statutory requirements. Contractor shall enable such facilities to BHEL/ customer.
9.16.3.	It is the responsibility of Contractor to arrange gate pass for all his employees, T&P, etc for entering the project premises. Necessary co-ordination with customer officials is the responsibility of Contractor. Contractor to follow all procedures laid down by customer for making gate pass. To work beyond normal working hours, Contractor shall arrange necessary work permits for working beyond normal working hours.
9.16.4.	If at any time during the execution of work, it is noticed that the work is suffering on account of non-availability/ shortfall of resources from Contractor's side, BHEL will make suitable alternate arrangements. The expenditure incurred along with applicable overheads shall be recovered from the Contractor.
9.16.5.	It is the responsibility of Contractor to engage his workmen in shifts and or on overtime basis to achieve targets, to suit BHEL''s commitments to customer or to adjust date of completion of events or due to other reasons. Decision of BHEL in this regard will be final & binding on Contractor.
9.16.6.	Contractor shall deploy only qualified & experienced engineers/ supervisors. They shall have professional approach in executing the work.
9.16.7.	Contractor's supervisory staff shall execute the work in the most professional manner in the stipulated time. Accuracy of work and aesthetic finish are essential part of this contract. They shall be responsible to ensure that workmanship conform to dimensions & tolerances given in drawings/ instructions given by BHEL engineer from time to time.
9.16.8.	The supervisory staff employed by Contractor shall ensure proper outturn of work and discipline on the part of labour put on the job. Also in general they should see that the works are carried out in a safe and proper manner and in coordination with other labour and staff employed directly by BHEL or other Contractors of BHEL or BHEL"s client.
9.16.9.	If at any time, it is found that Contractor is not in a position to deploy required engineers/ supervisors/ workmen due to any reason, BHEL shall have the option to make alternate arrangements. The expenditure incurred along with applicable overheads shall be recovered from the Contractor.
9.16.10.	The Contractor shall deploy all the skilled/semiskilled/ unskilled labour including highly skilled workmen etc. These workmen should have previous experience on similar job. They shall hold valid certificates wherever necessary. BHEL reserves the right to insist on removal of any employee of the Contractor at any time if he is found to be unsuitable and the Contractor shall forthwith remove him. Contractor should furnish a tentative deployment plan of his manpower as required in GCC. Also the actual deployment will be so as to satisfy the project schedule of erection and commissioning.
9.17.	**GATE PASS FORMALITIES**
9.17.1.	The contractor shall make his own arrangements of gate pass for his vehicles, T&Ps etc. as prescribed and instructed by the PVUNL /CISF at his own cost, each gate pass has to be endorsed by the PVUNL / 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 PVUNL /CISF at the end of the project all the gate passes endorsed by the PVUNL / CISF for use of the contractor's vehicle, T&Ps shall have to be returned.
9.17.2.	Vehicles equipped with flame arrester will only be allowed inside the premises. Valid RC book, insurance, fitness certificate, road tax certificate, PUC, driving license, etc. is required for gate pass formalities of all

	vehicles. Goods carrying certificate is also required for goods category vehicles. Gate pass formalities may take some time, so contractor has to plan well in advance accordingly.
9.17.3.	The contractor shall make his own arrangements of gate pass for his employees / workers as prescribed and instructed by the PVUNL /CISF at his own cost, each gate pass has to be endorsed by the PVUNL/ CISF before the pass can be used. In case of termination of the service of any of his employee during the contractual period, the contractor shall have to surrender the gate pass issued to the employees to the PVUNL / CISF. At the end of the project all the gate passes endorsed by the PVUNL / CISF for use of the contractor's employees shall have to be returned.
9.17.4.	Police verification and medical fitness certificate of all workers / employees of agencies is must for gate pass formalities. Contractor has to arrange the same at his own cost. Gate pass formalities may take time, so contractor has to plan well in advance accordingly.
9.17.5.	PPEs and Dangri is must for all workers and staffs working inside PVUNL premises. Contractor has to arrange all these for their worker and staffs at their own cost.
9.17.6.	Deployed electricians should have valid qualification & valid electrical license for gate pass.
9.18.	**LABOR CODES IMPLEMENTATION w. e. f. 21.11.2025:**
9.18.1.	Labor codes implementation w. e. f. 21.11.2025: Bidder to ensure workers' right to minimum wages, the Central Government has amalgamated. A. 4 laws in the Wage Code, B. 9 laws in the Social Security Code, C. 13 laws in the The Occupational Safety, Health and Working Conditions Code, 2020 D. 3 laws in the Industrial Relations Code The Central Government hereby appoints the 21st day of November, 2025 as the date on which the following provisions of the said Codes, shall come into force. 1. Social Security Code 2020 2. Occupational Safety, Health and Working Conditions Code, 2020 3. Code on Wages, 2019 4. Industrial Relations Code, 2020
9.19.	**DOCUMENTATION**
9.19.1.	The following information shall be furnished by the bidder within two weeks of award of contract for purchaser's approval. a. Bar chart covering planned activities at site b. Detailed organization chart Details of T&P available with contractors with documents proofs.
9.19.2.	The following information shall be furnished by the bidder after testing and inspection: Test certificates of various tests conducted at site. All inspection and test certificates shall be signed by customer's representative also, wherever called for as per field quality plan. **As built drawings:** After successful completion, testing and commissioning of installation work, Purchaser's drawings / documents shall be updated in line with the actual work carried out and as built drawings / documents shall be submitted by the contractor as agreed for the project.
9.20.	**PROJECT MANAGEMENT/ CONSTRUCTION MANAGEMENT**
9.20.1.	To meet the need of construction management at site, Contractor shall comply Clause No. 5.7 in Chapter-V within their accepted rates.

9.21.	**INFRASTRUCTURE**	
9.21.1.	Contractor shall install 2 nos all in one PCs (multimedia PC work station Core-i3, 2.1 GHz or above, 500 GB HDD, 4 GB RAM, 100/ 1000 MBPS LAN card) of HP/ Compaq/ Lenevo or equivalent make with window 8 or 7 O/S and required software like MS Office 2010 Professional, AutoCAD 2009 or higher, PageMaker (7.0, etc), ADOBE PDF CREATOR and ONE NO. SCANNER (HP Scan Jet Pro 2500 or equivalent), one no laser jet printer compatible for A4 size printing (ink/ cartridge for which to be supplied as & when required) with power backup at places, as per instruction of BHEL for exclusive use of BHEL. These computers/ printers/scanners shall remain Contractor's property and they will be allowed to take out the same after completion of contract period including extension. Contractor shall provide data/ information, etc in prescribed formats for periodical updating of progress reports, material management reports, updating of network pertaining to Contractor's scope of work, etc In case Contractor fails to provide 1 No. computer and 1 No. printer or personnel as per requirement, for a continuous period of fifteen days or more, suitable penalty (as decided by Erection In Charge) may be levied from contractor's RA Bill.	
9.21.2.	Contractor's site office must have facilities of communications like, E-mail, and telephone with STD facility within a month from LOI.	
9.22.	**SITE ORGANIZATION**	
9.22.1.	Contractor shall maintain a site organization of adequate strength in respect of manpower, construction machinery and other implements at all time for smooth execution of the contract headed by Site In-charge for site operations with sufficient level of authority to take site decisions. Contractor will submit organization chart (showing the name of Site In-charge) with individual bio-data indicating various levels of experts to be posted for supervision in the fields of supervision and execution, quality, material management, planning, safety, etc. The organization shall be reinforced from time to time, as required to make up slippage (if any) from the schedule without any commercial implication to BHEL. The organization chart is to be submitted within 10 days from the date of LOI.	
9.22.2.	Following (minimum) engineering manpower with power plant construction background to be deployed at site by Contractor for proper execution. This requirement is in addition to the normal manpower required for installation, erection, and commissioning activities under the scope of the contract.	
9.22.3.	Qualified safety officers with assistants (exclusive for safety supervision for project jobs).	As per relevant HSE clause/ manual.
9.22.4.	For planning function of entire scope of work.	1 no with sufficient experience.
9.22.5.	For quality inspection function of entire scope.	1 no engineer. 1 no supervisor.
9.22.6.	Material handling area for follow-up with BHEL for timely putting up material requirement, identification of material for receipt from BHEL store/ storage yard, etc for various systems, ie transformer, busduct, cable tray, cable, switchgear, panel, etc.	1 no engineer. 2 nos supervisor.
9.22.7.	Deputation of above man-power shall be jointly decided at site in line with construction schedule and front availability.	
9.22.8.	Engineer/ supervisor for other functions like store & purchase, material management, planning, finance, administration, etc are to be provided as per site requirement and not considered above.	
9.22.9.	In the event of non-deputation of engineer/ supervisor by the bidder as per above agreed schedule, BHEL shall reserve the right to deduct from RA bills as per prevailing rates applicable along with overheads for Skilled, Semi-skilled & Un-skilled for arranging alternative arrangements.	

