

TECHNICAL CONDITIONS OF CONTRACT (TCC) CONTENT

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Chapter - I: PROJECT INFORMATION

1.0 PROJECT INFORMATION

1x660MW SATPURA is being set up by Madhya Pradesh Generation Board with the following particulars.

S. No.	Description	Details
1.1	Location	1X660MW SATPURA
1.2	Nearest Railway Station	Betul Railway Station
1.3	Nearest Airport	Betul
1.5	Major Towns/Cities	Betul (District Headquarter)

The bidder is advised to visit and examine the site of WORKS and its surroundings and obtain for himself on his own responsibility all information that may be necessary for preparing the bid and entering into the contract. All costs for and associated with site visits shall be borne by the bidder.

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Chapter - II: SCOPE OF WORK

2.0 SCOPE OF WORK

The proposed construction power supply network shall have:

- a) 01 no. 33/11kV Substation consisting of 1 nos. 2.5MVA 33/11kV Transformers, 01 no. 33kV VCB, 01 no. 11kV VCB and other allied works.
- b) 10 nos substations of rating 500kVA, 11/0.433kV each. All the substations shall be connected to 11 kV ring main feeder through 11kV Overhead line and underground cables. The number of substations may vary depending on site requirements.
- c) overhead/underground lines of ring main system for Construction Power.
- d) Laying of HT & LT Cables as per the project requirement (underground/overhead).
- e) steel tubular swaged poles, 9-meter-long made of sheet steel for area lighting. Each pole shall have one 90W LED street light.
- f) Supply , erection & Commissioning of lighting for store yard area.
- g) Any other work which required to complete the job.
- h) Supply and laying 33 KV HT Cable as per BOQ
- i) Supply , installation including civil work (supply of civil material) for High mast lighting and other lighting works
- j) Operation & Maintenance
- k) Supply of items as per BOQ attached
- l) The total work is divided into two different packages:

Additionally, the scope covers:

- Deployment of required manpower, including electricians and helpers
- Supervision and management of the work
- Supply and use of tools & plants (T&P) and consumables
- Provision of watch & ward services for site security

2.01 PACKAGE - A

- The scope of work of this package covers design of construction power network, tentative supply of items as mentioned in BOQ (actual requirement shall be in line with the design and approved drawings) required for completion of work apart from the BHEL supplied items, further identification of items at stores / yards, checking, reporting the damages if any, taking delivery at storage yard / stores, 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, & post-commissioning activities obtaining statutory clearances along with the supply of all consumables, tools and tackles, testing instruments, supply of consumables like electrodes, gas, cable dressing materials, HT / LT insulation tapes, tag plates, PVC sleeves for wire marking, lugs, fasteners, paints and its consumables. Deployment of skilled / unskilled manpower, engineers / supervisors, Tools & Plants (T & P), Material handling equipments, testing instruments, returning of un-used materials / items to BHEL stores. The installation and commissioning of all the electrical equipments / items shall conform to the technical requirements specified elsewhere in the tender.
- The package-A also includes supply portion of various item (apart from BHEL supplied Major items).
- All the erection material is stored at BHEL laydown area.

- The scope of Package A also includes Operation and maintenance of construction power distribution system till commencement of contract period of package B.

2.02 PACKAGE - B

- Deployment of Electricians & Helpers satisfaction to site engineer with required T&P for all three shifts per day and 1 (One) Supervisor for day shift for the works of operation and maintenance of construction power distribution system which consists of all the components and equipments erected and commissioned under package A. **The**

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man power should be available throughout the year inclusive of all holidays and Sundays. The separate line items provided in price BOQ for manpower .

- Operation & maintenance of High Masts, Electrical works in BHEL Offices, BHEL Stores, BHEL yards, etc. inside the Main Plant boundary erected and commissioned by other agencies will be part of this package. The Electrical works of storage areas outside the main plant boundary (if any) erected and commissioning by other agencies shall also be covered under this O&M package.
- The scope of O & M work includes identification of items at stores / yards, checking, reporting the damages if any, taking delivery at storage yard / stores, loading, transportation to working yard, pre-assembly, calibration, checking, replacing, testing and commissioning, & post-commissioning activities using vendor's own tools and tackles and testing instruments along with the supply of all consumables like insulation tapes, HT tapes, electrodes, gas, paints, cable dressing materials, tag plates, PVC sleeves etc.
- The supply of faulty parts and spares are excluded from the contractor's scope and will be provided by BHEL free of cost.
- All necessary Hand tools, multi-meters, Megger, earth tester, earthing rods etc. shall be in the contractor's scope. Fire extinguishers supplied under package-A shall be maintained by the contractor till the of end O & M period.
- Any other special tools & tackles required to maintain the System shall be arranged by the contractor.
- The Cable jointing work of all cables (HT, LT Control cables) are under the scope of contractor during maintenance period. The contractor shall arrange suitable cable jointer immediately to rectify the cable damage. Rs 3000/- per LT cable joint and Rs 6000/- per HT cable Joint shall be paid extra for jointing work and required Cable Jointing Kits shall be issued by BHEL at free of cost.

2.03 BHEL SUPPLIED ITEMS

The following items will be supplied by BHEL (free of cost) for completion of the construction power network:

- a) 01Nos. 33/11 kV 2.5MVA oil filled transformers.
- b) 01 Nos. 33kV Vacuum Circuit Breaker (VCB) to be used at the primary side of the above transformer.
- c) 01 Nos. 11kV Vacuum Circuit Breaker (VCB) to be used at the secondary side of the above transformer.
- d) 10 Nos. of 11/433kV Package substations (500kVA) comprising of HT switchgears, 11/433kV transformer and LT switchgears.
- e) 13km ACSR DOG conductor for overhead lines.
- f) 3 kms of HT (11kV) Cables for Ring Main System and Interconnection of Packages substations and 2.5MVA transformers.

2.04 BROAD SCOPE OF WORK:

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.)

- a) This work comprises of construction power for 1x660MW SATPURA Project. Herein, the customer shall provide 01No. of source at 33kV supply. Contractor has to make all the arrangement for tapping Power from 33KV supply source and further supply and laying of 33KV HT cable to be laid from power supply source to 2.5MVA 33/11KV Substation transformer by making all necessary arrangements. The construction power substation (33/11kV) comprising of 01Nos. 33/11kV, 2.5MVA transformers, 01Nos. 33kV Vacuum Circuit Breaker (VCB) and 01Nos. 11kV Vacuum Circuit Breaker (VCB) is in the scope of this work. The power from this construction power substation shall feed the 11kV overhead line to be formed in the form of Ring Main System and shall be used for providing construction power to the complete project with occasional interconnection through underground HT cables at special places like road crossings, etc. 10Nos. Package substations of rating 500kVA, 11/.433 kV shall be fed from this ring main system for further distribution to end consumers. Supply and erection of High mast are also the part of this package. The scope also includes obtaining of statutory clearances for charging of the system.
- b) Any other items that are required for completion of construction power supply system but are not explicitly mentioned in the contract are also part of the contract on mutually acceptable rates. Sufficient evidence shall be provided for deriving the rates of these items.

To meet the construction power requirements of the project, the contractor shall:

- Construct an 33/11 KV substation

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- Establish an 11 KV ring main system utilizing a combination of overhead aerial bunched cables and under-ground lines, as deemed suitable based on site conditions
 - Install 11 kV/415 V Compact Package Substations (PSS) at strategic locations
 - Extend power supply from this construction power network to various BHEL facilities, including (but not limited to):
 - Site office and Customer office buildings
 - Material storage yards
 - Labour and staff accommodation areas
 - High-mast lighting systems
 - Any other utilities or infrastructure associated with construction activities
- c) The scope also includes obtaining all statutory clearances from the competent authorities for erection and charging of the system.
- d) The scope also includes obtaining of statutory clearances from electrical inspector before charging of network.
- e) Any other items that are required for completion of construction power supply system but are not explicitly mentioned in the contract are also part of the contract on mutually acceptable rates. Sufficient evidence shall be provided for deriving the rates of these items.
- f) The drawings provided along with the tender are only schematic, typical and tentative. The contractor shall prepare final detailed drawings in consultation with site engineers after carrying out the route survey for distribution. These drawings shall be prepared in accordance with IE-Rules and have to be approved by the electrical statutory authorities. Obtaining approval from statutory authority shall be the responsibility of the contractor and any expenditure involved in getting approval from statutory authority for the drawings and documents generated by the contractor shall be borne by the contractor. Based on the detailed drawings, contractor shall procure/ fabricate, install all construction power supply equipment as required and erect as per drawing. After CEA if any modification/correction is required in line with applicable IE standards the same has to be done by vendor.
- g) The work shall be done as per the final layout decided in consultation with BHEL Engineer at site which may vary with proposed drawings as above. This shall be done without any additional financial implication on BHEL.
- h) Contractor shall perform Erection, Testing & Commissioning Including Obtaining Approval of entire installation from appropriate statutory authority. Contractor shall bear all the statutory fees/ levies/ charges and all other expenses in connection with the approval of installations.
- i) Construction of entire system shall also include cutting/ trimming of branches of trees or clearing of any other obstruction that may come in the way of overhead line, however this must be done with the approval of MPPGCL/ BHEL.
- j) Contractor shall provide the services of Operation & Maintenance of entire system to ensure reliable availability of the system and shall attend to the break downs and replace the defective components promptly. Failing which BHEL will get the same done at the risk and cost of the contractor.
- k) Contractor shall provide Materials, Equipment, and Devices etc. as per finally approved documents. These should be of reputed make and the equipment/components shall conform to BIS specification and IE rules.
- l) Operation and Maintenance of the system as mentioned in **Package-B**.
- m) Agency shall quote for complete **Package – A & Package – B**. Incomplete bid shall not be acceptable.

ANOTHER TECHNICAL REQUIREMENT

1.All Civil works as required for Installation of poles/ stays/ posts including necessary earthwork like excavation, backfilling and provision of all requisite materials like cement, sand & grit are in scope of contractor.

2.Earthing of all the sub-station equipment and overhead line shall be carried out as per IS: 3043.

2.05 PACKAGES:

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For Ease of operation of the scope of work, the subject work is divided in to Two (02) nos. of Packages mentioned hereunder:

- a) Package A: Supply, Erection and commissioning of Construction power.
- b) Package B: Operation and Maintenance of Construction Power and other ancillaries.

Note:

Package A & B: Each package shall be treated separately. For each item, item rate shall be derived. Payment shall be made on actual execution of work on item rate basis.

2.06 MODALITY OF AWARD

- a) Each Package shall be considered as separate contract with separate contract period (as specified in Chapter-VI "Time Schedule" of TCC), separate start dates and separate contract value etc.

2.07 NOTE TO CHAPTER-II:

- a) Detailed BOQ with detailed specification of various equipments and items are given in the Chapter – XI: Bill of Quantity & Weightages/ Factor. The rate schedule is the summary of BOQ i.e. consolidated list of BOQ. Contractor shall go through the detailed BOQ with respective rate schedule Id no. and specification before filling the rate in the rate schedule.
- b) FOR FURTHER DETAILED SCOPE OF WORKS REFER RELEVANT CHAPTERS IN THIS BOOK.

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Chapter - III: FACILITIES IN THE SCOPE OF CONTRACTOR/BHEL (SCOPE MATRIX)

3.0 SCOPE MATRIX

Sl. No.	Description PART I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
3.1	ESTABLISHMENT			
3.1.1	For construction purpose			
A	Open space for office (as per availability)	Yes		Location will be finalized after joint survey with owner
B	Open space for storage (as per availability)	Yes		Location will be finalized after joint survey with owner
C	Construction of bidder's office, canteen and storage building including supply of materials and other services		Yes	
D	Bidder's all office equipment, office / store / canteen consumables		Yes	
E	Canteen facilities for the bidder's staff, supervisors and engineers etc		Yes	
F	Firefighting equipment like buckets, extinguishers etc		Yes	
G	Fencing of storage area, office, canteen etc of the bidder		Yes	
3.1.2	For living purpose			
A	Open space for labour colony (as per availability)		Yes	Contractor has to make his own arrangements for space, shelter and transportation of labors as per their requirement.
B	Labour Colony with internal roads, sanitation, complying with statutory requirements		Yes	
3.2	ELECTRICITY			
3.2.1	Electricity for construction purposes 3 Phase 415/440 V			Contractor has to make his own arrangement.
A	Single point source of 440 V		Yes	
B	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
C	Duties and deposits including statutory clearances if applicable		Yes	
3.2.2	Electricity for the office, stores, canteen etc. of the bidder (to be specified whether chargeable or free)			Contractor has to make his own arrangement.
A	Single point source		Yes	
B	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
C	Duties and deposits including statutory clearances if applicable		Yes	
3.2.3	Electricity for living accommodation of the bidder's staff, engineers, supervisors etc		Yes	Contractor has to make his own arrangement.

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Sl. No.	Description PART I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
A	Single point source		Yes	
B	Further distribution including all materials, Energy Meter, Protection devices and its service		Yes	
C	Duties and deposits including statutory clearances if applicable		Yes	
3.3	WATER SUPPLY			
3.3.1	For construction purposes (to be specified whether chargeable or free)			Contractor has to make his own arrangement.
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	
3.3.2	Water supply for bidder's office, stores, canteen etc			Contractor has to make his own arrangement.
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	
3.3.3	Water supply for Living Purpose			Contractor has to make his own arrangement.
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	
3.4	LIGHTING			Contractor has to make his own arrangement.
A	For construction work (supply of all the necessary materials) 1. At office/storage area 2. At the preassembly area 3. At the construction site /area		Yes	
B	For construction work (execution of the lighting work/ arrangements) 1. At office/storage area 2. At the preassembly area 3 At the construction site /area		Yes	
C	Providing the necessary consumables like bulbs, switches, etc during the course of project work		Yes	
D	Lighting for the living purposes of the bidder at the colony / quarters		Yes	
3.5	COMMUNICATION FACILITIES FOR SITE OPERATIONS OF THE BIDDER			Contractor has to make his own arrangement.
A	Telephone, fax, internet, intranet, e-mail etc.		Yes	
3.6	COMPRESSED AIR (wherever required for the work)		Yes	Contractor has to make his own arrangement.
3.7	DEMobilIZATION OF ALL THE ABOVE FACILITIES		Yes	Contractor has to make his own arrangement.

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Sl. No.	Description PART I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
3.8	TRANSPORTATION			Contractor has to make his own arrangement.
A	For site personnel of the bidder		Yes	
B	For bidder's equipments and consumables (T&P, Consumables etc)		Yes	

S. No.	Description PART II ERECTION FACILITIES	Scope / to be taken care by		Remarks
		BHEL	Bidder	
3.9				
3.9.1	Engineering works for construction			Not Applicable
A	Providing the erection/constructions drawings for all the equipment covered under this scope		Yes	In consultation with BHEL
B	Drawings for construction methods		Yes	In consultation with BHEL
C	As-built drawings – where ever deviations observed and executed and also based on the decisions taken at site- example – routing of small bore pipes		Yes	Changes are to be marked in drawing & handover to BHEL on completion of work.
D	Shipping lists etc for reference and planning the activities			NOT APPLICABLE
E	Preparation of site erection schedules and other input requirements		Yes	In consultation with BHEL
F	Review of performance and revision of site erection schedules in order to achieve the end dates and other commitments		Yes	In consultation with BHEL
G	Weekly erection schedules based on Sl. No. e		Yes	In consultation with BHEL
H	Daily erection / work plan based on Sl. No. g		Yes	In consultation with BHEL
I	Periodic visit of the senior official of the bidder to site to review the progress so that works is completed as per schedule.		Yes	
J	Preparation of preassembly bay		Yes	
K	Laying of racks for gantry crane if provided by BHEL or brought by the contractor/bidder himself			Not Applicable
L	Arranging the materials required for preassembly		Yes	

3.1 LAND FOR SITE OFFICE

- a) To establish a temporary site office, fabrication yard and storage area at the job site, open space will be provided free of charges. Contractor has to make his own arrangements for labour colony.
- b) BHEL shall not provide to the contractor any residential accommodation to any of his staff and the contractor has to make his own arrangements.
- c) Contractor has to furnish along with their offer, the details of requirements of area of space for his temporary site office, stores / storage shed.

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- d) Location and area requirement for office / storage sheds / fabrication yard shall be discussed and mutually agreed to.

3.2 CONSTRUCTION WATER

- a) Construction water to be arranged by Contractor (Bidder).

3.3 CONSTRUCTION POWER

- a) LT Power may be taken from first charged substation as mentioned below.
b) Electricity for construction purpose LT power will be provided by BHEL at one single point on non-chargeable basis. Further distribution of electricity shall be arranged by the contractor at his cost.
c) Any duty, deposit involved in getting the Electricity shall be borne by the bidder. As regards contractor's office shed also all such expenditure shall be borne by the contractor.
d) Provision of distribution of electrical power from the given single central common point to the required places with proper distribution boards, approved cables and cable laying including supply of all materials like cables, switch boards, pipes etc., observing the safety rules laid down by electrical authority of the State / BHEL / their customer with appropriate statutory requirements shall be the responsibility of the tenderer / contractor.
e) BHEL is not responsible for any loss or damage to the contractor's equipment as a result of variations in voltage / frequency or interruptions in power supply.

3.4 MATERIALS / CONSUMABLES TO BE ARRANGED BY THE CONTRACTOR FOR ERECTION AND COMMISSIONING AS PART OF THE SCOPE WITHIN THE QUOTED RATE / PRICE

- a) All types of welding electrodes, filler wires, Gases
b) Provision for Temporary Scaffoldings.
c) Insulation tape (HT/LT).
d) Paints required for primer & final coating and for protective coating.
e) Solder wire (Lead) -(60/40)
f) Protocol / Calibration report sheets as per BHEL Format.
g) Panel/ JB sealing compound material (for cable entry from bottom / top of Panel).
h) Materials required for cable dressing (GI / aluminium flats, PVC cable ties etc.).
i) PVC wire marker sleeves and Tag plates
j) Lugs of all size.
k) Anchor fasteners for fixing of frames, GI pipes & LDBs / JB's.

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Chapter - IV: T&Ps AND MMEs TO BE DEPLOYED BY THE CONTRACTOR

4.0 T&Ps and MMEs TO BE DEPLOYED BY CONTRACTOR

4.1 The following minimum major (T&P) shall be deployed by the contractor for execution of this contract with in the quoted rate:

S. No.	Description	Minimum quantity
1	Oil filtering machine with BDV kit	01
2	Man-lifter	01
3	Farana	01
4	Trailer	01

4.2 All the tools & plants required for this scope of work are to be arranged by the contractor within the quoted rates. Necessary accessories for the tools & plants shall also be provided by the contractor.

4.3 EQUIPMENT/ T&P FOR TESTING & COMMISSIONING:

The following testing equipment / T&P shall be made available at site by contractor in sufficient number to carry out the job simultaneously in more than one area.

- 1) Insulation tester:
 - a) Motorised megger: 0 - 1000 - 2000 - 5000V, 0 - 25000 M ohms
 - b) Hand operated megger: 0.5 kV/1.0 kV/2.5 kV, 200 - 100 M ohm
- 2) Earth resistance tester: 0 to 1, 10, 100 ohms
- 3) Torque wrench
- 4) Voltmeter AC: 0 - 125 - 250 - 625 V
- 5) Ammeter AC: - 0 - 2A - 10A.
- 6) Wattmeter AC/DC: 0 - 125 - 250 V 0-5-10A.
- 7) Multimeter analogue: AC: V 2.5V - 2500V,
AC: A 100 mA - 10 A, 10A- 200A
DC- V 25.V - 2500V, DC- A - 50mA - 10A
Resistance - 0 - 200 M ohms
- 8) Multimeter - digital:
Voltages AC&DC: 100mv - 1000V
Current: 10mA - 10A
Resistance: 0-20 M ohms
- 9) Variac - 1 /3 phase - 5A, 15A 3 phase - 10A, 20A.
- 10) Secondary injection kit - 0-5A.
- 11) HV Test kit - 50 kV AC 400kVA.
- 12) Vacuum cleaner.
- 13) Phase sequence meter - 110V - 450V - 25 to 65Hz.
- 14) Frequency meter - 0 - 115 - 230 - 4500 - 45 - 601/s.
- 15) Tong tester - 0 - 5A - 10A, 30A, 60A, 150A - 600A, 500A-1000A.
- 16) Tachometer etc.
- 17) mA Source
- 18) Contact resistance measurement kit
- 19) Micro ohm meter
- 20) Air blower.
- 21) Earth Discharge Rod: Minimum 04Nos.

4.4 EQUIPMENT / T & P FOR OPERATION AND MAINTENANCE:

The following testing equipment / T&P shall be made available at site by contractor in sufficient number to carry out the job simultaneously in more than one area.

- 1) Insulation tester:

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- a) Motorised megger - 0 - 1000 - 2000 - 5000V, 0 - 25000 M ohms
 - b) Hand operated megger - 0.5 KV/1.0 KV/2.5 KV, 200 - 100 M ohm
- 2) Multimeter–Digital / analogue:
AC: 2.5V - 1000V,
AC: 100 mA - 10A, 10A- 200A
DC: 25.V - 2500V,
DC: 50mA - 10A
Resistance: 0 - 200 M ohms
 - 3) Vacuum cleaner, Aluminium ladder
 - 4) Phase sequence meter - 110V - 450V - 25 to 65Hz.
 - 5) Tong tester - 0 - 5A - 10A, 30A, 60A, 150A - 600A, 500A-1000A.
 - 6) Air blower, earthing rods, Manila ropes for Changing of Disc insulator
 - 7) Tool box set.
 - 8) Man-lifter shall be arranged by the vendor for operation and maintenance of street light poles and any other height works as per requirement.

