VOLUME – IA
Part I & II
TECHNICAL CONDITIONS OF CONTRACT (TCC)

BHARAT HEAVY ELECTRICALS LIMITED

CONTENTS

VOLUME-IA PART – I CHAPTER – I
PROJECT INFORMATION

UDANGUDI SUPERCRITICAL TPS UNITS- 1 & 2 [2 x 660 MW] is being set up by **TAMILNADU GENERATION AND DISTRIBUTION CORPORATION** at a site in Kallamoli village of Tiruchendur Taluk, Tuticorin District., Tamil Nadu, India. The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given here in under is for general guidance and shall not be contractually binding on BHEL/Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.

1.1.1.	Project Title	:	2x660 MW Udangudi Super Critical Thermal Power Project
1.1.2.	Plant Capacity	:	2x660 MW
1.1.3.	Type of Project	:	Green Field
1.1.4.	Owner	:	Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO)
1.1.5.	Plant Site Location	:	Kallamoli – 628 203, Thiruchendur (Taluk), Tuticorin (Dt), Tamilnadu
1.1.6.	Nearest Village	:	Udangudi
1.1.7.	Nearest Town & City	:	Tuticorin at 41 kM
1.1.8.	State Capital	:	Chennai (App. 655 km)
1.1.9.	Nearest Railway Station	:	Thiruchendur at 8 km
1.1.10.	Nearest Airport	:	Domestic Airport Tuticorin at 41 km
1.1.11.	Nearest Seaport	:	Tuticorin Port at 45 km
1.2.	Meteorological Condition		
1.2.1.	Climate	:	Tropical, very dry and hot summer, dry and cold winter and good rain-fall in monsoon accompanied with strong wind
1.2.2.	Site Elevation	:	(+) 2.8 m above MSL
1.2.3.	**Ambient Temperature**		
a.	Annual Max. Mean Temperature	:	41^0 C
b.	Annual Min. Mean Temperature	:	22.3^0 C
c.	Dry Bulb Temperature (DBT) for Design Purpose	:	Max 41^0 C & Min 17^0 C
1.2.4.	Relative Humidity for Design Purpose	:	62-84 %
1.2.5.	**Annual Rainfall**		
	Average	:	384.4 mm to 718.2 mm
1.2.6.	Basic Design Wind Pressure	:	As per IS: 875 (Latest Edition)
1.2.7.	Wind Speed	:	11.8 kmph (Avg), 50 m/s (max)
1.2.8.	Seismic Zone	:	Zone-II as per IS-1893-2002 (Part- IV)

VOLUME-IA PART – I CHAPTER – II
SCOPE OF WORKS
ILLUMINATION WORKS

1.2.1.0	**GENERAL:** The scope of works covers Part works of Illumination Units 1 & 2 in CHP and AHP areas of 2x660 MW Udangudi Super Critical Thermal Power Project as mentioned below, including supply of labour, tools and plants. The Scope of the works is indicative but not limited to the given below: Erection, Testing & Commissioning including Handling of materials at BHEL stores / storage yard, transporting to site of erection and supply & application of final painting of Illumination works for Unit-1 & 2 in CHP and AHP areas of 2 x 660MW Udangudi Super Critical Thermal Power Project at Tuticorin Dt., Tamil Nadu. Area of work in CHP & AHP includes JNT8, JNT9, JNT10, and Bunker 1&2 areas, Bunker conveyor area, Silo Area, AWRS area. However, BHEL shall have the right to vary the above area depending on the site conditions. If any new area to be added in the later stage, the same will be decided by BHEL Site Engineer. (All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)
1.2.2.0	**SCOPE OF ILLUMINATION PACKAGE:** The Scope of the work will comprise of but not limited to the following: **Erection and Commissioning of :** 1. Deleted 2. Lighting Panels (with /without timers) of indoor and outdoor type 3. Lighting Luminaires complete with accessories 4. Switch Boxes of type SWB1/SWB2/SWB3 5. Junction Boxes of type JB-F/FE/S 6. Receptacles of type RA/RB/RC 7. Deleted 8. Deleted 9. Deleted

10. Deleted
11. PVC Coated conduits/GI Conduits with wires & Earth wires
12. Laying and termination of LT Power cables
13. Earthing Materials & Earth wires

Others:

1. Final Painting as detailed in scope of respective item/ equipment.
2. Supply of consumables other than BHEL supplied as detailed elsewhere in this specification, required for installation.
3. Embossing Permanent nomenclature on equipment erected as per site requirement.
4. Necessary arrangements for Protecting and safeguarding the Erected equipment from any damages and pilferages.
5. Fabrication and installation of steel supports wherever required.
6. Installation of any other items that have not been specifically indicated, but required for completing the Illumination works.
7. For installation of the above, minor civil works as detailed elsewhere in the specification.

Note:

1. If any peripheral illumination item associated with the above said main equipment required for complete commissioning, the same shall also be erected and commissioned by the contractor within the quoted rate.
2. Contractor shall have valid Electrical license to carry out the work indicated in the BOQ.
3. BHEL will provide OEM's technical support for commissioning of various proprietary type items, if any. The contractor shall carry out the works as per instructions of BHEL/ OEM's Engineer.

	4. The above provided list is indicative only. Any other area not mentioned above, but required for completion of the scope of the works, shall be deemed to have been included in the bidder scope under this contract. Such work will be executed under this contract by bidder as per the direction of Engineer in charge.
1.2.3.0	Scope of bidder also covers on getting Electrical Inspector/statutory authority's approval for charging of all LT installations erected by them as required.
1.2.4.0	The scope of work covers identification of items at stores / yards, checking, reporting the damages if any, loading, transportation, unloading at Contractor's stores / working yard, keeping in safe custody in contractor's stores, pre-assembly, calibration, checking, erection, testing and commissioning, supply of all Erection hardware and consumables (As specified in 1.3.17.0) including electrodes, gas, cable dressing materials, tag plates, PVC sleeves for wire marking, lugs (specific sizes), etc. (i.e. other than the BHEL supplied items mentioned in VOLUME- IA PART-I CHAPTER-IX), Deployment of skilled / unskilled manpower, engineers / supervisors, T & P, Material handling equipment's, Testing instruments, returning of un-used materials / items to BHEL stores.
1.2.5.0	It is not the intent to specify herein all details of material. Any item related to this work not covered by this but necessary to complete the system will be deemed to have been included in the scope of the work.
1.2.6.0	The scope of specification covers the material receipt from BHEL stores, transportation to erection site, installation, testing and commissioning of the electrical equipment along with accessories as detailed in Bill of Materials.
1.2.7.0	If any item or equipment not covered but requires be erected / commissioned, the same shall be carried out by the contractor. Equivalent unit rate for those item or equipment shall be considered wherever possible from the BOM.
1.2.8.0	Detailed BOQ are given in the VOLUME- IA PART-I CHAPTER-IX. The rate schedule is the summary of BOQ i.e. consolidated list of BOQ.

VOLUME-IA PART – I CHAPTER – III
FACILITIES & CONSUMABLES IN THE SCOPE OF CONTRACTOR / BHEL

Sl.No.	Description	Scope to be taken care by		Remarks
1.3.1.0	**PART-I**	**BHEL**	**BIDDER**	
1.3.1.1.0	**ESTABLISHMENT**			
1.3.1.1.1	**FOR CONSTRUCTION PURPOSE:**			
A	Open Space for Office	Yes		Free of Charges
B	Open space for storage	Yes		Free of Charges
C	Construction of bidder's office, canteen and storage building including supply of materials and other services		Yes	
D	Bidder's all office equipment's, office / store / canteen consumables		Yes	
E	Canteen facilities for the bidder's staff, supervisors and engineers etc.		Yes	
F	Firefighting equipment's like buckets, extinguishers etc.		Yes	
G	Fencing of storage area, office, canteen etc. of the bidder		Yes	
1.3.1.1.2	**FOR LIVING PURPOSES OF THE BIDDER**			
A	Open Space		Yes	
B	Living Accommodation		Yes	
1.3.1.2.0	**ELECTRICITY**			
1.3.1.2.1	Electricity for Construction Purpose			Chargeable as per prevailing TANGEDCO tariff
A	Single Point Source	Yes		Refer Cl.No. 1.3.4.0
B	Further distribution for the work to be done which include supply of materials and execution		Yes	
1.3.1.2.2	Electricity for the office, stores, canteen etc of the bidder which include:		Yes	

Sl.No.	Description	Scope to be taken care by		Remarks
		BHEL	BIDDER	
A	Distribution from single point including supply of materials and service		Yes	
B	Supply, installation and connection of material of energy meter including operation and maintenance		Yes	**Calibration certificate to be provided**
C	Duties and deposits including statutory clearances for the above		Yes	
D	Demobilization of the facilities after completion of works		Yes	
1.3.1.2.3	Electricity for living accommodation of the bidder's staff, engineers, supervisors etc on the above lines		Yes	
1.3.1.3.0	**WATER SUPPLY**			Refer Cl.No. 1.3.5
1.3.1.3.1	For Construction Purpose		Yes	
A	Making the water available at single point		Yes	
B	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.3.1.3.2	Water supply for bidder's office, stores, canteen etc.		Yes	
A	Making the water available at single point		Yes	
B	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.3.1.4.0	**LIGHTING**			
A	For construction work (supply of all the necessary materials) At office storage area At the preassembly area At the construction site / area		Yes	
B	For construction work (Execution of the lighting work / arrangements) At office storage area At the preassembly area At the construction site /area		Yes	

Sl.No.	Description	Scope to be taken care by		Remarks
		BHEL	BIDDER	
1.3.1.5.0	**COMMUNICATION FACILITIES FOR SITE OPERATIONS OF THE BIDDER**			
A	Telephone, Fax, internet, intranet, email etc (min 2 Nos of PC & Printer) – 2 Data entry operator with computer knowledge		Yes	
1.3.1.6.0	**Deleted**			
A	Deleted			
B	Deleted			
C	Deleted			
1.3.2.0	**PART-II**			
1.3.2.1.0	**ERECTION FACILITIES**			
1.3.2.1.1	Engineering works for construction	Yes		
1.3.2.1.2	Providing the erection drawings for all the equipment covered under this scope	Yes		
1.3.2.1.3	Drawing for construction methods		Yes	In consultation with BHEL
1.3.2.1.4	As-built drawings – wherever deviations observed and executed and also based on the decisions taken at site- example – routing of small bore pipes		Yes	In consultation with BHEL
1.3.2.1.5	Shipping lists etc for reference and planning the activities	Yes		
1.3.2.1.6	Preparation of site erection schedules and other input requirements		Yes	In consultation with BHEL As per requirements of BHEL targets
1.3.2.1.7	Review of performance and revision of site erection schedules in order to achieve the end dates and other commitments		Yes	
1.3.2.1.8	Weekly erection schedule based on Sl No 1.3.2.1.6		Yes	

Sl.No.	Description	Scope to be taken care by		Remarks
		BHEL	BIDDER	
1.3.2.1.9	Daily erection / work plan based on Sl. No 1.3. 2.1.8		Yes	For daily monitoring meeting at site
1.3.2.1.10	Periodic visit of the senior official of the bidder to site to review the progress so that works are 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	In consultation with BHEL
1.3.2.1.11	Preparation of preassembly bay		Yes	As required
1.3.2.1.12	Laying of racks for gantry crane if provided by BHEL or brought by the contractor / bidder themselves			Not Applicable
1.3.3.0	**LAND**			
1.3.3.1	Minimum Open space as made available by customer will be provided at free of charges to the contractor, for construction of temporary office shed, fabrication yard, storage area at the job site and contractor's stores shed(s).			
1.3.3.2	BHEL shall not provide to the contractor any residential accommodation to any of their Labour/staff and the contractor has to make their own arrangements. Contractor has to make their own arrangements for labour colony.			
1.3.3.3	Location and area requirement for office / storage sheds / fabrication yard shall be discussed and mutually agreed to.			
1.3.4.0	**ELECTRICITY:**			
1.3.4.1	In general, Construction power will be provided to the contractor on prevailing rates of TANGEDCO on chargeable basis at one single point by BHEL. The contractor has to Provide necessary energy meter for measuring the power consumption. The contractor shall make their own arrangement for further distribution with necessary isolator/LCB etc. However, based on request of Contractor and requirement of project, BHEL Site in charge, at their discretion, may provide construction power at multiple point (as close to work area as possible), for smooth execution of the work at site. If, BHEL provides electricity at more than one point (as close to work area as possible), it will be responsibility of the contractor to provide all the support necessary for enabling BHEL for extending such provision to contractor. However, the Construction power provided to the contractor shall be on chargeable basis at prevailing rates of TANGEDCO. The required energy meter for measuring power consumption shall be arranged by the contractor and taken care by the contractor. Any dispute,			

	BHEL engineer's decision shall be final and binding on contractor. Construction power prevailing charges are as below, The present LT tariff VI rate of TANGEDCO is: a. Consumption charges at Rs.12.25 per unit b. Maximum demand (MD) charges as applicable per month c. Low Power Factor (LPF) charges d. Electricity Tax on total amount e. Any other miscellaneous charges charged by M/s TANGEDCO pertaining to construction power supply. **Note -** The TANGEDCO tariff and tax may vary from time to time and the same is applicable for the bidder.
1.3.4.2	Any other charges, 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. Demand charges if any to be borne by the contractor.
1.3.4.3	Provision of distribution of electrical power from the given points 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.
1.3.4.4	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.
1.3.4.5	Necessary "Capacitor Banks" to improve the Power factor to a minimum of 0.9 shall be provided by the contractor at their cost. Penalty if any levied by customer on this account will be recovered from contractor's bills.
1.3.4.6	Contractor has to make their own arrangements for their electricity requirement for their labour colony at their cost. Any duty, deposit involved in getting the Electricity for contractors use i.e. Office shed, labour colony etc shall be borne by the bidder
1.3.4.7	As there are bound to be interruptions in regular power supply, power cut/load shedding in any construction sites/non availability of power source near work area, contractor should make their 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.
1.3.5.0	**CONSTRUCTION WATER**
1.3.5.1	The contractor shall make their 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.

1.3.6.0	**DRINKING WATER:** Bidder shall provide drinking water at the work spot at their cost.
1.3.7.0	**Deleted**
1.3.7.1	Deleted
1.3.8.0	**CONSUMABLES:**
1.3.8.1	Such of those consumables as indicated as consumables provided by BHEL alone will be provided to the contractor by BHEL at free of charge for erection activities. All the other Erection hardware and consumables not limited to the items mentioned in 1.3.17.0 including electrodes, all gases, and other materials for this scope of work are to be arranged by the contractor at their cost.
1.3.8.2	All the required electrodes (in contractor's scope) as approved by BHEL shall be arranged by contractor at their cost. It shall be the responsibility of the contractor to obtain prior approval of BHEL, before procurement regarding, suppliers, type of electrodes etc. On receipt of the electrodes at site, it shall be subject to inspection and approval by BHEL. The contractor shall inform BHEL details regarding type of electrodes, batch number and date of expiry etc.
1.3.8.3	The contractor shall provide within finally accepted price / rates, all Erection hardware and consumables (refer Cl.No.1.3.17.0) including welding electrodes, all gases (inert, welding, and cutting), soldering material, dye penetrants, radiography films. Other erection consumables such as tapes, jointing compound, grease, mobile oil, M-seal, Araldite, petrol, CTC / other cleaning agents, grinding and cutting wheels are to be provided by the contractor. Steel, H&S, packers, shims, wooden planks, scaffolding and pre-assembly materials, hardware items etc. required for temporary works such as supports, scaffoldings, bed are to be arranged by them. Sealing compounds, gaskets, gland packing, wooden sleepers, for temporary work, required for completion of work except those which are specifically supplied by manufacturing unit are also to be arranged by them.
1.3.8.4	All the shims, gaskets and packing, which go finally as part of equipment, shall be supplied by BHEL free of cost.
1.3.8.5	In the event of failure of contractor to bring necessary and sufficient consumables, BHEL shall arrange for the same at the risk and cost of the contractor. The entire cost towards this along with standard BHEL overhead shall be deducted from the contractor's immediate due bills.
1.3.9.0	**MATERIAL SUPPLY:**
1.3.9.1	BHEL will supply the materials/equipment indicated in the Bill of Quantity which are to be executed/incorporated in the permanent system.
1.3.10.0	**POSSESSION OF GENERATORS:**

1.3.10.1	As there are bound to be interruptions in regular power supply, power cut/ load shedding in any construction sites, suitable extension of time, if found necessary only be given and contractor is not entitled for any compensation. It shall be the responsibility of the contractor to provide, and maintain the complete installation on the load side of the supply with due regard to safety requirements at site. It shall be responsibility of the contractor to have at least 2 Nos. of diesel operated generator sets for welding to get urgent and important work to go on without interruptions. The consumables required to operate the generators are to be provided by tenderers. This may also be noted while quoting. No separate payment shall be made for this contingency.
1.3.11.0	**LIGHTING FACILITY (with ELCB):**
1.3.11.1	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 their cost.
1.3.12.0	**Deleted**
1.3.13.0	**ELECTRODES SUPPLY AND STORAGE:**
1.3.13.1	**The bidder shall use the BHEL / Customer approved quality welding electrodes only.**
1.3.13.2	It shall be the responsibility of the contractor to obtain prior approval of BHEL, before procurement, regarding suppliers, type of electrodes etc. On receipt of the electrodes at site, it shall be subject to inspection and approval by BHEL. The contractor shall inform BHEL details regarding type of electrodes, batch number and date of expiry etc.
1.3.13.3	Shortage of any of the electrodes or the equivalent suggested by BHEL shall not be quoted as reason for deficiency in progress or for additional rate. Contractor shall submit weekly/ fortnightly/ monthly statement/ report regarding consumption and available stock of all types of electrodes for avoiding stoppage of work on consumable scarcity.
1.3.13.4	Storage of electrodes shall be done in an air conditioned / controlled humidity room as per requirement, at their own cost by the contractor.
1.3.13.5	All low hydrogen electrodes shall be baked / dried in the electrode drying oven (range 375 deg. C - 425 deg. C) to the temperature and period specified by the BHEL Engineer before they are used in erection work and each welder should be provided with one portable electrode drying oven at the work spot. Electrode drying oven and portable drying ovens shall be provided by contractor at their cost.
1.3.13.6	In case of improper arrangement of procurement of above electrodes BHEL reserves the right to procure the same from any source and recover the cost from the contractor's first subsequent bills at market value plus departmental

	charges of BHEL communicated from time to time. Postponement of such recovery is not permitted.
1.3.13.7	BHEL reserves the right to reject the use of any electrodes at any stage, if found defective because of bad quality, improper storage, date expiry, unapproved type of electrodes etc. It shall be the responsibility of the contractor to replace at their cost without loss of time.
1.3.14.0	**OTHER FACILITIES:**
1.3.14.1	Adequate waterless urinals shall be arranged by the contractor within quoted rates, at site of construction with proper disposal arrangement.
1.3.15.0	**MATERIALS /CONSUMABLES TO BE ARRANGED BY THE CONTRACTOR AT THEIR COST FOR ERECTION AND COMMISSIONING OF RESPECTIVE EQUIPMENTS/ITEMS.**
1.3.15.1	All welding electrodes, filler wires, gases shall be arranged by the contractor at their cost.
1.3.15.2	Supply of paints, Ferrules, lugs for sizes up to 2.5 sq mm shall be in the scope of the contractor within the quoted rate.
1.3.15.3	Other items
	1. Provision for Temporary scaffoldings
	2. Insulation tapes
	3. Paints required for primer coating & final coating and for protective coating. paint of approved colour, consumables like thinner brushes, emery paper etc.,
	4. Solder wire (Lead 60/40)
	5. Protocol / calibration report sheets as per BHEL format
	6. PVC wire marker sleeves and tag plates
	7. Panel / JB sealing compound material (for cable entry from bottom / top of panel)
	8. Materials required for cable dressing (GI / Aluminium Flats, PVC Cable ties, etc.)
	9. Anchor fasteners for JBs wherever required.
	10. Lugs of size 2.5 sq.mm and below
	11. “U” clamps with nuts and washers for impulse pipes and GI pipe clamping.
	12. Tag Plates-Al/Fiberglass/Stainless Steel
	13. Teflon Tapes for GI pipe coupling
	14. Protocol/Calibration report sheets as per BHEL format
	15. Fastener for mounting JB, Local PB boxes and earthing flats.
	16. PVC cable tie, Aluminium or GI strips and fasteners for clamping of cables and other dressing materials required for cable dressing, grommet sleeves for cables.