9.22.10.	BHEL reserves the right to reject or approve the list of personnel proposed by Contractor. The persons whose bio-data have been approved by BHEL will have to be posted at site and deviation in this regard will not be permitted unless specific & reasonable justification is made.
9.22.11.	In addition to above, a well experienced qualified engineer to be designated, as 'Project Co-ordinator, shall be deployed by Contractor. Such engineer shall have adequate exposure on the job and shall remain fully involved in all planning activities, guidance etc to Contractor's own team during the complete execution period of contract.
9.22.12.	Contractor should also submit to BHEL for approval a list of T&Ps along with their fitness certificates. The tools & tackles shall not be removed from site without written permission of BHEL.
9.22.13.	Contractor should also submit network programs for the erection of various items. These networks shall show BHEL/ customer hold points (CHP), which have to be cleared by BHEL/ customer, or their authorized representatives before further erection can take place. These programs for the erection would clearly identify responsibilities of Contractor and BHEL/ customer. It is the responsibility of Contractor to get the networks approved by BHEL within four weeks of the date of finalization of award of work/ placement of LOI.
9.23.	**MANPOWER REQUIREMENT**
9.23.1.	Manpower requirement for Erection and Commissioning shall as follows: a. There shall be a Resident manager as Site In Charge at site, under whom there shall be sufficient area engineers who shall take care of the erection activities. b. Resident Engineer should have a minimum qualification of Electrical Engineering Degree with minimum 5 years' experience or Diploma in Electrical /Electronic engineering with minimum 10 years of experience in Thermal Power Station. c. Supervisor should have a minimum qualification of Diploma in electrical engineering or any graduate with minimum 5 years of experience in Thermal Power Station. d. Lab Technicians should have experience in Thermal Power Stations. e. Contractor should have one Store Keeper, one Transport Supervisor for the safe transportation of materials. f. Planning / safety Engineers should be available and they should have experience in construction field especially in power plant. g. Licensed supervisor-01 No. with valid HT electrical license h. HT cable jointer-01 No. should be available on 24x7 basis. Dedicated commissioning engineer should be deployed for commissioning of the equipment.
9.23.2.	There shall be separate Erection In-charge for HT electrical work. He shall work with required manpower, T&P etc., including storage facilities.
9.23.3.	Each Erection In-charge shall have minimum 3 erection engineers who shall be in charge of TRANSFORMERS, BUS DUCT, SWITCHGEAR & CONTROL PANELS AND CABLES &TRAYS.
9.23.4.	Each area engineer shall be provided with minimum four supervisors and adequate number of Technicians / electricians and other erection staff and T&P etc. The testing Engineers / supervisors / electricians shall be identified separately for the each Unit and the minimum requirement shall be as indicated in previous Clause. Besides, there shall be separate engineers for Planning, Safety and Quality.

9.23.5.	The Site in charge shall be provided with PCs and good communication facilities like telephone, fax, email etc. at the cost and expense of the contractor. Lack of communication facilities will not be an excuse for extension of completion date.
9.23.6.	All instructions from BHEL / Customer will be directed to the contractor through the Site in-charge and he shall be responsible for all the contractor's activities at site. The contractor shall name their authorized representative prior to or immediately on commencement of operations at site.
9.23.7.	The Site In charge shall be present at site during all normal working hours and their contact address after normal working hours shall be made available to BHEL so that if any emergency arises, the presence of the contractor's site Representative at site can be called for.
9.23.8.	The contractor shall not change the site Representative without the consent of BHEL. Should BHEL require the replacement of the contractor's site Representative for justifiable reasons (including inadequate progress of work) the contractor shall ensure that replacement is made as soon as possible and work is not allowed suffering delay on this account.
9.23.9.	The contractor shall provide to the satisfaction of BHEL sufficient and qualified staff for the execution of works. If and whenever any of the contractor's staff is found guilty of any misconduct or be incompetent or insufficiently qualified in the performance of their duties the contractor shall remove them from site as directed by Site Engineer.
9.23.10.	The contractor shall ensure that all their supervisor's staff and workmen conduct themselves in a proper manner. They shall all be persons who are familiar with and skilled at the jobs allocated to them. Any misconduct / inefficiency noted on the part of the contractor's personnel shall be brought to the attention of the contractor's site representative who shall immediately take such action as necessary including the removal of such misconducting / inefficient persons, if so required by the Engineer-in-Charge.
9.23.11.	The contractor shall ensure that replacement for such persons removed from site is provided immediately and the work is not allowed to suffer delay on that account.
9.24.	**REPORTING DAMAGES AND CARRYING OUT REPAIRS**
9.24.1.	Checking all components/ equipment at siding/ site and reporting to transport and/ or insurance authorities of any damages/ losses will be in the scope of Contractor. Necessary assistance for verification/ survey and lodging claims with underwriters and follow up to logical conclusion will also be part of this tender.
9.24.2.	Contractor shall render all help to BHEL in inspection including handling, opening packages, re-packing, re-stacking, assessing and preparing estimates for repairs of components damaged during transit, storage, erection, commissioning and preparing estimates for fabrication of materials lost/ damaged during transit, storage and erection. Contractor shall help BHEL to furnish all the data required by railways, insurance company or their surveyors.
9.24.3.	Contractor shall report to BHEL in writing any lost/ damages to equipment/ components during drawl of the materials from stores, in transit to site and unloading at a place of work and during erection & commissioning. The above report shall be as prescribed by BHEL site. Any consequential loss arising out of noncompliance of this stipulation will be borne by Contractor.
9.24.4.	Contractor shall carry out fabrication of any material lost/ damages as per Instructions from BHEL.
9.24.5.	BHEL, however, reserve the right to award or not to award to Contractor any of the rectification/ rework/ repairs of damages and also fabrication of components.
9.24.6.	All the repairs/ rectification/ rework of damages and fabrication of materials lost, if any, shall be carried out by a separately identifiable gang for certification of man-hours. Daily log sheets should be maintained for each work separately and be signed by Contractor's representative & BHEL. Signing of log sheets does not necessarily mean acceptance of these as extra works for payment purpose.