4.5 ACCURACY REQUIREMENT OF TESTING INSTRUMENTS

S. No.	INSTRUMENT / TOOL	RANGE	ACCURACY
1	Power Pack	0 to 50V DC, 3A	+ 2%
2	Analog Multimeter	Voltage 2.5 to 2500V AC	+ 1.0%
		Current 100 mA to 10A AC	+ 2.0%
		Current 250 micro A to 1A DC	+ 1.5%
		Resistance upto 100 ohms	+ 3.0%
		Voltage 2.5V to 2500V DC	+ 1%
3	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 010A AC	+ 1% + 1 digit	
5	Secondary Injection Kit	Upto 5A	+ 0.5mA
6	Motor operated Megger	Upto 200 Ohms	+ 5% at Centre scale
7	Tongue tester	0/300/600A AC	+ 5%
		0 to 300A DC	+ 5%
8	Tachometer (Hand held)	0 to 4000 rpm	+ 5%
9	Phase Sequence Meter		N/A
10	Three Phase Variac	15 A Capacity	N/A
11	Feeler gauges	300 mm long and 100 mm long	+ 2 microns
12	Dial gauges	0 to 10mm	+ 0.01 mm
13	Hand operated Megger 500V / 1000V	Upto 200 M Ohms	+ 5% at Centre Scale + 10% at end of Scale
14	Motorised Megger 2.5 kV	Upto 1000 M Ohms	+ 5% at Centre Scale + 10% at end of Scale
15	Motorised Megger 2.5 kV	Upto 200 M Ohms	+ 5% at Centre Scale + 10% at end of Scale

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S. No.	INSTRUMENT / TOOL	RANGE	ACCURACY
16	Earth Resistance tester (Megger)	0 to 1, 10, 100 Ohms	± 5% at Centre Scale range
17	AC tongue Tester	0 to 300A AC	± 3%
18	DC Tongue Tester	0 to 300A DC	± 5%
19	High Voltage test Kit	Upto 50 KV AC	± 10%
		Upto 70 KV DC	± 10%
20	Tacho Generator (Mech)	0 to 4000 rpm	± 0.25%
21	DC Ammeter	0 to 300 A	± 10%
22	DC Voltmeter	0 to 500 V	± 10%
23	Micro ohm meter	10V and 100 V	
24	Primary Injection Kit	0-10000A	
25	Single Phase Variac	0-15 Amps	
26	Motor direction tester		
27	DC Tong Tester (mA)	0-500 mA	
28	Contact resistance tester for breaker contact resistance measurement		
29	Motorised Megger 5kV	10000 M ohms	

4.6 NOTES FOR THIS CHAPTER:

- a. List of T & Ps and testing equipments are for illustrative purpose only. Any other T & Ps and testing equipments required for successful completion of the scope of the contract shall also be arranged by the contractor within the quoted rates.
- b. All testing instruments shall have calibration certificate issued by recognized / accredited agencies.
- c. The above instruments / equipment will be sent for testing and calibration wherever from time to time and maintained by contractor as required by BHEL.
- d. List of such agencies and periodicity of calibration with calibration certificate required for different instruments will be furnished to BHEL at site.
- e. Contractor shall maintain calibration records as per the BHEL format and produce them whenever called for by BHEL Engineers.
- f. Contractors shall arrange experienced/ qualified persons for using these calibration instruments at laboratory and also at work spot.
- g. Wherever frequent calibration is required, contractor shall arrange adequate number of instruments such that the work does not suffer for want of test instruments.
- h. Equipment, vehicles, tools and plants and materials brought to site by the contractor from his resources shall have distinctive identification marks and the contractor shall intimate the description and quantity to BHEL in writing.
- i. All construction materials brought by the contractor shall have prior approval regarding quality and quantity by BHEL. The contractor shall also provide without any extra cost necessary enclosure containers and protective materials for proper storage of materials inside while the materials are in their custody, whenever so instructed by the purchaser without any extra cost.
- j. No material or equipment or tools etc. shall be taken out of the work-site without the written consent of BHEL.
- k. BHEL shall not be responsible for the safety and protection of the materials of the contractor and the contractor shall make his arrangements for proper watch and ward for his materials.

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Chapter - V: T&Ps AND MMEs TO BE DEPLOYED BY BHEL

5.0 T&Ps AND MMEs TO BE DEPLOYED BY BHEL ON SHARING BASIS

Nil

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - VII: TERMS OF PAYMENT

6.0 TIME SCHEDULE

6.1 CONTRACT PERIOD FOR Package A

The entire work of erection, testing and commissioning of all electrical components including Supply & Application of Final Painting, as detailed in the Tender Specification shall be completed within 9 months from the date of commencement of work at site. However minimum 33 kV cable, 33kV/11kV substation, and 11kV O/H or underground line network for charging of 4 nos. of 11kV/433V substation shall be commissioned within 05 months from date commencement of work at site.

6.2 During the total period of contract of package- A, the contractor has to carry out the supply, erection, testing and commissioning activities in a phased manner as required by BHEL and the program of milestone events.

6.3 CONTRACT PERIOD FOR Package B

The operation and maintenance period of the construction power distribution system & yard lighting shall be 43 months from the date of start of commencement of operation and maintenance.

6.4 COMMENCEMENT OF CONTRACT PERIOD of Package A

The date of commencement of contract period shall be the mutually agreed date between the bidder and BHEL engineer to start the work. In case of discrepancy the decision of BHEL engineer is final.

6.5 COMMENCEMENT OF CONTRACT PERIOD of Package B

The date of commencement of contract period shall be the date of acceptance of the commissioning of the Main construction power 33/11kV substation & 04 Nos. PSS (11kV/433V) by BHEL Engineer as per original scheme. Till the start of Package-B the contractor has to operate & maintain the Package-B works free of cost within the Package-A rates. In case of discrepancy the decision of BHEL engineer is final.

6.6 MOBILISATION FOR ERECTION, TESTING, COMMISSIONING ETC. of Package A

The activities for erection, testing etc. shall be started as per directions of Construction manager of BHEL. The contractor has to augment his resources in such a manner that following major milestones of erection & commissioning are achieved on specified schedules:

Description	Milestone month for package A
Start of work (Expected)	Fifteen days from LOI.
Completion of 33/11 kV SS & first 04 substations of 11kV/ 433V.	5 months from start of work
Completion of next 6 substations	8 th month
Completion of balance work	9 th month

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.

6.7 MOBILISATION FOR Package B

The contractor has to provide the resources from the first day of commencement of contract period of package B.

6.8 GUARANTEE PERIOD FOR CONTRACTOR SUPPLIED ITEMS under Package -A

The guarantee period of twelve months shall commence from the date of acceptance of BHEL Engineer for start of operation and maintenance (after commissioning) of that particular equipment.

6.9 GUARANTEE PERIOD FOR WORKMANSHIP OF THE CONTRACTOR EXECUTED AND COMMISSIONED ITEMS under Package -A

The guarantee period shall be 12 months from the date of commissioning as certified by the BHEL Engineer.

Note: The guarantee period of Workmanship for Pkg-B shall be NIL.

6.10 PROVISION OF PENALTY IN CASE OF SLIPPAGE OF INTERMEDIATE MILESTONES IN PACKAGE-A

BHEL-PSWR (VOL-I-A- TECHNICAL BID SPECIFICATION)

E-Tender Specification No: BHE/PW/PUR/STP-CP/3215

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Chapter - VII: TERMS OF PAYMENT

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

M1 Milestone - Completion of 11/11.5 kV SS & first 04 substations of 11kV/ 433V.

M2 Milestone – Completion of next 6 substations.

Provision of Penalty in case of slippage of Intermediate Milestones:

- i) Two major Intermediate Milestones are mentioned as M1 & M2
- ii) In case of slippage of these identified Intermediate Milestones, Delay Analysis shall be carried out on achievement of each of these two Intermediate Milestones in reference to Form 14.
- iii) In case delay in achieving M1 Milestone is solely attributable to the contractor, 0.5% per week of Executable Contract Value*, limited to maximum 2% of Executable Contract Value, will be withheld.
- iv) In case delay in achieving M2 Milestone is solely attributable to the contractor, 0.5% per week of Executable Contract Value*, limited to maximum 3% of Executable Contract Value, will be withheld.
- v) 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.
- vi) 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.
- vii) Final deduction towards LD (if applicable as per clause above), on account of delay attributable to contractor shall be based on final delay analysis on completion / closure of contract. Withheld amount, if any due to slippage of identified intermediate milestone(s) shall be adjusted against LD or released as the case may be.
- viii) In case of termination of contract due to any reason attributable to contractor before completion of work, the amount already withheld against slippage of intermediate milestones shall not be released and be converted into recovery.

* 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.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - VII: TERMS OF PAYMENT

7.0 TERMS OF PAYMENT

7.1 **Terms of payment: No advance payment will be made.**

7.2 The progressive payment against monthly running bills for erection, testing and commissioning as per the percentage mentioned below on accepted rate / price of contract value will be released as mentioned below on Pro rata basis (References are from Chapter XI: Bill of Quantity & Weightages/ Factor)

S. No.	Activity / Work Description	% of unit rate
7.2.1	Preparation of drawings and obtaining statutory clearances etc. (BOQ ref 1.01)	
7.2.1.1	On completion of route survey and preparation of drawings.	50%
7.2.1.2	On getting of charging clearance from Statutory Authority.	50%
7.2.2	Supply of Materials (BOQ ref 2.01, 2.02, 2.03 & 2.04, supply portion of 2.10)	
7.2.2.1	On receipt of material, verification of documents and on acceptance at site.	90%
7.2.2.2	On charging of material OR final bill of Package-A.	10%
7.2.3	Laying of HT / LT cable	
7.2.3.1	On laying of cable.	45%
7.2.3.2	Termination of cables with respective equipment.	25%
7.2.3.3	On Charging.	30%
7.2.4	Laying of 11 kV O/H line and associated items	
7.2.4.1	On completion of line stringing	45%
7.2.4.2	On completion of end connection	25%
7.2.4.3	On Charging	30%
7.2.5	Erection and Commissioning of PSS & Main 33/11kV substation	
7.2.5.1	Construction of foundation plinth for transformer, HT & LT panels, Placement of transformer/ PSS, VCB (if applicable)	35%
7.2.5.2	Receipt, positioning, end termination of cables and earthing of equipments etc.	25%
7.2.5.3	Fencing, substation flooring, lighting and lightning poles erection etc., as applicable for each substation	20%
7.2.5.4	Testing, Commissioning and charging of each substation	20%
7.2.6	Erection and testing of Distribution Boards/Panels	
7.2.6.1	On erection of Distribution boards	65%
7.2.6.2	On charging of Distribution boards	35%
7.2.7	Erection of PSSC/ Steel poles	
7.2.7.1	On completion of erection including foundation	65%
7.2.7.2	On completion of line stringing	20%
7.2.7.3	On Charging	15%
7.2.8	Erection of any other item, not covered above, the terms of payment shall be as follows	
7.2.8.1	On Erection	65%
7.2.8.2	On Charging	35%

7.3 The dismantling works if any are required with written permission from Construction Manager/ Project Director shall be paid for the erection/ laying/ stringing rate of that item.

7.4 Payment for O&M portion shall be made on submission of monthly running Bills at the quoted/ accepted monthly charges and as certified by BHEL engineer.

7.5 Retention Amount as per GCC Clause 2.22 shall be applicable.

7.6 Following clauses of GCC is not applicable for Package A & B:

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - VII: TERMS OF PAYMENT

7.6.1.1.1.1	PVC as per GCC clause 2.17.
7.6.1.1.1.2	ORC as per GCC clause 2.12.
7.6.1.1.1.3	Secured Recoverable Advance as per GCC clause 2.13.

7.7 **Package B**

7.7.1 For Operation & Maintenance under Package B, payment for Monthly RA Bills shall be made as follows:

7.7.1.1 **Security Deposit**

Security Deposits for both Package A and Package B are to be submitted before start of the work of Package A.

However, Security Deposit of ~~each~~ Package will be returned upon fulfillment of contractual obligation of the respective Package in line with GCC Clause 1.11.

7.7.1.2 **Measurement of Work and Mode of Payment**

Measurement of Work and Mode of Payment as per GCC clause 2.6 shall be done separately for Package A and Package B.

Manpower For O&M Services

Payment for monthly basis on actual deployment as per the awarded monthly rate against each head.

Payment for the same shall be made as per the service-month rate fixed in item no 2.10.1, 2.10.2 & 2.10.3 of BOQ cum Rate Schedule 'Package -B' on pro-rata basis at actuals.

The actual requirement of manpower shall be discussed and finalized with engineer in-charge before start of the works. However, rates fixed are on the basis of total minimum wages for M.P Govt. Minimum wages circular at the time of NIT and the same shall be revised at times when it is changed by the Government.

Therefore, price variation compensation and overrun compensation will not be applicable for items in Package-B.

Payment against items in Package-B of BOQ cum rate schedule shall be calculated & paid in following manner;

- Per service month rate= 1.41 x minimum wages per month (rounded to next higher fifty value)

Minimum wages per month = Daily Rate Minimum Wage per day (rounded value) x 26 Days.

During the extended period of contract, O&M services for BHEL office and stores, Open Yard, site offices, etc. shall be provided by the contractor as per the instruction of BHEL site-in-charge.

7.7.2 **Rights of BHEL as per GCC clause 2.7**

7.7.2.1 Rights of BHEL as per GCC clause 2.7 shall be applicable for Package A and Package B separately.

7.7.2.2 Package A and Package B shall be treated as separate contract. However, the Security Deposits for both Package A and Package B are to be submitted before start of the work of Package A.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - VIII: TAXES AND DUTIES

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

1. All taxes excluding GST, GST Cess & BOCW Cess but including, Royalties, fees, license, deposits, commission, any State or Central Levy and other charges whatsoever, if any, shall be borne by you and shall not be payable extra.
2. Any increase of the taxes excluding GST, GST Cess & BOCW Cess, at any stage during execution including extension of the contract shall have to be borne by the contractor. Quoted/ accepted rates/ price shall be inclusive of all such requirements. Please note that since GST on output will be paid by BHEL separately as enumerated below, your quoted rates/ price should be after considering the Input Credit under GST law at your end.
3. **GST :**
The successful bidder shall furnish proof of GST registration. GST along with Cess (as applicable) legally leviable & payable by the successful bidder as per GST Law, shall be paid by BHEL. Hence Bidder shall not include GST along with Cess (as applicable) in their quoted price.
4. GST charged in the Tax Invoice/Debit note by the contractor shall be released separately to the contractor only after contractor files the outward supply details in GSTR-1 on GSTN portal and input tax credit of such invoice is matched with corresponding details of outward supply of the contractor and has paid the GST at the time of filing the monthly return
5. E-invoicing under GST has been implemented with effect from 1st October 2020 for all the taxable persons having turnover more than the threshold limit in any preceding financial year from 2017-18 onwards. Therefore, for all the taxable persons falling under the purview of E-invoice, it is mandatory to mention a valid unique Invoice Reference No. (IRN) and QR code as generated from E-Invoicing portal of the Government for the purpose of issuing a valid Tax Invoice. Only an E-invoice issued in the manner prescribed under rule 48(4) of CGST Rules shall be treated as valid invoice for reimbursement of GST amount. If the successful Bidder is not falling under the purview of E-Invoicing then he has to submit a declaration in that respect along with relevant financial statements.
6. Bidder shall note that the GST Tax Invoice complying with GST Invoice Rules (Section 31 of GST Act & Rules referred there under) wherein the 'Bill To' details will as below:
BHEL GSTN – As per **Annexure -1**
NAME – Bharat Heavy Electricals Limited
ADDRESS – Site address
7. Bidder to immediately intimate on the day of removal of Goods (in case of any supply of goods) to BHEL along with all relevant details and a scanned copy of Tax Invoice to below email ids to enable BHEL to meet its GST related compliances :-
Email id — to be intimated later on.
In case of delay in submission of the abovementioned documents on the date of dispatch, BHEL may incur penalty /interest for not adhering to Invoicing Rules under GST Law. The same will be liable to be recovered from the successful bidder, if such delay is not attributable to BHEL.
8. In case of raising any Supplementary Tax Invoice (Debit / Credit Note) Bidder shall issue the same containing all the details as referred to in Section 34 read with Rule 53.
9. Bidder shall note that in case GST credit is delayed/ denied to BHEL due to delayed / non receipt of goods and /or tax invoice or expiry of the timeline prescribed in GST Law for availing such ITC, or any other reasons not attributable to BHEL, GST amount shall be recoverable from the vendor along with interest levied / leviable on BHEL, as the case may be.
10. Bidder shall upload the Invoices raised on BHEL in GSTR-1 within the prescribed time as given in the GST Act. Bidder shall note that in case of delay in declaring such invoice in your return and GST credit availed by BHEL is denied or reversed subsequently as per GST Law , GST amount paid by BHEL towards such

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - VIII: TAXES AND DUTIES

ITC reversal as per GST law shall be recoverable from the bidder along with interest levied / leviable on BHEL.

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

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

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

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

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

13. For transportation work, bidder shall declare in his quotation whether he is registered under GST, if yes, whether he intends to claim GST on forward charge basis. In absence of this declaration, BHEL will proceed further with the assumption that bidder intends not to claim GST on forward charge basis. However, in case of GST registered transporter, the amount to the extent of goods and service tax will be retained till BHEL avails the credit of GST. Further, transporter shall issue tax invoice which inter alia includes gross weight of the consignment, name of the consigner and the consignee, registration number of vehicle in which the goods are transported, details of goods transported, details of place of origin and destination, GSTIN of the person liable for paying tax whether as consigner, consignee or goods transport agency, and also containing other information as mentioned under rule 46.
14. TDS under Income Tax shall be deducted at prevailing rates on gross invoice value from the running bills unless exemption certificate from the appropriate authority/ authorities is furnished.
15. TDS under GST shall be deducted at prevailing rates on applicable value from the running bills.
16. TCS under Income Tax 1961 has been implemented with effect from 1st October 2020 for every seller having turnover more than threshold limit during financial year immediately preceding financial year in which the sale of goods is carried out, who receives any amount as consideration for sale of any goods of the value or aggregate of such value exceeding threshold limit other than export of goods or who is already covered under other provision of section 206C, collect from the buyer, TCS as per applicable rates of the sale consideration exceeding threshold limit subject to following conditions

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

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

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

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - VIII: TAXES AND DUTIES

ANNEXURE-1

State wise GSTIN no.s of BHEL

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

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - IX: DRAWINGS & STANDARDS APPLICABLE

8.0 STANDARDS APPLICABLE

- 9.1 All equipment and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) except where modified and / or supplemented by this specification.
- 9.2 Equipment and materials conforming to any other standard which ensures equal or better quality may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.
- 9.3 The electrical installation shall meet the requirement of Indian Electricity Rules as amended up to dates, relevant IS codes of Practice and Indian Electricity Act. In addition, other rules or regulations applicable to the work shall be followed. In case of any discrepancy, the more restrictive rule shall be binding. A list of applicable standards is given below for reference.