<table>
<tr><td>1.3.16.0</td><td>TECHNICAL REQUIREMENTS FOR SUPPLY ITEMS</td></tr>
<tr><td>1.3.16.1</td><td>CABLE LUGS:
<table>
<tr><td>Type</td><td>Solderless Crimping Type</td></tr>
<tr><td>Material</td><td>Copper/ Aluminium</td></tr>
<tr><td>Whether Tinning required (for copper cable lugs)</td><td>Yes</td></tr>
<tr><td>Thickness of Tinning</td><td>10 Microns</td></tr>
<tr><td>Applicable Standard for LT cables</td><td>IS:8309</td></tr>
</table></td></tr>
<tr><td>1.3.16.2</td><td>FERRULES:
<table>
<tr><td>Colour of Ferrules</td><td>Yellow/White</td></tr>
<tr><td>Colour of Engraving</td><td>Black</td></tr>
</table></td></tr>
<tr><td>1.3.16.3</td><td>TAGS:
<table>
<tr><td>Material</td><td>Al/Fiberglass/Stainless Steel</td></tr>
<tr><td>Markings</td><td>Engraving/Embossing/Printing</td></tr>
</table></td></tr>
<tr><td>1.3.17.0</td><td>Void</td></tr>
<tr><td>1.3.18.0</td><td>POWER REQUIREMENT:</td></tr>
<tr><td>1.3.18.1</td><td>For the purpose of planning, contractor shall furnish the estimated requirement of power (month wise) for execution of work in terms of maximum kW demand before starting the work at site to BHEL Site Engineer.</td></tr>
<tr><td>1.3.19.0</td><td>CONTRACTOR’S OBLIGATION ON COMPLETION:</td></tr>
<tr><td>1.3.19.1</td><td>On Completion of work, all the temporary buildings, structures, pipe lines, cable etc. shall be dismantled and leveled and debris shall be removed as per instruction of BHEL by the contractor at their cost. In the event of their failure to do so, the expenditure towards clearance of the same will be recovered from the contractor. The decision of BHEL Engineer in this regard is final.</td></tr>
</table>

VOLUME-IA PART – I CHAPTER – IV
T&PS AND MMEs TO BE DEPLOYED BY CONTRACTOR
APPLICABLE FOR EACH PACKAGE

<table>
<tr><td>1.4.1.0</td><td>T&PS and MMEs TO BE DEPLOYED BY CONTRACTOR:
The following minimum major Tools & Plants (T&P) shall be arranged by the Contractor within the quoted rate for each package for execution of the scope of works covered under this contract.
<table>
<tr><th>Sl.No.</th><th>Description</th><th>Qty</th></tr>
<tr><td>01</td><td>For loading and transportation, all necessary T&P such as trailers, Cranes, Winches, welding generators, slings, jacks, sleepers, rails etc. are to be arranged by the contractor.</td><td>As required.</td></tr>
<tr><td>02</td><td>Crane of appropriate capacity</td><td>As required.</td></tr>
<tr><td>03</td><td>DG Set of appropriate capacity</td><td>As required.</td></tr>
</table></td></tr>
<tr><td>1.4.1.1</td><td>All the tools & plants required for this scope of work, are to be arranged by the contractor within the quoted rates as and when required.</td></tr>
<tr><td>1.4.1.2</td><td>T&Ps mentioned above is tentative requirement considering parallel working in all areas mentioned in scope of work. However, mobilization schedule, quantity / numbers and capacity as mutually agreed at site for major T&Ps, have to be adhered to. List of T&Ps required for the completion of entire scope of works shall be listed by the contractor and approval shall be obtained from BHEL Site In charge. Numbers/quantity, Capacity & time of requirement of T&Ps will be reviewed time to time by BHEL site and contractor will provide required T&Ps / equipment to ensure completion of entire work within schedule / target date of completion without any additional financial implication to BHEL. Vendor shall give advance intimation and certification regarding capacity etc. prior to dispatch of any heavy T&P. Also on completion of the respective activity, demobilization of T&P in total or in part can be done with the due approval of engineer in charge. Retaining of the T&P’s during the contract period will be mutually agreed in line with construction requirement.</td></tr>
<tr><td>1.4.1.3</td><td>The contractor shall furnish a list of Tools and plants including cranes, tractors/trailers/trucks etc. which are proposed for this work by the contractor to deploy, before start of works and approval to be obtained from BHEL Site In charge.</td></tr>
</table>

1.4.1.4	Computerized ferrules printing machine (min – 01 No.) shall be provided for making printed ferrules for all the cables.
1.4.1.5	**EQUIPMENT REQUIRED FOR TESTING, COMMISSIONING & OPERATION:** The tentative list of testing equipment shall be arranged by contractor in sufficient number to carry out the job simultaneously in more than one area within the quoted rate. i. Test Lamp ii. Buzzer iii. Lux Meter iv. Insulation tester: a) Hand operated Megger - 0.5 KV/1.0 KV/2.5 KV, 0- 1000 M Ohms v. Earth resistance tester 0 to 1, 10, 100 ohms vi. Voltmeter AC 0 - 125 - 250 - 625 V AC vii. Ammeter AC 0 - 2A - 10A AC viii. Multimeter - analogue: AC V 2.5V - 2500V, AC A - 100 mA - 10 A DC V 25.V - 2500V, dc A - 50mA - 10A ix. Digital Multi meters (make: Fluke) AC 0V-600V, DC 0V-300V x. Digital: voltages AC & DC - 100mv - 1000 V xi. Current 10-mA - 10A Resistance - 0-20 M ohms xii. Wheat stone bridge - 0.05 m ohm - 100 ohm. xiii. 220V DC power pack for control supply required for testing of panels xiv. Test setup for testing the lighting equipments such as 24V DC, 220 V DC and 240 V 1 Ph AC. xv. Tong tester - 0 - 5A - 10A, 30A, 60A, 150A - 600A, 500A-1000A. xvi. Lockout Tagout (LOTO) system for implementing during testing, commissioning & initial operation of Electrical equipment xvii. Insulating Rubber mats & Hand gloves (as required) ***Note:*** *The list mentioned above is tentative requirement considering parallel working in all areas mentioned in scope of work. However, mobilization schedule and quantity /numbers as mutually agreed at site for major T&Ps, have to be adhered to.*
1.4.1.6	**ACCURACY REQUIREMENT OF TESTING INSTRUMENTS**

S.No.	INSTRUMENT / TOOL	RANGE	ACCURACY
1	Digital Multimeter	Voltage 200mV to 1000 V DC	± 1% + 1 digit
		Philips Voltage 200mV to 1000 V AC	± 1% + 1 digit
		Hcl Current 200mA to 20 A AC	± 0.8% + 1 digit
		Philips Current 20 mA to 20 A AC	± 0.8% + 1 digit
		Resistance (Hcl) 2120 200* to 200M*	± 0.5% + 1 digit
		Resistance (Hcl) 2105 200* to 200M*	± 0.25% + 1 digit
		Hcl Voltage 200mA to 750 V	± 0.8% + 1 digit
		Philips Current 20 mA to 20 A DC	± 0.5% + 1 digit
		Hcl Current 200 mA to 010 A AC	± 1% + 1 digit
2	Motor operated Megger	up to 200 Ohms	± 5% at Centre scale
3	Tongue tester	0/300/600A AC	± 5%
		0 to 300A DC	± 5%
4	Hand operated Megger 500V / 1000V/2.5 KV	Up to 1000 M Ohms	± 5% at Centre Scale ± 10% at end of Scale
5	Motorized Megger 2.5 KV	Up to 1000 M Ohms	± 5% at Centre Scale ± 10% at end of Scale
6	Earth Resistance tester (Tester)	0 to 1, 10 Ohms	± 5% at Centre Scale range

7	AC tongue Tester	0 to 1000A AC	± 3%
8	DC Tongue Tester	0 to 300A DC	± 5%
9	DC Ammeter	0 to 300 A	
10	DC Voltmeter	0 to 500 V	
11	DC Tong Tester (mA)	0-500 mA	

Note:

1. For loading and transportation, all necessary T & P such as Trailers, Cranes, Winches, welding generators, slings, jacks, sleepers, rails etc., are to be arranged by the contractor.

2. Note for Contractor's Instruments:

a. The contractor shall arrange all the T&Ps, and instruments as indicated except testing instruments which are proprietary in nature.

b. The contractor at their cost shall arrange all cranes and truck / tractor, trailers required for material handling purpose and also cranes required for erection.

c. Any other tools and plants instruments and equipment required in addition to the above for the successful completion of this job will have to be arranged by the contractor at their cost.

d. Necessary accessories for the above shall also be provided by the contractor.

e. The above instruments / equipment shall be sent for testing and calibration whenever from time to time and maintained by contractor as required by BHEL.

f. All testing instruments shall have calibration certificate issued by recognized / accredited agencies

g. List of such agencies and periodicity of calibration required for different instruments will be furnished by BHEL at site.

h. Contractor shall maintain calibration records as per the BHEL format and produce them whenever called for by BHEL Engineers.

i. Contractors shall arrange experienced/qualified persons for using these calibration instruments at laboratory and also at work spot.

	j. Wherever frequent calibration is required; contractor shall arrange adequate number of instruments such that the work does not suffer for want of test instruments
1.4.1.7	In the event of contractor failing to arrange the required tools, plants, machinery, equipments, material or non availability of the same owing to the breakdown, BHEL will make alternative arrangement at the risk and cost of the contractor: **Case 1: BHEL provides its own Capital T&P:** In case the BHEL provides any T&P which is owned by BHEL, hire charges (as per BHEL norms) will be recovered from the contractor as per the prevailing BHEL Corporate hire charges. • In case, the T&P is specifically listed in "T&Ps to be deployed by Contractor", "hire charges applicable to outside agencies other than contractors working for BHEL" will apply. • If not listed, "hire charges applicable to contractors working for BHEL" will apply. The hire charges of Capital Tools & Plants are exclusive of operating expenses e.g., Operator, fuel & Consumables and the same shall be arranged by the contractor at his cost. **Case 2:** In all cases other than that specified in Case 1 above, actual expenses incurred by BHEL along with applicable overheads will be back-charged to the contractor. The present rates of BHEL's Corporate Crane hire charge are enclosed as part of this tender. This may get revised further as per the BHEL corporate guidelines. The prevailing rates as on date of execution shall be applicable.
1.4.1.8	All the T & P arranged by contractor including electrical connections wherein required shall be reliable / proven / tested with necessary test certificate.
1.4.1.9	All instruments, measuring tools etc. are to be calibrated periodically as per the requirement of BHEL and necessary calibration certificates are to be submitted to BHEL before use.
1.4.1.10	Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.
1.4.1.11	All the distribution boards, connecting cables, hoses etc., and temporary connection work including electrical connections for the BHEL issued T & Ps shall have to be arranged by the contractor at his cost
1.4.1.12	Other Relevant clauses shall be referred in Special Conditions of Contract (SCC) published in Volume IB of Book II.
1.4.1.13	**PROTECTION / HANDLING OF TOOLS AND PLANT ARRANGED BY THE CONTRACTOR**
1.4.1.13.1	Equipment, vehicles, tools and plants and materials brought to site by the contractor from their resources shall have distinctive identification marks and the contractor shall intimate the description and quantity to BHEL in writing.

<table>
<tr><td>1.4.1.13.2</td><td>All construction materials brought by the contractor shall have prior approval regarding quality and quantity by BHEL. The contractor shall also provide without extra cost necessary enclosures containers and protective materials for proper storage of materials inside, whenever so instructed by the purchaser without any extra cost.</td></tr>
<tr><td>1.4.1.13.3</td><td>No material or equipment or tools etc., shall be taken out of the work-site without the written consent of BHEL.</td></tr>
<tr><td>1.4.1.13.4</td><td>BHEL shall not be responsible for the safety and protection of the materials of the contractor and the contractor shall make their arrangements for proper watch and ward for their materials.</td></tr>
<tr><td>1.4.1.13.5</td><td>Until such time the work is taken over by BHEL, the contractor shall be responsible for proper protection including proper fencing, guarding, lighting, flagging, and watching. The contractor shall during the progress of work properly cover up and protect any part of the work liable to damage by exposure to the weather and shall take every reasonable precaution against accident or damage to the work from any cause.</td></tr>
<tr><td>1.4.1.13.6</td><td>CALIBRATION RECORD OF SUB-CONTRACTOR'S INSTRUMENTS
Format No. CP:PEX:FOX
Name of Site:
Name of Sub-Contractor:
<table>
<tr><th>Sl.No.</th><th>Name of the Instrument</th><th>Instrument REGN.No.</th><th>Date of Entry / Exit</th><th>Periodicity of Calibration</th><th>Calibration Details</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>Date of Cal:
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Next Due Date:</td></tr>
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VOLUME-IA PART – I CHAPTER – V
T&Ps AND MMEs TO BE DEPLOYED BY BHEL ON SHARING BASIS

1.5.1	The EOT crane at TG Hall without operating personnel shall be made available at free of charge for erection purposes based on the requirement. As the above crane is deployed for Boiler/T.G. & Aux. erection and also to various other contractors, the decision of BHEL engineers will be final with regard to allotment of crane. The contractor has to arrange experienced operator for EOT Crane. The decision of BHEL Engineers will be final with regard to allotment of crane.
1.5.2	If the EOT Crane is not available for any reason, bidder should make necessary arrangements for carrying out the works within the quoted rates.
1.5.3	Providing manpower assistance required for free movement of Trailing cable of EOT Crane is included in the scope of this contract.
1.5.4	The availability of crane is likely to be hampered from time to time due to routine preventive maintenance or breakdown maintenance. Contractor has to make alternative arrangement or plan / modify / alter his activities to suit the above conditions and the contractor will not be liable for any compensation or extension of time due to this non-availability, for maintaining the erection schedule.
1.5.5	In the event of the crane not available for longer duration due to major breakdown or any other reasons, BHEL will reschedule the work in consultation with bidder and direct the bidder to concentrate on other areas till such time the cranes are made available.
1.5.6	Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.
1.5.7	Depending upon the nature of work and availability of facilities locally, contractor may have to arrange for a temporary workshop for facilitating uninterrupted progress of work.
1.5.8	All the distribution boards, connecting cables, hoses etc., and temporary connection work including electrical connections for the BHEL issued T & Ps shall have to be arranged by the contractor at his cost.
1.5.9	Cranes provided by BHEL are only for erection purpose and shall not be available for material handling or transportation purpose. Contractor shall make their own arrangements for material transportation to erection site.
1.5.10	The contractor at his cost shall arrange for grouting of anchor points of T & Ps issued to him. Necessary grout materials are to be arranged by the contractor at their cost.
1.5.11	Contractor shall make good any loss or damage to the Equipment supplied to him and day to day maintenance and operations of equipment shall be borne by the contractor including all consumables like petrol, oil and air filters etc.,

1.5.12	Any additional crane and other T & P which may be required for successful and timely execution of the work covered within the scope of this tender shall be arranged and provided at site by the contractor at his cost. In case if the contractor fails to provide such equipment, BHEL will arrange for the same and the cost will be recovered from the contractor's bill with BHEL overheads, as applicable from time to time which may vary even during contract period.