9.24.7.	All rectification, repairs, reworks and fabrication of components lost, which are minor and incidental to erection work (consuming up to 50 man-hours on each occasion) shall be treated as part of work without any extra cost.
9.24.8.	In case the repairs/ rectification/ rework and fabrication of materials lost, the work has been done by more than one agency including Contractor, payment towards extra charges will be on pro-rata basis and decision of BHEL in this regard is final & binding on the Contractor.
9.25.	**ISSUE & HANDLING, USEAGE, RECONCILIATION, RECOVERY, ETC OF BHEL'S FREE ISSUED EQUIPMENT/ MATERIALS**
9.25.1.	**ISSUE & HANDLING**
i)	BHEL will issue various equipment/ materials/ items free of cost to Contractor as per the scope of this tender
ii)	Contractor shall maintain proper store account for all the BHEL issued materials and shall give requisite copies of monthly computerized reconciliation statement of such account to the BHEL.
iii)	Contractor shall solely be responsible for the safety & quality of material after it is handed over and issued to Contractor by BHEL.
iv)	BHEL issued materials shall not under any circumstances taken out of the project site unless otherwise permitted by BHEL.
v)	Necessary lifting tackles, cranes, tools & plants including tractors, Crane, Farana, trailers, trucks, pulley blocks, jacks, winches, wire ropes etc, of suitable capacities and other equipments incidental to carry out this work shall have to be arranged by Contractor within the accepted rates/ price. BHEL reserve the right to inspect lifting tackles and equipment before allowing their use. Such approval however shall not relieve Contractor to ensure safe handling of equipment taking precaution to avoid any accident and damage to other equipment and personnel.
vi)	Contractor shall satisfy himself of the quality and quantity of the materials at the time of taking delivery from BHEL/ customer store/ storage yard. No claims whatsoever will be entertained by BHEL because of quality or quantity after the materials are taken by Contractor from BHEL/ customer.
vii)	Contractor shall submit to BHEL, a statement indicating estimated quantity of equipment/ materials required atleast 1 month in advance.
viii)	Contractor shall ensure that no lamination materials are taken over by them from BHEL. Wastage, if any due to above, shall not be compensated by BHEL.
ix)	Contractor has to note that all fasteners like MS/ HT/ HSFG bolts/ nuts, lock nuts, washers, etc shall be supplied by Contractor as per applicable item of price schedule of tender.
x)	Contractor to note that steel required for their enabling job like store/ site office, etc shall be arranged at their own cost.
9.25.2.	**RETURN**
i)	All surplus equipment/ materials issued by BHEL shall be returned by Contractor to BHEL/ customer store/ storage yard.
ii)	Surplus, unused and un-tampered materials shall be sorted and returned separately at a place directed by BHEL within project area; Return of such materials will not be entitled to any handling and incidental charges.
iii)	All wastage/ scrap (including wastage, unusable scrap) shall be returned to stores/ designated area and a receipt obtained from BHEL for material accounting purposes. Return of such material will not be entitled to any additional cost due handling and transportation and incidental charge.
iv)	Scrap for structural steel shall be returned separately.
9.25.3.	**USE AND WASTAGE**
i)	Unless specified otherwise in the tender, following guidelines shall be applicable.

ii)	Theoretical consumption of various equipment/ materials shall be based on tender provision/ approved drawing/ guidelines/ mutual agreement with BHEL. No extra shall be payable for any deviation for two different procedures adopted for issue and calculation of the theoretical consumption.
iii)	Allowable wastage of the theoretical consumption shall be considered based on tender provision/ approved drawing/ guidelines/ mutual agreement with BHEL. Invisible wastage (loss of materials due to gas cutting, straightening of edges, etc) shall be limited to above specified guidelines and shall be considered for reconciliation purpose. But this invisible wastage shall be considered to be included in allowable wastage.
iv)	All wastage shall be returned to BHEL.
9.25.4.	**RECONCILIATION**
i)	Contractor shall submit a reconciliation statement of equipment/ materials issued to him, once in two months. The same may be submitted alongwith RA bill.
ii)	Contractor shall properly account for the material issued to him as specified herein to the satisfaction of BHEL certifying that the balance materials are available with Contractor's custody at site.
iii)	If it is noticed by BHEL that the wastage is high and calls recovery at the penal rate, then BHEL will proceed for recovery for the excess wastage as per penal recovery rates as specified from RA bill.
9.25.5.	**RECOVERY**
i)	If wastage exceeds the specified limit, recovery of excess wastage shall be made from monthly RA bill at the penal rate stipulated tender provision/ approved drawing/ guidelines/ mutual agreement with BHEL.
9.26.	**EXTENSION OF COMPLETION PERIOD**
9.26.1.	Contractor shall submit detail work program (L-2 schedule) for approval of BHEL, as detailed in construction schedule. The approved schedule will be taken into account as basis for consideration of contract extension as per following detail.
9.26.2.	If the completion of work as detailed in the scope of work gets delayed beyond the contract/ completion period, Contractor shall request for an extension of the contract and BHEL at its discretion may extend the contract.
9.26.3.	Based on the reviews jointly signed, the works balance at the end of original contract period less the backlog attributable to Contractor shall be quantified, and the number of months of 'Time extension' required for completion of the same shall be jointly worked out. Within this period of 'Time extension', Contractor is bound to complete the portion of backlog attributable to Contractor. Any further 'Time extension' or 'Time extensions' at the end of the previous extension shall be worked out similarly.
9.26.4.	However, if any 'Time extension' is granted to Contractor to facilitate continuation of work and completion of contract, due to backlog attributable to Contractor alone, then it shall be without prejudice to the rights of BHEL to impose penalty/ LD for the delays attributable to Contractor, in addition to any other actions BHEL may wish to take.
9.26.5.	A joint programme shall be drawn for the balance amount of work to be completed during the period of 'Time Extension', along with matching resources to be deployed by Contractor as per specified format. Review of the programme and record of shortfall shall be done.
9.26.6.	During the period of 'Time extension', Contractor shall maintain their resources as per mutually agreed program.
9.26.7.	At the end of total work completion as certified by BHEL, and upon analysis of the total delay, the portion of time extensions attributable to (i) Contractor, (ii) Force majeure conditions, and (iii) BHEL, shall be worked out and shall be considered to be exhausted in the same order. The total period of time extensions shall be the sum of (i), (ii) and (iii) above and shall be equal to period between the scheduled date of completion and the actual date of completion of contract. LD shall be imposed/ levied for the portion of time extensions attributable to Contractor and recoverable from the dues payable to Contractor.

10.	Drawings Details (Enclosed with the NIT as Annexure):	
S No	**Annexure No**	**Drawing Description**
1	Annexure-1	EKD OF IPB (MAIN, DELTA AND TAP-OFF RUN)
2	Annexure-2	EKD OF SEGREAGATED PHASE BUSDUCT
3	Annexure-3	TECHNICAL DATA SHEET OF IPBD
4	Annexure-4	TECHNICAL DATA SHEET OF SPBD
5	Annexure-5	DG SETS - LAYOUT DRAWINGS & SECTIONAL DETAILS
6	Annexure-6	ESLD
7	Annexure-7	OGA of GT
8	Annexure-8	OGA of ST
9	Annexure-9	HSE PLAN FOR Patratu WRHPP: PVUNL Rev-02 Dated 01.07.2018
10	Annexure-10	Cable Erection Philosophy
11	Annexure-11	BHEL T&P Hire Charges BHEL: PW:FM: FAX: T&P Hire: 2023-25
Note: - The above drawings are reference purpose only. These drawings may change and vendor will have to execute the work as per final approved drawings and instruction of BHEL engineer.		