S. No.	List of IS applicable	Description
1	IS: 10028: 1981 (Part-II & III)	Code of practice for Installation and maintenance of transformers (superseding IS: 1886)
2	IS: 10322: 1982 (Part-I)	Luminaires General Requirements
3	IS: 10322: 1982 (Part-II)	Luminaires Constructional Requirements
4	IS: 10322: 1984 (Part-III)	Luminaires Screw and screwless terminals
5	IS: 10322: 1984 (Part-IV)	Luminaires Methods of tests
6	IS: 10322: 1985 (Part-V) Sec-I	Luminaires Particular requirements Section 1 General purpose luminaires
7	IS: 10322: 1985 (Part-V) Sec-II	Luminaires Particular Requirements Section 2 Recessed Luminaires
8	IS: 10322: 1987 (Part-V) Sec-III	Luminaires Particular requirements Section 3 Luminaires for road and street lighting (superseding IS:2149)
9	IS: 10322: 1987 (Part-V) Sec-IV	Luminaires Particular requirements Section 4 Portable general purpose luminaires
10	IS: 10322: 1987 (Part-V) Sec-V	Luminaires Particular requirements Section 5 Flood light (superseding IS 1947)
11	IS: 104: 1979: (Second Revision)	Ready mixed paint, brushing, zinc chrome, priming
12	IS: 11171: 1985	Dry type power transformers
13	IS: 1180: 1989 (Part-I,II)	Outdoor type three phase distribution transformers up to and including 100kVA 11kV
14	IS: 1248: 2003 (Part I to IX)	Electrical measuring instruments and their accessories
15	IS: 1255: 1983	Code of practice for installation and maintenance of power cables up to and including 33kV rating
16	IS: 13118: 1991	Specification for High Voltage Alternating Current Circuit Breakers
17	IS: 13234: 1992	Guide for short circuit current calculation in three phase AC systems
18	IS: 13947: 2004 (Part-V)	Low voltage switchgear and control gear: Control circuit devices and switching elements
19	IS: 1445: 1977	Porcelain insulators for overhead lines with a nominal voltage up to and including 1000 V
20	IS: 15086: 2001 (Part-I)	Nonlinear resistor type gapped surge arresters for AC systems.
21	IS: 15086: 2001 (Part-V)	Surge Arresters selection and application recommendations.
22	IS: 15086: 2003 (Part-III)	Artificial Pollution Testing of Surge Arresters
23	IS: 15505: 2004	HCFC Blend- A Fire Extinguishing System

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24	IS: 1554 (Part-I): 1988	PVC insulated (Heavy duty) electric cables for working voltages up to & including 1100 volts (Third Revision)
25	IS: 1554 (Part-II): 1988	PVC insulated (Heavy duty) electric cables for working voltages from 3.3kV up to & including 11kV (second Revision)
26	IS: 15652: 2006	Insulating Mats for Electrical Purposes - Specification
27	IS: 1678: 1998	Specification for pre-stressed concrete poles for overhead power, traction and telecommunication lines
28	IS: 1866: 2000	Electrical maintenance & supervision of mineral insulating oil in equipment (Third Revision)
29	IS: 1885: 1961 (Part-I)	Fundamental Definition
30	IS: 1885: 1966 (Part-XI)	Electrotechnical Vocabulary Electrical Measurement
31	IS: 1885: 1971 (Part-XXX)	Electrotechnical Vocabulary Overhead Transmission Line and distribution of electrical energy
32	IS: 1885: 1992 (Part-IX)	Electrotechnical Vocabulary: Electrical Relays
33	IS: 1885: 1993 (Part-LIV)	Electrotechnical Vocabulary Insulators
34	IS: 1885: 1993 (Part-LXXVII)	Electrotechnical Vocabulary Overhead Lines
35	IS: 1885: 1993 (Part-LXXXI)	Electrotechnical Vocabulary electrical measuring instruments
36	IS: 1885: 1993 (Part-XXVIII)	Electrotechnical Vocabulary Instrument Transformers
37	IS: 1885: 1993 (Part-XXXVIII)	Electrotechnical Vocabulary Power Transformers and Reactors
38	IS: 1885: 2008 (Part-X)	Electrotechnical Vocabulary Electrical power system protection
39	IS: 2026: 1977 (Part-I)	Power Transformers General
40	IS: 2026: 1977 (Part-II)	Power Transformers Temperature rise
41	IS: 2026: 1977 (Part-IV)	Power Transformers Terminal marking, tappings and connections.
42	IS: 2026: 1981 (Part-III)	Power transformers Insulation level and dielectric tests
43	IS: 2026: 1994 (Part-V)	Power Transformers/Reactor bushings minimum external clearance in air specification
44	IS: 2099: 1986	Bushings for alternating voltages above 1000 V
45	IS: 2121: 1981 (Part-I)	Conductors and earth wire accessories for overhead power lines Armour rods, binding wires and tapes for conductors
46	IS: 2121: 1981 (Part-II)	Conductors and earth wire accessories for overhead power lines Mid span joints and repair sleeves for conductors
47	IS: 2121: 1991 (Part-II)	Conductors and earth wire accessories for overhead power lines Non tension joints
48	IS: 2121: 1992 (Part-II)	Conductors and earth wire accessories for overhead power lines Accessories for earth wire
49	IS: 2171: 1976	Portable fire extinguishers, dry powder (cartridge type)
50	IS: 2486: 1974 (Part-III)	Insulator fittings for overhead power lines with nominal voltage greater than 1000V Locking Devices
51	IS: 2486: 1981 (Part-IV)	Insulator fittings for overhead power lines with nominal voltage greater than 1000V Tests for Locking Devices
52	IS: 2486: 1989 (Part-II)	Insulator fittings for overhead power lines with nominal voltage greater than 1000V Dimensional requirements

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53	IS: 2486: 1993 (Part-I)	Metal fittings of insulators for overhead power lines with nominal voltage greater than 1000V General Requirements and tests.
54	IS: 2544:1973	Porcelain post insulators for systems with nominal voltage greater than 1000 Volts.
55	IS: 2675: 1983	Enclosed distribution fuseboards and cutouts for voltages not exceeding 1000 V Ac and 1200 V Dc
56	IS: 2705: 1992 (Part-I)	Current Transformers General Requirements
57	IS: 2705: 1992 (Part-II)	Current Transformers Measuring Current Transformers
58	IS: 2705: 1992 (Part-III)	Current Transformers Protective Current Transformers
59	IS: 2705: 1992 (Part-IV)	Current Transformers Protective Current Transformers for special purpose applications.
60	IS: 2878: 2004	Fire Extinguisher, Carbon Dioxide Type (Portable and Trolley Mounted) – Specification
61	IS: 2932: 2003 (First Revision)	Enamel, Synthetic, Exterior (a) Undercoating (b) Finishing – Specification
62	IS: 3043: 1987	Code of practice for earthing
63	IS: 3070: 1993	Lightning Arresters for Alternating Current Systems - Specification - Part 3 Metal Oxide Lightning Arresters Without Gaps
64	IS: 3156: 1992 (Part-I)	Voltage Transformers General Requirements
65	IS: 3156: 1992 (Part-II)	Voltage Transformers Measuring Voltage Transformers
66	IS: 3156: 1992 (Part-III)	Voltage Transformers Protective Voltage Transformers
67	IS: 3156: 1992 (Part-IV)	Voltage Transformers Capacitor Voltage Transformers
68	IS: 3188: 1980	Characteristics of String Insulator Units
69	IS: 3347: 1965	HV Porcelain Bushing for transformer
70	IS: 335: 1993	New Insulating Oils
71	IS: 3427: 1997	A.C. Metal Enclosed Switchgear and Controlgear for Rated Voltages Above 1 kV and Up to and Including 52 kV
72	IS: 3637: 1966	Gas operated relays
73	IS: 3639: 1966	Specification for Fittings and Accessories for Power Transformers
74	IS: 3961: 1967 (Part-I)	Recommended current ratings for cables: Part 1 Paper insulated lead sheathed cables
75	IS: 3961: 1967 (Part-II)	Recommended current ratings for cables: Part 2 PVC insulated and PVC sheathed heavy duty cables
76	IS: 3961: 1968 (Part-III)	Recommended current ratings for cables: Part 3 Rubber insulated cables
77	IS: 3961: 1968 (Part-V)	Recommended current ratings for cables: Part 5 PVC insulated light duty cables
78	IS: 398: 1976 (Part-III)	Aluminium conductors for overhead transmission purposes: Part 3 Aluminium conductors, aluminized steel reinforced
79	IS: 398: 1994 (Part-IV)	Aluminium conductors for overhead transmission purposes: Part 4 Aluminium alloy stranded conductors (aluminium magnesium silicon type)
80	IS: 398: 1996 (Part-I)	Aluminium conductors for overhead transmission purposes: Part 1 Aluminium stranded conductors

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81	IS: 398: 1996 (Part-II)	Aluminium conductors for overhead transmission purposes: Part 2 Aluminium conductors, galvanized steel reinforced
82	IS: 4012: 1967	Specification for Dust-proof Electric Lighting Fittings
83	IS: 4013: 1967	Dust-tight electric lighting fittings
84	IS: 4257: 1981 (Part-I)	Dimensions for Clamping Arrangements for Porcelain Transformer Bushings - Part 1 : For 12 kV to 52 kV Bushings
85	IS: 4770: 1991	Rubber Gloves - Electrical Purposes - Specification
86	IS: 5: 2007	Colours for Ready Mixed Paints and Enamels
87	IS: 5216: 1982 (Part-I)	Recommendations on Safety Procedures and Practices in Electrical Work - Part I General
88	IS: 5216: 1982 (Part-II)	Recommendation on Safety Procedures and Practices in Electrical Work - Part II Life Saving Techniques
89	IS: 5613: 1985 (Part-I) Sec-I	Code of Practice for Design, Installation and Maintenance of Overhead Power Lines - Part 1 Lines Up to and Including 11 kV - Section 1 Design
90	IS: 5613: 1985 (Part-I) Sec-II	Code of practice for design, installation and maintenance of overhead power lines Part 1 Lines up to and including 11 kV, Section 2 Installation and maintenance
91	IS: 5613: 1985 (Part-II) Sec-I	Code of practice for design, installation and maintenance of overhead power lines Part 2 Lines above 11 kV and up to and including 220 kV, Section 1 Design
92	IS: 5613: 1985 (Part-II) Sec-II	Code of practice for design, installation and maintenance of overhead power lines Part 2 Lines above 11 kV and up to and including 220 kV, Section 2 Installation and maintenance
93	IS: 5819: 1970	Recommended Short-circuit Ratings of High Voltage PVC Cables
94	IS: 6103: 1971	Method of test for specific resistance (resistivity) of electrical insulating liquids
95	IS: 6262: 1971	Method of Test for Power Factor and Dielectric Constant of Electrical Insulating Liquids
96	IS: 6600: 1972	Guide for loading of oil immersed transformers
97	IS: 6792: 1992	Method for Determination of Electric Strength of Insulating Oils
98	IS: 694: 1990	PVC Insulated cables for working voltages upto and including 1100 V
99	IS: 731: 1971	Porcelain insulators for overhead power lines with a nominal voltage greater than 1000 V
100	IS: 732: 1989	Code of Practice for Electrical Wiring Installations
101	IS: 800: 2007	General Construction in Steel - Code of Practice
102	IS: 8130: 1984	Conductors for insulated electric cables and flexible cords
103	IS: 8270: 1976: (Part-I)	Guide for preparation of diagrams, charts and tables for electrotechnology: Part 1 Definitions and classification
104	IS: 8270: 1976: (Part-II)	Guide for preparation of diagrams, charts and tables for electrotechnology: Part 2 Item designation
105	IS: 8270: 1976: (Part-V)	Guide for preparation of diagrams, charts and tables for electrotechnology: Part 5 Interconnection diagrams and tables
106	IS: 8270: 1977: (Part-III)	Guide for preparation of diagrams, charts and tables for electrotechnology: Part 3 General requirements for diagrams

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107	IS: 8270: 1977: (Part-IV)	Guide for preparation of diagrams, charts and tables for electrotechnology: Part 4 Circuit diagrams
108	IS: 8270: 1983: (Part-VI)	Guide for preparation of diagrams, charts and tables for electrotechnology: Part 6 Unit wiring diagrams and tables
109	IS: 8623: 1993: (Part-I)	Specification for Low-Voltage Switchgear and Controlgear Assemblies - Part 1 : Requirements for Type-Tested and Partially Type-Tested Assemblies
110	IS: 8623: 1993: (Part-II)	Specification for Low-voltage Switchgear and Controlgear Assemblies - Part 2 : Particular Requirements for Busbar Trunking Systems (Busway
111	IS: 8623: 1993: (Part-III)	Specification for Low-Voltage Switchgear and Controlgear Assemblies - Part 3 : Particular Requirements for Equipment Where Unskilled Persons have Access for Their Use
112	IS: 9920: 1982: (Part-III)	Specification for Alternating Current Switches for Voltages Above 1 000 V - Part III Design and Construction
113	IS: 9920: 1985: (Part-IV)	Specification for Alternating Current Switches for Voltages Above 1000 V - Part 4 Type Tests and Routine Tests
114	IS: 9920: 2001: (Part-II)	High-voltage Switches - Specification - Part 2 High-voltage Switches for Rated Voltages of 52 kV and Above
115	IS: 9920: 2002: (Part-I)	High Voltage Switches - Part 1 Switches for Rated Voltages Above 1 kV and Less Than 52 kV
116	IS: 9921: 1981: (Part-I)	Specification for Alternating Current Disconnectors (Isolators) and Earthing Switches for Voltages Above 1 000 V - Part I General and Definitions
117	IS: 9921: 1982: (Part-II)	Alternating current disconnectors (isolators) and earthing switches for voltages above 1000 V Part 2 Rating
118	IS: 9921: 1982: (Part-III)	Specification for Alternating Current Disconnectors (Isolators) and Earthing Switches for Voltages Above 1000 V - Part III Design and Construction
119	IS: 9921: 1985: (Part-IV)	Specification for Alternating Current Disconnectors (isolators) and Earthing Switches for Voltages Above 1000 V - Part 4 Type Tests and Routine Tests
120	IS: 9921: 1985: (Part-V)	Specification for Alternating Current Disconnectors (Isolators) and Earthing Switches for Voltages Above 1 000 V - Part 5 Information to be Given with Tenders, Enquiries and Orders
121	IS: 9974: 1981: (Part-I)	High pressure sodium vapour lamps - Part 1 General requirements and tests
122	IS: 9974: 1981: (Part-II)	High pressure sodium vapour lamps - Part 2 Standard lamp data sheets

9.4 In addition to the standards mentioned above, all works shall conform to the requirements of the following rules and regulations.

- a. Indian Electricity Act and Rules framed thereunder
- b. Fire insurance regulations
- c. Regulations laid down by the Chief Electrical Inspector of State and CEA
- d. Regulations laid down by the Factory Inspector of State
- e. Any other regulations laid down by the authorities.

9.5 In case any clause of contradictory nature arises between standards and this specification, the latter shall

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prevail.

ADDITIONAL DRAWINGS ATTACHED.

1. Drawing No.: PE-DG-508-100-M001 REV00 (PLOT PLAN)
2. Drawing No.: 9587-999-POE-F-00C REV00 (Tentative SLD for construction power)

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10.1 DETAILED TECHNICAL SPECIFICATIONS

10.2 GENERAL

- 10.1.1 Identification of equipment at storage yard, technical assistance for checking and making the shortage/ damage reports, taking delivery at storage yard (BHEL as well as contractor's supplied items) 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 using their tools and tackles and testing instruments along with the supply of all consumables.
- 10.1.2 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 his 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.
- 10.1.3 If any item or equipment not covered in this tender but requires erecting / commissioning, the same shall be carried out by the contractor. Equivalent unit rate for those item or equipment shall be considered wherever possible from the BOQ / rate schedule. The rates quoted by the contractor shall be uniform as far as possible for similar items appearing in rate schedule.
- 10.1.4 Receipt of materials / component to be erected by the contractor, loading and transportation from the storage yard to the project site, stacking, storage and preservation are part of this scope.
- 10.1.5 Fabrication and installation of steel supports wherever required.
- 10.1.6 It is not the intent to specify herein all details of material. Any item related to this work, not covered by this scope but necessary to complete the system will be deemed to have been included in the scope of the work.
- 10.1.7 Deployment of skilled/ unskilled manpower, engineers/ supervisors, Tools & Plants (T & P), Material handling equipment, testing instruments, returning of un-used materials/ items to BHEL stores. The installation and commissioning of all the electrical equipments / items shall conform to the technical requirements specified elsewhere in the tender.
- 10.1.8 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.
- 10.1.9 The contractor shall carry out 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.
- 10.1.10 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 his personnel shall co-operate with the personnel of other agencies, co-ordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.
- 10.1.11 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.
- 10.1.12 Contractor shall supply and 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.
- 10.1.13 During the course of erection, testing and commissioning of electrical work, certain rework / modification / rectification / repairs / fabrication etc. may be necessary on account of feedback from other power stations and site operation / maintenance requirements. Contractor shall carryout such rework / modification / rectification / fabrication / repairs etc, promptly and expeditiously.
- 10.1.14 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 drawals at the market rate.
- 10.1.15 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,

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- 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.
- 10.1.16 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.
- 10.1.17 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.
- 10.1.18 Contractor shall retain all T&P / Testing instrument / Material handling equipments 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.
- 10.1.19 The contractor at his cost shall arrange necessary security measures for adequate protection of his 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 his machinery equipment tools etc.
- 10.1.20 Wherever erection sequences are furnished by BHEL, the contractor shall follow the same sequence. If required by BHEL, the contractor shall change the sequence of his 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.
- 10.1.21 Any wrong erection shall be removed and re-erected promptly to comply with the design requirements to the satisfaction of Site Engineer.
- 10.1.22 Contractor has to work in close co-ordination with other erection agency at site. BHEL engineer will co-ordinate 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.
- 10.1.23 Contractor shall remove all scrap materials periodically generated from his working area in and around power station and collect the same at one place earmarked for the same. 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.
- 10.1.24 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 himself 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.
- 10.1.25 No member of the already erected structure / platform, pipes, grills, platform, other component and auxiliaries should be cut without specific approval of BHEL engineer.
- 10.1.26 For other agencies, such as piping, Boiler, ESP, instrumentation, insulation etc., to commence their work from / on the equipments coming under this scope, Contractor has to clear the front, expeditiously and promptly 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.
- 10.1.27 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.
- 10.1.28 Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.
- 10.1.29 On Completion of work, all the temporary buildings, structures, pipe lines, cable etc. shall be dismantled and levelled and debris shall be removed as per instruction of BHEL by the contractor at his own cost. In the event of his 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.
- 10.1.30 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.
- 10.1.31 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.

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- 10.1.32 If any item or equipment not covered but requires being erected/ commissioned, same shall be carried out by the contractor. The item rates shall be determined as per GCC.
- 10.1.33 The contractor shall ensure that his 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.
- 10.1.34 All the necessary certificates and statutory licenses required to carry out this scope of work are to be arranged by the contractor at his own cost. Also refer clause - ELECTRICAL INSPECTORATE'S APPROVAL-given below:

10.3 ELECTRICAL INSPECTORATE'S APPROVAL:

- 10.2.1 The contractor shall arrange necessary statutory inspections and obtain certificates for the installation work at his cost. Contractor is responsible for getting Electrical Inspector / statutory authority's approval for all electrical installation covered in his scope.
- 10.2.2 All electrical installation covered in contractor's scope is to be inspected / approved by the electrical inspector / statutory authority. For getting electrical inspector approval, contractor shall arrange the following:
- a. Work Completion certificate for all the equipment covered in the contract.
 - b. Details of Equipments (specification)
 - c. Copy of Test results conducted at site for all the equipment.
 - d. Any other documents as required by statutory authority. Any expenditure related to documentation shall be borne by contractor.
 - e. Contractor shall carry out the modifications / rectifications if any as suggested by the authority at his own cost. However, it is not applicable for equipment erected by Mechanical contractor.
 - f. **Valid Electrical Contractor's License of Madhya Pradesh state.**
 - g. **Valid Supervisory Competency Certificate.**

10.4 SITE INSPECTION

- 10.3.1 The owner / employer or his authorized agents may inspect various stages of work during the currency of the contract awarded to him. 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 for such duplication of inspection of work will be entertained.
- 10.3.2 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.
- 10.3.3 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.

10.5 MANPOWER REQUIREMENT

- 10.4.1 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 his duties the contractor shall remove them from site as directed by Site Engineer.
- 10.4.2 Supervisor should have a minimum qualification of Diploma in Engineering or any graduate with minimum 05 years of experience in Thermal Power Station.
- 10.4.3 The Site in charge shall be provided with PCs and good communication facilities like telephone, fax, email etc. at the cost and expense of the contractor. Lack of communication facilities will not be an excuse for extension of completion date.
- 10.4.4 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 his authorized representative prior to or immediately on commencement of operations at site

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- 10.4.5 The Site In-charge shall be present at site during all normal working hours and his 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.
- 10.4.6 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.
- 10.4.7 The contractor shall ensure that all his 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.

10.6 DOCUMENTATION

- 10.5.1 The following information shall be furnished by the bidder after testing and inspection:
Test certificates of various tests conducted at site. All inspection and test certificates shall be signed by customer's representative also, wherever called for as per field quality plan.
- 10.5.2 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.
- 10.5.3 These requirements are apart from the preparation of detailed engineering drawings which are part of the scope of work.

10.7 FOUNDATIONS AND GROUTING

- 10.6.1 Foundation for the equipments to be erected are in the scope of the contractor.
- 10.6.2 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.
- 10.6.3 The surface of foundations shall be dressed to bring the surface of the foundations to the required level and smoothness prior to placement of equipments.
- 10.6.4 Foundation pockets are to be cleaned thoroughly before placing the columns/ 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.
- 10.6.5 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. The required percentage contact between contact surfaces of Packer plates and foundation shall be achieved by chipping and scrapping as per BHEL Engineer's instructions.
- 10.6.6 For grouting of equipment; necessary cement, sand, gravels, etc. to be arranged by the contractor including the fine aggregates.
- 10.6.7 The BHEL supplied items are in the process of finalization. The foundation drawings and requirements mentioned are tentative which may change based on the actual foundation drawings received and finalized with the equipment manufacturer.
- 10.6.8 Contractor has to carry out the grouting as per the work instructions for grouting available at site.

10.8 MATERIAL HANDLING AND SITE STORAGE

10.7.1 SCOPE OF STORAGE / TRANSPORT OF CONTRACTOR SUPPLIED ITEMS

- a) Contractor shall make his own arrangement for transporting the materials to site from BHEL stores/ yards. Necessary material handling equipment for transporting to site/ stores and also for taking delivery from stores to work place shall be arranged at his cost.
- b) Any excess materials supplied for which payment has not been made can be taken back by the contractor as per customer procedure. Incoming material gate pass shall be made for any material supplied by the contractor.

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- c) Contractor shall unload, transport, store, erect, test and commission the equipment as per instructions of the manufacturer's recommendation.
- d) Contractor shall be responsible for examining all the shipment immediately for any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. However, the Contractor shall be solely responsible for any shortages or damages in transit, handling and/or in storage and erection of the equipment at Site.

10.7.2 COLLECTION OF BHEL SCOPE OF SUPPLY MATERIALS

- a) Contractor shall take delivery of BHEL/Contractor supplied materials from the / stores storage yard / sheds of BHEL / customer, which is within the plant premises 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 him till they are fully erected / commissioned. The contractor shall transport materials to erection site by the prescribed route without disturbing and damaging other's works in the most professional manner and the materials shall be stored in appropriate manner as per BHEL's instructions.
- b) 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 of the contractor. The scope includes taking materials / Equipments 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.
- c) 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 his cost.
- d) 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.
- e) 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.
- f) Upon receipt by the contractor the responsibility for any loss, damage and / or misuse of such materials shall rest with the contractor.
- g) 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.
- h) 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 of all surplus material to BHEL Stores, as determined by the Engineer-in-Charge.
- i) If the materials issued by BHEL are lost, damaged or unaccounted, the cost of such items shall be recovered from payments to the contractor. However, the contractor shall raise FIR and inform BHEL all details.
- j) 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.