VOLUME-IA PART – I CHAPTER-VI
TIME SCHEDULE

1.6.1.0	**TIME SCHEDULE**
1.6.1.1	The entire work of erection testing and commissioning of each package as detailed in the Tender Specification shall be completed within **3 (Three)** months from the date of commencement of works of respective package at site.
1.6.1.2	During the total period of contract, the contractor has to carry out the activities in a phased manner as required by BHEL and the program of milestone events.
1.6.1.3	The erection work shall be commenced on the mutually agreed date between the bidder and BHEL engineer at site. The decision of BHEL in this regard shall be final and binding of the contractor. The scope of work under this contract is deemed to be completed only when so certified by the site Engineer.
1.6.1.4	The contractor is required to refer Form 15 in Volume 1- BOOK 2 for all the instructions to be taken immediately after receipt of LOI.
1.6.2.0	**COMMENCEMENT OF CONTRACT PERIOD**
1.6.2.1	The date of commencement of contract period shall be the mutually agreed date between the bidder and BHEL engineer to start the work at site. In case of discrepancy the decision of BHEL engineer is final.
1.6.3.0	**MOBILIZATION FOR ERECTION, TESTING, ASSISTANCE FOR COMMISSIOING ETC.,**
1.6.3.1	The activities for erection, testing etc. shall be started as per directions of Construction manager of BHEL. The contractor has to augment their resources in such a manner that erection & commission are achieved within contract period
1.6.3.2	In order to meet above schedule in general, and any other intermediate targets set, to meet customer / project schedule requirements, contractor shall arrange & augment all necessary resources from time to time on the instructions of BHEL Engineer.
1.6.3.3	In case the project is to be advanced, the erection works in the scope of the contractor is to be advanced to meet the project requirement. No extra payment whatsoever shall be paid on this account.
1.6.4.0	**PENALTY FOR INTERMEDIATE MILESTONES FOR EACH PACKAGE**
1.6.4.1	M1 and M2 shall be intermediate Milestones for respective works under each package.
1.6.4.2	In case of slippage of these identified Intermediate Milestones, Delay Analysis shall be carried out on achievement of each of these two Intermediate Milestones with reference to Form 14.

1.6.4.3	Incase delay in achieving M1 milestone is solely attributable to the contractor, 0.5% per week of executable **contract value*** limited to Maximum 2% executable contract value will be withheld.
1.6.4.4	Incase 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.
1.6.4.5	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.
1.6.4.6	Amount required to be withheld on account of slippage of identified intermediate milestone(s) shall be withheld out of respective milestone payment and balance amount (if any) shall be withheld @ 10% of RA Bill amount from subsequent RA bills.
1.6.4.7	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 intermediate milestones shall be adjusted against LD or released as the case may be.
1.6.4.8	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 in to recovery.
1.6.4.9	Note: * 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.
1.6.5.0	**CONTRACT PERIOD**
1.6.5.1	The contract period for completion of entire work for each package under scope shall be 3 (Three Months) months from the “COMMENCEMENT OF CONTRACT PERIOD” as specified earlier.
1.6.6.0	**GUARANTEE PERIOD FOR EACH PACKAGE**
1.6.6.1	The guarantee period of 12 months shall commence from the date of satisfactory commissioning of the package. (Provided all erection, testing, commissioning and pending points works are completed in all respects).

VOLUME-IA PART – I CHAPTER-VII
TERMS OF PAYMENT

1.7.0 Terms of Payment:

The progressive payment for erection, testing and commissioning on accepted rate / price of contract value will be released as mentioned below.

(i) Seventy Five percent (75%) payment on pro-rata basis for the erection work completed, as per approved billing schedule, shall be payable against submission of MB(Measurement Book), RAB (Running Account Book) and other related documents duly certified by BHEL Engineer. Further, break up for activities involved in completion of erection work shall be mutually agreed during execution of contract.

(ii) Fifteen percent (15%) payment on pro-rata basis on successful completion of commissioning of the individual items as per approved billing schedule, shall be payable against submission of MB(Measurement Book), RAB (Running Account Book)and other related documents duly certified by BHEL Engineer.

(iii) Ten percent (10%) of the total value shall be released on successful completion of PG/ Demonstration test(s) at site/ handing over to BHEL/ BHEL's Customer, on submission of protocols, duly signed by BHEL site Engineer/ BHEL's Customer.

VOLUME-IA PART – I CHAPTER-VIII

TAXES AND DUTIES

Goods and service Tax (GST) & Cess

1.8.1.1 The successful bidder shall furnish proof of GST registration with GSTN Portal in the State in which the Project is being executed, covering the services under this contract. Registration should also bear endorsement for the premises from where the billing shall be done by the successful bidder on BHEL for this project/ work.

1.8.1.2 Contractor's price/rates shall be exclusive of GST & Cess (if applicable) (herein after termed as GST). Contractor shall submit to BHEL the GST compliant tax invoice/debit note/revised tax invoice on the basis of which BHEL will claim the input tax credit in its return. Since this is a works contract, the applicable rate shall be @ 18% GST, as applicable presently.

1.8.1.3 Bidder shall note that the GST Tax Invoice complying with GST Invoice Rules wherein the 'Bill To' details will as below:

BHEL GSTN - 33AAACB4146P2ZL

NAME - BHARAT HEAVY ELECTRICALS LIMITED

ADDRESS - BHEL-PSSR SITE OFFICE, 2X660 MW Udangudi Supercritical Thermal Power Station, Kallamoli Village, Thiruchendur Taluk, Thoothukudi District, Tamil Nadu - 628203

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

1.8.1.5 In case BHEL has to incur any liability (like interest / penalty etc.) due to denial/reversal / delay of input tax credit in respect of the invoice submitted by the contractor, for the reasons attributable to the contractor, the same shall be recovered from the contractor.

1.8.1.6 Further, in case BHEL is deprived of the Input tax credit due to any reason attributable to contractor, the same shall not be paid or Recovered if already paid to the contractor.

1.8.1.7 Tax invoice/debit Note/revised tax invoice shall contain all such particulars as prescribed in GST law and comply to the timelines for issue of the same. Invoices shall be submitted on time to the concerned BHEL Engineer In Charge.

1.8.1.8 TDS under GST (if/ as & when applicable) shall be deducted at prevailing rates on gross invoice value from the running bills.

1.8.1.9 E-way bills / Transit passes / Road Permits, if required for materials / T&P etc., bought into the project site is to be arranged by the Contractor only.

1.8.1.10 BHEL shall not reimburse any amounts towards any interest / penalty etc., incurred by contractor. Any additional claim at a later date due to issues such as wrong rates / wrong classification by contractor shall not be paid by BHEL.

1.8.2 **All taxes and duty other than GST & Cess**

The contractor shall pay all (except the specific exclusion viz GST & Cess) taxes, fees, license charges, deposits, duties, tools, royalty, commissions, Stamp Duties, or other charges / levies, which may be levied on the input goods & services consumed and output goods & services delivered in course of his operations in executing the contract and the same shall not be reimbursed by BHEL. In case BHEL is forced to pay any of such taxes, BHEL shall have the right to recover the same from his bills or otherwise as deemed fit.

1.8.3 **Statutory Variations**

Statutory variations are applicable under the GST Acts, against production of proof. The changes implemented by the Central / State Government during the tenure of the contract viz. increase / decrease in the rate of taxes, applicability, etc. and its impact on upward revision / downward revision are to be suitably paid/ adjusted from the date of respective variation. The bidder shall give the benefit of downward revision in favor of BHEL. No other variations shall be allowed during the tenure of the contract.

1.8.4 **New Taxes/Levies**

In case Government imposes any new levy / tax after submission of bid during the tenure of the contract, BHEL shall reimburse the same at actual on submission of documentary proof of payment subject to the satisfaction of BHEL that such new levy / tax is applicable to this contract.

1.8.5 **Direct Tax**

BHEL shall not be liable towards Income Tax of whatever nature including variations thereof arising out of this contract as well as tax liability of the bidder and their personnel. Deduction of tax at source at the prevailing rates shall be effected by BHEL before release of payment as a statutory obligation, unless exemption certificate is produced by the bidder. TDS certificate will be issued by BHEL as per the provisions of Income Tax Act

VOLUME-IA PART – I CHAPTER IX
BILL OF QUANTITY (BOQ)

1.9.1.0 BOQ of Package

S. No	Description	UOM	Quantity
1	**LIGHTING FIXTURES**		
1.1	40W LED 40W INDUSTRIAL TYPE LED LIGHT- FC06	Nos.	821
1.2	40W LED DECORATIVE RECESSED TYPE LED LIGHT- FC30	Nos.	225
1.5	100W LED MEDIUM BAY LIGHT LIGHT- SB11	Nos.	547
1.7	120W LED STREET LIGHT- SS62	Nos.	463
1.8	45W LED WELL GLASS LIGHT- SW41	Nos.	1671
1.9	70W LED WELL GLASS LIGHT- SW42	Nos.	358
1.10	14W LED RECESSED LIGHT_FC33 - 220V AC/ DC	Nos.	33
1.11	14W LED BULKHEAD LIGHT_FC34 -220V AC/DC	Nos.	231
1.12	45W FLAME PROOF WELLGLASS- MW96	Nos.	82
2	**POINT WIRING WITH CONDUIT & WIRES:**		
2.1	20 MM DIA. G.I. CONDUIT	Mtrs.	40000
2.2	25 MM DIA. G.I. CONDUIT	Mtrs.	6000
2.3	20 MM DIA. EPOXY COATED CONDUIT	Mtrs.	500
2.4	2.5 SQ.MM, COPPER, FLEXIBLE LIGHTING WIRE	Mtrs.	109800
2.5	4.0 SQ.MM, COPPER, FLEXIBLE LIGHTING WIRE	Mtrs.	27120
2.6	20 MM PVC COATED GI FLEXIBLE CONDUIT	Mtrs.	4853
3	**SWITCHBOARDS, JUNCTION BOXES & RECEPTACLES**		
3.1	JUNCTION BOXES FOR LIGHTING FIXTURES	Nos.	4388
3.2	MODULAR TYPE SWITCHBOARDS TYPE- SWB 1	Nos.	58
3.5	10/20A MODULAR REECPTACLE TYPE- RA	Nos.	66
3.6	20A INDUSTRIAL REECPTACLE TYPE- RB	Nos.	179
3.7	20A INDUSTRIAL FLAMEPROOF REECPTACLE	Nos.	3
5	**LIGHTING PANELS**		

5.4	AC NORMAL OUTDOOR LP18-C WITH TIMER	Nos.	18
5.5	AC NORMAL INDOOR LP12-A WITH TIMER	Nos.	11
5.6	AC NORMAL OUTDOOR LP12-B WITH TIMER	Nos.	23
5.7	DC INDOOR LIGHTING PANEL LPD6-A	Nos.	9
5.8	DC OUTDOOR LIGHTING PANEL LPD6-B	Nos.	11
8	PORTABLE EMERGENCY LIGHTING UNIT	Nos.	10
14	**Cables**		
14.4	3.5Cx 70 sqmm Al Cable	Mtrs.	2100
14.6	3.5Cx 25 sqmm Al Cable	Mtrs.	25500
14.7	2Cx 16 sqmm Al Cable	Mtrs.	5000

VOLUME-IA PART –I CHAPTER –X
GENERAL

The scope of the work will comprise of but not limited to the following:
(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

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

All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.

1.10.1.1 Deleted

1.10.1.2 Bidders are requested to furnish the proof of documents for the following at PSSR-Site.

a. Provident Fund (PF) Registration Number
b. Labour License Number
c. Workmen Insurance Policy Number

1.10.2 **In addition to the clause 2.8 of General Conditions of Contract (Volume-1C of Book-II) the contractor shall comply with the following:**

1.10.2.1 BOCW ACT & BOCW WELFARE CESS ACT :

1.10.2.1.1 The Contractor should Register their Establishment under BOCW Act 1996 read with rules 1998 by submitting Form I (Application for Registration of Establishment) and Form IV (Notice Of Commencement / Completion of Building Other Construction Work) to the respective Labour Authorities i.e.,

a) Assistant Labour Commissioner (Central) in respect of the project premises which is under the purview of Central Govt.–NTPC, NTPL etc.

b) Appropriate State authorities in respect of the project premises which is under the purview of State Govt.

1.10.2.1.2 The Contractor should comply with the provisions of BOCW Welfare Cess Act 1996 in respect of the work awarded to them by BHEL.

1.10.2.1.3 The contractor should ensure compliance regarding Registration of Building Workers as Beneficiaries, Hours of work, welfare measures and other conditions of service with particular reference to Safety and Health measures like Safety Officers, safety committee, issue of Personal protective equipments, canteen, rest room, drinking water, Toilets, ambulance, first aid centre etc.

1.10.2.1.4 The contractor irrespective of their nature of work and manpower (Civil, Mechanical, Electrical works etc) should register their establishment under BOCW Act 1996 and comply with BOCW Welfare Cess Act 1996.

1.10.2.1.5 Contractor shall make remittance of the BOCW cess as per the Act **in consultation with BHEL** as per the rates in force (presently 1%). BHEL shall reimburse the same upon production of documentary evidence. However, BHEL shall not reimburse the fee paid towards the registration of establishment, fees paid towards registration of Beneficiaries and contribution of Beneficiaries remitted

1.10.2.1.6 Non-compliance to Provisions of the BOCW Act & BOCW Welfare Cess Act is not acceptable. In case of any non-compliance, BHEL reserves the right to withhold any sum as it deems fit. Only upon total compliance to the BOCW Act and also discharge of total payment of Cess under the BOCW Cess Act by the Contractor, BHEL shall consider refund of the Amounts

1.10.2.2 PROVIDENT FUND & MINIMUM WAGES

1.10.2.2.1 The contractor is required to extent the benefit of Provident Fund to the labour employed by them in connection with this contract as per the Employees Provident Fund and Miscellaneous Provisions Act 1952. For due implementation of the same, contractor is hereby required to get themselves registered with the Provident Fund authorities for the purpose of reconciliation of PF dues and the code number allotted to them by the Provident Fund authorities shall be furnished to our office within one month from the date of issue of this letter of intent. In case contractor are exempted from such remittance, an attested copy of authority for such exemption is to be furnished. Please note that in the event of their failure to comply with the provisions of said Act, if recoveries therefore are enforced from payments due to BHEL by the customer or paid to statutory authorities by BHEL, such amount will be recovered from payments due to the contractor.

1.10.2.2.2 The contractor shall ensure the payments of minimum labour wages to the workmen under them as per the rules applicable from time to time in the state.

1.10.2.2.3 The final bill amount would be released only on production of clearance certificate from PF / ESI and labour authorities as applicable.

1.10.2.3 OTHER STATUTORY REQUIREMENTS

1.10.2.3.1 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.

1.10.2.3.2 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.

1.10.2.3.3 The Contractor should ensure compliance of Sec 21 of Contract Labour (R&A) Act 1970 regarding responsibility for payment of Wages. In case of "Non-compliance 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.

1.10.2.3.4 The Contractor shall submit copies of Final Settlement statement of disbursal of retrenchment benefits on retrenchment of each workman under I D Act 1948, 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 Act1948 (If applicable) to BHEL along with the Final Bill.

1.10.2.3.5 In case of any dispute pending before the appropriate authority under I D 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.

1.10.2.3.6 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.

1.10.2.4 DEPLOYMENT OF SKILLED / SEMI-SKILLED TRADESMEN

The following clause is applicable in case the contract value / contract price is Rs. Five crores and above.

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.

1.10.3. OTHER GENERAL REQUIREMENTS

1.10.3.1. The scope of specification covers the installation, testing and commissioning of the erected equipment / instrument along with accessories as detailed in Bill of Quantity.

1.10.3.2. Identification of equipment at storage yard, technical assistance for checking and making the shortage/damage reports, taking delivery at storage yard and pre-assembly of equipment wherever required, erecting the equipment, aligning, fastening, supporting, cleaning, checking and carrying out statutory tests as required, trial operation, pre-commissioning, commissioning and post-commissioning activities up to the time of completion of commissioning activities and commercial operation of the unit and handing over to customer or till completion of contract period (including extended period) whichever is earlier, along with the supply of all consumables, tools and tackles and testing instruments.

1.10.3.3. Scope of work covered under this specification requires quality workmanship, engineering and construction management. The contractor shall ensure timely completion of work. The contractor shall have adequate tools, measuring instruments, calibrating equipment etc., in their possession. He shall also have adequate trained, qualified and experienced engineers, supervisory staff and skilled personnel. The manpower deployment identified by contractor shall match with above scope of works.

1.10.3.4. It is not the intent to specify herein all details of material. Any item related this work not covered here but necessary to complete the system will be deemed to have been included in the scope of the work.

1.10.3.5. The contractor shall have valid ELECTRICAL LICENCE as required to carry out the scope of work indicated in the BOQ.

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

1.10.3.7. Contractor shall erect all items/materials etc. as per sequence prescribed by BHEL at site. BHEL engineer depending upon the availability of materials/work fronts etc will decide the sequence of erection/commissioning methodology. 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 job or for any reasons whatsoever.

1.10.3.8. Site testing wherever required shall be carried out for all items / materials installed by the contractor to ensure proper installation and functioning in accordance with drawings, specifications and manufacturer's recommendations and Field quality plans of BHEL.

1.10.3.9. The contractor shall co-ordinate and provide assistance for satisfactory testing, pre-commissioning, commissioning and trial run of the connected equipment under overall guidance of BHEL and shall locate any cause of malfunction and rectify the same for proper operation. Testing shall also include any additional tests, which the Engineer feels necessary because of site conditions and also to meet system specification.

1.10.3.10. During the course of erection, testing and commissioning certain rework / modification/ rectification / repairs / fabrication etc. may be necessary on account of feedback from other power stations or units already commissioned and/ or units under erection and commissioning and also on account of design changes and manufacturing incompatibilities and site operation / maintenance requirements. Contractor shall carryout such rework / modification / rectification / fabrication / repairs etc, promptly and expeditiously. Payments for such works shall be governed by Cl. 2.15.1 of GCC.

1.10.3.11. The work shall be executed under the usual conditions without affecting power plant construction and in conjunction with other operations and contracting agencies at site. The contractor and their personnel shall co-operate with the personnel of other agencies, co-ordinate their work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.