11.	SPECIFIC INCLUSIONS & EXCLUSIONS
11.1.	**INCLUSIONS**
11.1.1.	**Consumables/ items to be provided by BHEL free of charge**
a)	Metallic Cable glands.
b)	Steel for fabrication.
c)	Lugs beyond 4 sq. mm size.
d)	HT Termination/Jointing Kits/ Straight through jointing Kits.
e)	Trefoil Clamps with hardware except mentioned in BOQ which is to be supplied by subcontractor.
11.1.2.	**All Consumables/ items to be arranged by Bidder at his/ her own cost, broad items are mentioned below (except mentioned in Clause 9.1.1 a) to e) of TCC)**
a)	Lugs up to 4 sq. mm size.
b)	Paint, primer and consumables.
c)	LT cable Straight through jointing Kits.
d)	Cable ferruling printing machine along with ferrule rolls.
e)	Identification tags PVC/ Metals with tying/ fixing material, sleeve and clamps with hardware. PVC ties, Ferrule, Buttons and tap for cables at both end & field instruments.
f)	Cable Markers.
g)	Trefoil Clamps with hardware as mentioned in BOQ.
11.1.3.	**EXCLUSIONS**
11.1.4.	Erection of dampers, valves, electrical actuators, pneumatic actuators.
11.1.5.	Erection of ESP rectifier transformer, electrical heaters, rapping motors, mechanical interlock and ALI's.(except ALI Commissioning)
11.1.6.	Erection of HT/ LT motors and Hoists. (except those specified herein)
11.1.7.	Erection, testing and commissioning of elevators.
11.1.8.	Generator Erection
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.	

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

S. No	Description	UOM	Total Quantity	Weightage
E1A	**CABLE TRAYS AND ACCESSORIES**			
E1A.01	Ladder type Cable Tray 150mm	Meter	8737	0.0053847138
E1A.02	Ladder type Cable Tray 300mm	Meter	11541	0.0085602467
E1A.03	Ladder type Cable Tray 600mm	Meter	20462	0.0182680099
E1A.04	Perforated type Cable Tray 50mm	Meter	1375	0.0005802175
E1A.05	Perforated type Cable Tray 100mm	Meter	4345	0.0021680245
E1A.06	Perforated type Cable Tray 150mm	Meter	3951	0.0028141953
E1A.07	Perforated type Cable Tray 300mm	Meter	4206	0.0036695520
E1A.08	Perforated type Cable Tray 600mm	Meter	5184	0.0062666340
E1B	**CABLE TRAY SUPPORT AND ACCESSORIES**			
E1B.01	Single Channel (in standard length of 6meter per piece)	Meter	9017	0.0059575624
E1B.02	Double Channel (in standard length of 6meter per piece)	Meter	8144	0.0072197799
E1C	**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.01	For 750mm trays	No	100	0.0000642792
E1C.02	For 600mm trays	No	21136	0.0194649532
E1C.03	For 300mm trays	No	8622	0.0051804575
E1C.04	For 150mm trays	No	6426	0.0034520272
E1C.05	For 100mm trays	No	100	0.0000155596
E1D	**CLAMPS & FITTINGS (COMPLETE WITH REQUIRED HARDWARE I.E. SPRING NUTS / WASHERS, TRESTLE BRACKET, ETC. AS REQUIRED FOR COMPLETE INSTALLATION)**			
E1D.01	Base plate for single channel.	No	5573	0.0014213066
E1D.02	Base plate for double channel.	No	3011	0.0008472548
E1E	**FABRICATION OF IRREGULAR BEND TO BE DONE FROM THE EXISTING CABLE TRAY AS PER SITE REQUIREMENT (cable tray material will be issued by BHEL free of cost) (CONSUMABLES etc. TO BE PROVIDED BY VENDOR) (Applicable for BEND TYPE 'E', 'F' & G)**			
E1E.1	IRREGULAR BEND FOR LADDER/PERFORATED 600 MM TRAYS (Site Fabricated/Readymade)	No	3200	0.0066705877
E1E.2	IRREGULAR BEND FOR LADDER 450 MM TRAYS	No	100	0.0001896789
E1E.3	IRREGULAR BEND FOR LADDER/PERFORATED 300 MM TRAYS (Site Fabricated/Readymade)	No	1500	0.0024469275
E1E.4	IRREGULAR BEND FOR LADDER 150 MM TRAYS	No	100	0.0001365763

E2A	LT XLPE/ PVC ARMOURED/ UNARMOURED ALUMINIUM/ COPPER CONDUCTOR POWER/ FRLS CABLE			
E2A.01	1Cx35sqmm Al Cable	Meter	13500	0.0016849542
E2A.02	1Cx70sqmm Cable	Meter	500	0.0000671470
E2A.03	1Cx120sqmm Al Cable	Meter	16800	0.0030104072
E2A.04	1Cx300sqmm Al Cable	Meter	101200	0.0196613128
E2A.05	1Cx630sqmm Al Cable	Meter	28200	0.0076437257
E2A.06	2Cx10sqmm Al Cable	Meter	12000	0.0010056237
E2A.07	2Cx16sqmm Al Cable	Meter	600	0.0000554456
E2A.08	2Cx25sqmm Al Cable	Meter	400	0.0000416889
E2A.09	2Cx35sqmm Al Cable	Meter	8700	0.0009341884
E2A.10	2Cx70sqmm Al Cable	Meter	14400	0.0016894907
E2A.11	2Cx95sqmm Al Cable	Meter	16200	0.0024154920
E2A.12	2Cx120sqmm Al Cable	Meter	500	0.0001022360
E2A.13	3Cx10sqmm Al Cable	Meter	39600	0.0035380961
E2A.14	3Cx16sqmm Al Cable	Meter	31200	0.0029927935
E2A.15	3Cx25sqmm Al Cable	Meter	27600	0.0035637301
E2A.16	3Cx35sqmm Al Cable	Meter	500	0.0000656043
E2A.17	3Cx50sqmm Al Cable	Meter	13800	0.0022705232
E2A.18	3Cx70sqmm Al Cable	Meter	2400	0.0004375832
E2A.19	3Cx95 sqmm Al Cable	Meter	10320	0.0023819387
E2A.20	3Cx150 sqmm Al Cable	Meter	4480	0.0012967417
E2A.21	3Cx240sqmm Al Cable	Meter	500	0.0001839347
E2A.22	3.5Cx25sqmm Al Cable	Meter	19200	0.0030100583
E2A.23	3.5Cx50sqmm Al Cable	Meter	40400	0.0079638128
E2A.24	3.5Cx95sqmm Al Cable	Meter	5100	0.0010223034
E2A.25	2Cx1.5sqmm Cu Control Cable	Meter	51700	0.0040119547
E2A.26	2Cx2.5sqmm Cu Power Cable	Meter	116400	0.0091510304
E2A.27	3Cx1.5sqmm Cu Control Cable	Meter	43700	0.0034858586
E2A.28	3Cx2.5sqmm Cu Power Cable	Meter	238300	0.0202356164
E2A.29	4Cx1.5sqmm Cu Screened Cable for ESP	Meter	61000	0.0056910330
E2A.30	4Cx2.5sqmm Cu Screened Cable for ESP	Meter	400	0.0000373182
E2A.31	4CX16 SQMM ARMOURED/UNARMOURED CABLE	Meter	2500	0.0002528599
E2A.32	4CX70 SQMM ARMOURED/UNARMOURED CABLE	Meter	1000	0.0001645209
E2A.33	5Cx1.5 sqmm Cu Control Cable	Meter	4160	0.0003218554
E2A.34	5Cx2.5sqmm Cu Control Cable	Meter	3240	0.0002662521
E2A.35	7Cx1.5sqmm Cu Control Cable	Meter	8700	0.0007239451
E2A.36	7CX2.5 SQMM ARMOURED/UNARMOURED CABLE	Meter	5000	0.0004468383
E2A.37	10CX2.5 SQMM ARMOURED/UNARMOURED CABLE	Meter	20000	0.0019221385
E2A.38	12Cx1.5 sqmm Cu Control Cable	Meter	10880	0.0010708528
E2A.39	12Cx2.5 sqmm Cu Control Cable	Meter	77920	0.0076691957