10.7.3 STORAGE

- a) The contractor shall provide any fixtures, concrete blocks & wooden sleepers, which are required for temporary supporting / storage of the components and equipment at site.
- b) The equipment should be preferably in its original package and should not be unpacked until it is absolutely necessary for its installation. The equipment should be best protected in its cases. It should be arranged away from walls.
- c) The wooden pallet provided for packing itself can be retained for raised platform to protect equipment from ground damp, sinking into ground and to circulate air under the stored equipment. This will also help in lifting the packing with fork lift truck.
- d) Periodic inspection of silica gel placed inside the equipment is necessary. It has to be replaced when decolonization takes place or regenerated. BHEL shall supply the material and contractor shall replace.

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- e) 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.
- f) 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.
- g) Contractor shall keep BHEL informed about such problem and try to rectify the problem at his risk and cost.
- h) 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 site immediately to the Engineer in Charge.
- i) The loose items supplied for the main equipment falls into various categories like tools, modules, prefabricated cables, console inserts, recorders, modules and display units, printers, sensors and transducers, PCs, monitors, cable glands, cable ducts, frames etc. are to be categorized and stored separately.

10.7.4 SUB-ASSEMBLIES

- a) All sub-assemblies should be kept in a separate place where they are 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.
- d) 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.

10.9 SCOPE OF ROUTE SURVEY LAYOUT AND DETAILED DRAWINGS

The drawings provided along with the tender are only schematic, typical and tentative. The contractor shall prepare final detailed drawings in consultation with site engineers after carrying out the route survey for distribution. These drawings shall be prepared in accordance with IE-Rules and have to be approved by the electrical statutory authorities. Obtaining approval from statutory authority shall be the responsibility of the contractor and any expenditure involved in getting approval from statutory authority for the drawings and documents generated by the contractor shall be borne by the contractor. **Mentioned quantities in BOQ are only tentative. Based on the detailed drawings, contractor shall arrive at the final quantities of items which are to be procured/ fabricated, installed for construction power equipments as required and erected as per drawings.** After CEA INSPECTOR VISIT, if any modification/ correction is required in line with applicable IE standards the same has to be completed by the vendor WITHIN THE QUOTED RATES. However, the material as required will be provided by BHEL with the approval of site incharge.

10.10 SCOPE OF SUPPLY

- a) The given BOQ is tentative. Scope of supply of materials shall be as finalized after drawings approval and quantities arrived thereafter. Contractor has make all such drawings as per the requirement as get it approved by BHEL site engineer. However, tentative quantities are mentioned in BOQ. All materials shall be procured from reputed manufacturers as per IS specification. Bidder shall ensure technical compliance for supply and erection to ensure trouble-free operation. Necessary test certificates, guarantee certificate etc. shall be submitted to BHEL along with supply.
- b) The quantities furnished in the BOQ for supply items are approximate only. Contractor shall assess the quantity of supply items after conducting route survey and detailed engineering, which is part of this contract and also taking in to consideration the materials supplied by BHEL.
- c) If suitable materials are available with BHEL, the quantity of supply items shall be reduced accordingly. The payment for erection of BHEL supply items shall be as per rate quoted for erection.
- d) The quantity to be supplied shall be strictly as per site requirement only in consultation with Engineer-in-Charge. Before starting erection, the contractor shall get all the supply items in his scope verified by BHEL and also get necessary endorsement from BHEL Stores. BHEL's endorsement or Store Receipt Voucher (SRV) shall be submitted along with bills for payment of Supply items. After BHEL verification, material shall be kept under contractor's custody.

10.11 SCOPE OF ERECTION

- a) The scope of this Construction Power Package work includes detailed engineering, supply, identification of equipment at BHEL storage yard, technical assistance for checking and making the shortage / damage

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reports, taking delivery at storage yard, transportation to site, handling of material at site, erecting, and carrying out statutory tests as required, commissioning and maintenance of the equipments erected till contract period using their tools and tackles and testing instruments along with the supply of all consumables.

- b) The scope of specification covers the installation, testing and commissioning of the equipment / instrument along with accessories as detailed in Bill of Quantity. The detailed engineering is in the scope of the vendor which may result in minor changes to the items and quantities.
- c) Site testing shall be carried out for all electrical equipment installed by the contractor to ensure proper installation and functioning in accordance with drawings specifications and manufacturer's recommendations.
- d) 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.
- e) Since customer is providing 33KV source, all necessary arrangement for tapping the 33 KV source from customer point to be done by vendor and further 33KV HT cable to be laid from customer 33KV source point to 33/11 KV 2.5MVA Substation transformer.

10.12 SCOPE OF SUB STATION YARD LEVELING AND FENCING

- a) After conducting route survey and identifying substation location, the yard shall be levelled suitably. Necessary, PCC pavement, fencing, construction of foundation for Transformer, VCB, PSS, LTDB, etc. plinth wall, etc. shall be carried out by the contractor. The supply of materials required for the above civil works shall be arranged by the contractor.
- b) 2) No separate unit rate shall be paid for the substation yard levelling and fencing which shall be part of respective 33/11kV substation or 11 kV/433V substation works.

10.13 SCOPE OF ERECTION OF 2.5 MVA – ONAN TRANSFORMER

- a) 2.5 MVA, 33/11 kV ONAN transformers will be supplied by BHEL and the same shall be drawn from BHEL – stores or yard and transported to the required location. The contractor shall make his own arrangements for loading the transformers from BHEL- Stores and unloading the same at the specified location. T& P and other materials required for loading and unloading the transformers shall be arranged by the contractor.
- b) Transformer shall be checked up thoroughly and if any items are found to be damaged and requires replacement, the same shall be carried out by the contractor at free of cost. However, replacement materials shall be arranged by BHEL including Transformer oil.
- c) All BHEL transformers will be supplied in oil filled / without oil filled and assembled conditions. Filling of oil and filtration shall be carried out by the contractor for all the transformers supplied by BHEL.
- d) All testing instrument such as megger, multi-meter, oil test kit, oil-filtering machine, H.V test kit, etc. shall be arranged by the contractor to carry out the checking of the transformer. Oil filtration shall be carried out by the contractor till achieving the Dielectric strength as stipulated, other tests like insulation resistance and earth resistance checks, and Dielectric strength test of oil before filling, Buchholz relay test and phase sequence test shall be carried out by the contractor. After completing all the works, touch up painting shall be carried out for all the transformers.
- e) No separate unit rate shall be paid for the erection of Transformers which shall be part of 33/11 kV substation works.

10.14 SCOPE OF 11 kV RING MAIN SYSTEM (FEEDER POWER DISTRIBUTION SYSTEM)

- a) **BHEL Scope of supply as free issue:**
 - i. HT Cables of required Qty
- b) **Contractor scope of work for 11 kV Ring Main Distribution System includes:**

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- i. Conducting route survey
- ii. 11KV HT Power cable
- iii. ACSR Dog Conductor.
- iv. Preparation of distribution drawings
- v. Vetting of drawings & documents by BHEL
- vi. Installation of BHEL supplied free issued materials as mentioned under above clause.
- vii. Supply and installation of poles, accessories and O/H line forming ring main system.
- viii. RCC poles / RS joist poles/ 11 kV GI stay set: The scope of erection work shall include excavation of earth, as per drawing, grouting with concrete of M20/M25, supply of cement, sand, metal etc. to withstand wind velocity and coping of poles etc. complete.
- ix. Supply and installation of HT Termination and joining kits, Glands, lugs, etc. Separate item rates are provided for laying of HT and LT cables, supply and installation of HT termination kits, stringing of ACSR Rabbit conductor.
- x. Supply and installation cable route markers. (Separate item rates are provided.)

10.15 SCOPE OF PACKAGE SUBSTATION (PSS)

- a) PSS will be supplied by BHEL and the same shall be drawn from BHEL stores and transported to the required location. The contractor shall make his own arrangements for loading the PSS from BHEL- Stores and unloading the same at the specified location. The contractor shall arrange necessary T&P and other materials required for loading and unloading. Necessary civil foundation including supply of materials shall be arranged by the contractor before erecting the PSS.
- b) If any loose items supplied along with PSS that are required to be mounted, the same shall be carried out by the contractor at free of charge.
- c) The base framed shall normally be supplied along with the PSS. These shall be aligned, levelled and grouted in position, as per approved drawings. Wherever the base channels are not available, the same shall be fabricated and painted and the same shall be carried out by the contractor at free of cost. However, required materials shall be arranged by BHEL with the approval of Site In-charge/BHEL. Base channels shall be grouted on the foundation.
- d) PSS shall be checked thoroughly before charging. After the satisfactory completion of these checks, the LT Board and 11 kV VCB shall be energized. The contractor shall arrange all instruments required for testing at his cost.
- e) The Package substations shall be assessed and checked up thoroughly and if any items are found to be damaged/defective/ not working and requires replacement or any internal wiring to be modified, the same shall be carried out by the contractor at free of cost. However, replacement materials shall be arranged by BHEL.
- f) No separate unit rate shall be paid for the erection of PSS which shall be part of shall be part 11kV/433V substation works.

10.16 SCOPE OF LAYING AND TERMINATION OF H.T. AND L.T. CABLE

- a) BHEL shall supply the HT cables (Only 11KV) as free issue.
- b) Vendor to supply 33KV HT cable as per BHEL site requirement.
- c) All cables shall be drawn by the contractor from BHEL Stores.
- d) The cables thus drawn shall be cut to size as per route length and laid.
- e) The cables drawn from the BHEL stores shall be meggered before laying and any defect observed after laying also, the contractor shall replace / rectify the same free of charges.
- f) Unit rate quoted for LT cables are on per meter basis and shall cover laying, termination, excavation of earth for a depth of approx. 1000mm refilling of excavated earth & compaction.
- g) Unit rate quoted for HT cables are on per meter basis and shall cover laying, excavation of earth for a depth of approx. 1000mm refilling of excavated earth & compaction.
- h) H.T Cable termination shall be carried out only by the HT cable jointer with utmost care.
- i) Cable laying and termination shall be in accordance with IS specification as listed as a part of this document. The cables shall be suitably supported so that the cable load should not cause strain to the equipment connected.

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- j) If suitable cable box is not supplied along with the equipment i.e. the transformer, Suitable cable adaptor boxes shall be arranged by the contractor at free of cost and cable termination shall be carried out by using suitable cable glands etc as required.
- k) Suitable pillar box shall be installed to form ring main systems at the incomer side.
- l) HT Cables shall be laid in below ground at a depth of 1000 mm. Before starting excavation, route survey shall be conducted in consultation with site engineers. Cable shall be laid through GI pipes / Hume pipes as protective cover wherever road crossings are there. Excavation, laying of pipes and refilling of earth etc. are included in the respective item rates.
- m) Both supplying and laying of GI pipes & Hume pipes are in the scope of contractor with separate item rates.
- n) Supply of LT cable glands, lugs, etc., are part of the respective cable laying and under contractor's scope.
- o) No separate payment shall be made for jointing of LT Cables as they are already included in the laying of respective LT Cable sizes.
- p) The cables to be laid on the cable trays (300/600mm) mentioned in the BOQ and the trench of the 33/11kV substation shall utilize the same item rate as underground cables.
- q) Transportation and storage of cable drums shall generally conform to the requirements of IS: 1255.

10.17 SCOPE OF ERECTION OF L.T. KIOSK (LT DISTRIBUTION BOARD, LIGHTING DISTRIBUTION BOARD)

- a) LT Kiosk will be supplied by the contractor as per the BOQ or BHEL, which may be diverted from other sites and the same shall be drawn from BHEL stores and transported to the required location. The contractor shall make his own arrangements for loading the L.T Kiosk from BHEL- Stores and unloading the same at the specified location. The contractor shall arrange necessary T&P and other materials required for loading and unloading.
- b) LT Kiosk shall be totally enclosed dust and vermin proof cubicles without louvers and suitable for outdoor application and wall/ column/ structure mounting type with sloping canopy conforming to IP 55 class
- c) LT Kiosk shall be constructed from CRCA sheet. The sheet steel used shall be cold rolled and two mm thick. The construction of LT Kiosk shall ensure adequate rigidity. All components of the LT Kiosk shall be fully mounted inside the panel. LT Kiosk shall have only one operational Front. Door shall be provided to give full access to all the components. Door shall have padlocking arrangement.
- d) Good quality synthetic rubber/ neoprene gaskets shall be fixed around the door. The door when closed, shall compress the gasket uniformly.
- e) LT Kiosk shall be designed to prevent contact with live parts when the front door is open.
- f) LT Kiosk shall be fitted with MS mounting brackets and adequate size of removable undrilled gland plate of three mm thickness.
- g) LT Kiosk shall be fitted with two GI earth studs located in accessible position on the outside of the panel on opposite sides.
- h) All metal parts of the panel except current carrying parts shall be bonded together electrically to the earthing stud. Phase barriers of fireproof insulating material shall be fitted in such a manner that it is not readily possible for personnel to touch the phase bus-bars.
- i) The incomers and outgoing of the LT Kiosk are mentioned in the respective item of the BOQ. LT Kiosk shall be provided with earth stud, earth bus bar etc. designated with labels. Applicable standards are IS: 2675, IS: 4237, IS: 13947
- j) 9. The location for erection shall be decided at site, in consultation with BHEL Engineer. Any mounting arrangement like construction of foundation, fabrication and fixing of mounting supports including supply of materials like cement, sand, steel, metal etc. shall be arranged by the vendor at his cost. Fabrication materials like angle and channels will be supplied by BHEL. The scope of erection of LT Kiosk includes providing two numbers of Earth pits per LT Kiosk for which separate item rates are provided.
- k) If any loose items supplied along with L.T Kiosks are required to be mounted, the same shall be carried out by the contractor at free of charge.
- l) Kiosk shall be checked up thoroughly and if any items are found to be damaged/ defective/ not working and requires replacement or any internal wiring to be modified, the same shall be carried out by the contractor at free of cost. However, replacement materials shall be arranged by BHEL.
- m) Erection of LT Kiosks shall cover all the works mentioned above including touch up painting. The base frames shall normally be supplied along with the kiosks. These shall be aligned, levelled and grouted in position, as per approved drawings. Wherever the base channels are not available, the same shall be

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fabricated and painted by the contractor within the quoted rates. However, required steel materials shall be arranged by BHEL with the approval of Site In-charge/BHEL. Base channels shall be grouted on the foundation.

- n) LT Kiosk shall be checked thoroughly and before charging. Contractor shall carry out checking of Breaker operation, Fuse unit operation, Bus bar clearances, earth resistance and protection checks etc. After the satisfactory completion of these checks, the LT Kiosk shall be energized. The contractor shall arrange all instruments required for testing at his cost.

10.18 SCOPE OF SUPPLY AND INSTALLATION OF SIGN BOARDS AND SAFETY MEASURES

- a) All required signboards, caution boards and safety boards shall be arranged and installed by the contractor in all poles and substations wherever required. Feeder description and line description shall be displayed at vital locations. Foremost importance shall be given to Safety, and the contractor shall adhere to safety instructions and ensure use of safety appliances, as required. The contractor shall provide all safety equipments to his workmen to avoid accidents.
- b) No separate unit rate shall be paid for the supply and erection of sign board which are to be laid with in the substation and that shall be part 11 kV/ 433 V substation works or 11kV/11.5kV substation works as per BOQ.

10.19 SCOPE OF EARTHING AND LIGHTNING PROTECTION SYSTEM

- a) The scope of earthing covers earthing of all substation equipments, and providing earth pits as per IS requirement.
- b) The scope of earth pits covers excavation, supply and erection of 3m long earth electrode, filling the pits with alternate layer of charcoal & salt as per IE specification, making of brick chamber with both side plastering supply and fixing of manhole cover plate with RCC slab, as per typical drawing provided by BHEL.
- c) Number of earth pits for substation shall be decided considering soil resistivity. However, PSS substation shall have 6 Nos pits. i.e. 2 Nos for neutral, 2 No for Body and 2 Nos for LA and 33/11kV substation.
- d) LIGHTNING: The scope of work of Lightning Protection system includes supply and installation of two numbers vertical air terminations and poles of 06m long with base plate. The pole shall be tubular stepped type as per applicable standard. Vertical air terminal shall be grounded with earth pits. Required civil works for lightning pole erection and grouting, grounding the air terminals and supply of grouting and grounding materials are in the scope of Contractor. The supply of above base plate is in the scope of contractors.

10.20 DETAILED SCOPE OF WORKS – YARD LIGHTING:

10.19.1 SWAGED LIGHTING POLES:

- e) Lighting poles for flood lights shall be of steel tubular swaged type 09-metre-long steel poles as per applicable standard. The steel poles shall be coated with bituminous preservative paint on the inside as well as outside surface. Exposed outside surface of steel poles shall be painted with one coat of red lead oxide primer. After installation, two coats of Aluminium paint shall be applied
- f) The poles shall be supplied with associated pole mounted Junction Boxes, suitable MS base with shop drilled holes or by suitable clamps for fixing of light fixtures. No cutting or drilling of galvanized structure is permitted.
- g) The lighting poles shall be erected at the locations shown in the layout drawing (This drawing is in the scope of bidder). The scope of erection work shall include excavation of earth, as per drawing, grouting with concrete M20/ M25, supply of cement, sand, metal etc. to withstand wind velocity, mounting of assembled fittings, wiring/ cabling from junction box at the bottom of pole up to the lighting fixture, installation of 50mm dia of medium thickness GI pipe for cable protection from trench to junction box for loop-in-loop-out cable. All the above required materials shall be supplied by the bidder under the respective item rates as mentioned in the BOQ.
- h) Unit rate quoted for Erection of lighting pole includes Earthing of lighting pole Junction boxes and lighting fixtures, in compliance with IE rules and applicable Indian Standard. Each lighting pole JB shall be earthed by 25x3mm GI Flat bonded to 25 mm dia GI earth electrode of 3-meter length driven vertically in the ground. 14SWG GI wire shall be taken from fixture to JB including fixing of clamps.

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10.19.2 LIGHTING FIXTURES

- a) The luminaries shall be street light LED fittings of 150W.
- b) Street light luminaires shall be of weather proof for outdoor application.
- c) Luminaires shall be of continuous trouble free operation under atmospheric conditions, without reduction in lamp life or without deterioration of materials and internal wiring. Fixtures shall be provided with outdoor type weather proof box with IP-54 or better. Applicable standards are IS: 1913, IS: 1777, IS: 4012, IS: 4013.

10.19.3 a) 3-Phase metering and power distribution board complete with:

- (1) Incoming SFU TPN 400 Amps - 1no,
- (2) Outgoing SFU TPN 200 Amps -1nos.
- (3) Outgoing SFU TPN 63 Amps -1nos.
- (4) Outgoing SFU TPN 32 Amps -7nos.

3 Phase Electronic Energy Meter - BHEL / L&T / GEC make.

Ammeter, Voltmeter and Selector Switches for both - AE and Kaycee make. Phase indication lamps, HRC fuses for IC and OG feeders, cable glands, power terminals for cables termination, cable lugs and provision for doubly earthing the panel enclosure. Panel enclosure shall be made of sheet metal thickness not less than 1.6 mm and suitable for out door installation, modular construction, hinged door with locking arrangement, base frame, should have slopped canopy, duly painted with first coat of primer and two coats of synthetic enamel paint (interior with white paint and exterior with light grey as per shade 5, is 630) internal power distribution to devices shall be with al busbars or copper flexible single core PVC cables of 1.1 kV grade, control wiring with 1.5 sqmm, suitable stool made out of MS structure of 1.2 meter high for mounting of panel with anchoring arrangement at foundation, suitable for bottom entry of cables.

b) 415 Volt AC, 3 phase/four wire power feeder pillar board, board shall be comprises of three number and one number aluminium bus bar for phase & neutral respectively. Bus bar rating shall be 200 amps and shall be mounted on epoxy insulator of 1.1 kV grade, each bus bar shall have drilled hole for connecting incoming /outgoing cables, provision for earthing the panel enclosure. Panel enclosure shall be made of sheet metal thickness not less than 1.6 mm and suitable for out door installation, hinged door with locking arrangement, base frame, should have slopped canopy, duly painted with first coat with primer and two coats of synthetic enamel paint (interior with white paint and exterior with smoke grey as per IS), suitable stool made out of MS structure of 1.2-meter-high for mounting of panel with anchoring arrangement at foundation.

c) out door type metal clad Lighting Panel (LP) having IP-55 protection with double door type and one incomer with 100A TPN MCCB additionally with 3 nos. 32 A TPN ELCBs with 30mA tripping and timer & contactors for auto on/off street lights and 3 indicating lamps with fuse for indication bus supply ON, Digital Voltmeter & VSS 0-500V etc. Suitable busbar arrangement for Phase and Neutral. Sufficient space should be provided in the removable cable gland plate to accommodate incoming power cable and all outgoing cables.

10.21 PROGRESS OF WORK

- a) BHEL uses SDD (Site Data Digitization), IPMS (Integrated Project Management System) or any other system etc for work progress and the same shall be utilized for planning and review. Necessary help and coordination shall be given by the vendor for the same.
- b) 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 and the slippages do not accumulate and affect the overall programme.
- c) 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.
- d) 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.
- e) Progress review meetings will be held at site during which actual progress during the week vis-a-vis scheduled program shall be discussed for actions to be taken for achieving targets. Contractor shall also present the program for subsequent week. The contractor shall constantly update / revise his work program to meet the overall requirement. All quality problems shall also be discussed during the above review meetings. Necessary preventive and corrective action shall be discussed and decided upon in such review

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meetings and shall be implemented by the contractor in a time bound manner so as to eliminate the cause of nonconformities.

- f) 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.
- g) The contractor shall submit weekly / fortnightly / monthly statement report regarding consumption of all consumables for cost analysis purposes.
- h) The manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.
- i) The monthly report shall be submitted at the end of every month as a booklet and shall contain the following details: -
 - i. Colour Progress photographs of executed jobs etc.
 - ii. 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.
 - iii. Site Organization chart of engineers & supervisors as on the last day of the month with further mobilization plan.
 - iv. 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 technician's helpers, security etc. Data shall be split up under the work areas like Boiler (pressure parts, structures) Rotating machines, Electrostatic precipitator, Insulation, Piping, Steam turbine, Condenser, Generator etc.
 - v. Consumables report giving consumption of all types of gases and electrodes during the previous month.
 - vi. Availability report of cranes
 - vii. Safety implementation report in the format
 - viii. Pending material and any other inputs required from BHEL for activities planned during the subsequent month.
- j) 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 and will update the construction schedule forming part of this contract each month.