1.10.3.12. If any item or equipment not covered but requires being erected/commissioned, same shall be carried out by the contractor. Equivalent or proportional unit rate shall be considered wherever possible from the BOQ.

1.10.4. After completing all the works, contractor shall hand over all remaining extra materials with proper identification tags in a packed condition to BHEL stores. In case of any use over actual design requirements, BHEL reserves the right to recover the cost of material used in excess or misused. Decision of BHEL engineer in this regard will be final and binding on the contractor.

1.10.4.1. Contractor shall, transport all materials to site and unload at site / working area, or pre-assembly yard for inspection and checking. All material handling equipment required shall be arranged by the contractor.

1.10.4.2. Contractor shall retain all T&P / Testing instrument / Material handling equipment etc., at site as per advice of BHEL engineer and same shall be taken out from site only after getting the clearances from engineer in charge.

1.10.4.3. Contractor shall remove all scrap materials periodically generated from their working area in and around power station and collect the same at one place earmarked for the same. Load of scraps is to be shifted to a place earmarked by BHEL. Failure to collect the scrap is likely to lead to accidents and as such BHEL reserves the right to collect and remove the scrap at contractor's risk and cost if there is any failure on the part of contractor in this respect. All the package materials, including special transporting frames, etc., shall be returned to the BHEL stores / customer's stores by the contractor.

1.10.4.4. The scrap generated after executing the work shall be returned to BHEL earmarked area every week and the same shall be vetted by the Engineer-in-charge, to be produced along with the running bill.

1.10.4.5. The contractor at their cost shall arrange necessary security measures for adequate protection of their machinery, equipment, tools, materials etc. BHEL shall not be responsible for any loss or damage to the contractor’s construction equipment and materials. The contractor may consult the Engineer-in-Charge on the arrangements made for general site security for protection of their machinery equipment tools etc.,

1.10.4.6. The contractor shall ensure that their premises are always kept clean and tidy to the extent possible. Any untidiness noted on the part of the contractor shall be brought to the attention of the contractor’s site representative who shall take immediate action to clean the surroundings to the satisfaction of the Engineer-in-Charge.

1.10.5. The Contractor may have to execute work in such a place and condition where other agencies also will be under such circumstances. However, completion time for erection agreed will be subject to the condition that contractor’s work is not hampered by the agencies.

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

1.10.6. If required by BHEL, the contractor shall change the sequence of their operation so that work on priority sectors can be completed within the projects schedule. The contractor shall afford maximum assistance to BHEL in this connection without causing delay to agreed completion date.

1.10.6.1. Any wrong erection shall be removed and re-erected promptly to comply with the design requirements to the satisfaction of Site Engineer.

1.10.6.2. Contractor has to work in close co-ordination with other erection agencies at site. BHEL engineer will co-ordinate for area clearance. In a project of such magnitude, it is possible that the area clearance may be less/more at a particular given time. Activities and erection program have to be planned in such a way that the

milestones are achieved as per schedule/ plans. Contractor shall arrange & augment the resources accordingly.

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

1.10.6.4. The contractor is strictly prohibited from using BHEL's regular components like angles, channels, beams, plates, pipe/tubes, and handrails etc for any temporary supporting or scaffolding works. Contractor shall arrange themselves all such materials. In case of such misuse of BHEL materials, a sum as determined by BHEL engineer will be recovered from the contractor's bill. The decision of BHEL engineer is final and binding on the contractor.

1.10.6.5. The contractor will be responsible for the safe custody and proper accounting of all materials in connection with the work. If the contractor has drawn materials in excess of design requirements, recoveries will be effected for such excess drawls at the rate prescribed by manufacturing units.

1.10.6.6. No member of the already erected structure/ platform, pipes, grills, platform, other component and auxiliaries should be cut without specific approval of BHEL engineer.

1.10.6.7. Contractors shall ensure that all their Staff/Employees are exposed to periodical training program conducted by qualified agencies/ personnel on ISO 9001 /2015 Standards.

1.10.6.8. Contractor has to clear the front, expeditiously and promptly for other agencies, such as piping, Boiler, ESP, TG, Instrumentation, insulation etc., to commence their work from/on the equipment's coming under this scope (or) as instructed by BHEL Engineer. Some time it may be required to re-schedule the activities to enable other agencies to commence/continue the work so as to keep the overall project schedule.

1.10.6.9. The terminal points decided by BHEL are final and binding on the contractor for deciding the scope of work and effecting the payment for the work done up to the terminals.

1.10.6.10. On Completion of work, all the temporary buildings, structures, pipe lines, cable etc. shall be dismantled and leveled and debris shall be removed as per instruction of BHEL by the contractor at their cost. In the event of their failure to do so, the

expenditure towards clearance of the same will be recovered from the contractor. The decision of BHEL Engineer in this regard is final.

1.10.6.11. Prior to erection of any components inspection to be done for any foreign materials and damages and they are to be attended as per directions of BHEL engineer.

1.10.6.12. All the equipment /material to be taken inside the plant building shall be cleaned thoroughly before taking them inside and erect.

1.10.6.13. It is the responsibility of the contractor to do the alignment, checking, etc., if necessary, repeatedly to satisfy BHEL Engineer / Customer Engineers with all the necessary tools and tackles, manpower etc. without any extra cost. The alignment will be completed only when jointly certified so, by the BHEL Engineer & Customer. Also the contractor should ensure that the alignment is not disturbed afterwards.

1.10.6.14. No temporary supports shall be welded on the pressure parts of piping. Welding of temporary supports, cleats, etc. on the boiler columns shall be avoided. In case of absolute necessity contractor shall take prior approval from BHEL Engineer. Further, any cutting or alternation of member of the structure of platform or other equipment shall not be done without specific prior approval of BHEL Engineer.

1.10.6.15. In electrical MCC's the fixed and moving contacts in contactors & Copper strips shall be removed and kept in safe custody. The same shall be re-erected during commissioning of the system.

1.10.6.16. Whenever cable glands are supplied along with MCC'/JB's/ PB's/etc. they shall be removed and kept in safe custody. The same shall be re-erected during cable termination.

1.10.6.17. Permanent nomenclature/identification on Junction boxes/AC Fuse DB/DC Fuse DB/Control panel, LDB, Lighting Panel & individual feeders, Transformers are to be done by the contractor as per the requirement decided BHEL Engineer at site.

1.10.6.18. All the necessary certificates and licenses required to carry out this scope of work are to be arranged by the contractor then and there (if required) within the quoted rate. Also refer the clause - ELECTRICAL INSPECTORATE'S APPROVAL below.

1.10.7. ELECTRICAL INSPECTORATE'S APPROVAL

1.10.7.1. Contractor is responsible for getting Electrical Inspector/statutory authority's approval for all electrical installation covered in their scope.

1.10.7.2. 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).

Any other documents as required by statutory authority. Any expenditure related to documentation shall be borne by contractor.

1.10.7.3. 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.

1.10.7.4. Contractor shall also have valid electrical installation license on their company as well as for individuals acceptable to respective state electrical inspectorate requirement.

1.10.7.5. 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).

1.10.7.6. 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 to design change shall be treated as extra work.

1.10.8. SITE INSPECTION

1.10.8.1. Various Inspection / quality control / quality assurance procedures/methods at various stages of erection and commissioning will be as per BHEL / Customer quality control procedure / codes and other statutory provisions and as per BHEL Engineer's instructions.

1.10.8.2. The owner / employer or their authorized agents may inspect various stages of work during the currency of the contract awarded to them. The contractor shall make necessary arrangements for such inspection and carry out the rectification pointed out by the owner / employer without any extra cost to the owner / employer. No cost whatsoever such duplication of inspection of work be entertained.

1.10.8.3. BHEL / Customer will have full power and authority to inspect the works at any time, either on the site or at the contractor's premises. The contractor shall arrange every facility and assistance to carry out such inspection. On no account will the contractor be allowed to proceed with work of any type unless such work has been inspected and entries are made in the site inspection register by customer / BHEL.

1.10.8.4. Wherever the performance of work by the contractor is not satisfactory in respect of workmanship, deployment of sufficient labour or equipment, delay in execution of work or any other matter, BHEL shall have the right to engage labour at normal ruling rates and get the work executed through other agency and debit the cost to the contractor and the contractor shall have no right to claim compensation thereof. In such a case, BHEL shall have the right to utilize the materials and tools brought by the contractors for the same work.

1.10.9. MANPOWER REQUIREMENT

1.10.9.1. 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. Area Engineer should have minimum qualification of Diploma in Engineering or any graduate with minimum 3 years of experience in Thermal Power Station.

d. Supervisor should have a minimum qualification of Diploma in Electrical/Electronics/C&I engineering or any graduate with minimum 3 years of experience in Thermal Power Station.

e. Lab Technicians should have 2 years' experience in Thermal Power Stations.

f. Contractor should have one Store Keeper, one Transport Supervisor for the safe transportation of materials.

g. Planning / safety Engineers should be available and they should have experience in construction field especially in power plant.

h. Licensed supervisor-01 No. with valid HT/LT electrical license

i. Dedicated commissioning engineer should be deployed for commissioning of the equipment.

1.10.9.2. Each area engineer shall be provided with minimum four (04) supervisors and adequate number of Technicians / electricians and other erection staff and T&P etc. The testing Engineers / supervisors / electricians shall be identified separately and the minimum requirement shall be as indicated in previous Clause. Besides, there shall be separate engineers for Planning, Safety and Quality.

1.10.9.3. The above said manpower requirement is only tentative and any additional requirement shall be fulfilled within the quoted rate.

1.10.9.4. The Site in charge shall be provided with PCs and good communication facilities like telephone, email etc. at the cost and expense of the contractor. Lack of communication facilities will not be an excuse for extension of completion date.

1.10.9.5. 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.

1.10.9.6. 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.

1.10.9.7. 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.

1.10.9.8. 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.

1.10.9.9. 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.

1.10.9.10. 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.

1.10.10. DOCUMENTATION

1.10.10.1. 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

c. Details of T&P available with contractors with documents proofs.

1.10.10.2. The following information shall be furnished by the bidder after testing and inspection:

a. 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.

b. **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.

1.10.10.3. VOLUME-IA PART- II CHAPTER -4 of this booklet contains general guidelines for Erection and Commissioning of Illumination package.

VOLUME-IA PART –I CHAPTER –XI
FOUNDATIONS AND GROUTING

The scope of the work will comprise of but not limited to the following.

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified)

1.11.1.0	**FOUNDATIONS, GROUTING AND CIVIL WORKS**
1.11.1.1	**Deleted**
1.11.1.2	**For Road Crossing:** Cables wherever required shall pass through the hume pipes. Laying of hume pipes is excluded from the scope of the bidder. However, laying of cables through hume pipes of required length and closing the ends of hume pipes by suitable cover is in the scope of bidder. Any incidental materials required then and there shall be part of contractor's scope within the quoted rate. No extra payment will be made for materials to be arranged by contractor.
1.11.1.3	**For Underground Cabling:** Contractor has to make arrangement for cables which are to be laid underground as per drawing. Civil Works related to laying of Underground Cables are excluded from the scope of bidder. All materials required for Underground Cabling except cables shall be part of contractor's scope within the quoted rate. No extra payment will be made for materials to be arranged by contractor.
1.11.1.4	Cleaning of foundation surfaces, pocket holes and anchor bolt pits etc., de-watering, making them free of oil, grease, sand and other foreign materials by soda wash, water wash, compressed air or any other approved methods etc., form/shuttering work are within the scope this work.
1.11.1.5	The contractor at their cost shall arrange for grouting of foundation bolt holes of equipment as specified in the drawings / specification or as advised by the Engineer of BHEL after preparing the foundation top surface for grouting, All the materials for grouting (sand, gravel & cement including special Cement) shall be arranged by the contractor. The grouting has to be done up to basement level. The required consumables like Portland cement, gravel, sand etc., have to be provided by the contractor at their cost. If required, special cement like conbextra, GP1, GP2, PAGAL, shrinkomp etc., or its equivalent as approved by BHEL, shall be arranged by the contractor at their cost. It shall be the responsibility of the contractor to obtain prior approval of BHEL, regarding suppliers, type of grouting cements before procurement of grouting cements.
1.11.1.6	It shall be contractor's responsibility to check the various equipment foundations for their correctness with respect to level, orientation, dimensions etc., and ascertained dimensions shall be measured and submitted to BHEL for approval before erection. Also minor chipping, dressing of foundations up to 30 mm for

	obtaining proper face for packer plates/shims, and may be required for the erection of the equipment/plants will have to be carried out by the contractor without extra cost.
1.11.1.7	The surface of foundations shall be dressed to bring the surface of the foundations to the required level and smoothness prior to placement of equipment.
1.11.1.8	Foundation pockets are to be cleaned thoroughly before placing the equipment. Verticality of foundation bolts to be checked along with correctness of the threads and freeness of the nuts movement. If required cleaning of the threads to be done with proper dies.
1.11.1.9	The concrete foundation, surfaces shall be properly prepared by chipping, as required to bring the top of such foundation to the required level to provide the necessary roughness for bondage and to ensure enough bearing strength. All laitance and surface film shall be removed and cleaned and the packers placed with suitable mortar prior to erection of the equipment. Packer plates should not only be blue matched with foundation but also inter-packer contact surfaces between the packers and foundation frame etc., shall also be blue matched by Prussian Blue match checks and required percentage contact shall be achieved by chipping and scrapping as per BHEL Engineers instructions.
1.11.1.10	The certificates of the grout are to be submitted to BHEL. If necessary, test cubes are to be made and tested at site to ensure the quality of the grout as per relevant IS standards. In case grouting with Portland cement is approved, necessary cement, sand etc to be arranged by the contractor including the fine aggregates.
1.11.1.11	Certain packer plates and shims over and above the quantity received as part of supplies from manufacturing units of BHEL will have to be cut out from steel plates/sheets at site by the contractor to meet site requirement. However, machining of the packers, wherever necessary, will be arranged by BHEL at free of cost.
1.11.1.12	Shims and packer plates required for temporary use are to be arranged by the contractor within the quoted rate.
1.11.1.13	The contractor at their cost shall arrange for grouting of anchor points of T & Ps issued to them. Necessary grout materials are to be arranged by the contractor at their cost.
1.11.1.14	Works such as minor rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin etc. are covered in the scope of work.
1.11.1.15	Minor civil works like drilling, chipping and punching holes on slabs and brick-walls and grouting related to installation of Lighting Panels/LDBs/control panels, Junction boxes etc., shall be included in the erection cost of such items. No separate payment is applicable. The scope also includes supply of grouting

	material. More details regarding scope of civil are given in the respective equipment erection.
1.11.1.16	**Deleted**

VOLUME-IA PART –I CHAPTER -XII
MATERIAL HANDLING, TRANSPORTATION AND SITE STORAGE

The scope of the work will comprise of but not limited to the following:
(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

1.12.1.0	**COLLECTION OF BHEL SCOPE OF SUPPLY MATERIALS**
1.12.1.1	BHEL shall issue materials covered in BHEL scope from their stores at site. The contractor shall collect such materials from BHEL stores and transport to site of work at their cost.
1.12.1.2	The contractor shall inspect such materials as soon as received by the contractor and shall bring to the attention of the Engineer-in-Charge any shortage / damage or other defects noticed before taking over the materials. Materials once taken over will be deemed to have been received in good condition and in correct quantities except for intrinsic defects which cannot be observed by visual and dimensional inspection and weighing.
1.12.1.3	Upon receipt by the contractor the responsibility for any loss, damage and / or misuse of such materials shall rest with the contractor.
1.12.1.4	All materials issued by BHEL shall be properly stored and systematic records of receipts, issue and disposal will be maintained. Periodic inventory shall be made available to BHEL Engineer-in-Charge.
1.12.1.5	All materials issued by BHEL shall be utilized as directed by Engineer-in-Charge or most economically in the absence of such direction. The contractor shall be responsible for the return to BHEL Stores of all surplus material, as determined by the Engineer-in-Charge.
1.12.2.0	**STORAGE**
1.12.2.1	Materials shall be stacked neatly, preserved and stored in the contractor's shed/ work area in an orderly manner. In case it is necessary to shift and re-stack the materials kept at work area/ site to enable other agencies to carry out their work, same shall be done by the contractor at no extra cost.
1.12.2.2	The equipment should be preferably in its original package and should not be unpacked until it absolutely necessary for its installation. The equipment should be best protected in its cases. It should be arranged away from walls.
1.12.2.3	The wooden pallet provided for packing itself can be retained for raised platform to protect equipment from ground damps, sinking into around and to circulate air under the stored equipment. This will also help in lifting the packing with fork lift truck.
1.12.2.4	Periodic inspection of silica gel placed inside the equipment is necessary. It has to be replaced when de-colorization takes place. BHEL shall supply the silica gel and contractor shall replace.