E2A.40	14Cx1.5sqmm Cu Control Cable	Meter	21000	0.0023912436
E2A.41	14CX2.5 SQMM ARMOURED/UNARMOURED CABLE	Meter	15000	0.0017080311
E2A.42	19CX2.5 SQMM ARMOURED/UNARMOURED CABLE	Meter	4000	0.0004574468
E2A.43	Laying & Termination of UTP cable	Meter	6000	0.0002383889
E2B	**HT ALUMINIUM CONDUCTOR, ARMOURED/ UNARMOURED XLPE POWER CABLE**			
E2B.01	11/11kV, 1Cx240sqmm Power Cable	Meter	9900	0.0028561995
E2B.02	11/11kV, 1Cx400sqmm Power Cable	Meter	19500	0.0093033613
E2B.03	11/11kV, 1Cx630sqmm Power Cable	Meter	5400	0.0028519819
E2B.04	11/11kV, 3Cx185sqmm Power Cable	Meter	17775	0.0139670221
E2B.05	3.3/3.3kV, 1Cx150sqmm Power Cable	Meter	2400	0.0010405984
E2B.06	3.3/3.3kV, 3Cx150sqmm Power Cable	Meter	13920	0.0078888596
E2B.07	3.3/3.3kV, 3Cx185sqmm Power Cable	Meter	30	0.0000170019
E2C	**CABLE TERMINATION KITS & JOINING KITS**			
E2C.1	**HT END TERMINATION JOINTING KITS, XLPE INSULATED, UNARMOURED/ ARMOURED, ALUMINIUM CABLE WITH LUGS**			
E2C.1.01	11/11kV, 1Cx630 Sqmm End Jointing Kit	Nos	40	0.0008926046
E2C.1.02	11/11kV, 1Cx240sqmm Power Cable	No	54	0.0014869734
E2C.1.03	11/11kV, 1Cx400sqmm Power Cable	No	120	0.0033071290
E2C.1.04	11/11kV, 3Cx185sqmm Power Cable	No	3	0.0000949497
E2C.1.05	3.3/3.3kV, 1Cx150sqmm Power Cable	No	12	0.0002950888
E2C.1.06	3.3/3.3kV, 1Cx240sqmm Power Cable	No	3	0.0000795381
E2C.1.07	3.3/3.3kV, 3Cx150sqmm Power Cable	No	3	0.0000958277
E2C.1.08	3.3/3.3kV, 3Cx185sqmm Power Cable	No	8	0.0002627197
E2C.2	**HT STRAIGHT THROUGH JOINTING KITS, XLPE INSULATED, UNARMOURED/ ARMOURED, ALUMINIUM CABLE WITH LUGS**			
E2C.2.01	11/11kV, 1Cx240sqmm Power Cable	No	60	0.0014754438
E2C.2.02	11/11kV, 1Cx630sqmm Power Cable	No	36	0.0009921387
E2C.2.03	11/11kV, 1Cx400sqmm Power Cable	No	27	0.0006661162
E2C.2.04	11/11kV, 3Cx185sqmm Power Cable	No	21	0.0005180904
E2C.2.05	3.3/3.3kV, 1Cx240sqmm Power Cable	No	3	0.0000839561
E2C.2.06	3.3/3.3kV, 3Cx185sqmm Power Cable	No	3	0.0000896257
E2C.2.07	3.3/3.3kV, 3Cx150sqmm Power Cable	No	3	0.0000826083
E2C.3	**TREFOIL CLAMPS (COMPLETE WITH FIXING HARDWARES) 11/11kV,3.3/3.3kV GRADE ALUMINIUM CONDUCTOR,XLPE INSULATED, ARMOURED/ UNARMOURED CABLES AS PER CABLE OD.**			

E2C.3.1	Trefoil Clamp	No	52704	0.0413606491
E3	**JUCTION BOXES AND PUSH BUTTON**			
E3.01	Start Stop Push Button Station (Local push button station Type A/ B/ C/ D)	No	974	0.0038015852
E3.02	Local Motor Starter	No	447	0.0018090830
E3.02	Junction Box 12/ 24/ 26/ 48/ 96 way.	No	102	0.0004546319
E3.03	Local Control box for panel type hopper heater.	No	120	0.0022262208
E3.04	AC/ DC Fuse DB	No	30	0.0008011248
E3.05	Junction Boxes for ACC Tube Cleaning System	No	60	0.0002849993
E4	**STRUCTURAL STEEL**			
E4.01	Structural Steel fabrication & Installation (MS angle, Channel, Plate etc)/ Cable tray structural steel fabrication & installation.	MT	253	0.0291207639
E5	**SWITCHGEARS/ MCC/ PCC**		0	0.0000000000
E5A	**HT SWITCHGEAR (3.3 kV)**			0.0000000000
E5A.1	3.3kV FGD Auxiliary Switchboard #3GA. Each Board shall have 20 panels. Approx. overall dimension of each panel is 820x2692x1831 to 2651 mm. Each shipping section weight is approximately 3MT.	Set	1	0.0013215307
E5B	**LT SWITCHGEAR (415/220V)**		0	0.0000000000
E5B.1	415V ACC PMCC PANEL (3000A). Approx overall dimensions 3000x1700x2450mm.	Set	8	0.0074004006
E5B.2	415V ACC STANDBY PANEL (3000A). Approx overall dimensions 3000x1700x2450mm.	Set	3	0.0030880817
E5B.3	AC & Ventilation MCC for ACC-3 (Approx overall dimension 1000X5000MM)	Set	1	0.0009874009
E5B.4	415V Service building MCC (3000A). Approx overall dimension 16350x1700x2400mm	Set	1	0.0009980326
E5B.5	415V Hydrogen plant MCC (1600A). Approx overall dimension 7150x1500x2400mm	Set	1	0.0005148182
E5C	**STARTER PANEL/BOXES/POWER DISTRIBUTION BOX/MARSHALLING BOXES**			
E5C.01	Electronic Control Panel, overall approx dimenions are 600mm (L)x550mmx2300mm. Approx overall weight of each panel is 0.25MT.	No	120	0.0064351793
E5C.02	IOS PANEL with approx overall dimension 1000x650x2050; approx. weight of panel 0.3MT along with loose accessories such as IOS PC, Computer Furniture, Data Logger PC, Printer, PC termination box, peripheral cables etc.	Set	1	0.0000633127
E5C.03	SAS-2 Panel in Plant Control Room; approx dimensions 2200x800x800.	No	1	0.0000492145
E5C.04	3D Acoustic level transmitter for first field ESP along with probe head assembly, electronic unit, JB, etc.	No	12	0.0006426375