HIGH MASTS:

1. The brief scope of work shall include:

- a) Designing, supplying, dispatching to site handling, erection, testing and commissioning of lighting mast, complete in all respects including luminaries. These shall be complying with the Technical Specifications, as detailed below.
- b) Necessary design and engineering of civil works is in the scope of the bidder. The foundation bolts and necessary hardware are also in the scope of the bidder. Contractor will complete the supply of civil materials, construction of foundation.
- c) BHEL shall provide power supply up to Control Panel of High Mast. The bidder shall carry all further necessary power distribution.
- d) The location of lighting mast / tower shall be decided at site and bidder has to comply with the same.
 - E) All civil work including supply for High masts will be under contractor's scope.

2. Scope of Supply

- a) Supply of 30 m High Mast system with all accessories including but not restricted to the following:
 - i) Mast shaft in two or three sections, hot dip galvanized and suitable for wind velocity as per IS: 875 part 3.
 - ii) Head frame, steel wire rope of min. 6mm dia., double drum winch.
 - iii) Galvanized Lantern Carriage arrangement suitable for 08 nos./12nos Luminaries (as per approved drawing) & their control gear Boxes and Lighting finial (as per requirement).
 - iv) Integral power tool installed inside base compartment for its operation.
- b) Supply of 08 nos./12nos (as per approved drawing) per high mast integral LED luminaires with Lamps of minimum 500W and control gear boxes (if required) suitable for operation on 230V, 50Hz, AC supply. Power Factor of the luminaires shall be greater than 0.90. Colour Temperature shall be minimum 5000K.

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- c) Supply of twin dome aviation obstruction light with 2 nos. LED lamps.
- d) Supply of control panel housing control circuit for the operation of the mast, precision timer for automatic ON/ OFF control and required controls for the power tool motor.
- 3. The winch shall be of completely self-sustaining type, without the need for brake shoe, springs of clutches. Driving spindle of the winch shall be locked when not in use. The capacity, operating speed, safe working load, recommended lubrication and serial number of the winch shall be clearly marked on the winch. The winch drum shall be grooved to ensure perfect seat for stable and tidy rope lay, with no chances of rope slippage. The rope termination in the winch shall be such that distortion is eliminated and at least 5 to 6 turns of rope remains on the drum even when the lantern carriage is fully lowered and rested on the rest pads. It should be possible to operate the winch manually by a suitable handle in-case of problem with electrically operated tool.
- 4. The head frame, which is to be designed as a unit of the mast, shall be of welded steel construction, galvanized both internally and externally after assembly.
- 5. **LANTERN CARRIAGE-** A fabricated MS hot dip galvanized lantern carriage shall be provided for mounting of luminary arm assemblies. The diameter of the lantern carriage shall not be less than 1200 mm.
- 6. A suitable, high-powered, electricity driven, internally mounted power tool, with manual over ride shall be supplied for the raising and lowering of the lantern carriages for maintenance purpose.
- 7. One number heavy duty hot dip galvanized lightning spike rod shall be provided for each mast.
- 8. Suitable Aviation Obstruction Lights of reliable design and reputed manufacturer shall be provided on top of each mast.
- 9. Suitable earth terminals shall be provided at a convenient location on the base of the mast, for lightning and electrical earthing of the mast and Including Earth Links up to each of these Earth Pits.
- 10. Incoming TPN Switch Fuse Unit with HRC fuses or MCCB of suitable current rating, incoming/ outgoing terminals and control for the power motor, suitable digital timer of reputed make, with necessary contactors, wiring for ON/OFF control of the lamps shall be provided in the control panel.

10.22 TESTING AND COMMISSIONING WORKS:

- a) The contractor shall take the full responsibility of testing and commissioning of the equipment being installed by him under the overall supervision of BHEL. It shall be the responsibility of the contractor to arrange and complete all the testing, pre-commissioning and commissioning activities for the particular equipment as per relevant standard, code of practice, manufacturer's instructions and BHEL norms. All these will be witnessed by BHEL Engineers and reports signed jointly.
- b) All T&P / instruments required for testing are to be arranged by the contractor. Any special equipment, tools and tackles, IMTEs etc. required for the successful completion of the Commissioning Tests shall be provided by the Contractor, free of cost.
- c) All testing activities shall be carried out as per relevant standard, code of practice, manufacturer's instructions and BHEL norms. The contractor shall submit a checklist to BHEL prior to taking up testing and commissioning activities and the activities shall be carried out in accordance with the checklist approved by BHEL. All the above will be witnessed by BHEL engineer and the reports signed jointly.
- d) The commissioning activities, tests, trial runs may have to be repeated till satisfactory results are obtained and also to satisfy the requirements of BHEL / customer / consultant / statutory authorities like boiler inspector, electrical inspector etc.
- e) 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.
- f) It shall be the responsibility of the contractor to commission and attend any problem in the equipment erected by the contractor using various categories of workers in sufficient numbers along with Supervisors. Association of BHEL's / Client's staff during above period will not absolve contractor from above responsibilities. The commissioning group shall have the knowledge of various systems referred in the tender and possess adequate experience in testing and commissioning.
- g) All the tests at various stages shall be repeated till all the equipment satisfy the requirement of BHEL / Customer. Any rectifications required shall have to be done / redone by the contractor at his cost.
- h) The contractor shall carryout any other test not listed in the tender but as desired by BHEL Engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning,

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commissioning, and operation, to demonstrate the completion of any part or whole work performed by the contractor.

- i) 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 his cost. If any equipment / part is 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.
- j) 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.

10.23 FINAL PAINTING

- k) The quoted rate / price shall be inclusive of supply and application of final painting of all the erected equipments like all steel items such as supports, racks, frames, HT/LT KIOSK, Transformers, etc as per the painting specifications of customer / BHEL.
- l) In the case of steel fabricated items, raw steel after fabrication has to be cleaned and subsequent painting to be carried out.
- m) All the exposed metal parts of the equipments including busducts, transformers, structures, etc., wherever applicable after installation unless otherwise specified the surface protected, are to be first painted with at least one coat of suitable primer and required number of finish coats as specified by BHEL which matches the shop primer paint used after thoroughly cleaning the dust, rust, scales, grease oil, and other foreign materials by wire brushing scrapping and chemical cleaning and the same being inspected and approved by BHEL engineers for painting. Afterwards the above parts shall be finished with as per the instructions of BHEL / Customer official.
- n) Normally Paint shall be applied by brushing as per the instruction of BHEL Engineer. It shall be ensured that brush marks are minimum. If needed and insisted either by BHEL / Customer in certain cases, spray painting has to be carried out within the Quoted rates. Spray painting gun and compressed air arrangement has to be made by the contractor himself within the Quoted rates.
- o) All damaged galvanized surfaces including cable trays shall be coated with cold galvanizing paint.
- p) Paint used shall be stirred frequently to keep the pigment in suspension. Paint shall be of the ready mix type in original sealed containers as packed by the paint manufacturer. No thinners shall be permitted. Paint manufacturer's instructions shall be followed in method of application, handling, drying time etc.,
- q) The scope of painting includes application of colour bands, lettering the names of the systems, equipments, danger / warning signs and other data as required by BHEL within the quoted rate.
- r) 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.
- s) The actual colour to be applied shall be approved by the customer / BHEL before starting of actual painting work.
- t) Primer & finish paint shall be of reputed paint supplier approved by BHEL / Customer. Contractor has to procure paints from the BHEL / Customer approved agencies only. The quality of the finish paint shall be as per the standards of IS or equivalent as approved by BHEL / Customer. Before procurement of paint the contractor has to obtain the clearance from BHEL authorities.
- u) No paint shall be applied when the surface temp is above 55 °C or below 10°C, and when the humidity is greater than 90% to cause condensation on the surface or frost / foggy weather.
- v) Before commencement of final painting, contractor has to obtain written clearance from BHEL / Customer for effective completion of surface preparation.

10.24 PRESERVATION / TOUCH UP PAINTING

- a) Supply & application of primer & finish paints with all manpower, tools & plants and consumables is covered in the scope of this tender.
- b) Contractor shall carryout cleaning and preservation / touches up painting for the materials / equipments under this tender specification right from pre- assembly stage till the equipment is cleared for final painting within the quoted rate.

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- c) Any equipment which has been given the shop coat of primer shall be carefully examined after its erection in the field and shall be treated with touch up coat of red oxide primer wherever the shop coat has been abraded, removed or damaged during transit / erection, or defaced during welding.
- d) 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.

10.25 SCOPE OF OPERATION AND MAINTENANCE

- a) The scope of O & M work includes identification of items at stores / yards, checking, reporting the damages if any, taking delivery at storage yard / stores, loading, transportation to working yard, pre-assembly, calibration, checking, replacing, testing and commissioning, & post-commissioning activities using vendor's own tools and tackles and testing instruments along with the supply of all consumables like insulation tapes, HT tapes, electrodes, gas, paints, cable dressing materials, tag plates, PVC sleeves etc.
- b) Operation & maintenance of High Masts, Electrical works in BHEL Offices, BHEL Stores, BHEL yards, etc. inside the Main Plant boundary erected and commissioned by other agencies will be part of this package. The Electrical works of storage areas outside the main plant boundary (if any) erected and commissioning by other agencies shall also be covered under this O&M package.
- c) The contractor shall operate and maintain all the electrical installation by deploying electricians, helpers, supervisor etc. on a three shift basis as per the instruction of Engineer in charge.
- d) Contractor shall attend the break down and replace the defective components promptly.
- e) During the maintenance period, if the contractor fails to deploy adequate manpower continuously for two weeks, BHEL shall engage a maintenance agency at the risk and cost to contractor.
- f) All the tools and plants required for preventive maintenance and breakdown maintenance shall be arranged by the contractor.
- g) During the maintenance period, Contractor shall also replace any defective items from spares at free of cost for all electrical installation. However, replacement materials / spares shall be supplied by BHEL as free issue.
- h) The man power should be available throughout the year inclusive of all holidays and Sundays.
- i) The supply of faulty parts and spares are excluded from the contractor's scope and will be provided by BHEL free of cost.

10.26 TECHNICAL REQUIREMENT FOR ITEMS SUPPLIED BY THE CONTRACTOR.

10.25.1 GENERAL

- a) Equipment and material supplied shall comply with description, rating, type and size as detailed in this specification, drawings and annexures.
- b) Equipment and materials furnished shall be complete and operative in add details.
- c) 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.
- d) 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.
- e) Samples of all items shall be made available for purchaser's approval prior to supply of item to site.

10.25.2 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.

10.25.3 TAGS

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- a) Cables tags shall be provided with cable number 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.
- 10.25.4 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.

10.27 GUIDELINES FOR ERECTION OF GI PIPES, SUPPORTS & ACCESSORIES

- a) For installation of cables in GI conduits the conduits shall be installed first without cables but having suitable pull wires laid in conduits.
- b) 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.
- c) GI conduits shall run without moisture or water traps and shall be made drawing arrangement towards the end.
- d) 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.
- e) Bends of GI pipes/conduits shall be made without causing damage to the pipes/conduits.
- f) Occupancy of conduits shall not be greater than 40%.
- g) The adopter for coupling rigid GI pipe/conduits and flexible conduit shall be of aluminium or galvanised steel.

10.28 INSTALLATION, TESTING & COMMISSIONING IN GENERAL:

- a) The stages of completion of various works shall be as follows:
- b) Completion: 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.
 - Cable laying, termination with continuity check.
 - Applying of finishing coat of paint.
- c) 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.
- d) The contractor shall be responsible for satisfactorily working of complete integrated system and guaranteed performance.

10.29 SITE TESTS AND CHECKS

10.28.1 General

- a) All the equipment shall be tested at site to know their condition and to prove suitability for required performance.
- b) 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

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manufacturer of the equipment, contractor or mentioned in commissioning manual has to be conducted at site.

- c) 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.
- d) The contractor shall be responsible for satisfactory working of complete integrated system and guaranteed performance.
- e) 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.
- f) After clearance from Electrical Inspector system/equipment shall be charged in step by step method.
- g) 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 and this information is to be brought to the notice of the BHEL Engineer by the contractor.

10.28.2 Trial Run Test

After the successful test of each equipment as per standard test procedure, the entire control system shall be put on trial run test on actual site conditions and operation of the system.

10.28.3 Acceptance Test

The acceptance test on the system shall be carried out by the supplier as per mutually agreed test procedures to establish satisfactorily functioning of the system as a whole and each equipment as part of the system.

10.30 TRANSFORMER

10.29.1 INSPECTION

- a) In connection with receiving and unloading at site, and at the final storing place before assembling, the transformers shall be inspected carefully. External visible damages as dents, paint damage etc. may imply that the transformer has been subjected to careless handling during transport and/or re-loading, and a careful investigation is therefore justified.
- b) After the arrival of the material at receiving points, before unloading, the condition of packing and of the visible parts should be checked and possible traces of leaks verified (condenser bushing). If necessary, appropriate statements and claims should be made.
- c) Drums containing oil which have been separately dispatched should be examined carefully for leaks or any sign of tampering. All dispatched drums are filled up to their capacity and any shortage should be reported.
- d) Check immediately the gas pressure at the arrival. A positive indicates that the tank and the transformer components respectively are tight, and that the active part including the insulation materials is dry.
- e) If there is no positive gas-pressure, transformer should be immediately filled with dry Nitrogen gas to a pressure of 0.17 kg/cm² (2.5 psi) without loss of time.
- f) Otherwise, it should be checked if the core isolation is satisfactory and that accessories packed separately have not been damaged during transportation.

10.29.2 UNLOADING

- a) Whenever rollers/trolleys are supplied with transformer, movement of transformer at site is carried out by mounting these rollers / trolleys.
- b) Alternatively, for movement of transformer from loading bay to actual site of the equipment, skidding on greased rails etc can also be resorted to.

10.29.3 STORING

- a) Dismantled equipment and components are packed to the protected against normal handling and transport stresses. The instructions for lifting given on the packages must be complied with to avoid damages.
- b) Goods stored outdoors must not be placed directly on the ground, and should be covered carefully with tarpaulin or similar materials.
- c) Oil drum should be stored in horizontal (lying) position with both the bungs also in horizontal position.

10.29.4 CHECK POINTS BEFORE STARTING AND DURING ERECTION

- a) Check points before starting erection.
 - i. Conditions of leads

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- ii. Bracing, clamping of leads
 - iii. Connections
 - iv. Tap changer checks
 - v. General conditions of insulation
 - vi. Core check that it has not moved in transit.
 - vii. Core-ground; this is checked with the megger after removing earth connection
 - viii. CTs, including the secondary leads and their passage through metal parts
 - ix. Check that shipping frame for bushings have been removed.
 - x. Check that coil position has not moved in transit
 - xi. Check for dirt, metal swarf, moisture
 - xii. Check that the bushing leads set without being too close to ground or other points of different potential.
- 10.29.5 **CHECK-POINTS DURING ERECTION:**
- i. By means of the part list and the transformer/reactor OGA, the assembling of a fully completed transformer is carried out according to the following instructions. The following precautions are to be taken:
 - ii. Fire-fighting equipment shall be available at the oil-treatment equipment as well as at work on and adjacent to the transformer.
 - iii. Welding work on or adjacent to the transformer shall be avoided, but if this is not possible, the work shall be supervised by fire-protection personnel.
 - iv. Smoking on or near the transformer shall not be allowed.
 - v. Transformer tank, control cabinet etc, as well as assembling and oil-treatment equipment shall be connected with the permanent earthing system of the station
 - vi. Check that there is no overpressure in the transformer when blanking plates or connection lids are to be opened.
 - vii. All loose objects, tools, screws, nuts etc. shall be removed from the transformer cover before opening the connection and blanking lids.
 - viii. All loose objects (tools, pencils, spectacles etc.) shall be removed from the boiler- suit pockets etc. before starting the work through man-holes.
 - ix. Tools to be used inside the transformer e.g. for tightening of screws-joint-shall be fastened to the wrist or another fixed point by means of cotton tape or string.
 - x. Tools with loose sleeves and tools with catches must not be used at work inside the transformer.
 - xi. Greatest possible cleanliness shall be observed at work inside the transformer, and at handling of part to be mounted inside the transformer.
 - xii. Fibrous cleaning materials should not be used as it can deteriorate oil when mixed with it.
 - xiii. All components despatched separately should be cleaned inside and outside before being fitted.
 - xiv. A Transformer is best protected for damp hazard by circulating warm, dry, de-aerated oil through it until its temperature is 5°C to 10°C above ambient. This should be done before allowing external excess to the interior of the tank. The warm oil should be circulated all the time transformer is open to atmosphere.
 - xv. Oil pump & all joints in the oil pipe work should be air tight to avoid entrance of air through leakage joints.
 - xvi. The active part (core and winding) should be exposed to the surrounding air for as short a time as possible. Therefore, only one blanking plate or connection lid at a time should be opened for remounting of bushing, valves etc.
 - xvii. Objects which-despite all precaution is dropped inside transformer / reactor, must absolutely be brought up from the equipment.
 - xviii. Check that the oxygen content inside the transformer tank is minimum 20% if a person is to enter the tank.
- 10.29.6 **ASSEMBLY**
- Assembly of wheels Bushing Valves, cooling device, Oil conservator, Pilol Flanges, Blanking plates and accessories like cooling fans, pumps, OLTC and components for supervision and control oil level indicator, flow indicators, gauges, Buchholz relay, PRV, thermometers etc. are assembled according to leaflet / description valid for the components.
- 10.29.7 **OIL FILLING**
- The following procedure is recommended.
- i. Close and blank the valve to isolate the conservator from main tank. Fill the oil in transformer under vacuum up to Buchholz level as per instructions given elsewhere.
 - ii. After filling the oil in transformer and breaking the vacuum, oil can be filled in the conservator either through reactor or by drain valve.
 - iii. Remove the inspection cover provided on the side of the conservator and check the air cell assuring that it

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is inflated. The air must remain in fully inflated condition during oil filling operation. If the air cell is found deflated, fit the inspection cover and inflate the air cell with dryair / nitrogen gas to 0.035 kg/sq. cm max. A gauge may be put by removing plug. After filling close these connections.

- iv. Remove air release plugs provided on top of the conservator.
 - v. Slowly pump the oil through main reactor / drain valve. Temporarily stop filling operation when oil starts coming from opening after ensuring that no air bubbles come out through these air release holes. Fit the two air release plugs.
 - vi. Continue oil filling till oil start coming from air release plug stop oil after ensuring that no air bubbles come out. Fit the plug.
 - vii. Now release the air pressure held inside the air cell from point and continues oil filling until magnetic oil gauge indicates 35°C level.
 - viii. Remove oil pump and connect air cell to breather from point. Also remove pressure gauge and put plug.
 - ix. The system is now properly filled. Air release plugs are fitted in normal operation.
- 10.29.8 **EQUIPMENT FOR OILOFILLING UNDER VACUUM**
- i. High-vacuum 2 storage oil filtration plant provided with thermostat-controlled oil heaters and vacuum-proof hoses with dependent vacuum pumping system for tank evacuation. Capacity: 6 kl/hr
 - ii. Oil-storage tanks provided with silica-gel breathers and inlet / outlet valves for oil circulation. Recommended capacity 20kl
 - iii. Vacuum gauges provided in filtration plant.
 - iv. Equipment for measurement of electric strength (BDV) of oil - 100 kV set.
 - v. Equipment for moisture content of oil.
 - vi. Equipment for measurement of Resistivity and Tan delta at 90°C.
 - vii. Transparent vacuum-proof tubes for checking of oil-level during oil filling.
 - viii. Valves, fitting, gaskets etc.
 - ix. Dry nitrogen cylinders.
- 10.29.9 **COMMISSIONING**
- Testing after Assembly of the Transformer
- After the transformer has been assembled at site, it shall be tested in order to check that it has not been damaged during transport and assembly to such an extent that its future operation will be at risk. Regarding the performance of the test, refer to the testing method as per standards. The results of the test shall be documented.
- 10.29.10 **COMMISSIONING CHECKS**
- i. Breather Silica gel (Blue when dry)
 - ii. Oil in the Breather housing cup.
 - iii. All valves for their correct opening and closing sequence.
 - iv. Oil level in conservator tank.
 - v. Oil in cooling system.
 - vi. Oil level in bushings.
 - vii. Release air, wherever necessary.
 - viii. Cooling accessories (Pump motors, Fan motors etc.) for direction and O/L setting.
 - ix. Buchholz, oil level indicator, pressure gauges, thermometer, temperature indicators etc.
 - x. Neutral earthing.
 - xi. Earth Resistance of Electrodes.
 - xii. Earthing of bushing test tap.
 - xiii. Check oil leakage for 24 hrs.
 - xiv. Check Auxiliary circuit voltage (415 V)
 - xv. Calibration of OTI / WTI with hot oil.
 - xvi. Check Working of WTI / RTD repeaters at control room.
 - xvii. IR of core to earth.
 - xviii. Die electric strength of oil PPM & Chemical analysis, specific gravity test
 - xix. IR tests on windings to earth and between winding
 - xx. Phase sequence test & vector group check
 - xxi. Continuity test
 - xxii. No load voltage ratio on all tap position
 - xxiii. Winding resistance in all taps
 - xxiv. Tap changing at 415V 50 Hz supply in all three phases

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- xxv. TAN-DELTA tests if quality check list calls for.
xxvi. Dew point check for N2 Gas at the time of oil filling

10.31 GUIDELINES FOR ERECTION OF HT SWITCHGEAR PANELS

10.30.1 Erection

- a) 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.
- b) 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.
- c) All the boards will be delivered in sections. Necessary interconnection of busbar, bolting of panels, left out panel / interpanel wiring, etc. will have to be done after assembling the panel.