1.12.2.5	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.
1.12.2.6	The storage room and the equipment should be checked at regular interval of three months to ensure protection from termites, mould growth, condensation of water etc. which can damage the equipment.
1.12.2.7	Contractor shall keep BHEL informed about such problem and try to rectify the problem at their cost.
1.12.2.8	All the instrument, 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 BHEL site Engineer.
1.12.2.9	Packing material shall be retained if the cubicle to be repacked after inspection
1.12.2.11	**Sub-Assemblies:** a. All sub-assemblies should be kept in a separate place where it is easily accessible. b. Sub-assemblies should have a protective cover in case it is stored without wooden packing / case to prevent accumulation of dust. Silica gel packets should also be kept along with it. c. Sub-assemblies should not be stacked one above the other.
1.12.2.12	**Loose items (wherever applicable):** The loose items supplied for the main equipment falls into various categories like tools, modules, prefabricated cables, console inserts, modules and display units, cable glands, cable ducts, frames are to be categorized and stored separately.
1.12.2.13	Sometimes it may become necessary for the contractor to handle certain unrequired components at Customer's / BHEL's stores in order to take out the required materials. The contractor has to take this contingency also into account. No extra payment is payable for such contingencies.
1.12.2.14	The contractor shall provide any fixtures, concrete blocks & wooden sleepers, which are required for temporary supporting / storage of the components at site.
1.12.2.15	Contractor has to arrange required fire resistant tarpaulins to protect the machined components / assembled parts drawn from BHEL before and after erection at their cost.
1.12.2.16	The contractor shall take delivery of item, materials and consumables from the storage yard / stores / sheds of BHEL / customer which are within a radius of 5 kms after getting approval of engineer / customer in the prescribed indent forms of BHEL / customer. He shall also make arrangements for safe custody, watch and ward of equipment after it has been handed over to them till they are fully erected, tested and commissioned.
1.12.2.17	Loading at BHEL / Customer stores and storage yard, transport to site, unloading at site / working area of equipment placement on respective foundation/location, fabrication yard, pre-assembly bay or at working area are in the scope of work. The scope includes taking materials / Equipment from customer stores / storage yard also. Contractors Quoted / Accepted rate shall

	be inclusive of the same. Required cranes, tractors, trailer or trucks / slings / tools and tackles / labour including operators, Fuel lubricants etc for loading & unloading of materials will be in the scope of contractor.
1.12.2.18	The equipment / materials from the storage yard shall be moved in sequence 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.

VOLUME-IA PART – I CHAPTER- XIII
SCOPE OF WORKS-DETAILED

1.13.1.0	**DETAILED SCOPE OF ILLUMINATION WORK**
1.13.1.1	Receipt from BHEL stores, handling, unpacking, storing and preservation of all lighting equipment as specified by BHEL at site and Erection, testing, commissioning including performance measurement of complete lighting, low voltage power services for the power station. Please refer relevant chapters for the area of Illumination works elsewhere in the specification.
1.13.1.2	Erection and commissioning of BHEL supplied all the Lightings and fixtures along with LDBs, poles, panels, junction boxes, saddles, clamps, fittings, conduit boxes, cables, wires and conduits, Fabrication and erection supporting structures as applicable for the package. However, bidder scope of supply includes all the consumables other than the items indicated in Weight Schedule/BOQ (Volume – IA, Part-I, Chapter – IX) and incidental materials required for the completion of the package for successful operation and to the satisfaction of BHEL/Customer. Deployment of skilled / unskilled manpower, engineers/ supervisors, T &P, Material handling equipment, testing instruments, returning of un-used materials / items to stores are also covered in the scope of works.
1.13.1.3	Laying & termination of Power cables from lighting distribution boards LDBs to lighting panels (LPs), LDBs to street lighting panel, street lighting panels to poles (including underground cabling) and control cables from LDBs to remote street lighting control panel which will be supplied by BHEL as free issue to contractor.
1.13.1.4	Fabrication and Erection of supporting structural steel i.e. angles, channels etc. are also to be covered in the quoted rate. During contract stage contractors has to furnish total requirement for structural steel.
1.13.1.5	All tools & tackles/tools and plants, ladders, testing equipment etc. required for erection, testing & commissioning of complete lighting system are to be arranged by the bidder.
1.13.1.6	The entire work shall be carried out in accordance with specified installation instruction, manufacturer's recommendations, BHEL's approved drawings and/or as directed by the BHEL. Manufacturer' drawings and instructions shall be correctly followed in handling setting, testing and commissioning of all equipment and care shall be taken in handling to avoid distortion to structures, marring of finished surface, damage to delicate instruments etc. The equipment shall be installed in a neat workmanship like manner.

1.13.1.7	The erection work shall conform to latest applicable Indian standards, codes and practices, Electricity rules, fire insurance regulations and safety regulations of the locality where the equipment will be installed.	
1.13.2.0	**CODES AND STANDARDS for reference**	
	I. Electrical installation practices & miscellaneous	
	IS: 5	Colour for ready mixed paints 2 enamels.
	IS: 1293	3 Pin, Plug & Socket Outlets.
	IS: 226	Structural steel (standard quality).
	IS: 2509	Rigid non-metallic conduits for electric wire.
	IS: 371	Ceiling roses
	IS: 3854	Switches for domestic and similar purposes.
	IS : 5216	Guide for safety procedures and practices in Electrical Installation Practices & Miscellaneous electrical work.
	IS: 1913	General and safety requirements for electric lighting fittings.
	IS: 3419	Fittings for rigid non-metallic conduit.
	IS: 732	Code of practice for Electrical Wiring installation (System Voltage not exceeding 650V).
	IS: 3646	Code of practice for interior illumination part I, II & III.
	IS: 1944	Code of practice for lighting of public thorough forces.
	IS: 3106	Code of practice for selection of installation and maintenance of fuses. (Voltage not exceeding 650V).
	IS: 4615	Switch socket out let (Non-locking).
	IS: 5571	Guide for selection of electrical equipment for hazardous areas.
	IS: 5572	Classification of hazardous areas electrical installation
	IS: 800	Code of practice for use of structural steel in general building construction
	IS: 2633	Method of testing uniformity of coating in zinc plated articles
	IS: 6005	Code of practice for phosphating of form & steel
	IS: 3043	Code of practice for earthing
	II. Indian Electricity Act and Rules	
	IS: 6665	Code of practice for industrial lighting
	IS: 458	Specification for concrete pipes
	III. Fire Insurance Regulations Rule no. 35, 48, 49, 50, 61 & 64 of Indian Electricity Rule with amendment-3 rules 1986	
	IV. Regulations laid down by the chief Electrical Inspector of the State	

1.13.3.0	**GUIDELINES FOR LIGHTING SYSTEM ERECTION WORK.**
1.13.1.10	**GENERAL**
1.13.1.11	The contractor shall provide holes or openings in walls and floors that are required for routing the conduits wherever required within the quoted rate. Closure of the openings, holes by suitable packing materials shall be in the scope of bidder. No separate payment will be made for Supply of packing materials, packing, closure & finishing of holes. All shall be included within the quoted rate.
1.13.1.12	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.
1.13.1.13	All items shall be checked for its good condition and tested for its operation before erection as per FQP. If any item is found defective before erection due to manufacturing, then it shall be supplied by BHEL and the same shall be erected by the contractor within the quoted rates. A suitable test set up is required for testing.
1.13.1.14	The contractor shall note that for any change in the location with respect to the released drawings for 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.
1.13.1.15	Any modification work required by BHEL 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 to design change shall be treated as extra work.
1.13.1.16	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 BHEL will have the right to carry out the cleaning operation and any expenditure incurred in this regard will be to the contractor account.
1.13.1.17	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.

1.13.1.18	The scope of painting includes application of colour bans, lettering the names of the systems, equipment; tag nos (as applicable), panel name/number, circuit number and other data required by BHEL within the quoted rate.
	LIGHTING FIXTURES AND ACCESSORIES.
1.13.1.20	Fixtures shall be mounted to maintain sufficient clearance from the overhead travelling crane trolley (wherever applicable).
1.13.1.21	In FGD Scrubber galleries, mounting height of fixtures shall be about 2500 mm from platforms except shown otherwise. Bracket for fixture mounting shall be fabricated at site by using suitable conduits with a reducing socket to suit the fixtures and clamped on to the handrails. The fixing shall be strong enough to withstand vibration and high wind velocity. If a roof over platform is available, the fixture can be pendant mounted.
1.13.2.0	Floodlights shall be mounted on steel base facing the tentative direction shown on drawings. Fixing holes shall be provided with slot to turn the fixture about 5 Deg on both sides. Bolts shall be finally tightened with spring washer. BHEL will supply the steel base and contractor has to install the same for fixing the flood light on the flood light structures. Terminal connection to the floodlight shall be made through PVC coated flexible metallic conduits.
1.13.2.1	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. 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.
1.13.2.2	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 BHEL approval.

1.13.2.3	The bracket for mounting the lighting fixtures on boiler platforms shall be fabricated at site (as per the typical drg) using suitable GI conduit with a reducing socket to suit the fixture and clamped to the handrails. 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).
1.13.2.4	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 structural steel or form ceiling and not by the false ceiling board. The arrangement shall be installed as per the approved fixture mounting arrangement drawings.
1.13.2.5	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.
1.13.2.6	To distinguish emergency AC fixtures from normal AC fixtures, red painted circular mark of 1 cm dia. shall be provided on emergency fixtures.
1.13.2.7	The self-contained emergency lighting fixtures shall be installed in required areas using Mounting brackets.
	LIGHTING DISTRIBUTION BOARD AND LIGHTING PANELS.
1.13.2.9	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.
1.13.2.10	Suitable Space provision for LDB mounting on floor would be made by the BHEL. The contractor shall supply necessary foundation bolts and do the grouting to fix up the LDBs.
1.13.2.11	LPs shall be installed by fastening to studs of not less than 12 mm dia. which will be suitably grouted/welded to the wall/column by the contractor.
1.13.2.12	Unless specifically noted otherwise on the drawings the height of the centre line of lighting panels from the floor shall be 1200 mm.
1.13.2.13	**LIGHTING CONTROL SWITCH BOXES & RECEPTACLE BOXES.**
1.13.2.14	The tentative locations of switch/receptacle boxes will be as per the drawings. The exact location shall be finalised by the contractor in consultation with the BHEL Site engineer at site.
1.13.2.15	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. Unless Otherwise noted on the drawings the mounting height of switch/receptacle boxes shall be as follows. a. Lighting Control switch boxes - 1500 mm. b. Receptacle boxes 500 mm for indoor and 900 mm for outdoor locations.
1.13.2.16	**CONDUITS AND ACCESSORIES**

1.13.2.17	Conduits will be heavy-duty type hot dip galvanised steel conforming to IS-9537. Conduit accessories will be hot dip galvanised. In corrosive area, conduits will have suitable epoxy coating additionally.
1.13.2.18	Flexible conduits made with bright, cold rolled annealed and electro galvanised mild steel strips and coated with PVC will be used wherever required.
1.13.2.19	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 for better aesthetics.
1.13.2.20	Conduit shall run along wall, floor, ceiling, on steel structures, embedded in wall, floor, for ceiling, in accordance with relevant layout drawings. 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. Conduits supports shall be provided at an interval of 750 mm for horizontal runs and 1000 mm vertical runs
1.13.2.21	Conduit shall be clamped on to 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 / screwing and to concrete or brick work by grouting or by nylon rawl plugs.
1.13.2.22	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.
1.13.2.23	Spacing of embedded conduits shall be such as to permit flow of concrete between them and in no case shall be less then 40mm.
1.13.2.24	Where conduits are along cable trays provided by BHEL, they shall be clamped to supporting steel at an interval of 600 mm.
1.13.2.25	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.
1.13.2.26	Conduits shall be installed in such a way as to ensure against trouble from trapped condensation.
1.13.2.27	The contractor shall be made 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.
1.13.2.28	Conduits shall be kept, wherever possible, at least 300 mm away from hot pipes, heating devices etc.
1.13.2.29	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

<table>
<tr><td>1.13.2.30</td><td>For long conduit runs junction/pull boxes shall be provided at suitable intervals (not exceeding 10 m) to facilitate wiring.</td></tr>
<tr><td>1.13.2.31</td><td>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 termination’s shall be made water & vermin proof.</td></tr>
<tr><td>1.13.2.32</td><td>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.</td></tr>
<tr><td>1.13.3.0</td><td>Conduits lengths shall be jointed connection and shall be made thoroughly water-tight and rust-proof by application of a thread compound which will not insulate the joints. White lead will be used for embedded conduit and red lead for exposed conduit.</td></tr>
<tr><td>1.13.3.1</td><td>For Fuel Oil Pump House, Battery Rooms, Chemical House, Water treatment plants, Gas Chlorination plant, etc lighting installations shall be made with epoxy coated steel conduits and accessories.</td></tr>
<tr><td>1.13.3.2</td><td>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 used for this purpose.</td></tr>
<tr><td>1.13.3.3</td><td>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.</td></tr>
<tr><td>1.13.3.4</td><td>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.</td></tr>
<tr><td>1.13.3.5</td><td>After installation, the conduits shall be thoroughly cleaned by compressed air before pulling the wire.</td></tr>
<tr><td>1.13.3.6</td><td>French chalk shall be used before pulling the wires. Fish wire shall be used during conduit installation.</td></tr>
<tr><td>1.13.3.7</td><td>Lighting fixtures shall not be suspended directly from the junction box in the main conduit run.</td></tr>
<tr><td>1.13.3.8</td><td>All lighting wires shall be run inside the conduit. Size of conduit shall be selected as per the table given below.
<table>
<tr><th rowspan="2">Size of wire</th><th colspan="2">Maximum Number of wires in</th></tr>
<tr><th>20 mm Conduit</th><th>25 mm Conduit</th></tr>
<tr><td>1.5 Sq.mm</td><td>4</td><td></td></tr>
<tr><td>2.5 Sq.mm</td><td>4</td><td>6</td></tr>
</table></td></tr>
<tr><td>1.13.4.0</td><td>Filling of wires in conduit shall not exceed 40% of the conduit area.</td></tr>
</table>

1.13.4.1	Lighting and receptacles will be fed from separate circuits. No two different phase circuits will be run in the same conduit. However, different circuits of same phase may be laid in the same conduit.
1.13.5.0	Maximum 03 numbers of 1-phase receptacles will be loop in & loop out in a circuit.
1.13.5.1	**LIGHTING WIRES**
1.13.5.2	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).
1.13.5.3	All wires in a conduit shall be drawn simultaneously. No subsequent drawing is permissible.
1.13.5.4	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.
1.13.5.5	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.
1.13.5.6	A.C. normal, A.C. emergency and D.C. emergency system wiring shall run throughout in separate conduits.
1.13.5.7	Wiring shall be spliced only at junction boxes. Maximum two wires shall be connected at each terminal.
1.13.5.8	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.
1.13.5.9	All lighting wires shall be crimped using suitable type of solderless, crimping, tinned fork type copper lugs. The lugs shall be supplied within the quoted rates.
1.13.5.10	**JUNCTION BOXES**
1.13.5.11	Junction boxes having volume upto 1600 cubic centimeter may be installed without any support other than that resulting from connecting conduits where two or more rigid metallic conduits enter and accurately position the box. Boxes shall be installed so that they are levelled, properly aligned and present a pleasing appearance. Boxes with volumes greater than 1600 cubic cm. or for other reasons not rigidly held, shall be adequately supported. The contractor shall perform all drilling, cutting, welding, shimming and bolting required for attachment to supports.
1.13.5.12	Necessary holes for conduit/cable entry shall be done during installation depending on the requirement. The holes shall be drilled/punched neatly and shall be dust/vermin proof after installation of the conduit.
1.13.5.13	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).

1.13.5.14	**STREET LIGHTING/FLOOD LIGHTING POLES INSTALLATION**
1.13.5.15	The lighting poles and lighting Tower shall be erected by the contractor at locations shown in the street lighting layout. Installation of necessary wiring/ cabling including underground cabling as required, junction/ switch box and mounting of assembled fittings. All the above erection work shall be done by contractor for lighting masts including making of foundations. For loop-in-loop out, the cables from trench to junction box, shall run through the conduits.
1.13.5.16	The lighting poles shall be painted with two coats of aluminium paint after completion of installation or as specified by BHEL.
1.13.6.0	The flood light fixtures shall be mounted on galvanised M.S. base making use of shop drilled holes or by suitable clamps. No cutting or drilling of galvanised structure is permitted.
1.13.6.1	Each lighting poles and lighting/lightning mast junction box shall be earthed by 25X3 mm GS flat bonded to one (1) 20 mm dia MS earth electrode of 3 meter length driven vertically in the ground. 16 SWG GI wire shall be taken from fixture to JB.
1.13.6.2	**EARTHING OF LIGHTING SYSTEM**
1.13.6.3	All junction boxes, receptacles, switch boxes, lighting fixtures, conduits, glands etc. shall be earthed in compliance with the provision of I.E. rules and applicable Indian Standard amended upto date.
1.13.6.4	A continuous earth conductor of 16 SWG G.I. wire shall be run all along each conduit run and bonded at every 600 mm by not less than two turns of the same size of wires. This conductor shall be connected to the earth bus of lighting panel from which the conduits originate. All junction boxes, receptacles, lighting fixtures etc. shall be connected to this 16 SWG GI earth conductor. All lighting panels and LDBs shall be earthed by GI flats to the BHELs earthing bus.
1.13.6.5	Masts shall be earthed in the earthpits. Poles shall be earthed by earthrod (or) earthwire as directed by BHEL-Site Engineer.
1.13.6.6	**CEILING FANS AND REGULATORS**
1.13.6.7	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.
1.13.6.8	The fan regulators shall be flush mounted on the lighting control switch boxes provided in that area.
1.13.6.9	Hook/Anchor fasteners, rubber bush, if required, shall be arranged by contractor for mounting the ceiling fan within the quoted rate.
1.13.6.10	**CABLING WORK:**