E5C.05	DC motor starter panels, etc (DC JOP, DC EOP, Seal oil panel, DC Scanner fan), including resistance boxes. Approx weight 0.5 MT and approx. dimension 1000x800x2200 mm each.	No	7	0.0005682222
E5C.06	Local Motor Starter Panels Suitable for (0.37KW/0.55KW/0.75KW, 1.1kW/1.5kW/2.2kW/3.7kW/5.5kW)	No	306	0.0024627753
E5C.07	Ground Brush Monitoring System	Set	1	0.0000535521
E5C.08	Rotor Flux Monitoring System	Set	1	0.0000811740
E5D	**220V DC BATTERY & BATTERY CHARGER SYSTEM**			
E5D.01	220Volt DC Battery Charging System with battery (2x170cells) with DC Battery Charger. Approx total weight of battery system -23MT, approx total weight of battery charger - 2MT)	Set	2	0.0031313450
E5E	**VARIABLE FREQUENCY DRIVE SYSTEM FOR CEP**			
E5E.01	Transportation from stores/ storage yards to erection site, erection, assembly, testing & commissioning of Variable Frequency Drive System consisting of IGBT based VFD Panel and accessories including transformer for CEP-A, B, C (complete for Unit-2)	Set	1	0.0056054749
E5F	**MISCELLANEOUS EQUIPMENT**			
E5F.01	Ash Level Indicator comprising of level probe with extension lagging pipe, Electronic Unit, Interconnecting PTFE Cabling, Conduit, etc.	Set	120	0.0007342483
E5F.02	Opacity Monitor consisting of Transmitter & Receiver, Electronic Unit, Air Blower unit, Weather Proof housings, Junction boxes, flexible hoses, mounting flanges with pipe for Transmitter, Receiver & Air blower, interconnected cables etc. for mounting on ESP outlet duct.	Set	6	0.0003942658
E5G	**PLANT ILLUMINATION PACKAGE (LIGHTING SYSTEM)**			
E5G.1	**LIGHTING DISTRIBUTION BOARD (LDB)**			
E5G.1.01	AC LDB Type LDB-H (12) without transformer (including cubicles suitable for 1 No 100kVA transformer)	No	11	0.0009480617
E5G.1.02	100kVA transformer for housing in E5F.1.01 above.	No	11	0.0005131816
E5G.1.03	AC LDB Type LDB-H (12) without transformer (including cubicles suitable for 2 No 100kVA transformer)	No	3	0.0003479320
E5G.1.04	100kVA transformer for housing in E5F.1.03 above.	No	6	0.0003058441
E5G.1.05	AC LDB Type LDB-H (18) without transformer (including cubicles suitable for 1 No 100kVA transformer)	No	1	0.0000771768
E5G.1.06	100kVA transformer for housing in E5F.1.05 above.	No	1	0.0000593082
E5G.1.07	DCLDB Type LDB-D (12)	No	2	0.0001102939

E5G.1.08	AC LDB Type WDB-H (18) without transformer (including cubicles suitable for 1 No 100kVA transformer)	No	5	0.0005485068
E5G.1.09	100kVA transformer for housing in E5F.1.08 above.	No	5	0.0003166618
E5G.1.10	AC LDB Type LDB-F (8) without transformer (including cubicles suitable for 2 No 50kVA transformer)	No	1	0.0000760284
E5G.1.11	50kVA transformer for housing in E5F.1.10 above.	No	2	0.0001182232
E5G.2	**LIGHTING PANELS (LP)**			
E5G.2.01	AC Normal /Emergency indoor Type LP – A (12)	No	20	0.0004432321
E5G.2.02	AC Normal /Emergency outdoor Type LP – A (12) [with timer]	No	20	0.0003198507
E5G.2.03	AC Normal (Decorative) Type LP – A (12)	No	5	0.0001099538
E5G.2.04	AC Normal (Decorative) Type LP-A (18)	No	3	0.0000473446
E5G.2.05	AC Normal /Emergency indoor Type LP – A (18)	No	17	0.0003011380
E5G.2.06	AC Normal /Emergency outdoor Type LP – A (18) [with timer]	No	29	0.0005231233
E5G.2.07	DC indoor Type LP – D (6)	No	6	0.0001015640
E5G.2.08	DC outdoor Type LP – D (6)	No	9	0.0001776507
E5G.2.09	Street Lighting Type LP – S (6)	No	4	0.0000654823
E5G.2.10	LP Outdoor type (LP-E24) with 3kVA TRF	No	5	0.0000766247
E5G.3	**LIGHTING LUMINAIRES (COMPLETE WITH ACCESSORIES)**			
E5G.3.01	Luminaire Type FC02/ FC06/ FC07-DC/ FC30/ FC30 with dimmable ballast/ FC32/ FC33-DC/ FC34-DC/ FC81	No	3029	0.0114141140
E5G.3.02	Luminaire Type SF64/ SF66	No	183	0.0012030382
E5G.3.03	Luminaire Type SB02/ SB11	No	393	0.0017598680
E5G.3.04	Luminaire Type SS62/ SS63	No	601	0.0025975693
E5G.3.05	Luminaire Type SW41/ SW42	No	8205	0.0326806903
E5G.3.06	Luminaire Type MW96/ MW98	No	157	0.0008607652
E5G.3.07	Downlighter (18W= 6x3W) / (18W= 6x3W) Dimmable	No	529	0.0032439837
E5G.4	**SWITCH BOXES**			
E5G.4.01	Type SWB1	No	274	0.0007574904
E5G.4.02	Type SWB2	No	138	0.0003963781
E5G.4.03	Type SWB3	No	18	0.0000541770
E5G.4.04	Type SWB4	No	2	0.0000078493
E5G.4.05	Type SWB5	No	51	0.0002785173
E5G.5	**JUNCTION BOXES**			
E5G.5.01	Type JB-F	No	10000	0.0401220875
E5G.5.02	Type JB-FE	No	108	0.0004342743
E5G.5.03	Type JB-S	No	524	0.0018371018
E5G.6	**RECEPTACLES**			