10.30.2 The Following Points shall be Checked up During Erection

- i. Layout of foundation channels.
- ii. Floor level covered by the panel with respect to main floor level.
- iii. Location and serial no. of panels.
- iv. Positioning of panels.
- v. Verticality of switchgear panels within the limit specified.
- vi. Freeness of Breaker Truck and modules in housing and its manual operation.
- vii. Earthing of panels and breaker truck to station earth.
- viii. Lugs for termination of HT and LT cables.
- ix. Mounting and fixing arrangements of Bus bars.
- x. Tightening of Busbar jointing bolts as specified.
- xi. Clearance between:
 - Phase to Phase
 - Phase to earth
- xii. Minimum clearance for:
 - Breaker, Truck and modules withdrawal
 - Distance required for maintenance work
- xiii. Check the operation of:
 - Remote control
 - Various required - closing / tripping / alarm / indications / interlocks
- xiv. Installation position of instruments and relays
- xv. Operation of relays and meters by secondary injection.
- xvi. 15. AC/DC supplies for panel
- xvii. 16. Final relay settings as per customer requirements.
- xviii. 17. Tightness of terminal connections for HT & LT connections.
- xix. 18. Opening operation of breaker, manually and electrically.
- xx. 19. Working of ammeters and voltmeters for their entire range and other panel mounted instruments like recorder, indicator etc.

10.30.3 HT SWITCHGEAR TESTS

- i. IR test
- ii. HV one minute P.F. test checking of oil level
- iii. Measurement of contact resistance for HT breakers
- iv. Test to prove inter changeability of similar parts (including breaker module)
- v. Testing of relays as per supplier's commissioning manual
- vi. Testing and calibration of all meters.
- vii. Operation of all relays by secondary injection method
- viii. Testing of CT polarities and CT ratio by primary injection test.
- ix. Measurement of knee point voltage and secondary resistance for CTs used for differential protection.
- x. IR and voltage ratio test for PTs
- xi. Functional test of all circuit components for each panel / feeder.
- xii. Test to prove closing/tripping operation at minimum and maximum specified voltage in test and service

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- position.
- xiii. Check for drawout test and service position of breakers for all feeders.
- xiv. Check for covering of all openings in the panel - check for continuity and operation of aux. contacts of breaker.
- xv. HV test on vacuum interrupters (for VCBs)
- xvi. Check for pressure of SF6 gas and air (for SF6).

10.32 LT SWITCHGEAR PANELS

10.31.2 Erection

- a) The base frames will be supplied normally along with the boards or shall be fabricated at site with steel supplied in the BOQ. 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 and within this contract.
- b) 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
- c) All the boards will be delivered in sections. Necessary interconnection of busbar, bolting of panels, left out panel / inters panel wiring, etc. will have to be done after assembling the panel.
- d) Earthing Pit for the body and neutral 2 Nos each is to be made as per the drg. The same shall be quoted in the E&C rate.

10.31.3 Checks during erection

- i. Layout of foundation channels.
- ii. Floor level covered by the panel with respect to main floor level.
- iii. Location and serial no. of panels.
- iv. Positioning of panels.
- v. Verticality of switchgear panels within the limit specified.
- vi. Freeness of Breaker Truck and modules in housing and its manual operation.
- vii. Earthing of panels and breaker truck to station earth.
- viii. Lugs for termination of LT cables.
- ix. Mounting and fixing arrangements of Bus bars.
- x. Tightening of Busbar jointing bolts as specified.
- xi. Clearance between :
- Phase to Phase
 - Phase to earth
- xii. Minimum clearance for:
- Breaker, Truck and modules withdrawal
 - Distance required for maintenance work
- xiii. Check the operation of:
- Remote control
 - Various required - closing / tripping / alarm / indications / interlocks
- xiv. Installation position of instruments and relays
- xv. Operation of relays and meters by secondary injection.
- xvi. AC/DC supplies for panel
- xvii. Final relay settings as per customer requirements.
- xviii. Tightness of terminal connections for HT & LT connections.
- xix. Opening operation of breaker, manually and electrically.
- xx. Working of ammeters and voltmeters for their entire range and other panel mounted instruments like recorder, indicator etc.

10.31.4 LT Switchgear tests

- i. IR test
- ii. Measurement of contact resistance for LT breakers
- iii. Test to prove inter changeability of similar parts (including breaker module
- iv. Testing of relays as per supplier's commissioning manual.
- v. Testing and calibration of all meters.
- vi. Operation of all relays by secondary injection method.
- vii. Testing of CT polarities and CT ratio by primary injection test.

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- viii. Measurement of kneepoint voltage and secondary resistance for CTs used for differential protection
- ix. IR and voltage ratio test for PTs
- x. Functional test of all circuit components for each panel / feeder
- xi. Test to prove closing / tripping operation at minimum and maximum specified voltage in test and service position
- xii. Check for drawout test and service position of breakers for all feeders
- xiii. Check for covering of all openings in the panel - check for continuity and operation of aux. contacts of breaker.

10.33 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 (if required)
 - v. DC high voltage test (for LT power cables of higher sizes interconnecting PCCs& MCC)
 - vi. Absence of cross phasing
 - vii. Firmness of terminations.

10.34 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 as instructed by the manufacturer of the equipment shall also have to be carried out if deemed 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. Test certificates of the vendor scope items, where ever necessary same should be produced by the bidder long with the dispatch documents/ Invoice of the supplied items.

10.35 Supply of 33kV HT Cables:

This specification covers the design, manufacture, testing, proper packing, transportation, insurance during transit, delivery to site/ BHEL store of 3C x 185 sq. mm Al (33kV Unearthed, ARMoured) **XLPE POWER CABLES**

CONDUCTOR

The conductors shall be composed of aluminium wires complying with **IS: 8130: 1984** or latest amendments thereof.

INSULATION

The insulation shall be of cross-linked polyethylene conforming to the requirements given in Table 1 of **IS: 7098: 2011 (Part-II)** or latest amendment thereof.

INSULATION SCREENING

The insulation screening shall consist of two parts:

- a) Non-Metallic Screening
Non-metallic part shall be applied directly over the insulation of each core and shall consist of either a semi-conducting tape or extruded semi-conducting compound or a combination of the two or either material with a semi-conducting coating. Minimum thickness should be 0.3 mm.

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- b) Metallic Screening
Metallic screening shall be helical wrapped Copper tape.

FILLERS AND INNER SHEATH

- a) The Inner Sheath shall be of polyvinyl chloride (PVC) compound conforming to the requirements of Type ST1 of **IS: 5831: 1984** or latest amendments thereof.
- b) The colour of the inner sheath should be black.
- c) The filler material is to be compatible with that of inner sheath.
- d) The filler material will be same as inner sheath.
- e) The method of application for inner sheath with filler material shall be Pressure/Vacuum extruded and for inner sheath without filler material shall be Pressure extruded.

10.36 Supply of LT Cables:

The vendor may choose to opt for:

PVC Insulated and PVC Sheathed LT POWER CABLES

OR

XLPE Insulated and PVC Sheathed LT POWER CABLES

This document covers the technical specification of Polyvinyl chloride (PVC) insulated and PVC sheathed power cables and cross-linked polyethylene (XLPE) insulated and PVC sheathed power cables for three phase system up to 1100Volts

Four core cables shall be acceptable if 3.5 core cables are not available.

CONDUCTOR

- a) The conductors shall be composed of plain copper or aluminium wires complying with **IS: 8130: 1984** or latest amendments thereof.
- b) **FOR PVC Cable:** Cables with reduced neutral conductor shall have sizes as given in Table 1 of **IS: 1554: 1988 (Part-I)** or latest amendment thereof.
- c) **FOR XLPE Cable:** Cables with reduced neutral conductor shall have sizes as given in Table 2 of **IS: 7098: 1988 (Part-I)** or latest amendment thereof.

INSULATION (PVC)

- a) **General Purpose Insulation:** The insulation shall be of Type A PVC compound conforming to the requirements of **IS: 5831: 1984** or latest amendments thereof.

OR

Heat Resisting Insulation: The insulation shall be of Type C PVC compound conforming to the requirements of **IS: 5831: 1984** or latest amendments thereof.

- b) The method of application of PVC insulation shall be extrusion.
- c) The average thickness of insulation shall not be less than the nominal value specified in Table 2 of **IS: 1554: 1988 (Part-I)** or latest amendment thereof.
- d) The insulation shall be so applied that it fits closely on the conductor (or the barrier if any) and it shall be possible to remove it without damaging the conductor.
- e) The smallest of measured values of thickness of insulation shall not fall below the nominal value specified in Table 2 of **IS: 1554: 1988 (Part-I)** or latest amendment thereof by more than $0.1\text{mm} + 0.1 \times \text{nominal value}$.

INSULATION (XLPE)

- a) The insulation shall be of cross-linked polyethylene conforming to the requirements given in Table 1 of **IS: 7098: 1988 (Part-I)** or latest amendment thereof.
- b) The method of application of cross-linked polyethylene insulation shall be extrusion.
- c) The average thickness of insulation shall not be less than the nominal value specified in Table 3 of **IS: 7098: 1988 (Part-I)** or latest amendment thereof.
- d) The insulation shall be so applied that it fits closely on the conductor (or the barrier if any) and it shall be possible to remove it without damaging the conductor.

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- e) The smallest of measured values of thickness of insulation shall not fall below the nominal value specified in Table 3 of **IS: 7098: 1988 (Part-I)** or latest amendment thereof by more than $0.1\text{mm}+0.1 \times \text{nominal value}$.

CORE IDENTIFICATION

- a) Cores shall be identified as specified below for 3.5Core cables as Red, blue, and yellow colouring of PVC/ XLPE insulation for three phase conductors and black colouring of PVC/ XLPE insulation for reduced neutral conductor.
- b) For balance cables, the core identification shall be in line with clause no. 10 of **IS: 1554: 1988 (Part-I)** and **IS: 7098: 1988 (Part-I)** for PVC insulated and XLPE insulated cables respectively.

FILLERS AND INNER SHEATH

- f) The fillers and inner sheath shall be of the following:
- Vulcanized rubber, or
 - Thermoplastic materials, or
 - Proofed tape requirement as per IS.
- g) Vulcanized or thermoplastic material used for inner sheath shall not be harder than PVC used for insulation and outer sheath. Fillers and inner sheath materials shall be so chosen as to be compatible with the temperature ratings of the cable and shall have no deleterious effect on any other component of the cable.
- h) The inner sheath shall be applied by extrusion. It shall be ensured that it is as circular as possible.
- i) The inner sheath shall be so applied that it fits closely on the laid up cores and it shall be possible to remove it without damaging the insulation.
- j) **FOR PVC Cables:** The thickness of inner sheath shall be as given in Table 4 of **IS: 1554: 1988 (Part-I)** or latest amendment thereof.
- k) **FOR XLPE Cables:** The thickness of inner sheath shall be as given in Table 5 of **IS: 7098: 1988 (Part-I)** or latest amendment thereof.
- l) When one or more layers of binder tapes are applied over the laid up cores, the thickness of such tapes shall not be construed as part of the inner sheath.

ARMOURING

- a) Armouring shall be of Galvanized round steel wire.
- b) The galvanized steel wires shall comply with the requirements of **IS: 3975: 1979** or latest amendments thereof.
- c) Armouring shall be applied over the inner sheath.
- d) The galvanized round steel wire of the armouring shall be applied as closely as practicable.
- e) A binder tape may be provided on the armour.
- f) **FOR PVC Cables:** The dimensions of galvanized round steel wire shall be as specified in Table 5 of **IS: 1554: 1988 (Part-I)** or latest amendment thereof.
- g) **FOR XLPE Cables:** The dimensions of galvanized round steel wire shall be as specified in Table 6 of **IS: 7098: 1988 (Part-I)** or latest amendment thereof.
- h) The joints in armour wire shall be made by brazing or welding and the surface irregularities shall be removed. A joint in any wire shall be at least 300 mm from the nearest joint in any other armour wire in the completed cable.

OUTER SHEATH

- a) The outer sheath shall be of polyvinyl chloride (PVC) compound conforming to the requirements of Type ST2 of **IS: 5831: 1984** or latest amendments thereof.
- b) The outer sheath shall be applied over the armouring.
- c) The outer sheath shall be applied by extrusion.
- d) The outer sheath shall be of black colour.
- e) The outer sheath shall be so applied that it fits closely over the armouring. It shall be possible to remove it without damage to the insulation or inner sheath.
- f) **FOR PVC Cables:** The thickness of outer sheath shall be not less than the minimum value specified in col 5 of Table 7 or latest amendments thereof of IS: 1554: (Part-I)/ 1988 Clause 14.4.2 Armoured Cables.
- g) **FOR XLPE Cables:** The thickness of outer sheath shall be not less than the minimum values specified in col 5 of Table 8 or latest amendments thereof of IS: 7098: (Part-I)/ 1988 Clause 14.3.2 Armoured Cables.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - X: DETAILED TECHNICAL SPECIFICATIONS

- h) **FOR PVC Cables:** The minimum thickness of PVC outer sheath shall not fall below the nominal value specified in Table 7 of **IS: 1554: 1988 (Part-I)** by more than $0.2\text{mm} + 0.2 \times \text{nominal value}$.
- i) **FOR XLPE Cables:** The minimum thickness of PVC outer sheath shall not fall below the nominal value specified in Table 8 of **IS: 7098: 1988 (Part-I)** by more than $0.2\text{mm} + 0.2 \times \text{nominal value}$.

TECHNICAL CONDITIONS OF CONTRACT (TCC)

Chapter - XI: BILL OF QUANTITY & Weightages/ Factor

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

CONTENTS	
Description	Remarks
Part A: Instructions to the Bidders	Instructions
PART B: % weightage for amount of individual items of Schedule of quantity	Refer Latest Chapter-XI of Vol-IA TCC (BILL OF QUANTITIES AND % WEIGHTAGE OF INDIVIDUAL ITEMS)
PART C: Total Lump Sum Price for entire scope of Work	This part is implanted in the E- Procurement portal entitled as “ Part-C of Vol-II Price Bid ”.

Part A: Instructions to the Bidders

1. **Bidders shall quote Total Lump-sum Price for the entire scope of work at the place implanted in the E-Procurement Portal titled as “Part-C of Vol-II Price Bid”.** Price mentioned elsewhere in the offer of the bidder shall be treated as Null and Void.
2. BHEL has fixed the % weightages as in “Part-B” for the amount of individual items of Schedule of Quantity w.r.t. the total price of Price Bid Vol-II.
3. Based on the pre-fixed % weightages, amount of individual items shall be derived by BHEL. This amount shall not be rounded off.
4. Based on the quantities of individual item and the amount arrived in SI No 3 above, item rate of individual items shall be derived by BHEL. This item rate shall be rounded off up to two decimal places and shall be used to calculate the total amount of an item.
5. For the convenience of bidders, BHEL has issued an excel sheet with all requisite formulae as detailed above. ***However, this excel sheet shall not form part of contract document. Further, this sheet should not be uploaded at the e-Portal.***
6. Bidders to note that this is an ‘item rate contract’. Payment shall be made for the actual quantities of work executed at the Unit rate arrived at as per serial no 4 above.

TECHNICAL CONDITIONS OF CONTRACT (TCC)
Chapter - XI: BILL OF QUANTITY & Weightages/ Factor

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

Note: This Chapter-XI is uploaded separately as file titled ‘Chapter XI-BOQ and Percentage Weightage’-3215 (PACKAGE A & PACKAGE –B)

S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
BILL OF QUANTITIES FOR PACKAGE-A				
1.00	PREPARATION OF DRAWING & OBTAINING STATUTORY APPROVAL			
1.01	Route survey, preparation of route drawing, Detailed SLD, route from source to 33/11kV substation , Detailed 33/11kV substation (including VCBs and other accessories) and 11kV/433V package substation drawing, 11kV distribution drawing, Two/Four/Six/Eight pole structure arrangement drawing, Earthing layout, sag calculation for OH line & any other document /drawing as required by Electrical inspectorate and getting approval of above from statutory authority and also includes liaison with electrical inspectorate for field inspection and obtaining clearance certificate for charging the entire system in a phased manner as per site requirement (any number of times till completion of entire scope under this contract.). Since 33kV source shall be provided by Maharashtra Electricity board, vendor has to make all the arrangement for tapping of the source as per TCC.	Lump sum	1	0.012656520154260600
2.01	SUPPLY PORTION OF BOM FOR 33kV and 11kV OH LINES/ CABLES/ SUBSTATIONS ETC.			
2.01.A	Supply of 33kV 3Cx185sqmm Armoured HT Cable (for interconnection from customer's source to 33/11kV construction power substation).	Mtrs	200	0.010531143010586900

TECHNICAL CONDITIONS OF CONTRACT (TCC)
Chapter - XI: BILL OF QUANTITY & Weightages/ Factor

S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.01.B	33kV/11kV SUBSTATION RELATED ITEMS AND			
2.01.B.1	Supply of Pole ISMB-250 11m for 33/11kV Height for Overhead line two/four/six/eight pole steel structure at Sub Station.	Nos.	6	0.002705080555351440
2.01.B.2	Supply of ISMC-100 for cross beam for Overhead line two/four/six/eight pole steel structure at Sub Station.	MT	2	0.003246096666421720
2.01.B.3	Supply of ISMC-75 for cross beam for Overhead line two/four/six/eight pole steel structure at Sub Station.	MT	1	0.001623048333210860
2.01.B.4	Supply of 2kVA 230V 1 phase sine wave UPS of reputed make with 2 nos. of exide make 150AH 12V tubular lead acid batteries. Vendor shall submit relevant certificates along with supply.	Sets	1	0.001352540277675720
2.01.B.5	Supply of 50kVA 3 phase 4 wire 11kV/433V copper wound DYN11 oil filled out door plinth mounted Distribution transformer of reputed make to provide auxilliary power supply to 33/11kV sub station and illumination etc.	Nos.	1	0.009016935184504790
2.01.B.6	Supply of 125A out door type Floor mounted Power distribution board (PDB), IP 55 protection, Double Door type, Incomer-01 no. 125A TPN MCCB. Outgoing-02 nos. 63A TPN ELCBs with 30mA tripping, 03 nos. 40A TPN ELCBs with 30mA tripping, 02 nos. 32 A TPN ELCBs with 30mA tripping with Timer & contactors for auto on/off and 3 indicating lamps with fuse for indication bus supply ON, Digital voltmeter & VSS 0-500V, suitable bus bar arrangement for phase and neutral. Sufficient space should be provided in the removable cable gland plate to accommodate minimum 1Rx3.5Cx70/ 3.5Cx95 sq. mm. All incoming cable and outgoing cables of different sizes. All MCCB, MCBs and ELCBs shall be of reputed make.	Nos.	1	0.002254233796126200

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.01.B.7	Supply of operator remote control desk/Relay control panel with chair for operating the 33kV/11kV Substation consisting of 01 Nos. of 2.5 MVA 33kV/11kV and 50kVA 11kV/0.440kV Transformers, 01 Nos. 33kV Outdoor Vacuum Circuit Breakers & 01 Nos. 11kV Outdoor Vacuum Circuit Breakers. This remote control desk/relay control panel shall control all operation points of Substation i.e control supply on status, UPS and battery healthiness, main supply on status for 33kV/11kV and 11kV/0.440kV transformers & VCBs. Other healthiness monitoring which includes breaker on/off status, trip circuit healthy indication, relay coordinations & trip alarm annunciation window etc. The panel shall be approved by BHEL.	Set	1	0.002254233796126200
2.02	11kV OVERHEAD RING MAIN LINE RELATED ITEMS.			
2.02.01	Supply of 9 m long 280kg working load pre-stressed cement concrete poles (PSCC) as per IS:1678.	Nos.	140	0.030296902219936100
2.02.02	Supply of Pole ISMB-250 11 m for 11kV Height for Overhead line two/four pole steel structure at Sub Station.	Nos.	20	0.014427096295207700
2.02.03	Supply of ISMC-100 for cross beam for Overhead line two/four pole steel structure at Sub Station.	MT	4	0.006492193332843450
2.02.04	Supply of ISMC-75 for cross beam for Overhead line two/four pole steel structure at Sub Station.	MT	1	0.001623048333210860
2.02.05	Supply of 11kV 'V' Cross arms/Straight Arm with suitable back clamps including supply of necessary fasteners as per IE specification.	Nos.	140	0.010098967406645400

TECHNICAL CONDITIONS OF CONTRACT (TCC)
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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.02.06	Supply of 11kV GI stay (7/3.15mm) sets with Guy, Bow, Stay Rod, wire etc. as per I.E. Specifications. (Each set consist of all 3 Phases).	Sets	140	0.018935563887460100
2.02.07	Supply of 11kV top fittings (I Clamp) with suitable back clamps including supply of necessary fasteners as per IE specification.	Nos.	140	0.003155927314576680
2.02.08	Supply of 11kV disc insulator with fixing & conductor and holding clamp as per IS: 3188/1965 & IEC 309/1969/Latest. (Each set consist of all 3 Phases).	Sets	30	0.001893556388746010
2.02.09	Supply of 11kV pin insulator with pins as per IS: 2544/1963 AMD 125 & IEC 168/1969 Latest. (Each set consist of all 3 Phases).	Sets	140	0.003155927314576680
2.02.10	Supply of 11kV 400A Air break switch-double break-horizontal mounting rotating type as per ISS/IEC Spec No.4710/1968-265-C/1970/Latest.	Nos.	20	0.016230483332108600
2.02.11	Supply of 11kV 400A Air break switch-double break-Vertical mounting rotating type as per ISS/IEC Spec No.4710/1968-265-C/1970/Latest.	Nos.	10	0.008115241666054310
2.02.12	Supply of 11kV Lightning arrester set as per ISS/IEC Spec No. IS:3070/2-1985/Latest. (Each set consist of all 3 Phases).	Sets	10	0.002254233796126200