<table>
<tr><td>1.13.6.11</td><td>BHEL will supply necessary cables, wires and glands required for the system as per the specification & the bidder shall have to lay & terminate the same. This shall include all clamping, fixing, drilling, cutting, glanding, lugging, connecting to terminal blocks, grounding, etc. as required to complete the job. Cost of all consumable materials required for cable laying & cable termination shall be included within the quoted rate.</td></tr>
<tr><td>1.13.6.12</td><td>Bidder shall supply all necessary lugs required for cable termination carried out by them. Size of lugs shall be as per the size of the cables issued for installation.</td></tr>
<tr><td>1.13.7.0</td><td>Cable lugs shall be tinned copper, solderless crimping type, conforming to IS:8309 suitable for Al or Cu conductors. Crimping of terminals shall be done by using corrosion inhibitory compound.</td></tr>
<tr><td>1.13.7.1</td><td>All cable entry points shall be sealed & made vermin & dust proof. Unused opening shall be effectively closed.</td></tr>
<tr><td>1.13.7.2</td><td>Cables shall be laid in owner's trays wherever available. In areas, where owners trays are not available, cable shall be clamped to the structures or laid in conduit or buried depending on the area.</td></tr>
<tr><td>1.13.7.3</td><td>Each cable shall be tagged with the cable no. as per cable schedule. The tag shall be of rectangular shape & attached to the cable by not less than two turns of 16 SWG GI wire. Cable tag shall be provided at each end of the cable before entering the equipment enclosure, on both sides of wall or floor crossing and every 30 meter of cable runs.</td></tr>
<tr><td>1.13.7.4</td><td>Minimum bending radius for the cables shall not be less than 12D, where D is the overall dia of the cable.</td></tr>
<tr><td>1.13.7.5</td><td>Following sizes of 1100 V grade, PVC insulated, Single core, stranded copper conductor wires will be used unless otherwise stated.
<table>
<tr><th>Equipment</th><th>Size of Cables</th></tr>
<tr><td>Lighting panel to JBs/Switches</td><td>6.0 sq.mm (Cu)</td></tr>
<tr><td>JBs/Switches to Fixtures</td><td>2.5 sq.mm (Cu)</td></tr>
<tr><td>Panel to First receptacles</td><td>4.0 sq.mm (Cu)</td></tr>
<tr><td>First receptacles to looping other receptacles</td><td>4.0 sq.mm (Cu)</td></tr>
<tr><td>Panel/JBs to flood light fixtures</td><td>2.5 sq.mm (Cu)</td></tr>
<tr><td>Wiring in hazardous area, Transformer yard</td><td>3C-2.5 sq.mm (Cu), XLPE,FRLS PVC sheathed, Armoured</td></tr>
<tr><td>Boiler & ESP platforms</td><td>2C/3C-2.5 sq.mm (Cu) with conduit</td></tr>
</table></td></tr>
<tr><td>1.13.7.6</td><td>Contractor shall thoroughly test and megger all cables, wires and equipment to prove that the same are free from ground and short circuit.</td></tr>
<tr><td>1.13.7.7</td><td>If any ground or short circuit is found, the fault shall be rectified or the cable and/or equipment replaced.</td></tr>
<tr><td>1.13.7.8</td><td>Cables Laying Direct in Ground: Cables shall be laid in the middle of the trench on a bedding of minimum 75 mm riddled soil or sand at the bottom of</td></tr>
</table>

	the trench, and covering it with additional riddled soil or sand of minimum 75 mm and protecting by means of tiles, bricks or slabs as indicated in the drawing. Please refer the attached drawing for Underground cabling.
1.13.8.0	**MINIMUM DEPTH OF LAYING:** Min depth of laying from ground surface to the top of cable shall be as follows: 1. Low Voltage Power and Control Cables: 0.75 m 2. Cables at Road crossings: 1.00 m (min)
1.13.8.1	**CLEARANCES**: a. Power cable to Power Cable: Clearance not necessary; however, larger the clearance, better would be current carrying capacity. b. Power cable to Control Cables: 0.2 m c. Power cable to Communication cables: 0.3 m d. Power cable to gas/water main: 0.3 m
1.13.8.2	**TESTING OF CABLES:** a. The contractor shall submit to the Engineer a checklist for testing and commissioning and the activities shall be carried out in accordance with the checklist. b. Testing and electrical measurement of cable installations shall conform to IS : 1255 c. Prior to installation, cables shall be tested for : I. Continuity of conductors II. Insulation resistance between conductors & earth III. Insulation resistance between conductors. d. After installation cables shall be tested for : I. Insulation resistance between conductors & iron II. Insulation resistance between conductors & earth III. Conductor resistance IV. Capacitance between conductors & earth (for cables above 7C, 1.1 kV grade) V. DC high voltage test (for LT power cables of higher sizes VI. interconnecting PCCs & MCC) VII. Absence of cross phasing VIII. Firmness of terminations
1.13.8.3	**STEEL/PIPE/FLAT FABRICATION**
1.13.8.4	The steel structures supplied shall be fabricated by the contractor to the 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.
1.13.8.5	The welds shall be wire brushed or cleaned otherwise. The holes shall be touched up with metal primer.
1.13.8.6	All steel fabrications shall be painted with two coats of metal primer and oxide paint followed by two coats of aluminium paint.

1.13.8.7	The pipes & Flats MS/GI supplied shall be fabricated by the contractor to the required shape as per the drawing (or) as required. The fabricated material shall be free from defects, kinks, cleaned of rust, grease, oil etc,. and sharp edges shall be removed.
1.13.8.8	**CUTTING & WASTAGE ALLOWANCES:**
1.13.8.9	Contractor shall carefully plan cutting schedule of each cable drum, conduit, lighting wires, GI wires such that wastages are minimised and any resultant short length can be used where appropriate route length are available. The following wastage's allowances are permissible for various materials.
1.13.9.0	**Wastage Allowances:** **Material** / **Allowance permitted** Support Installation — 1% by weight Structural Steel — 2% Cable Tray/Conduits — 2% HT/LT Cables & wires — 1% Control Instrumentation Cable — 2% Earth flats — 2% Any wastage generated by the vendor in excess of the allowable percentage shall be charged at the penal rates decided by the site engineer whose decision shall be final and binding on the vendor. **Note:** Usable length shall be returned to BHEL. Minimum wastage length is to be decided in consultant with site engineers.
1.13.9.1	**SPECIFIC TECHNICAL REQUIREMENTS FOR BIDDER SUPPLY ITEMS** 1. Ferrules / Fire stop cable sealing system / tags: 2. Tag i. Material: Aluminium / Fiber / Stainless Steel ii. Markings: Engraving / Embossing / Printing iii. Size : As required 3. Cable lugs of size 2.5 Sqmm and below: Copper (crimping type) 4. Anchor fasteners for JBs, etc: As required 5. Insulation tapes: As required. 6. Solder wire (Lead) -(60/40): As required 7. Panel sealing compound material (for cable entry from bottom / top of Panel): As required 8. Materials required for cable dressing. (GI / aluminum flats, PVC ties etc). 9. PVC wire marker sleeves and Tag plates 10. Welding electrodes, filler wires, gases etc 11. Metallic clamps for flexible and rigid conduits

1.13.9.2	**FERRULES:** a. Ferrules shall be required for individual core of cable hence they shall be suitable for the insulated conductor diameter. b. Ferrules shall be of plastic material. c. Numbering on the ferrules shall be engraved type with contrast colour to the base. Engrave colouring shall be of durable quality to match the entire life of the plant. Engraving shall be legible from a distance of 600 mm. d. Ferrules shall be interlocking type in such a way that the interlocked ferrules take the shape of tube with complete ferrule number appearing in a straight line.
1.13.10.0	**TAGS:** a. Cables shall be provided with cable number tags for identification. b. Cable tags shall be of durable fibre, aluminium or stainless steel sheets. c. Cable number shall be engraved type in case of aluminium or stainless steel tags, and printed type in case of fibre sheet. d. Tags shall be durable quality of size 60mm x 12mm with holes at both ends. e. Samples of tags shall be approved by BHEL Engineer before delivery. f. Tags shall be provided with non-corrosive wire of sufficient strength for taggings.
1.13.10.1	**FIRE STOP CABLE SEALING SYSTEM:** a. Fire stop cable sealing system shall have two (2) hours fire protection rating suitable for sealing both vertical & horizontal cable penetrations. The sealing compound in conjunction with mineral wool shall form effective fire seals. The sealing compound shall have special property to allow for short circuit conditions. b. "GPG fire stop sealing compo" or equivalent sealing compound shall be used.
1.13.10.2	**QUANTITY MEASUREMENT:**
1.13.10.3	For all payment purpose, measurement shall be made on physical measurements. Physical measurements shall be made by the contractor in the presence of the site engineer/BHEL.
1.13.10.4	The measurement of cable laying shall be made on the basis of length actually laid from lug to lug including that of loops provided.
1.13.10.5	In the measurement of conduits, the Qty of wires and earthing wires will not be included.
1.13.10.6	The E & C cost of lighting wires and earthing wires shall be included in the E & C cost of conduits. No separate cost of erection of lighting wires and earthing wires shall be paid.

1.13.11.0	The accountable wastage to be returned to BHEL's store in good condition and as directed by site engineer.
1.13.11.1	Measuring of each item in the BOQ
1.13.11.2	Contractor to make a protocol in consultation with site engineer and customer's representative for erection, testing & commissioning of all lighting equipment.
1.13.11.3	**TESTING & INSPECTION AT CONTRACTOR'S WORKS**
1.13.11.4	Field quality plan (FQP) for quality checks to be observed at site during erection, testing & commissioning.
1.13.11.5	**TESTING AND COMMISSIONING**
1.13.11.6	On completion of erection work, the contractor shall request the site engineer for inspection and test.
1.13.12.0	The site engineer shall arrange for joint inspection of the installation by BHEL's and customer's representative for completeness and correctness of the work. Any defect pointed out during such inspection shall be promptly rectified by the contractor.
1.13.12.1	The installation shall be then tested and commissioned in presence of the site Engineer & customer's representative.
1.13.12.2	The contractor shall provide all men, material and equipment required to carry out the tests.
1.13.12.3	All rectification's, repairs or adjustment work found necessary during inspection, testing and commissioning shall be carried out by the contractor without any extra cost. The handing over of the lighting installation shall be effected only after the receipt of written instruction from the site engineers/ customer.
1.13.12.4	The testing shall be done in accordance with the applicable Indian standards and codes of practice. The following tests shall be specifically carried out for all lighting installation. a. Insulation resistance b. Testing of earth continuity path c. Polarity test of single phase switches.
1.13.12.5	The lighting circuits shall be tested in the following manner. i) All switches ON and consuming devices in circuit, both poles connected together, to obtain resistance to earth. ii) Insulation resistance between poles with lamps and other consuming devices removed and switches ON
1.13.12.6	**PERFORMANCE TESTING:**
1.13.12.7	Contractor has to measure the lux level available in the specified rooms/offices/areas using **suitable** calibrated lux meter/light meter. The final reading shall be recorded in the format.

1.13.12.8	BHEL will furnish the luminous Intensity of level of the Lighting Luminaires and the overall lux level required for the identified areas.
1.13.12.9	Contractor has to measure the Lux level of the areas to establish the performance of the Lighting Luminaires.
1.13.13.0	Contractor has to hold the Lux meter/light meter at minimum 5 surface locations in the area to be measured at a distance of 1 m (height) above the ground level. During measurement the light sensor has to be kept upward, facing the Lighting Luminaire. The average of all readings shall be the lux level available in the room/area.
1.13.13.1	The lux meter shall have a sensor and display and shall be of digital type. The lux meter shall be a calibrated instrument. The range of the meter shall be wide enough to measure different lux level as specified by BHEL.
1.13.13.2	**DRAWINGS/ DOCUMENTS:**
1.13.13.3	Mounting Drawings: Refer the attached Typical drawings.
1.13.13.4	**STATUTORY AND REGULATORY REQUIREMENTS**
1.13.13.5	Statutory and regulatory regulation shall be applicable as per Indian Electricity Rule, 1956 with amendment-3 Rule No. 35, 48, 49, 50, 61 & 64 for illumination & low voltage power services.
1.13.13.6	**PRICES**
1.13.14.0	The contractor shall quote their prices for erection, testing & commissioning of complete lighting system as per the pricing format attached with the specification.
1.13.14.1	Unit price quoted for erection, testing & commissioning of items listed under B O Q shall be deemed to have been included the prices for the T&Ps, consumables, manpower, statutory approvals if any, and other relevant clauses of this specification for various lighting equipment.

VOLUME-IA PART-I CHAPTER-XIV
PROGRESS OF WORK

1.14.0.0	**PROGRESS OF WORK**
1.14.1.0	Deleted
1.14.2.0	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 program.
1.14.3.0	It is the responsibility of the contractor to provide all relevant information on a regular basis regarding erection progress, labour availability, equipment deployment, testing, etc.
1.14.4.0	During the course of erection, if the progress is found unsatisfactory, or if the target dates fixed from time to time for every milestone are to be advanced, or in the opinion of BHEL, if it is found that the skilled workmen like fitters, operators, technicians employed are not sufficient BHEL will induct required additional workmen to improve the progress and recover all charges incurred on this account including all expenses together with BHEL overheads from contractor's bills.
1.14.5.0	Contractor is required to draw mutually agreed monthly erection 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.
1.14.6.0	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 their 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 non-conformities.
1.14.7.0	The contractor shall maintain a record in the format as prescribed by BHEL of all operations carried out on each weld and maintain a record indicating the number of welds, the names of welders who welded the same, date and time of start and completion, preheat temperature, radiographic results, rejection if any, percentage of rejection etc. and submit copies of the same to the BHEL Engineer as required.

1.14.8.0	The contractor shall submit daily, weekly and monthly progress reports, manpower reports, materials reports, consumables (gases / electrodes / ferrules / lugs) report, cranes availability report and other reports as per Performa considered necessary by the Engineer as per the BHEL formats.
1.14.9.0	The contractor shall submit weekly / fortnightly / monthly statement report regarding consumption of all consumables for cost analysis purpose.
1.14.10.0	The manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.
1.14.11.0	The monthly report shall be submitted at the end of every month as a booklet and shall contain the following details :- a. Colour photographs of the works progress. b. Erection progress in terms of tonnage, percentage of work completion, welding joints, radiography, stress relieving, etc., completed as relevant to 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. Category- wise man hours engaged during the previous month under the categories of fitters, welders, riggers, khalasis, grinder-men, gas-cutters, electricians, crane operations, store keepers, lab technicians, helpers, security etc. Data shall be split up under the work areas like Boiler (pressure parts, structures) Rotating machines, Electro static precipitator, Insulation, Piping, Steam turbine, Condenser, Generator etc. e. Consumables report giving consumption of all types of gases and electrodes during the previous month. f. Availability report of cranes & T&Ps g. Safety implementation report in the format h. Pending material and any other inputs required from BHEL for activities planned during the subsequent month
1.14.12.0	The contractor to reflect actual progress achieved during the month and will be submitted to BHEL, so that slippages can be observed and necessary action taken in order to ensure that the situation does not get out of control will update the construction schedule forming part of this contract each month.

VOLUME-IA PART - I CHAPTER- XV
TESTING AND COMMISSIONING

The scope of the work will comprise of but not limited to the following:
(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

<table>
<tr><td>1.15.1</td><td>VOID</td></tr>
<tr><td>1.15.2.1</td><td>TESTING, PRE – COMMISSIONING & COMMISSIONING AND POST COMMISSIONING (All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)</td></tr>
<tr><td>1.15.2.2</td><td>Contractor has to safely receive the items from BHEL store and test them as advised by BHEL Site Engineer before erection in the respective area.</td></tr>
<tr><td>1.15.2.3</td><td>The mobilization of testing team shall be planned in time and shall be undertaken round the clock. Contractor shall discuss on day to day / weekly / monthly basis the requirement of testing 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 the cost will be recovered from contractor.</td></tr>
<tr><td>1.15.2.4</td><td>Prior to commissioning and after commissioning, protocols have to be made with BHEL / Customer. The formats will be given by BHEL and have to be printed by the contractor in adequate numbers. It shall be specifically noted that above personnel of the contractor may have to work round the clock along with BHEL commissioning engineers which may involve over time payment which forms part of Contractors Scope.</td></tr>
<tr><td>1.15.2.5</td><td>Any rework / rectification / modification is required to be done because of contractor's faulty erection, which is noticed during commissioning at any stage, the same has to be rectified by the contractor at their cost. During commissioning, any improvement rework / rectification / modification due to design improvement / requirement is involved, the same shall be carried out promptly and expeditiously. Claims if any, for such works from the contractor shall be governed by clauses covered elsewhere.</td></tr>
<tr><td>1.15.2.6</td><td>Minimum requirement of Man Power for testing/checking works shall be as follows: (Requirement given below is per package):
Illumination Package:
<table>
<tr><th></th><th>Package</th><th>CABLING</th></tr>
<tr><td>Engineer</td><td>2</td><td>2</td></tr>
<tr><td>Supervisor</td><td>3</td><td>2</td></tr>
<tr><td>Technician</td><td>6</td><td>6</td></tr>
</table>
The above testing / checking group shall be identified at the Pre-commissioning time. The above commissioning group shall have the knowledge of various</td></tr>
</table>

	systems referred in the tender and possess adequate experience in testing. The above manpower for commissioning is only tentative and if any additional manpower required as per site requirement, the same shall be arranged by the contractor. If the contractor fails to deploy the above Engineer / Supervisor / Technician at appropriate time of commissioning, no payment shall be made against commissioning activities as per terms of payment.
1.15.2.7	All T&P / instruments required for testing are to be arranged by the contractor.
1.15.2.8	All testing activities shall be carried out as per relevant standard, code of practice, manufacturer's instructions and BHEL norms. The contractor shall follow the checklist of BHEL prior to taking up testing & commissioning activities and the activities shall be carried out in accordance with the checklist. All the above will be witnessed by BHEL engineer and the reports signed jointly.
1.15.2.9	It shall be specifically noted that the contractor and employees of the contractor may have to work round the clock during the pre-commissioning, commissioning and post-commissioning period along with BHEL Engineers / customer officials. Hence contractor's quoted rate shall take into consideration of all expenses that will be incurred for such arrangement of personnel including engineers/supervisors.
1.15.2.10	In case, any rework is required because of contractor's faulty erection, which is noticed during pre-commissioning and commissioning, the same has to be rectified by the contractor at their cost. If any equipment / part are required to be inspected during pre-commissioning and commissioning, the contractor will dismantle / open up the equipment / part and reassemble / redo the work without any extra claim.
1.15.2.11	During commissioning any improvement / repair / rework / rectification / fabrication / modification due to design improvement / requirement is involved, the same shall be carried out by the contractor promptly and expeditiously.
1.15.2.12	The contractor shall carryout any other test not listed in the tender as desired by BHEL Engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning, commissioning, and operation, to demonstrate the completion of any part or whole work performed by the contractor.
1.15.2.13	It is the responsibility of the contractor to provide necessary manpower, tools, tackles and consumable till the completion of work under these specifications including for trial operation, even if commissioning of equipment is delayed due to reasons not attributable to the contractor. Association of BHEL's / Client's staff during above period will not absolve contractor from above responsibilities.
1.15.2.14	It shall be specifically noted that the contractor and employees of the contractor may have to work round the clock during the pre-commissioning, commissioning and post-commissioning period along with BHEL Engineers / customer officials. Hence contractor's quoted rate shall take into consideration

	of all expenses that will be incurred for such arrangement of personnel including engineers/supervisors.
1.15.2.15	In case, any rework is required because of contractor's faulty erection, which is noticed during pre-commissioning and commissioning, the same has to be rectified by the contractor at their cost. If any equipment / part are required to be inspected during pre-commissioning and commissioning, the contractor will dismantle / open up the equipment / part and reassemble / redo the work without any extra claim.
1.15.2.16	The contractor shall carryout any other test as desired by BHEL Engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning, commissioning, and operation, to demonstrate the completion of any part or whole work performed by the contractor.
1.15.2.17	Contractor to provide necessary commissioning assistance from pre-commissioning state onwards and up to continuous operation of the unit & handing over to customer. The category of personnel to be as per site requirement and to meet the various pre-commissioning and commissioning programs made to achieve the schedule agreed with customer.
1.15.2.18	During commissioning any improvement / repair / rework / rectification / fabrication / modification due to design improvement / requirement is involved, the same shall be carried out by the contractor promptly and expeditiously.
1.15.2.19	The contractor shall carryout any other test not listed in the tender as desired by BHEL Engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning, commissioning, and operation, to demonstrate the completion of any part or whole work performed by the contractor.
1.15.2.20	It is the responsibility of the contractor to provide necessary manpower, tools, tackles and consumable till the completion of work under these specifications including for trial operation, even if commissioning of equipment is delayed due to reasons not attributable to the contractor.