E5G.6.01	Type RA	No	339	0.0011151629
E5G.6.02	Type RA (Flame proof)	No	8	0.0000316516
E5G.6.03	Type RB	No	201	0.0008000957
E5G.6.04	Type RC	No	200	0.0008771042
E5G.6.05	Type RC (Flame proof)	No	1	0.0000076004
E5G.7	**CEILING FANS WITH ELECTRONIC REGULATORS**			
E5G.7.01	1200 mm sweep	No	30	0.0000994391
E5G.7.02	Pedestal Fans	No	3	0.0000127984
E5J.8	**EMERGENCY LIGHTING UNITS INSTALLATION**		0	0.0000000000
E5G.8.01	With Ni-Cd battery and 2x9W fluorescent lamp	No	11	0.0000582796
E5G.9	**POLES INSTALLATION INCLUDING ALL ACCESSORIES. (SWAGED, STEEL TUBULAR, GALVANIZED)**			
E5G.9.01	Type PS1	No	101	0.0039286084
E5G.9.02	Type PS2	No	152	0.0058118955
E5G.9.03	Type PS4/ PF1	No	5	0.0001583852
E5G.9.04	Type PF2	No	14	0.0005254392
E5G.9.05	Fabrication of J poles	No	3000	0.0118573961
E5G.10	**WIRES**			
E5G.10.01	1x1.5sqmm Cu PVC	Meter	180000	0.0031646902
E5G.10.02	1x2.5sqmm Cu PVC	Meter	330000	0.0092770196
E5G.10.03	1x4sqmm Cu PVC	Meter	68000	0.0025048327
E5G.11	**HOT DIP GALVANISED RIGID STEEL CONDUITS (HEAVY DUTY)**			
E5G.11.01	20 mm dia GI conduit, 1.6 mm thick	Meter	195000	0.0814138396
E5G.11.02	25 mm dia GI conduit, 1.6 mm thick	Meter	28800	0.0134093816
E5G.11.03	40 mm dia GI conduit, 2 mm thick	Meter	13000	0.0099385679
E5G.11.04	50 mm dia GI conduit, 2 mm thick	Meter	1500	0.0010328120
E5G.11.05	20 mm dia GI conduit with epoxy coating, 1.6 mm thick	Meter	2000	0.0007569513
E5G.11.06	20mm dia TERENE conduit, 1.6mm thick	Meter	16037	0.0043177700
E5G.12	**HUME PIPE**			
E5G.12.01	Hume pipe 100 mm dia	Meter	1000	0.0009239418
E5G.13	**24V SUPPLY MODULE & LAMP UNIT COMPLETE WITH ALL ACCESSORIES**			
E5G.13.01	Portable type 24V supply modules	No	10	0.0000337089
E5G.13.02	Portable halogen lamp unit	No	10	0.0000269239
E5G.13.03	5A, 24V industrial type sockets	No	69	0.0001692997
E5G.13.04	Exit Sign	No	32	0.0004657411
E5G.14	**LAYING & TERMINATION OF CABLES (ARMOURED CABLES TO BE BURIED UNDERGROUND)**			
E5G.14.01	3.5Cx25sqmm Al	Meter	15000	0.0067283923

E5G.14.02	3.5Cx95sqmm Al	Meter	10000	0.0077853339
E5G.14.03	3.5Cx50sqmm Al	Meter	6000	0.0059059386
E5G.14.04	3Cx2.5sqmm Cu	Meter	10000	0.0100107353
E5G.15	**LAYING & TERMINATION OF CABLES**			
E5G.15.01	3.5Cx95sqmm Al	Meter	10000	0.0021060455
E5G.15.02	3.5Cx50sqmm Al	Meter	20000	0.0038502856
E5G.15.03	3Cx2.5sqmm Cu	Meter	10000	0.0008898846
E5G.15.04	2Cx95sqmm Al	Meter	2000	0.0003277074
E5G.16	**GREEN BUILDING ECBC COMPLIANCE**			
E5G.16.01	Occupancy Sensor	Nos	56	0.0000643250
E5G.16.02	Control System	Set	2	0.0001109202
E5G.16.03	Lighting Sensor System	Nos	1	0.0000443681
E5G.16.04	Lighting Dimmer System	Nos	1	0.0000601165
E6	**ABOVE GROUNG EARTHING & LIGHTNING PROTECTION MATERIALS for ACC work area**			
E6.01	8 SWG GI wire	Meter	3872	0.0001570029
E6.02	14SWG GI wire	Meter	220000	0.0102749627
E6.03	25x3mm GI flat	Meter	4797	0.0015564587
E6.04	25x6mm GI flat	Meter	13352	0.0045488716
E6.05	50x6mm GI flat	Meter	4776	0.0025730720
E6.06	65x8mm GI flat	Meter	11681	0.0119381168
E6.07	40mm dia MS Rod	Meter	1620	0.0011940821
E6.08	Ground Electrode with 40mm Dia rod (One end Sharpened) 3000mm long located along the periphery of Earting Grid (Without Treated Pit Other than Earth Test Pit)	No	176	0.0020302019
E6.09	GS Rod 20mm dia Vertical Air Termination	No	176	0.0019249223
E6.10	Test Links with 150x150x3mm GS flat	No	20	0.0000487752
E6.11	Flexible braided Copper conductor of 600mm with tinned Cu, clamp connected by U-bolt for fence gate earthing.	No	18	0.0000031794
E6.12	50NB gal MS pipe(PERF) (for neutral earthing along with salt, sand, charcol & chamber with cover)	No	100	0.0018288629
E7	**BUS DUCTS**			
E7A	**LT BUS DUCTS**			
E7A.01	415V, 1000A/ 1600A/ 2500A/ 3200A/ 4000A, LT Bus Duct(For MCC/Emergency MCC/ PMCC/ FGD PMCC/ ESP/DG Boards etc). Loose items like silicagel Breather pipe, GI Channel Supports and associated accessories.	Meter	542	0.0102611354
E7A.02	Sandwich Bus Duct for Emergency Board	Meter	300	0.0042460887
E7B	**BUS DUCT (SPBD)**			

E7B.01	11kV, 1000A/ 2500A/3150A/ 4000A, SPBD (Including erection of Support structure, duct earthing, support insulator, space heater etc. supplied by manufacturing unit)	Meter	566	0.0121270898
E7B.02	3.3kV, 600/1000A/ 2500A , SPBD including CHP/AHP area (Including erection of Support structure, duct earthing, support insulator, space heater etc. supplied by manufacturing unit)	Meter	103	0.0016627152
E7B.03	Shifting of 11kV SPBD (Without inside conductor to site)	No	30	0.0003768135
E7B.04	Shifting of 11 KV loose conductors from BHEL store (works include loading, shifting & unloading)	No	200	0.0005273340
E7B.05	Assembly of 11kV SPBD conductors in its SPBD for readiness	No	50	0.0002140783
E7B.06	Space heater fixing, including wiring in SPBD Ducts	No	48	0.0004249635
E7C	**NEUTRAL GROUNDING RESISTOR**			
E7C.1	Neutral Grounding Resistor including NGR support structure 11kV (approx dimensions: NGR-1510x1110x1855, weight-1MT; support structure-1400x1000x2500, wight-0.3MT) & 3.3kV (approx dimensions: NGR-1510x635x1405, weight-0.4MT; support structure-1400x525x2400, weight-0.25MT)	Set	16	0.0249039877
E7D	**BUS DUCTS (IPBD)**			
E7D.01	Isolated Phase Bus Duct main run (27kV: 22250A- approx length 210 mtrs), Isolated Phase Bus Duct Delta Run (27kV: 13000A- approx length 135 mtrs), Isolated Phase Bus tap off run (24kV: 2800A- approx length 110 mtrs) (Including SPVT Cubicle (1 set), NG Cubicle (1 set), Air pressurisation equipment (23 KW load consist of compressor and receiver -1 set, Drier and pressuring panel- 1 set, Control panel- 1 set) , Support structure for IPBD - 50 To ns etc)	Set	1	0.0202951989
E8	**OIL FILLED TRANSFORMERS (GT, UT, UAT & ST)**			
E8.01	Single Phase 315MVA, 420/27kV, YNd11 (after 3-ph bank formation), Generator Transformer (GT) including all accessories, piping, cabling etc.	Set	3	0.0286780103
E8.02	Re-erection, testing and commissioning of 144/72/72 MVA, 3-phase, 400/11.5/11.5kV Station Transformer (ST), OLTC, ONAN/ ONAF (60%/100%) including all accessories, piping, cabling etc.	Set	1	0.0067811270
E8.03	65MVA, 27/11.5kV Unit Transformer (UT) including all accessories, piping, cabling etc.	Set	2	0.0077805737
E8.04	10/12.5/16/20MVA, 11/11.5kV / 11/3.5kV UAT, FGD Auxiliary, Miscellaneous Transformer including all accessories, piping, cabling etc.	Set	4	0.0085677924