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.02.13	Supply of 11kV HG fuse as per ISS/IEC Spec IS: 9385/Latest. (Each set consist of all 3 Phases)	Sets	10	0.001623048333210860
2.02.14	Supply of 11kV DO fuse as per ISS/IEC Latest. (Each set consist of all 3 Phases)	Sets	10	0.002254233796126200
2.02.15	Supply of out door type weather proof 630A capacity 11kV Pillar box IP 55 Protection as per IS with one no. Incoming and two nos. outgoing including supply of accessories.	Nos.	1	0.002254233796126200
2.02.16	Supply and fixing of anti climb device (barbed wire) roled on the poles at 2m height as per I.E. specification and numbering of poles.	Sets	140	0.018935563887460100
2.03	COMMON ITEMS FOR 11KV OH LINES AND SUBSTATION EQUIPMENTS.			
2.03.01	Supply of 65x10 mm GI earth flat.	Meters	155	0.002096437430397360
2.03.02	Supply of 50x6 mm GI earth flat.	Meters	229	0.001486712273221150
2.03.03	Supply of 25x3 mm GI earth flat.	Meters	51	0.000183945477763898
2.03.04	Supply of 8SWG wire	Meters	1000	0.000541016111070287
2.03.05	Supply of 3.5Cx300 sq.mm LT Power cable (XLPE Armoured)	Meters	500	0.014341703792017900
2.03.06	Supply of 3.5Cx70/95 sq.mm LT Power cable (XLPE Armoured)	Meters	4000	0.032371894187126500

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.03.07	Supply of 3.5Cx35 sq.mm LT Power cable (XLPE Armoured)	Meters	5000	0.018008493415090500
2.03.08	Supply of 3.5Cx16/25sqmm LT Power Cable (XLPE Armoured)	Meters	1000	0.003601698683018100
2.03.09	Supply of 5Cx2.5sqmm/ 3Cx2.5 LT Power Cable (XLPE Armoured)	Meters	2000	0.005803942154863500
2.03.10	Supply of 2CX2.5 Sq.mm LT Power Cable (XLPE Armoured)	Meters	2000	0.003547456232972650
2.03.11	Supply of Required MS/GI/Nickel cadmium fasteners/anchor fasteners for erection of all supply materials and completion of entire works covered under this package. (M6 to M16).	kg	100	0.000450846759225239
2.03.12	Supply of Heat shrink type HT Indoor/Outdoor end termination kits of reputed make suitable for 3Cx185 sqmm 33/11kV Cables including for VCB. The exact details of VCB end termination shall be shared separately (touch proof/ normal).	Nos.	26	0.007033209443913730
2.03.13	Supply of Heat shrink type HT straight through jointing kits of reputed make for 3Cx185sqmm 33/11kV Armoured Cables.	Nos.	5	0.002254233796126200
2.03.14	Supply of 200mm dia RCC hume pipes for cable crossing where ever required such as existing culverts, trenches and road etc for HT Cables.	Meters	150	0.003246096666421720
2.03.15	Supply of 150mm NB 4.8mm thick medium class GI pipes for make use of cable crossing where ever required such as existing culverts, trenches and road etc for for LT Cables.	Meters	150	0.002028810416513580

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.03.16	Supply of Fire Buckets with stand floor mounted type of rigid & good quality-4 nos. 10 ltr capacity Fire buckets per stand-Type & make shall be approved by BHEL/ Engineer.	Sets	12	0.000865625777712460
2.03.17	Supply of Aluminium alloy 5kg CO2 fire extinguisher industrial type with ISI Mark of reputed make. Type & make shall be approved by BHEL/ engineer.	Nos.	12	0.000973828999926517
2.03.18	Supply of HT cable route markers standard size with 1m height angle support.	Nos.	150	0.002028810416513580
2.03.19	Supply of LT cable route markers standard size with 1m height angle support.	Nos.	305	0.004125247846910940
2.03.20	Supply of Griddle Guards of length 15m, with 8SWG GI Wire for Road crossing with necessary fixing arrangement etc, as per IS Specification.	Nos.	5	0.015779636572883400
2.03.21	Supply of outdoor type metal clad LT distribution board (LTDB) having IP -55 Protection, one incomer with 400A TPN CHANGE OVER SWITCH for EB supply & DG SET POWER SUPPLY and 2 nos. 200 A and 2 nos. outgoing feeders with 63 A TPN ELCBs, 3 indicating lamps with fuse for indication bus supply ON, Voltmeter & VSS 0-500V etc. Sufficient space should be provided for the removable cable gland plate to accommodate the power cable and all outgoing cables from suitable connectors from each MCB/ELCB. Neutral link bar for incoming and outgoing neutrals.	Nos.	2	0.004508467592252400
2.04	FOR AREA LIGHTING RELATED ITEMS.			

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.04.01	Supply of steel tubular swaged poles, 9 mtr long made of sheet steel having ultimate tensile strength 42 kg F/sq. mm conforming to BIS: 2713 (part-II) complete with 300x300x6 mm thick MS base plate for welding at site and size as per configuration given in BIS for 410 SP-28 (113 kg- pole weight) .	Nos.	106	0.030585444145840200
2.04.02	Supply of Electrical junction box (GI/PVC)of good quality to suit the opening available in above lighting pole, one connector block for 3 Phase 4 wire incoming and outgoing cable to next street light pole with 01 no. 6A SP MCB for street light and earthing etc.	Nos.	106	0.004778975647787540
2.04.03	Supply of 90W LED street light fitting of make Philips/CGL/Bajaj/Havells/Wipro only.	Nos.	106	0.009175633243752070
2.04.05	Supply of 50mm NB 3.6mm thick medium class standard GI pipe for incoming and outgoing cables.	Meters	426	0.006914185899478270
2.04.06	Supply of out door type metal clad Lighting distribution board (LDB) having IP-55 protection with double door type and one incomer with 100A TPN MCCB additionally with 3 nos. 32 A TPN ELCBs with 30mA tripping and timer & contactors for auto on/off street lights and 3 indicating lamps with fuse for indication bus supply ON, Digital Voltmeter & VSS 0-500V etc. Suitable busbar arrangement for Phase and Neutral. Sufficient space should be provided in the removable cable gland plate to accommodate incoming power cable and all outgoing cables.	Nos.	3	0.004869144999632590
BILL OF QUANTITIES FOR ERECTION, TESTING AND COMMISSIONING				

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.05	33kV/11kV SUBSTATION RELATED ITEMS.			
2.05.01	Laying and termination of 33 KV 3CX185 HT cable From source to 33/11 KV Transformer	Mtrs	200	0.001025741528503200
2.05.02	Erection of Pole ISMB-250 11m for 33/11kV Overhead line two/four/six/eight pole steel structure at Sub Station.The erection includes excavation of earth of size 1x1x1.8m depth, fasteners, foundation bolt, grouting with concrete of ratio 1:4:8 for size of 1x1x1.8m depth including supply of cement, sand, metal etc for the foundation and coping of poles by 1 feet height.	Nos.	6	0.000865625777712460
2.05.03	Erection of ISMC-100 for cross beam for Overhead line two/four/six/eight pole steel structure at Sub Station.	MT	2	0.001442709629520770
2.05.04	Erection of ISMC-75 for cross beam for Overhead line two/four/six/eight pole steel structure at Sub Station.	MT	1	0.000721354814760383
2.05.05	Erection, testing and commisioning of 2kVA 230V 1 phase sine wave UPS of reputed make with 2 nos. of exide make 150AH 12V tubuler lead acid batteries.	Sets	1	0.000225423379612620
2.05.06	Erection, testing and commisioning, including oil filteration and submission of oil test report of 50kVA 3 phase 4 wire 11kV/433V copper wound DYN11 oil filled out door plinth mounted Distribution transformer of reputed make to provide control supply to 33/11kV sub station and illumination etc.	Nos.	1	0.001352540277675720

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.05.07	Erection, testing and commissioning of operator remote control desk/Relay control panel with chair for operating the 33kV/11kV Substation consisting of 01 Nos. of 2.5 MVA 33kV/11kV and 50kVA 11kV/433V Transformers, 01 Nos. of 33kV Outdoor Vacuum Circuit Breakers and 01 Nos. of 11kV Outdoor Vacuum Circuit Breaker. This remote control desk/relay control panel shall control all operation points of Substation i.e control supply on status, UPS and battery healthiness, main supply on status for 33kV/11kV and 11kV/433V transformers & VCBs. Other healthiness monitoring which includes breaker on/off status, trip circuit healthy indication, relay coordinations & trip alarm annunciation window etc. The panel shall be approved by BHEL.	Set	1	0.000450846759225239
2.05.08	1. Supply of materials as required and mentioned below for erection, testing & commissioning of 1 bay 33/11kV substation consists of 1 no 2.5MVA 33/11kV Transformer, 01 Nos. of 33kV Outdoor Vacuum Circuit Breakers and 01 Nos. of 11kV Outdoor Vacuum Circuit Breaker with allied works. This includes E&C of 1 nos 2.5MVA 33/11kV Transformer, 01 Nos. of 33kV Outdoor Vacuum Circuit Breakers and 01 Nos. of 11kV Outdoor Vacuum Circuit Breaker with allied works as described below.	Set	1	0.050494837033226800
	A- Leveling of substation yard, supply and spreading of 40mm size stone aggregate of 100 mm thick for an area as per approved drawing. supply and construction of brick work with cement mortar 1:6 of 230 mm thick and 450 mm height all around the substation yard, plastering the brick work in CM 1:6 etc.			
	B- Supply and construction of RCC foundation as per scheme drawing for 1 no 2.5MVA 33/11kV Transformer, 01 Nos. of 33kV Outdoor Vacuum Circuit Breakers and 01 Nos. of 11kV Outdoor Vacuum Circuit Breaker. Excavation of plinth pit and base concreting and plastering, white washing , oil soak pit etc as per IE standard and as per detailed approved foundation and substation layout Drg.			

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
	C- Supply and fixing of 3.15mm GI chain linked wire fencing height 2 m for the substation. . Grouting of 3m height ISA 75 fabricated posts at an interval of 1.5m (2m vertical 0.5m slanting, 0.5m grouting). Three runs of barbed wire along with the fencing on the slanting angle post, fixing of mesh with post by 50x6mm MS flat with fasteners (2 nos./post) and earthing of fencing by 25x3 GI flat and providing finish aluminum painting of all steel materials etc. (separate rate given for supply and E&C of earthing flat)			
	D- Supply and installation of 3m x 2m height double door type MS gate made of Angle, channel/rolled sections including supply and fixing of hinges, fasteners, locking arrangement etc, including providing of finish aluminum painting .			
	E- Supply and Erection of 3m long 50mm dia 3.6 mm thick medium class GI funnel type earth electrode with filling of bentonite earthing powder as per standard, four side brick work chamber with cement plastering , white washing and removable type RCC/ cast iron cover plate. Scope includes supply of required bentonite earthing powder, cement, brick, sand, RCC/cast iron cover plate. Making of earth mat using 65X10 mm GI flats for main equipment body earthing & neutral earthing, 25x5 flat for LA earthing and others . Minimum 04 earth pits for earth Mat & Body earthing , 2 nos. for Neutral earthing as per detailed layout.			
	Installation/Erection of steel tubular swaged poles, 9 mtr long made of sheet steel having ultimate tensile strength 42 kg F/sq. mm conforming to BIS: 2713 (part-II) complete with 300x300x6 mm thick MS base plate for welding at site and size as per configuration given in BIS for 410 SP-28 (113 kg- pole weight) with 1.5 mtr deep excavation, concreting in 1:4:8 ratio size 45 cms x 45 cms x 150 cms and pole plinth in 1:3:6 cement concreting having 300 mm height and 300 mm dia including double earthing of pole with suitable arrangement, duly painted with two coats of red oxide paint and one coat of aluminium paint to be applied after erection; the length of pole below ground to be painted with two coats of black bituminous paint. the			

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
	<p>pole shall be complete with JB, fuse and minor fabrication as below :</p> <p>i) Driling 20 mm dia hole at about 2.5 mtr from ground level for wire leads from junction box to light fixture.</p> <p>ii) Driling 15mm dia holes at about 0.7 and at 2.5 mtr from ground level and welding 12 mm nuts for using a 12 mm GI bolt for fastening earth conducters.</p> <p>iii) Welding required holes for fixing pole cap of street light bracket.</p> <p>iv) Welding diametrally 10 mm MS round 30 mm below pole top edge for clipping wire leads.</p> <p>Erection of Electrical junction box (GI/PVC)of good quality to suit the opening availabe in above lighting pole, one connector block for 3 Phase 4 wire incoming and outgoing cable to next street light pole with 01 no. 6A SP MCB for street light and earthing etc.</p> <p>Erection of 90W LED street light fitting of make Philips/CGL/Bajaj/Havells/Wipro only.</p> <p>Total 06Nos. of street light per substation.</p> <p>Supply rates of LED provided separately.</p>			
	<p>G-Erection, testing and commisioning of 125A out door type Floor mounted Power distribution board (PDB), IP 55 protection, Double Door type, Incomer-01 no. 125A TPN MCCB. Outgoing-02 nos. 63A TPN ELCBs with 30mA tripping, 03 nos. 40A TPN ELCBs with 30mA tripping, 02 nos. 32 A TPN ELCBs with 30mA tripping withTimer & contactors for auto on/off and 3 indicating lamps with fuse for indication bus supply ON, Digital voltmeter & VSS 0-500V, suitable bus bar arrangement for phase and neutral. Sufficient space should be provided in the removable cable gland plate to accommodate minimum 1Rx3.5Cx70/ 1Rx3.5Cx95 sq. mm. incoming cable and outgoing cables of different sizes. All MCCB, MCBs and ELCBs shall be of reputed make.</p>			
	<p>H- Suppy & fixing of 15 nos. 11 kV safety danger boards of standard size (Per Substation).</p>			

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
	Erection, testing and commissioning, including oil filtration and submission of oil test report of 33 kV/11 kV, 2.5MVA oil filled outdoor transformer as per BHEL Technical Specifications.			
	supply and installation of two numbers vertical air terminations, 6m height 50 mm NB 3.6mm thick medium class GI Pipe with 1m height lightning spike on the top (total height -7m) with suitable Base plate & foundation bolts for Lightning protection of substation. Vertical air terminal shall be grounded with earth pits. Required civil works for lightning pole erection and grouting including supply of grouting civil materials are in the scope of Contractor.			
	Erection, testing and commissioning of 33 & 11kV Outdoor Vacuum Circuit Breaker (VCB) with outdoor busbar terminal bushing connectors as per BHEL Technical Specifications including 230 V AC/220/110 V DC Power Pack/ SMPS Facility Power Supply for control circuit inside the panel.			
2.06	11kV OVERHEAD RING MAIN LINE RELATED ITEMS AND PSS			
2.06.01	Stringing of ACSR DOG conductors as per IS:398/1961 (To meet 3 phases/lines)	Meters	13000	0.014066418887827500
2.06.02	Erection of 9 m long 280kg working load pre-stressed cement concrete poles (PSCC). The erection includes excavation of earth of size 1x1x1.8m depth, grouting with concrete of ratio 1:4:8 for size of 1x1x1.8m depth including supply of cement, sand, metal etc. for the foundation and coping of poles by 1 feet height.	Nos.	140	0.011361338332476000
2.06.03	Erection of Pole ISMB-250 11 m Height for 11kV Overhead line two/four/six/eight pole steel structure at Sub Station. The erection includes excavation of earth of size 1x1x1.8m depth, fasteners, foundation bolt, grouting with concrete of ratio 1:4:8 for size of 1x1x1.8m depth including supply of cement, sand, metal etc for the foundation and coping of poles by 1 feet height.	Nos.	20	0.002885419259041530

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.06.04	Erection of ISMC-100 for cross beam for Overhead line two/four/six/eight pole steel structure at Sub Station.	MT	4	0.002885419259041530
2.06.05	Erection of ISMC-75 for cross beam for Overhead line two/four/six/eight pole steel structure at Sub Station.	MT	1	0.000721354814760383
2.06.06	Erection of 11kV 'V' Cross arms/Straight Arm with suitable back clamps including erection of necessary fasteners as per IE specification.	Nos.	140	0.001514845110996800
2.06.07	Erection of 11kV GI stay (7/3.15mm) sets with Guy, Bow, Stay Rod, wire etc. as per I.E. Specifications. (Each set consist of all 3 Phases).	Sets	140	0.006311854629153350
2.06.08	Erection of 11kV top fittings (I Clamp) with suitable back clamps including erection of necessary fasteners as per IE specification.	Nos.	140	0.001009896740664540
2.06.09	Erection of 11kV disc insulator with fixing & conductor and holding clamp as per IS: 3188/1965 & IEC 309/1969/Latest. (Each set consist of all 3 Phases).	Sets	30	0.000324609666642172
2.06.10	Erection of 11kV pin insulator with pins as per IS: 2544/1963 AMD 125 & IEC 168/1969 Latest. (Each set consist of all 3 Phases).	Sets	140	0.001009896740664540
2.06.11	Erection of 11kV 400A Air break switch-double break-horizontal mounting rotating type as per ISS/IEC Spec No.4710/1968-265-C/1970/Latest.	Nos.	20	0.005410161110702870
2.06.12	Erection of 11kV 400A Air break switch-double break-vertical mounting rotating type as per ISS/IEC Spec No.4710/1968-265-C/1970/Latest.	Nos.	10	0.002164064444281150

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.06.13	Erection of 11kV Lightning arrester set as per ISS/IEC Spec No. IS:3070/2-1985/Latest. (Each set consist of all 3 Phases).	Sets	10	0.001082032222140570
2.06.14	Erection of 11kV HG fuse as per ISS/IEC Spec IS: 9385/Latest. (Each set consist of all 3 Phases)	Sets	10	0.002164064444281150
2.06.15	Erection of 11kV DO fuse as per ISS/IEC Latest. (Each set consist of all 3 Phases)	Sets	10	0.002164064444281150
2.06.16	Erection, testing and commisioning of out door type weather proof 630A capacity 11kV Pillar box IP 55 Protection as per IS with one no. Incoming and two nos. outgoing.	Nos.	1	0.000450846759225239
2.06.17	Erection and fixing of anti climb device (barbed wire) roled on the poles at 2m height as per I.E. specification and numbering of poles.	Sets	140	0.010098967406645400
2.06.18	Overhead Laying and Installation of HT & LT cables on poles including supply and installation of poles and all other accessories. HT Cable supply, laying and termination is excluded here and paid separately.	Meters	250	0.006762701388378590
2.06.19	Laying and Termination of 11kV 3Cx185sqmm Armoured HT Cable along with supply and installation of double compression type brass cable glands and required number of termination lugs of reputed make suitable (for Interconnection of Ring Main System and interconnection from customer's source to 33/11kV construction power substation)	Meters	3000	0.010820322221405700
2.06.20	Supply of materials as required for erection, testing & commissioning of 11kV/433V Package Substation.	Set	10	0.072135481476038300

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
	A- Leveling of substation yard, supply and spreading of 40mm size stone aggregate of 75mm thick for an area as per the approved drawing , supply and construction of Brick work with cement mortar 1:6 of 230 mm thick and 450 mm height all-round the substation yard, plastering the brick work in CM 1:6 , white washing etc complete. (Per Sub Station).			
	B- Supply and construction of foundation as per supplier foundation drawing for 500kVA. Package Substation. Actual size to be taken as per the approved drawing including excavation of plinth pit and base concreting and plastering, white washing etc... as per the instruction of BHEL site engineer.			
	C- Supply and fixing of 3.15mm GI chain linked wire fencing height 2m for the substation of size as per approved drawing including grouting of 3m height ISA 75 fabricated posts at an interval of 1.5m (2m vertical 0.5m slanting, 0.5m grouting) and three runs of barbed wire along with the fencing on the slanting angle post, fixing of mesh with post by 50x6mm MS flat with fasteners (2 nos./post) and earthing of fencing by 8 SWG GI wire and providing finish aluminum painting of all steel materials etc. (separate rate given for supply and E&C of earthing wire and earthing flat)			
	D-.Supply and installation of 1m x 2m height MS gate made of MS Angle, channel/rolled sections including supply and fixing of hinges, locking arrangement etc including providing finish aluminum painting etc. (Per Sub Station)			

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
	E-Supply and Erection of 3m long 50mm dia 3.6 mm thick medium class GI funnel type earth electrode with filling of bentonite earthing powder as per standard, four side brick work chamber with cement plastering, white washing and removable type RCC/ cast iron cover plate. Scope includes supply of required betonite eathing powder, cement, brick, sand, RCC/cast iron cover plate. Minimum 06 earthpits per sub station. Sub station earthing shall be carried out by using supplied 50x6, 25x6 and 25x3 mm earth flats (separate rate given for supply and E&C of earth flats.)			
	F-Supply and erection 2 nos. 5m height 3mm thick conical GI street light pole of reputed make with 40W LED street light fitting with base plate, foundation bolts and single lighting GI arm bracket with fasteners including suplly all civil materials like cement , metal & sand etc for making foundation and cabling from LT panel. Supply and providing of necessary timer circuit for auto charging of lights. Make shall be approved by BHEL site Engineer			
	G- supply and installation of two numbers vertical air terminations, 6m height 50 mm NB 3.6mm thick medium class GI Pipe with 1m height lightning spike on the top (total height -7m) with suitable Base plate & foundation bolts for Ligtning protection of PSS. Vertical air terminal shall be grounded with earth pits. Required civil works for lightning pole erection and grouting including supply of grouting civil materials are in the scope of Contractor. (Per Sub Station)			
	H- Suppy & Fixing of 06 nos. 11kV danger board of standard size (Per Sub Station).			
	I -Erection , Testing & Commissioing of PSS Substation and allied accessories.			