VOLUME-IA PART- I CHAPTER-XVI
PAINTING

1.16.0.0	**PAINTING**
1.16.1.0	FINAL PAINTING **The scope of the work will comprise of but not limited to the following:**
1.16.1.1	The scope of work shall also include application of final painting of all the structures, Poles and Masts, etc. which forms the part of this tender book.
1.16.1.2	The scope of painting generally includes painting of all steel items such as supports, racks, frames, etc. carried out by the contractor.
1.16.1.3	The scope also includes supply of Paints, Primers, Aluminium paint, tools/consumables like brushes, rollers, emery papers, thinner etc., at no additional cost.
1.16.1.4	In the case of steel fabricated items, raw steel after fabrication has to be surface cleaned and subsequent painting to be carried out.
1.16.1.5	The scope of painting includes application of colour bands, lettering the names of the systems equipment; tag Nos of valves, marking the directions and other data required by BHEL within the quoted rate.
1.16.1.6	All surfaces shall be thoroughly cleaned, free from scales, dirt and other foreign matter. Each coat shall be applied in an even & uniform film free from lumps, streaks, runs, sags and uncoated spots. Each coat (Primer, intermediate, finish) shall have a minimum thickness of dry film thickness (DFT) in microns and the DFT of finish paint shall not be less than the specified. Necessary instrument for measuring the thickness of paint applied is to be arranged by the contractor.
1.16.1.7	Finish coat paint, No of coat and DFT shall be as per this tender / relevant BHEL document/ customer's specifications.
1.16.1.8	The actual colour to be applied shall be approved by the customer before starting of actual painting work.
1.16.1.9	No paint shall be applied when the surface temp is above 55 deg. Centigrade or below 10 deg. Centigrade, and when the humidity is greater than 90% to cause condensation on the surface or frost / foggy weather.
1.16.1.10	Before commencement of final painting, contractor has to obtain written clearance from BHEL / Customer for effective completion of surface preparation.
1.16.2.0	**PRESERVATION / TOUCH UP PAINTING**
1.16.2.1	Due to atmospheric conditions erected materials are likely to get rusted more frequently. It is the responsibility of the contractor to preserve the erection materials drawn from stores for erection till these are commissioned and handed over to customer. The required consumables for this purpose like paint, thinner, rust converter compound (Ruskill or Ferropro) or any other equivalent shall be arranged by bidder. However, the contractor should also arrange other

	consumables like wire brushes, emery paper, cotton waste, cloth etc., at their cost. The contractor should ensure that the materials are not rusted on any account till they are handed over to customer. The decision of the BHEL Engineer is final with regard to frequency of application of paint and rust converter compound.
1.16.2.2	Mostly the equipment / items/ components will be supplied with one coat of primer paint and one coat of finish paint. However, during storage and handling, the same may get peeled off / deteriorate. All such surfaces are to be thoroughly cleaned and to be touch up painted with suitable approved primer and finish paint matching with shop paint / approved final colour. Besides above two coats of approved primer paint are to be applied on all the bare / unpainted surfaces. Touch up painting is generally required for trays, control panels.
1.16.2.3	All damaged galvanized surfaces including cable trays shall be coated with cold galvanizing paint.
1.16.2.4	Contractor shall carryout cleaning and preservation / touch up painting for the materials / equipment under this tender specification right from pre- assembly stage to till the equipment is cleared for final painting.

VOLUME-IA PART-II CHAPTER-1
CORRECTIONS / REVISIONS IN SPECIAL CONDITIONS OF CONTRACT, GENERAL CONDITIONS OF CONTRACT AND FORMS & PROCEDURES

Sl No. 1

Following clauses in GCC are not applicable for this contract.

1) Clause No. 1.9 (Earnest Money Deposit)
2) Clause No. 1.10 (Security Deposit)
3) Clause No. 2.12 (Over Run Compensation)
4) Clause No. 2.13 (Interest Bearing Recoverable Advances)
5) Clause No. 2.14.1 (Variation in Final Executed Contract Value sub-clause(i))
6) Clause No. 2.16 (Supplementary Items)
7) Clause No. 2.17 (Price Variation Clause)

Sl. No.: 02

Following Clauses in General Conditions of Contract (GCC) are modified/ revised/ added:

S.No	GCC Clause Reference	Modification / Revision / Addition in GCC Clause
1.	GCC Clause 2.22.1	**GCC Clause 2.22.1 is revised as:** Retention Amount shall be 5% of the Contract Value and shall be furnished through BG in line with clause 1.12 of GCC before payment of first RA Bill. The validity of the said BG shall be initially for the contract period & shall be extended, if so required, up to acceptance of final bill. In case of increase in contract value, additional BG for 5% of differential amount shall be submitted by Contractor before payment of next RA Bill due. Retention Amount can also be recovered at the rate of 10% of the gross amount progressively from each of the running bills of the contractor till the total amount of the required retention amount is collected. In case, contractor opts cash deduction from RA bills in the beginning & subsequently offers to submit BG later on, then refund of deducted retention amount may be permitted against submission of BG for 5% of the Contract Value.
2.	New Clause for "Breach of Contract, Remedies and Termination" is added in place of existing clause of Risk & Cost (i.e. 2.7.2.1 to 2.7.3)	**Clause 2.7.2 and 2.7.3 are revised as:** **2.7.2 <u>Breach of Contract, Remedies and Termination</u>** **2.7.2.1** BHEL shall terminate the contract after due notice of a period of 14 days in any of the following cases, which if not rectified/ improved within the time period mentioned in the notice, then, 'Breach of Contract' will be considered to have been established: i). Contractor's poor progress of the work vis-à-vis execution timeline as stipulated in the Contract, backlog attributable to contractor including unexecuted portion of work does not appear to be executable within balance available period considering its performance of execution.

S.No	GCC Clause Reference	Modification / Revision / Addition in GCC Clause
		ii). Withdrawal from or abandonment of the work by contractor before completion of the work as per contract. iii). Non-completion of work by the Contractor within scheduled completion period as per Contract or as extended from time to time, for the reasons attributable to the contractor. iv). Repeated failure of contractor in deploying the required resources, to comply the statutory requirements etc. even after given by BHEL is writing. v). Strike or Lockout declared is not settled within a period of one month. vi). Termination of Contract on account of any other reason (s) attributable to Contractor. vii). Assignment, transfer, subletting of Contract without BHEL's written permission. viii). Non-compliance to any contractual condition or any other default attributable to Contractor. **2.7.2.2 Remedies in case of Breach of Contract is established** In case 'Breach of Contract' is established, Security Deposit and Retention Amount shall be encashed/ forfeited. This is without prejudice to BHEL's right to levy of liquidated damages, debarment etc. which shall be applied as per the provisions of the contract. Sequence of recovery to be made in case of breach of contract is established, is as below: a) In case the value of Security Deposit & Retention Amount, available for the Contract, is less than 10% of the Contract Value, the balance amount shall be recovered from dues available in the form of Bills payable to contractor, BGs against the same contract etc. b) Demand notice for deposit of balance recovery amount shall be sent to contractor, if funds are insufficient to effect complete recovery against dues indicated in (a) above.

S.No	GCC Clause Reference	Modification / Revision / Addition in GCC Clause
		c) If contractor fails to deposit the balance amount to be recovered within the period as prescribed in demand notice, following action shall be taken for balance recovery: i) Dues payable to contractor against other contracts in the same Region shall be considered for recovery. ii) If recovery cannot be made out of dues payable to the contractor as above, balance amount to be recovered, shall be informed to other Regions/Units for making recovery from the Unpaid Bills/Running Bills/SD/BGs/Final Bills of contractor. iii) In-case recoveries are not possible with any of the above available options, Legal action shall be initiated for recovery against contractor. Note: 1) In addition to above, levy of liquidated damages, debarment, termination, short-closure etc. shall be applied as per provisions of the contract. 2) If tendering is done for the balance work, the defaulted contractor (including all the members/partners in case of JV/ partnership firm) shall not be eligible for either executing the balance work or to participate in the tender(s) for executing the balance work. **2.7.3** In case Contractor fails to deploy the resources as per requirement informed by BHEL in writing to expedite the work, BHEL can deploy own/hired/otherwise arranged resources and recover the expenses incurred from the dues payable to contractor. Recoveries shall be actual expenses incurred plus 5% overheads or as defined in TCC.
3.	GCC Clause 2.7.7	**GCC Clause 2.7.7 is revised as:** BHEL may permit or direct contractor to demobilize and remobilize at a future date as intimated by BHEL in case of following situations for reasons other than Force majeure conditions and not attributable to contractor: i) suspension of work(s) at a Project either by BHEL or Customer,

S.No	GCC Clause Reference	Modification / Revision / Addition in GCC Clause
		or ii) where work comes to a complete halt or reaches a stage wherein worthwhile works cannot be executed and there is no possibility of commencement of work for a period of not less than three months In such cases, charges towards demobilization and remobilization shall be as decided by BHEL after successful remobilization by contractor at site, and decision of BHEL shall be final and binding on the contractor. After remobilization, all conditions as per contract shall become applicable. In case Contractor does not remobilize with adequate resources or does not start the work within the period as intimated, then BHEL reserves the right to terminate the contract and effect remedies under Clause 2.7.2.2. Duration of the contract/time extension shall be revised suitably. In case of any conflict, BHEL decision in this regard shall be final and binding on the contractor.
4.	GCC Clause 2.11.3	**GCC Clause 2.11.3 is revised as:** However, if any 'Time extension' is granted to the contractor to facilitate continuation of work and completion of contract, due to backlog attributable to the contractor alone, then it shall be without prejudice to the rights of BHEL to impose penalty/LD for the delays attributable to the contractor, in addition to any other actions BHEL may wish to take under clause 2.7.2 of GCC i.e. "Breach of Contract, Remedies and Termination".
5.	GCC Clause 2.19.1	**GCC Clause 2.19.1 is revised as:** The contractor will be fully responsible for all disputes and other issues connected with his labour. In the event of the contractor's labour resorting to strike or the Contractor resorting to lockout and if the strike or lockout declared is not settled within a period of one month, it may be considered as 'Breach of Contract' under Clause 2.7 and the remedies under Clause 2.7.2.2 may be executed, at the discretion of BHEL.
6.	GCC Clause 2.24.1	**GCC Clause 2.24.1 is revised as:** Even though the work will be carried out under the supervision of BHEL Engineers the Contractor will be responsible for the quality of the workmanship and shall guarantee the work done for a period of Twelve months

S.No	GCC Clause Reference	Modification / Revision / Addition in GCC Clause
		from the date of commencement of guarantee period as defined in Technical Conditions of Contract, for good workmanship and shall rectify free of cost all defects due to faulty erection detected during the guarantee period. In the event of the Contractor failing to repair the defective works within the time specified by the Engineer, BHEL may proceed to undertake the repairs of such defective works, by itself, without prejudice to any other rights and recover the cost incurred for the same along with 5% overheads from the Security Deposit.

Sl. No.: 03

Clause No. 10.5 on RA Bill Payments, in Special Conditions of Contract (SCC), Volume-IB, Book- II, is revised as under:

"The payment for running bills will normally be released within 30 days of 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."

VOLUME-IA PART – II CHAPTER 2
PAINTING SCHEDULE

2.2.0.0	PAINTING SCHEDULE	
Sl.No.	**Equipment Description**	**Painting Schedule**
1	All types Poles and Masts (Before installation and final touch up both painting)	1. Two coats of red oxide and zinc chromate in synthetic medium (Surface exposed to atmosphere). 2. Bituminous preservative paint inside as well as embedded outside surface.
2	All LP/LDB/Fuse DB/ACDB/DCDB Panels supplied by EPD	**RAL 7035:** Complete Panel (Exterior & Interior) **RAL 9002:** Mounting Plate & Trolleys Paint Thickness: Min. 85 Microns for PCC/MCC & 50 Microns for DCDB
3	All LP/LDB/Fuse DB/ACDB/DCDB Panels supplied by PEM (Final touch up only)	RAL 7035 For all sides Min 85 Microns (Minimum total DFT shall be 100 Microns)
4	Nomenclature for panel, bus duct, feeder, etc	Yellow for background and Black for letters.

VOLUME-IA PART- II CHAPTER -3
DATA SHEET

2.3.1.0	**SPECIFIC TECHNICAL REQUIREMENTS FOR SUPPLY ITEMS**
2.3.1.1	**CLAMPS:** **A. Material type:** Nylon Self-Locking ties Aluminium strips clamps as mentioned in Chapter-3 of Technical Conditions of Contract (Volume-IA Part-II in Book-I) **B. Sizes:** To meet the requirements mentioned in Chapter-3 of Technical Conditions of Contract (Volume-IA Part-II in Book-I)
2.3.1.2	**FERRULES: Please refer VOLUME-IA PART – I CHAPTER- XIII**
2.3.1.3	**TAGS:** **A. Material:** Aluminium / Fibre / Stainless Steel **B. Markings:** Engraving / Embossing / Printing **C. Size:** As required
2.3.1.4	**CABLE LUGS:** Copper / Aluminium (Crimping Type)
2.3.1.5	**CLAMP SPACING:** **A. Power Cables:** **Above 35 mm OD** i) Horizontal Runs: Individually clamped at 3000 mm Interval (max) ii) Vertical Runs Individually clamped 3000mm intervals (max) **Up to 35 mm OD** i) Horizontal Runs: Collectively clamped at 3000 mm intervals (max) ii) Vertical Runs: Collectively clamped at 2000 mm interval (max) **B. Control Cables:** i) Horizontal Runs: Collectively clamped at 3000 mm interval (max) ii) Vertical Runs: Collectively clamped at 3000 mm interval (max) **C. Spacing for Cables supported along structure / ceiling** i) Horizontal Runs: 750 mm (max) ii) Vertical Runs: 750 mm (max) iii) Spacing between cables: 30 mm (min) Note:

	a. Supports shall also be proved at each bend. b. For any change in above spacing, prior approval of Engineer shall be taken.
	CABLE TERMINATION: **Type of Lugs** **a. Power Cables:** Copper / Aluminium / Both crimping type **b. Control Cables:** Copper pin type, copper screw type, Direct termination **c. Special Cables:** Pin type, maxi-termi type
2.3.1.1	**Wastage Allowance: Please refer VOLUME-IA PART – I CHAPTER- XIII**

VOLUME-IA PART- II CHAPTER -4
TECHNICAL REQUIREMENTS AND GUIDELINES FOR INSTALLATION, TESTING, COMMISSIONING AND SUPPLY ITEMS OF ILLUMINATION PACKAGE

2.4.0.0	**TECHNICAL REQUIREMENTS AND GUIDELINES**
2.4.1.0	**INSTALLATION, TESTING & COMMISSIONING IN GENERAL:** The stages of completion of various works shall be as follows: • Equipment shall be considered to be completely erected when the following activities have been completed. • Moving of all equipment to the respective foundations. • Fixing of anchor bolts or tack welding as required. • Leveling and alignment of equipment. • Assembling of all accessories such as relays, CTs, PTs, meters, instruments etc. as described in the job specification. • Filtration and filling of oil as required. • Cable laying, termination with continuity check. • Applying of finishing coat of paint. All the equipment shall be tested at site to know their condition and to prove suitability for required performance. The site tests and acceptance tests to be performed by contractor are detailed below. The contractor shall be responsible for satisfactorily working of complete integrated system and guaranteed performance.
2.4.2.0	**SITE TESTS AND CHECKS:**
2.4.2.1	**GENERAL:** All the equipment shall be tested at site to know their condition and to prove suitability for required performance. The test indicated in following pages shall be conducted after installation. All tools, accessories and required instruments shall have to be arranged by contractor. Any other test which is considered necessary by the manufacturer of the equipment, contractor or mentioned in commissioning manual has to be conducted at site.