E8.07	630/ 1000/ 1600/ 2000/ 2500/ 5000 kVA, 11/0.433kV Auxiliary Transformers including ACC area transformers	No	27	0.0345895327
E8.08	Complete dismantling of 144/72/72 MVA, 3-phase, 400/11.5/11.5kV Station Transformer (ST), OLTC, ONAN/ ONAF (60%/100%), required portion busduct including all accessories, piping, cabling etc and Cable Tray and Cabling Upto 500 meters	Set	1	0.0067811270
E9	**ONLY TESTING & COMMISSIONING**			
E9.01	Heating elements for Hopper Heater of ESP.	No	4320	0.0105956659
E9.02	Heating elements for Support Insulator Heater, Shaft Insulator Heaters of ESP.	No	600	0.0015014823
E9.03	HighVoltage Rectifier Transformers (95kV peak, 1000 mA) including oil filtration.	No	120	0.0057027159
E9.04	Testing & Commissioning of Collecting, Emitting, GD Screen Motor	No	252	0.0020902645
E9.05	Testing and commissioning of 3.3kV, 6.6kV &11kV HT motors including dryout.	No	20	0.0014990232
E9.06	Testing and commissioning of 415V LT motors including dry out.	No	200	0.0074240858
E9.07	Generator System Testing	No	1	0.0009100939
E9.09	Testing & Commissioning of Wall, Long Retractable, Air Heater Soot Blower	No	250	0.0090288163
E9.10	Testing & Commissioning of Furnace Temperature Probe (including Solenoids, Thermocouples, JB etc)	No	2	0.0000148666
E9.11	Thermostats including Calibration	No	132	0.0003235290
E9.12	Electrically (LT) Operated Valves, Dampers and Gates with Actuators, Limit Switches, etc. (Regulating & ON/OFF Type).	No	466	0.0038359894
E9.13	Electrical Operated Hoist at various area like ESP, Mill, IDF, PAF, FDF, Vacum Pumps, BFP, CW & ACW area	No	24	0.0004798723
E9.14	Testing and Commissioning of H2 Drier Panels.	No	2	0.0000507659
E9.15	1750/2000kVA, 3-Phase, 415V Diesel Generator set. approx. overall weight 43MT.	Set	2	0.0000781324
E10	**OTHER ITEMS**			

E10.1	Interconnection of each Hopper Heater Cables to Hopper Heater Junction Box for total 06 passes, with detialed works as per below section. 36 Nos Heaters each with 2X16 Sqmm AWG Heat Resistant Cable of 2.5 Sqmm Core approx. Length 6.0 meter. (Will be electrically tested and erected by BHEL other agencies) Each Hopper heater cables of 6 meter lenght to be pass through separate flexible metallic conduit (12-15 mm) supplied by BHEL and conduit with cables to be dressed in Hopper Surface with conduit and clamp supplied by BHEL. To be issued. Each Hopper is having 36 Nos Heaters.	Nos	120	0.0073366153
E10.2	Laying and Testing, etc of Optical Fibre Cable on cable trays, conduits etc with minor civil works	Mtr	40000	0.0049232112
E10.3	Termination & OTDR Testing etc. of Optical Fibre Cable including all consumables like Break-out Kits , OFC Markers, etc	Nos	300	0.0021583439
E10.4	Erection ,Testing and Commissioning of Outdoor CMS Panels (03 Nos) and Indoor CMS Panels (01 Nos) for Generator Transformers.	Set	4	0.0006932328
E10.5	Erection,Testing and Commissioning of Online Moisture Removal System for Generator Transformer	Set	1	0.0000684060
E10.6	Laying and Placement of HT and LT Insulation Mats for HT and LT Swgrs.	Mtr	300	0.0001531286
B	**ACC Work Area (including man lifter/sky climber etc)**			
EB1A.01	Ladder type Cable Tray 150mm	Meter	400.00	0.0002808165
EB1A.02	Ladder type Cable Tray 300mm	Meter	500.00	0.0004524386
EB1A.03	Ladder type Cable Tray 600mm	Meter	5000.00	0.0049891709
EB1A.04	Perforated type Cable Tray 50mm	Meter	200.00	0.0001290142
EB1A.05	Perforated type Cable Tray 100mm	Meter	200.00	0.0001181411
EB1A.06	Perforated type Cable Tray 150mm	Meter	400.00	0.0003114449
EB1A.07	Perforated type Cable Tray 300mm	Meter	500.00	0.0005211783
EB1A.08	Perforated type Cable Tray 600mm	Meter	2000.00	0.0029536032
EB1B	**CABLE TRAY SUPPORT AND ACCESSORIES for ACC work area**			
EB1B.01	Single Channel (in standard length of 6meter per piece)	Meter	800.00	0.0009202518
EB1B.02	Double Channel (in standard length of 6meter per piece)	Meter	1500.00	0.0018789578
EB1C	**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) for ACC work area**			
EB1C.01	For 600mm trays	No	4000.00	0.0030748647

EB1C.02	For 300mm trays	No	500.00	0.0002507109
EB1C.03	For 150mm trays	No	400.00	0.0002799108
	LT CABLES for ACC work area			0.0000000000
EB2A.1	1Cx300Sqmm	Mtr	500.00	0.0001356295
EB2A.2	2Cx1.5Sqmm	Mtr	20000.00	0.0023228132
EB2A.3	2Cx2.5Sqmm	Mtr	1500.00	0.0001647711
EB2A.4	3Cx2.5Sqmm	Mtr	7000.00	0.0008062196
EB2A.5	3Cx16Sqmm	Mtr	800.00	0.0001048225
EB2A.6	3Cx95Sqmm	Mtr	1000.00	0.0002721882
EB2A.7	3Cx240Sqmm	Mtr	27000.00	0.0110293607
EB2A.8	4Cx10Sqmm	Mtr	400.00	0.0000580521
EB2A.9	5Cx1.5Sqmm	Mtr	15000.00	0.0017409576
EB2A.10	5Cx2.5Sqmm	Mtr	4000.00	0.0004678535
EB2A.11	3.5Cx25Sqmm	Mtr	1500.00	0.0003510366
EB2A.12	3.5Cx50Sqmm	Mtr	700.00	0.0001821205
EB2A.13	3.5Cx95Sqmm	Mtr	500.00	0.0001370800
EB6	**ABOVE GROUNG EARTHING & LIGHTNING PROTECTION MATERIALS for ACC work area**			
EB6.1	25x6 Flat	Mtr	1083.54	0.0006031134
EB6.2	8 SWG GI wire	Meter	700.00	0.0000323196
EB6.3	65x8mm Flat	Meter	4758.45	0.0039017477
EB6.4	50x6mm flat	Meter	1183.94	0.0007890405
EB6.5	25x3mm GI flat	Meter	314.47	0.0001748771
EB6.6	50NB gal MS pipe(PERF) (for neutral earthing along with salt, sand, charcol & chamber with cover)	No	40.00	0.0037290125
EB6.7	75X12 Flat	Mtr	5000.00	0.0056844117
EB6.8	Test Links with 150x150x3mm GS flat	No	25.00	0.0000475517
EB6.9	100NB gal MS pipe	No	35.00	0.0012994064
				1.0000000000