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.07	COMMON ITEMS FOR 11KV OH LINES AND SUBSTATION EQUIPMENTS.			
2.07.01	Laying and Termination of 3.5Cx300sqmm LT Power Cable along with supply and erection of double compression type brass cable glands and required number of termination lugs of reputed make suitable for interconnection of LTDB with Package Substation.	Meters	500	0.001352540277675720
2.07.02	Laying and termination of 3.5Cx70/ 3.5Cx95sqmm LT Power Cable along with supply and erection of double compression type brass cable glands and required number of termination lugs of reputed make suitable for Lighting LDB &50 kVA Aux. Transformer.	Meters	4000	0.010820322221405700
2.07.03	Laying and termination of 3.5Cx35sqmm LT Power Cable along with supply and erection of double compression type brass cable glands and required number of termination lugs of reputed make	Meters	5000	0.013525402776757200
2.07.04	Laying and termination of 3.5Cx16/25sqmm LT Power Cable along with supply and erection of double compression type brass cable glands and required number of termination lugs of reputed make .	Meters	1000	0.002705080555351440
2.07.05	Laying and termination of 3C/5Cx2.5sqmm LT Power Cable along with supply and erection of double compression type brass cable glands and required number of termination lugs of reputed make	Meters	2000	0.002705080555351440
2.07.06	Laying and termination of 2Cx2.5sqmm LT Power Cable along with supply and erection of double compression type brass cable glands and required number of termination lugs of reputed make	Meters	2000	0.002705080555351440

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.07.07	Erection of 65 x 10 mm GI earth flat.	Meters	155	0.000419287486079473
2.07.08	Erection of 50 x 6 mm GI earth flat.	Meters	229	0.000495570757740383
2.07.09	Erection of 25 x 3 mm GI earth flat.	Meters	51	0.000091972738881949
2.07.10	Erection of 8SWG wire.	Meters	1000	0.000450846759225240
2.07.11	Erection of Required MS/GI/Nickel cadmium fasteners/ anchor fasteners for erection of all Erection materials and completion of entire works covered under this package (M6 to M16).	kg	100	0.000360677407380191
2.07.12	Erection of Heat shrink type HT Indoor/Outdoor end termination kits of reputed make suitable for 3Cx185sqmm 33/ 11kV Cables including for VCB.	Nos.	26	0.002109962833174120
2.07.13	Erection of Heat shrink type HT straight through jointing kits of reputed make for 33/ 11kV 3Cx185 Armoured Cables.	Nos.	5	0.000676270138837859
2.07.14	Erection of 200 mm dia RCC hume pipes for cable crossing where ever required such as existing culverts, trenches and road etc for HT Cables.	Meters	150	0.001352540277675720
2.07.15	Erection of 150mm NB 4.8mm thick medium class GI pipes for make use of cable crossing where ever required such as existing culverts, trenches and road etc for for LT Cables.	Meters	150	0.000676270138837859
2.07.16	Erection of Fire Buckets with stand floor mounted type of rigid & good quality-4 nos. 10 liter capacity Fire buckets per stand-Type & make shall be approved by BHEL/ Engineer.	Sets	12	0.000973828999926517

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.07.17	Erection of Aluminium alloy 5kg CO2 fire extinguisher industrial type with ISI Mark of reputed make. Type & make shall be approved by BHEL/ engineer.	Nos.	12	0.000973828999926517
2.07.18	Erection of HT cable route markers standard size with 1m height angle support.	Nos.	150	0.000541016111070287
2.07.19	Erection of LT cable route markers standard size with 1m height angle support.	Nos.	305	0.001100066092509580
2.07.20	Erection and fixing of Griddle Guards of length 15m, with 8 SWG GI Wire for Road crossing with necessary fixing arrangement etc, as per IS Specification.	Nos.	5	0.006328260077130300
2.07.21	Erection of outdoor type metal clad LT distribution board (LTDB) IP -55 Protection with one incomer with 400A TPN CHANGE OVER SWITCH for EB supply & DG SET POWER SUPPLY and 2 nos. 200 A and 2 nos outgoing feeders with 63 A TPN ELCBs, 3 indicating lamps with fuse for indication bus supply ON, Voltmeter & VSS 0-500V etc. Sufficient space should be provided for the removable cable gland plate to accommodate the power cable and all outgoing cables from suitable connectors from each MCB / ELCB. Neutral link bar for incoming and outgoing neutrals. All MCCB, MCBs and ELCBs shall be of reputed make.	Nos.	2	0.000901693518450479
2.08	FOR AREA LIGHTING RELATED ITEMS.			

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.08.01	Installation/Erection of steel tubular swaged poles, 9 mtr long made of sheet steel having ultimate tensile strength 42 kg F/sq. mm conforming to BIS: 2713 (part-II) complete with 300x300x6 mm thick MS base plate for welding at site and size as per configuration given in BIS for 410 SP-28 (113 kg- pole weight) with 1.5 mtr deep excavation, concreting in 1:4:8 ratio size 45 cms x 45 cms x 150 cms and pole plinth in 1:3:6 cement concreting having 300 mm height and 300 mm dia including double earthing of pole with suitable arrangement, duly painted with two coats of red oxide paint and one coat of aluminium paint to be applied after erection; the length of pole below ground to be painted with two coats of black bituminous paint. the pole shall be complete with JB, fuse and minor fabrication as below : i) Drilling 20 mm dia hole at about 2.5 mtr from ground level for wire leads from junction box to light fixture. ii) Drilling 15mm dia holes at about 0.7 and at 2.5 mtr from ground level and welding 12 mm nuts for using a 12 mm GI bolt for fastening earth conducters. iii) Welding required holes for fixing pole cap of street light bracket. iv) Welding diametrally 10 mm MS round 30 mm below pole top edge for clipping wire leads.	Nos.	106	0.014336926943362600
2.08.02	Erection of Electrical junction box (GI/PVC) of good quality to suit the opening available in above lighting pole, one connector block for 3 Phase 4 wire incoming and outgoing cable to next street light pole with 01 no. 6A SP MCB for street light and earthing etc.	Nos.	106	0.000955795129557508
2.08.03	Erection of 90W LED street light fitting of make Philips/CGL/Bajaj/Havells/Wipro only.	Nos.	106	0.003823180518230030
2.08.04	Erection of 50mm NB 3.6mm thick medium class standard GI pipe for incoming and outgoing cables.	Meters	426	0.001536485755439620

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.08.05	Erection, testing and commissioning of out door type metal clad Lighting distribution board (LDB) having IP-55 protection with double door type and one incomer with 100A TPN MCCB additionally with 3 nos. 32 A TPN ELCBs with 30mA tripping and timer & contactors for auto on/off street lights and 3 indicating lamps with fuse for indication bus supply ON, Digital Voltmeter & VSS 0-500V etc. Suitable busbar arrangement for Phase and Neutral. Sufficient space should be provided in the removable cable gland plate to accommodate incoming power cable and all outgoing cables.	Nos.	3	0.001352540277675720
2.08.06	Supply of 500W LED flood light luminaires of Bajaj, Crompton, Phillips or equivalent	Nos.	80	0.008546562177358680
2.08.07	Supply, civil work for foundation (including supply of all civil material) ,Erection & Commissioning of High Mast (30 mtrs height) including Assembly and erection at its foundation , supply, civil work and erection of LANTERN CARRIAGE and poles , erection and supply of its accessories (all other accessories including supply of civil material , which are not mentioned in this BOQ), final commissioning , Supply , E&C of high mast panel panels, laying of cable for high mast, Construcion of earth pit (2 nos pit/mast) and connection to panel and mast as per relevent clause of technical specification.(LED fitting shall be mounted on lighting mast /tower, on each tower 8 such fitting shall be mounted) as per relevent clause of technical specification.	Set	10	0.105882748199712000
2.09	SUPPLY & ERECTION PORTION OF BOM FOR CIVIL RELATED WORKS.			
2.09.01	Excavation of cable trench size 0.4x1.0 m depth for HT cable and 0.4x0.8 m depth for LT cable. After cable laying, the trench will be back filled with excavated earth materials / other outside earth materials with compaction.	CUM	5760	0.039472535463688200

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.09.02	Supply & Erection and spreading of river sand in cable trench of 300 mm thick for protection of HT /LT Power cable.	CUM	360	0.019476579998530300
2.09.03	Supply and laying of red/ ash bricks in the cable trench for protection of HT /LT Power cable.	Nos	30000	0.016230483332108600
2.09.04	Construction of Control room as per approved drawing, including supply of required civil materials like cement, sand, bricks, metal, reinforcement rods etc. The control room is concrete roof, brick wall room with inside & out site plastering, cement flooring with necessary trench arrangements for control desk & UPS and two nos 4ftX 4 ft glass alu. slide type windows, one wooden door of normal size (2.1X 1.2m) with lock & key arrangement. Including painting of control room. Supply & providing of control room lighting with minimum 4 nos. of 40 W Tube light fitting , 2 nos. 1200 sweep ceiling fans and 4 nos of 40 W LED street light fitting for out side area lighting, necessary electrical wiring for fans & lights with 02 nos 5A switched socket & 2 nos 15 A switched socket in lighting board, incoming main switch, earthing, incoming power connection etc. complete(Light fittings & fans are reputed make only).	Set	1	0.011722015739856200
2.09.05	Supply and installation of One No. vertical air terminations, 6m height 50 mm NB 3.6mm thick medium class GI Pipe with 1m height lightning spike on the top (total height-7m) with suitable Base plate & foundation bolts for Lightning protection of PSS. Vertical air terminal shall be grounded with earth pits. Required civil works for lightning pole erection and grouting including supply of grouting civil materials are in the scope of Contractor. (for 11/11.5kV substation.)	Sets	2	0.000270508055535144

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.09.06	Supply and Erection of 3m long 50mm dia 3.6 mm thick medium class GI funnel type earth electrode with filling of bentonite earthing powder as per standard, four side brick work chamber with cement plastering, white washing and removable type RCC/ cast iron cover plate. Scope includes supply of required bentonite earthing powder, cement, brick, sand, RCC/cast iron cover plate. Minimum 02 earthing pits per LDB. Earthing shall be carried out by using 50x6 and 25x3 mm earth flats (Supply and erection rates of earth flats is provided separately.)	Nos.	7	0.000946778194373003
2.09.07	Supply and erection of 300mm Ladder type tray along with all accessories	Meters	200	0.003246096666421720
2.09.08	Supply and erection of 600mm Ladder type tray along with all accessories	Meters	100	0.002705080555351440
2.10	For Open Storage Yard (Supply and E&C)			
2.10.1	Supply of steel tubular swaged poles, 9 mtr long made of sheet steel having ultimate tensile strength 42 kg F/sq. mm conforming to BIS: 2713 (part-II) complete with 300x300x6 mm thick MS base plate for welding at site and size as per configuration given in BIS for 410 SP-28 (113 kg- pole weight) .	Nos	100	0.028854192590415300
2.10.2	Supply of weather proof LED street light fitting 150 watt of Bajaj, Crompton, Philips or equivalent make, complete with one piece of appropriate driver (integral/non-integral) and suitable for directly slipping over light mounting bracket made out of 40 mm OD pipe and suitable for lamps, JB, cabling & termination of items supplied (To be mounted on 9 mtr pole)	Nos	100	0.009901346826336680

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.10.3	<p>Supply of 3-Phase metering and power distribution board complete with:</p> <p>(1) Incoming SFU TPN 400 Amps - 1no, (2) Outgoing SFU TPN 200 Amps -1nos. (3) Outgoing SFU TPN 63 Amps -1nos. (4) Outgoing SFU TPN 32 Amps -7nos.</p> <p>3 Phase Electronic Energy Meter - BHEL / L&T / GEC make. Ammeter, Voltmeter and Selector Switches for both - AE and Kaycee make. Phase indication lamps, HRC fuses for IC and OG feeders, cable glands, power terminals for cables termination, cable lugs and provision for doubly earthing the panel enclosure.</p> <p>Panel enclosure shall be made of sheet metal thichnness not less than 1.6 mm and suitable for out door installation, modular construction, hinged door with locking arrangement, base frame, should have slopped canopy, duly painted with first coat of primer and two coats of synthetic enamel paint (interior with white paint and exterior with light grey as per shade 5, is 630) internal power distribution to devices shall be with al busbars or copper flexible single core PVC cables of 1.1 kV grade, control wiring with 1.5 sqmm, suitable stool made out of MS structure of 1.2 meter high for mounting of panel with anchoring arrangement at foundation, suitable for bottom entry of cables.</p>	Nos	2	0.004508467592252400

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.10.4	Supply of 415 Volt AC, 3 phase/four wire power feeder pillar board, board shall be comprises of three number and one number aluminium bus bar for phase & neutral respectively. Bus bar rating shall be 200 amps and shall be mounted on epoxy insulator of 1.1 kV grade, each bus bar shall have drilled hole for connecting incoming /outgoing cables, provision for earthing the panel enclosure. Panel enclosure shall be made of sheet metal thichnness not less than 1.6 mm and suitable for out door installation, hinged door with locking arrangement, base frame, should have slopped canopy, duly painted with first coat with primer and two coats of synthetic enamel paint (interior with white paint and exterior with smoke grey as per IS), suitable stool made out of MS structure of 1.2 meter high for mounting of panel with anchoring arrangement at foundation .	Set	6	0.013525402776757200
2.10.5	Supply of out door type metal clad Lighting Panel (LP) having IP-55 protection with double door type and one incomer with 100A TPN MCCB additionally with 3 nos. 32 A TPN ELCBs with 30mA tripping and timer & contactors for auto on/off street lights and 3 indicating lamps with fuse for indication bus supply ON, Digital Voltmeter & VSS 0-500V etc. Suitable busbar arrangement for Phase and Neutral. Sufficient space should be provided in the removable cable gland plate to accommodate incoming power cable and all outgoing cables.	Set	6	0.009738289999265170
2.10.6	Supply of 2Cx6/10 sqmm Aluminium Armoured PVC/XLPE insulated cable confirming to IS 1554 (Part-I)/ IS 7098 (part-I) respectively along with double compression type brass cable glands, required nos of termination lugs, Jointing kits, Strainght throughs and suitable glands.	Mtrs	5000	0.008868640582431620

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.10.7	Supply of 3.5Cx185 sqmm aluminium armoured PVC/XLPE insulated cable confirming to IS 1554 (Part-I)/ IS 7098 (part-I) respectively along with double compression type brass cable glands, required nos of termination lugs, Jointing kits, Strainght throughs and suitable glands.	Mtrs	1500	0.027659000170320200
2.10.8	Installation/Erection of steel tubular swaged poles, 9 mtr long made of sheet steel having ultimate tensile strength 42 kg F/sq. mm conforming to BIS: 2713 (part-II) complete with 300x300x6 mm thick MS base plate for welding at site and size as per configuration given in BIS for 410 SP-28 (113 kg- pole weight) with 1.5 mtr deep exacavation, concreting in 1:4:8 ratio size 45 cms x 45 cms x 150 cms and pole plinth in 1:3:6 cement concreting having 300 mm height and 300 mm dia including double earthing of pole with suitable arrangement, duly painted with two coats of red oxide paint and one coat of aluminium paint to be applied after erection; the length of pole below ground to be painted with two coats of black bituminus paint. the pole shall be complete with JB, fuse and minor fabrication as below : i) Driling 20 mm dia hole at about 2.5 mtr from ground level for wire leads from junction box to light fixture. ii) Driling 15mm dia holes at about 0.7 and at 2.5 mtr from ground level and welding 12 mm nuts for using a 12 mm GI bolt for fastening earth conducters. iii) Welding required holes for fixing pole cap of street light bracket. iv) Welding diametrally 10 mm MS round 30 mm below pole top edge for clipping wire leads .	Nos	100	0.013525402776757200

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.10.9	Installation/Erection & Commissioning of LED street light fitting 150 watt of Bajaj, crompton, Philips or equivalent make, complete with one piece of appropriate driver (integral/non-integral) and suitable for directly slipping over light mounting bracket made out of 40 mm OD pipe and suitable for lamps, JB, cabling & termination of items supplied .	Nos	100	0.003606774073801920
2.10.10	<p>Providing suitable foundation, installation & commissioning of mounting AC distribution board as specified and Installation/Erection and Commissioning of 3-Phase metering and power distribution board complete with:</p> <p>(1) Incoming SFU TPN 400 Amps - 1no, (2) Outgoing SFU TPN 200 Amps -1nos. (3) Outgoing SFU TPN 63 Amps -1nos. (4) Outgoing SFU TPN 32 Amps -7nos.</p> <p>3 Phase Electronic Energy Meter - BHEL / L&T / GEC etc or any reputed make. Ammeter, Voltmeter and Selector Switches for both - AE and Kaycee make. Phase indication lamps, HRC fuses for IC and OG feeders, cable glands, power terminals for cables termination, cable lugs and provision for doubly earthing the panel enclosure. Panel enclosure shall be made of sheet metal thickness not less than 1.6 mm and suitable for out door installation, modular construction, hinged door with locking arrangement, base frame, should have slopped canopy, duly painted with first coat of primer and two coats of synthetic enamel paint (interior with white paint and exterior with light grey as per shade 5, is 630) internal power distribution to devices shall be with al busbars or copper flexible single core PVC cables of 1.1 kV grade, control wiring with 1.5 sqmm, suitable stool made out of MS structure of 1.2 meter high for mounting of panel with anchoring arrangement at foundation, suitable for bottom entry of cables.</p>	Set	2	0.000901693518450479

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S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components
2.10.11	Providing suitable foundation for mounting 415 Volt AC power feeder pillar board and Installation/Erection and Commissioning of 415 Volt AC, 3 phase/four wire power feeder pillar board, board shall be comprises of three number and one number aluminium bus bar for phase & neutral respectively. Bus bar rating shall be 200 amps and shall be mounted on epoxy insulator of 1.1 kV grade, each bus bar shall have drilled hole for connecting incoming /outgoing cables, provision for earthing the panel enclosure. Panel enclosure shall be made of sheet metal thichnness not less than 1.6 mm and suitable for out door installation, hinged door with locking arrangement, base frame, should have slopped canopy, duly painted with first coat with primer and two coats of synthetic enamel paint (interior with white paint and exterior with smoke grey as per IS), suitable stool made out of MS structure of 1.2 meter high for mounting of panel with anchoring arrangement at foundation .	Set	6	0.002705080555351440
2.10.12	Erection, testing and commissioning of out door type metal clad Lighting Panel (LP) having IP-55 protection with double door type and one incomer with 100A TPN MCCB additionally with 3 nos. 32 A TPN ELCBs with 30mA tripping and timer & contactors for auto on/off street lights and 3 indicating lamps with fuse for indication bus supply ON, Digital Voltmeter & VSS 0-500V etc. Suitable busbar arrangement for Phase and Neutral. Sufficient space should be provided in the removable cable gland plate to accommodate incoming power cable and all outgoing cables.	Set	6	0.002705080555351440
2.10.13	Cable Laying and Termination of 2Cx6/10 sqmm Aluminium Armoured PVC/XLPE insulated cable confirming to IS 1554 (Part-I)/ IS 7098 (part-I) respectively along with double compression type brass cable glands, required nos of termination lugs, Jointing kits, Strainght throughs and suitable glands and including laying . Cables are to be laid from 415 Volt AC power feeder pillar board to lighting poles & pole to pole.	Mtrs	5000	0.006762701388378590

TECHNICAL CONDITIONS OF CONTRACT (TCC)
Chapter - XI: BILL OF QUANTITY & Weightages/ Factor

S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components		
2.10.14	Cable Laying and Termination of 3.5CX185 sqmm aluminium armoured PVC/XLPE insulated cable confirming to IS 1554 (Part-I)/ IS 7098 (part-I) respectively along with double compression type brass cable glands, required nos of termination lugs, Jointing kits, Straight throughs and suitable glands and including laying . Cables are to be laid from transformer sub station to 415 Volt AC distribution board.	Mtrs	1500	0.004057620833027160		
				1.00000000		
PACKAGE-B						
BILL OF QUANTITIES FOR OPERATION AND MAINTENANCE PACKAGE-B						
2.10	Operation and running maintenance including attending breakdown jobs for the entire Construction Power Network, Yard Lighting and Area lighting by providing required Manpower of skilled electricians, Helpers and supervisors with required T&Ps. Manpower strength shall be decided by BHEL site as per site requirement. Monthly unit rates are based on minimum wages as per MP govt minimum wage circular at the time of NIT multiplied by factor of 1.41. Monthly unit rates shall be revised as when it is changed/informed by MP govt .	UOM	Quantity	Minimum wages from 01.10.25 to 31.03.26 as per Madhya pradesh govt circular (Monthly wage rates shall be revised as when it is changed by MP govt)	Fix Factor	Amount as per Minimum wages from 01.10.25 to 31.03.26 as per Madhya pradesh govt circular

TECHNICAL CONDITIONS OF CONTRACT (TCC)
Chapter - XI: BILL OF QUANTITY & Weightages/ Factor

S. No.	DESCRIPTION	UOM	QUANTITY	Factor Components		
2.10.1	Menial Services (Unskilled)	Man-Months	215	12150	1.41	3683272.5
2.10.2	Secretarial Services (Skilled)	Man-Months	215	14869	1.41	4507537.35
2.10.3	Supervisor (Highly-skilled)	Man-Months	43	16494	1.41	1000031.22
				Package B		9190841.07