	In addition to tests on individual equipment some tests / checks are to be conducted / observed from overall system point of view. Such checks are highlighted under miscellaneous tests but these shall not be limited to as indicated and shall be finalized with consultation of client before charging of the system. The contractor shall be responsible for satisfactory working of complete integrated system and guaranteed performance. All checks and tests shall be conducted in the presence of client's representative and test results shall be submitted in six copies to client and one copy to Electrical Inspector. Test results shall be filled in proper proforma. After clearance from Electrical Inspector system/equipment shall be charged in step by step method. Based on the test results clear cut observation shall be indicated by testing engineer with regard to suitability for charging of the equipment or reasons for not charging are to be brought by the contractor.
2.4.3.0	**LT SWITCHGEAR PANELS (INCLUDES ALL LP/LDB/ACDB/DCDB/FUSE DBs)**
2.4.3.1.	**ERECTION** 1. The base frames will be supplied normally along with the boards. These will have to be aligned, levelled and grouted in position as per approved drawings. Wherever the base channels are not available, the same will have to be fabricated and painted at site. Base frames shall be grouted on the openings which shall be made on the floor during the time of casting. All necessary concrete chipping and finishing works are to be completed. 2. All the panels/board shall be placed on its foundation or supporting structures and shall be assembled as required. All panels should be installed with parallel, horizontal and vertical alignment by skilled craftsmen 3. All the boards will be delivered in sections. Necessary interconnection of bus bar, bolting of panels, left out panel / inter panel wiring, etc. will have to be done after assembling the panel.
2.4.3.2.	**CHECKS DURING ERECTION** 1. Layout of foundation channels. 2. Floor level covered by the panel with respect to main floor level.

	3. Location and serial no. of panels. 4. Positioning of panels. 5. Verticality of switchgear panels within the limit specified. 6. Freeness of Breaker Truck and modules in housing and its manual operation. 7. Earthing of panels and breaker truck to station earth. 8. Lugs for termination of LT cables. 9. Mounting and fixing arrangements of Bus bars. 10. Tightening of Bus bar jointing bolts as specified. 11. Clearance between : a. Phase to Phase b. Phase to earth 12. Minimum clearance for : a. Breaker, Truck and modules withdrawal b. Distance required for maintenance work 13. Check the operation of: a. Remote control b. Various required - closing / tripping / alarm / indications / interlocks 14. Installation position of instruments and relays operation of relays and meters by secondary injection. 15. AC/DC supplies for panel final relay settings as per customer requirements. 16. Tightness of terminal connections for HT & LT connections. 17. Opening operation of breaker, manually and electrically. 18. Working of ammeters and voltmeters for their entire range and other panel mounted instruments like recorder, indicator etc.
2.4.3.3.	**LT SWITCHGEAR TESTS (INCLUDES ALL LP/LDB/ACDB/DCDB/FUSE DBs)** 1. IR test 2. Measurement of contact resistance for LT breakers 3. Test to prove inter changeability of similar parts (including breaker module

	4. Testing of relays as per supplier's commissioning manual. 5. Testing and calibration of all meters. 6. Operation of all relays by secondary injection method. 7. Testing of CT polarities and CT ratio by primary injection test. 8. Measurement of kneepoint voltage and secondary resistance for CTs used for differential protection 9. IR and voltage ratio test for PTs 10. Functional test of all circuit components for each panel / feeder 11. Test to prove closing / tripping operation at minimum and maximum specified voltage in test and service position 12. Check for drawout test and service position of breakers for all feeders 13. Check for covering of all openings in the panel - check for continuity and operation of aux. contacts of breaker.
2.4.4.0	**GUIDELINES FOR CABLE LAYING:** 1. In the plant building, substations, switchgear rooms, control rooms etc. Power and control cables shall generally be laid on cable trays installed in concrete trenches, tunnels, cable basements, cable vaults, cable shafts or along building and structures as the case may be. 2. In case of multi-core cables of diameter up to 20 mm where not more than 3 cables are taken in one run, these can be taken directly along structures, walkways, platforms, galleries, walls, ceiling etc. by proper clamping at regular intervals of more than 300 mm. 3. Power & control cables installed along buildings and structures, ceilings, walls, etc. which are required to be protected against mechanical damage shall be taken in G.I. conduits. 4. GI conduits shall also be used for flameproof installations, wherever required, with sealing at both ends. GI conduits shall be provided by BHEL. 5. In corrosive atmosphere, where 1100 V grade cables are required to be taken in pipes, rigid heavy duty PVC pipes shall be provided**.** PVC pipes shall be provided by BHEL. 6. Entry of cables through trenches/tunnels into buildings shall be by means of one of the methods indicated in drawing as applicable for different buildings. 7. Cables laid exposed in racks/trays and routed through trenches/tunnels/basements etc. to individual drive/control devices etc.

shall be taken in embedded surface exposed rigid GI conduits and or flexible conduits unless directly terminated to the equipment in the panels located, above trenches, tunnels or basement.

8. All cables routed along walls or in equipment rooms shall be protected by means of laying them through GI pipes or by providing sheet metal covers up to a height of 2000 mm from the working floor levels and platforms, for protection against mechanical damage. All vertical risers shall be of enclosed type.
9. Wherever direct heat radiation exists, heat isolating barriers (subject to customers approval), for cabling system shall be adopted.
10. For 415V power wiring in ancillary buildings, offices and laboratories, cables shall be taken through embedded/exposed GI conduits or rigid PVC pipes as applicable.
11. If required, a few numbers of cables in exceptional areas may be directly buried into the earth.
12. Wherever cables are to be laid below roads and railway tracks, the same shall be taken through ducts buried at a suitable depth as decided by Engineers.
13. At certain places where hazardous fumes / gases may cause fire to the cables, cable trenches after installation of cables may be sand-filled.
14. In corrosive atmosphere, PVC conduits shall be used for cables.
15. Single core cables, when pulled individually shall be taken through PVC pipes only.
16. Laying and installation of power, control and special cables shall generally conform to IS : 1255
17. The cables shall be laid-out in proper direction from the cable drums (opposite to the normal direction of rotation for transportation).
18. In case of higher size cables, the laid out cables shall run over rollers placed at close intervals and finally transferred carefully on the racks/trays. Care shall be taken so that kinks and twists or any mechanical damage does not occur to cables. Only approved cable pulling grips or other devices shall be used. Under no circumstances cables shall be dragged on ground or along structure while paying out from cable drums, carrying to site and straightening for laying purpose.
19. Suitable extra length of cables shall be provided for all feeders for any future contingency, in consultation with Engineer.
20. Cable runs shall be uniformly spaced, properly supported and protected in an approved manner. All bends in runs shall be well defined and made

with due consideration to avoid sharp bending and kinking of cable. The bending radius of various types of cables shall not be less than those specified by cable manufacturers and that specified in IS 1255.

21. All cables shall be provided with identification tags indicating the cable numbers in accordance with the cable circuit schedule. Tags shall be fixed at both ends of cables (both inside & outside of panel) both sides of floor / wall crossings, every 25m spacing for straight runs or as specified by Engineer for easy identification of cable.
22. When a cable passes through a wall, cable number tags shall be fixed on both sides of the wall.
23. Single core cables for AC Circuits shall form a complete circuit in trefoil formation supported by means of trefoil clamps of non-magnetic material. Trefoil clamps shall be provided by BHEL
24. Multi-core cables above 1100 V grade shall be generally laid in ladder type trays in one layer with spacing not less than one cable diameter of bigger diameter cable.
25. All 1100 V grade multicore power cables and single core DC cables shall be placed in single layer, touching each other and clamped by means of single or multiple galvanised MS saddles / aluminium strips / nylon cable ties. Cables above 35mm diameter shall be clamped individually.
26. Control cables shall be laid touching each other and wherever required may be taken in two layers. All control cables shall be clamped with a common clamp/tie.
27. Segregation of the cables on the basis of their types and their functions shall be as under for horizontal formation:
    A. HT cables shall be laid in the top tier(s)
    B. LT power cables to be laid in the tray(s) below the HT cable trays.
    C. LT control cables to be laid in the Tray(s) next below to the LT power cable (trays)
    D. Special control cables including screened control cables to be laid in the bottom most tray(s).
28. For vertical formations, the trays closest to the wall shall be considered as bottom most tray and the order indicated in clause just above shall be followed. However, where there is no clear distinction of bottom / top trays, the order convenient for linking the horizontal and vertical formations shall be followed.
29. When it may not be possible to accommodate the cables as per the criteria indicated in the two clauses 29 & 30 indicated above, the

following rules shall override the criteria. However, prior approval of the Engineer will be required. In hierarchical order:

A. Control cables are mixed up with the special control cables with clear minimum gap of 100 mm between them.

B. LT power cables are mixed up with control cable with clear minimum gap of 150 mm between them.

C. LT power cables are mixed up with HT power cables with clear minimum gap of 200 mm between them.

D. LT power cables are mixed up with special control cables with clear minimum gap of 200 mm between them.

30. In case of duplicate feeders to essential loads, the respective cables shall be laid through separate raceways. Alternatively, such cables shall be laid on the opposite sides of a trench / tunnel / basement.

31. For laying cables along building steel structures and technological structures, the cables shall be taken by clamping with MS saddles screwed to the MS flats welded to the structure. MS saddles and flats shall be galvanized.

32. For laying cables along concrete walls, ceilings etc. The cables shall be taken by clamping with MS saddles screwed to the MS flats welded on the inserts. Where inserts are not available the saddles shall be directly fixed to the walls using raw plus and MS flat spacers of minimum 6 mm thickness.

33. To facilitate pulling of cables in GI conduits, powdered soft stone, plastic scoop or other dry inert lubricant may be used but grease or other material harmful to the cable sheaths shall not be used.

34. No single core cable shall pass through a GI conduit or duct except DC single core cables. AC single core cables shall pass through GT conduits/pipes in trefoil formation only.

35. In case of a 3 phase, 4 wire system, more than one single phase circuit, unless originating from the same phase shall not be taken in the same GI conduit.

36. Entry of cables from underground trenches to the buildings or tunnels shall be by some approved method. Necessary precautions shall be taken to make the entry point fully water tight by properly sealing the pipe sleeves wherever they enter directly into the building at trench level. The sealing shall be by cold setting compound. Any alternative sealing arrangement may be suggested with the offer for consideration by BHEL.

37. Wherever specific cable routes are not shown in cable schedules cables shall be laid as directed by Engineer.

38. SUPPORT SPACINGS & CLAMPINGS
Support spacing and clamping suitably provided and as required

39. LAYING OF CABLES DIRECTLY BURIED IN GROUND
Laying and installation of directly buried cables in ground shall conform to the requirements of IS 1255.

40. SUPPORT SPACINGS & CLAMPINGS

Trefoil Clamps:	
i. Horizontal run spacing	1000 mm (max)
ii. Vertical run spacing	1000 mm (max)
iii Axial spacing between adjacent trefoils	Double the diameter of larger cable or 150 mm Whichever is less

41. OTHER CLAMPS: Please refer VOLUME-IA PART – II CHAPTER 3

42. CABLE TERMINATION AND JOINTING

a. When the equipment are provided with undrilled gland plates for cable/conduit entry into the equipment, drilling and cutting on the gland plate and any minor modification work required to complete the job shall be carried out at site and drawings shall be prepared and take engineer's approval before drilling holes. Cutting shall not be allowed.

b. Termination of cables shall be done as per termination drawings & interconnection diagrams furnished to the contractor. Looping of cores/wires at terminals as shown in interconnection diagrams is to be done.

c. All cable entries in the equipment shall be sealed after glanding the cables.

d. Adequate length of cables shall be pulled inside the switch boards, control panels, terminal boxes etc. as per near termination of each core/conductor.

e. Power cable terminations shall be carried out in such a manner as to avoid strain on the terminals by providing suitable clamps near the terminals.

f. End sealing / termination of cables shall be done by means specified on the specification for terminations. The system shall be suitable for types of cable specified and complete with stress relief system.

g. Termination and jointing of aluminium / copper conductor power cables shall be done by means of compression method using compression type aluminium / tinned copper lugs.

h. Copper conductor control cables shall be terminated directly into screwed type terminals provided in the equipment. Wherever control cables are to be terminated by means of terminal lugs, the same shall be of tinned copper compression type.

i. Cable joints shall normally be made at an intermediate point in the straight run of the cable only when the length of the run is more than the standard drum length supplied by the cable manufacturer. In such cases, when jointing is unavoidable, the same shall be made by means of specified cable-jointing kit, subject to BHEL's approval of Engineer shall be taken for deciding location of joint. The straight through jointing kits for LT power/control cables as required shall be arranged by the contractor at their cost. The make shall subject to approval of BHEL's Engineer.

j. Termination and jointing shall generally conform to the requirements of IS: 1255 and shall strictly conform to the recommendations of termination and jointing kit supplier.

43. **TESTING OF CABLES:**

i. The contractor shall submit to the Engineer a checklist for testing and commissioning and the activities shall be carried out in accordance with the checklist.

ii. Testing and electrical measurement of cable installations shall conform to IS : 1255

iii. Prior to installation, cables shall be tested for :
   a) Continuity of conductors
   b) Insulation resistance between conductors & earth
   c) Insulation resistance between conductors.

iv. After installation cables shall be tested for :
   a) Insulation resistance between conductors & iron
   b) Insulation resistance between conductors & earth
   c) Conductor resistance
   d) Capacitance between conductors & earth (for cables above 7C.1.3KV grade)
   e) DC high voltage test (for LT power cables of higher sizes interconnecting PCCs & MCC)
   f) Absence of cross phasing
   g) Firmness of terminations

2.4.5.0	**ERECTION AND COMMISSIONING OF MISCELLENEOUS ITEMS** All the miscellaneous items shall be Erected, Tested and Commissioned as per the instruction manuals (or) as instructed by the Engineer.
2.4.6.0	**PANELS: (**Includes LP/LDB/ACDB/DCDB/FUSE DB) A. The scope of commissioning of Panels covers checking of internal wiring and associated loop cables from panels to Illumination items, field JBs, etc. B. If any loop cables (power or control) are to be laid or replaced, the same shall be carried out at unit rates available in the BOQ.
2.4.7.0	**NOTE:** The scope of work also includes collecting the replacement instruments/parts from BHEL/customer stores, stockyard etc. Separate group shall be identified for commissioning. The above group shall be available right from Trial run to full load operation including shift operation.
2.4.8.0	**TECHNICAL REQUIREMENT FOR ITEMS SUPPLIED BY THE CONTRACTOR.**
2.4.8.1	**GENERAL** 1. Equipment and material supplied shall comply with description, rating, type and size as detailed in this specification, drawings and annexures. 2. Equipment and materials furnished shall be complete and operative in add details. 3. All the accessories, fittings, supports, anchor bolts etc., which form part of the equipment or which are necessary for safe and satisfactory installation and operation of the equipment shall be furnished. 4. All parts shall be made accurately to standard gauges so as to facilitate replacement and repair. All corresponding parts of similar equipment shall be interchangeable. 5. Samples of all items shall be made available for purchaser's approval prior to supply of item to site.
2.4.8.2	**FIRE STOP CABLE SEALING SYSTEM (AS APPLICABLE)** Fire stop cable sealing system shall have two (2) hours fire protection rating suitable for sealing both vertical & horizontal cable penetrations. The sealing compound in conjunction with mineral wool shall form effective fire seals. The sealing compound shall have special property to allow for short circuit conditions. **GPG fire stop sealing compo** or equivalent sealing compound shall be used.

2.4.9.0	**GUIDELINES FOR ERECTION OF GI PIPES , SUPPORTS & ACCESSORIES** **1.** For installation of cables in GI conduits the conduits shall be installed first without cables but having suitable pull wires laid in conduits. **2.** For equipment and devices having GI conduit entry arrangement other than standard GI conduit adopter, adopters shall be provided as required to enable the GI conduit to be properly terminated, between conduit end and motor T.B. **3.** GI conduits shall run without moisture or water traps and shall be made drawing arrangement towards the end. **4.** The entire GI conduit system shall be firmly fastened in position. All boxes and fittings shall generally be secured independently from the GI pipes entering them. **5.** Bends of GI pipes / conduits shall be made without causing damage to the pipes/conduits. **6.** Occupancy of conduits shall not be greater than 40%. **7.** The adopter for coupling rigid GI pipe/conduits and flexible conduit shall be of aluminium or galvanized steel. **8.** Transportation and storage of cable drums shall generally conform to the requirements of IS: 1255. **9.** All the cables shall be supplied to the contractor free of cost from BHEL / Customer's store / storage area. Transportation of cables from storage area to the work site shall be the responsibility of the contractor. **10.** The cable drums shall be transported on wheels to the place of work. ***Note:*** *The tests specified above for all the electrical equipment are not exhaustive. Any other pre-commissioning and field tests not included in the above list but necessary as per relevant standards, Electricity rules, code of practice and instructed by the manufacturer of the equipment shall also have to be carried if deemed necessary shall be carried out as per requirement either within the quoted rates / price or at additional cost. Decision of Engineer in charge will be the final regarding additional cost for testing. The contractor shall take the full responsibility of testing, commissioning, trial run and successful operation of the equipment under overall.*

VOLUME-IA PART-II CHAPTER 5
DRAWINGS & SCHEMES/REPORTS

2.5.1.0 LUX LEVEL MONITORING RECORD FORMAT (TYPICAL)- FOR INFORMATION ONLY

Lux Level Monitoring Record

Date of Lux Monitoring:……

Name of the Instrument ……. Type:…….

Range of the Instrument:……. Resolution of the Instrument:…….

Instrument Calibration due:…….

Area:……..

Sl.No.	Name of the Location	Lux Level					Average Lux
		L1	L2	L3	L4	L5	$L_{(AVG)=L1+L2..L5/5}$
Measured by		Checked by				Accepted by	

Note:

The range and resolution of the instrument (typical) as follows:

1. Range A: 0 to 1999 Lux – The resolution shall be 1
2. Range B: 2000 to 19999 Lux- The resolution shall be 2
3. Range C: 20000 to 500000 Lux – The resolution shall be 100

LIST OF APPLICABLE STANDARDS	
ILLUMINATION	
Code of practice for interior illumination	IS: 3646
Code of practice for industrial lighting	IS: 6665
Code of practice for lighting of public thoroughfare	IS: 1944

This above list is not exhaustive. Standards not listed above but are applicable also to be followed to meet the requirement